

# **Dell EMC Solutions Enabler TimeFinder® Family (Mirror, Clone, Snap, VP Snap) CLI User Guide**

8.2 and higher

## 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, 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 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 EMC Online Support (<https://support.emc.com>). Check to ensure that you are using the latest version of this document.

## Purpose

This document is part of the EMC Solutions Enabler documentation set, and describes how to use TimeFinder Mirror, Clone, Snap, and VP Snap.

## 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 EMC Solutions Enabler software.

## Related documentation


The following documents provide additional Solutions Enabler information:


- |  |  |
|--|--|
| <b><i>EMC Solutions Enabler, VSS Provider, and SMI-S Provider Release Notes</i></b>              | Describes new features and any known limitations.  |
| <b><i>EMC Solutions Enabler Installation and Configuration Guide</i></b>                         | Provides host-specific installation instructions.  |
| <b><i>EMC Solutions Enabler Array Controls and Management for HYPERMAX OS CLI User Guide</i></b> | Describes how to configure array control, management, and migration operations using SYMCLI commands for arrays running HYPERMAX OS. |
| <b><i>EMC Solutions Enabler CLI Reference Guide</i></b>  | Documents the SYMCLI commands, daemons, error codes and option file parameters provided with the Solutions Enabler man pages.        |
| <b><i>EMC Solutions Enabler SRDF Family CLI User Guide</i></b>                                   | Describes how to configure and manage SRDF environments using SYMCLI commands.   |
| <b><i>EMC Solutions Enabler TimeFinder SnapVX for HYPERMAX OS CLI User Guide</i></b>             | Describes how to configure and manage TimeFinder SnapVX environments using SYMCLI commands.  |


**EMC Solutions** Provides Storage Resource Management (SRM) information related to various data objects and data handling facilities.  
**Enabler SRM CLI**  
**User Guide**


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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


EMC uses the following style conventions in this document:

**Table 1. Typographical conventions used in this content**

<b>Bold</b>	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"><li>• System code</li><li>• System output, such as an error message or script</li><li>• Pathnames, filenames, prompts, and syntax</li><li>• Commands and options</li></ul>
<i>Monospace italic</i>	Used for variables
<b>Monospace bold</b>	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

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## 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](mailto:VMAXContentFeedback@emc.com)

# Introduction to the TimeFinder Family

This chapter introduces the EMC Solutions Enabler TimeFinder Family (Mirror, Clone, Snap VP Snap) and the SYMCLI commands for each of these products.

## Topics:

- [Introduction to TimeFinder Family](#)

## Introduction to TimeFinder Family

EMC TimeFinder family of replication products (Mirror, Clone, Snap, VP Snap) allows nondisruptive creation and management of point-in-time copies of data, enabling simultaneous action of business tasks that were previously sequential. TimeFinder creates and manages point-in-time copies of critical data that can be used for backups, decision support, and to refresh data warehouse, test, and development environments.

The ability to access source data during the TimeFinder copy operation eliminates the backup window and provides benefits such as accelerated upgrades and high availability. TimeFinder can also shorten the maintenance window, minimize infrastructure costs, and improve service levels.

TimeFinder Mirror, Clone, Snap, and VP Snap are supported on VMAX arrays running Enginuity 5773 and 5876. Each TimeFinder product has its own features and use cases. These TimeFinder products require a target volume to retain snap or clone data. The following chapters provide more information about operations using these TimeFinder products:

- [TimeFinder/Clone Operations](#) on page 20
- [TimeFinder/Mirror Operations](#) on page 94
- [TimeFinder/Snap Operations](#) on page 57
- [TimeFinder VP Snap Operations](#) on page 91

**NOTE:** Legacy TimeFinder operations can be run on arrays running HYPERMAX OS 5977 and higher using "as is" commands and scripts. SnapVX transparently interprets legacy commands and automatically maps TimeFinder/Clone, TimeFinder VP Snap, and TimeFinder/Mirror commands to the executable of the appropriate SnapVX command. The following restrictions apply when running legacy operations:

- Legacy commands (commands used for TimeFinder Clone, Mirror, Snap, and VP Snap) provide TimeFinder functions and features only for Enginuity 5876. 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 provides more information.

**NOTE:** Any state table changes or any issues with legacy TimeFinder operations running on arrays with HYPERMAX OS 5977 are documented in the latest version of the Solutions Enabler Release Notes.

## Copy Session Limits

VMAX arrays running Enginuity 5773 and 5876 support up to 16 sessions per source device, which can be used for TimeFinder/Clone, TimeFinder/Snap, SRDF/Star, Solutions Enabler Open Replicator (ORS), or Symmetrix Differential Data Facility (SDDF) operations. TimeFinder VP Snap allows an additional 32 sessions per device. This limits the number of available copies that can be created.

**NOTE:** Not all VMAX arrays support all of these technologies. In addition, the number of supported copy sessions per source device may vary on certain platforms. Refer to the product guide for specific VMAX arrays for details on supported TimeFinder features.



**Table 2. Number of session slots used per operation**

Operation	Session slots
TimeFinder/Snap	One session slot per snap session, plus an additional session slot for restore operations. For arrays running Enginuity 5876: One session slot per snap session, plus two additional session slots for restore operations.
Multivirtual snap	One session slot (regardless of the number of sessions), plus an additional session slot reserved for restore operations. For arrays running Enginuity 5876: One session slot per session, plus two additional session slots for restore operations.
TimeFinder/Clone	Two session slots per copy session, unless using the <code>-nodifferential</code> option, in which case one session slot is used per copy session.
TimeFinder/Clone Emulation mode	Two session slots.
ORS	One session slot per ORS session, and one session slot for each additional session unless the session was created with the <code>-nodifferential</code> option.
SRDF/Star	Two session slots.
SRDF/A	One session slot.
SDDF	One session slot per SDDF session

## TimeFinder CLI overview

This section provides an overview of the TimeFinder Family Command Line Interface (CLI).

TimeFinder commands include: `symclone`, `symsnap`, `symbcv`, and `symmir`.

- The TimeFinder/Clone `symclone` command creates a point-in-time copy.
 

The TimeFinder/Clone operations are `create`, `activate`, `recreate` and `activate` (or `establish` that combines the two procedures into one operation), `restore`, and `terminate`. [TimeFinder/Clone Operations](#) on page 20 describes the `symclone` command and the TimeFinder/Clone operations in greater detail.
- The TimeFinder/Snap `symsnap` command creates virtual device copy sessions between a source device and multiple virtual (VDEV) target devices. These virtual devices only store pointers to changed data blocks from the source device, rather than a full copy of the data.
 

The TimeFinder/Snap operations are `create`, `activate`, `recreate`, `restore` and `terminate`. [TimeFinder/Snap Operations](#) on page 57 describes the `symsnap` command and the TimeFinder/Snap operations in greater detail.
- TimeFinder VP Snap utilizes the `symclone` command to create space-efficient snaps for thin devices. VP Snap provides the efficiency of Snap technology with improved cache utilization and simplified pool management. [TimeFinder VP Snap Operations](#) on page 91 describes how to use the `symclone` command to perform VP Snap operations.

## TimeFinder Family command summary (Mirror, Clone, Snap, VP Snap)

 **NOTE:** The *EMC Solutions Enabler CLI Command Reference* provides complete details about command syntax.

**Table 3. TimeFinder command summary**

Command	Description
<code>symclone</code> <sup>a</sup> ,	Performs TimeFinder/Clone control operations on standard or BCV devices: <ul style="list-style-type: none"> <li>• Creates a copy session for making multiple data copies between a source device and target devices.</li> </ul>

**Table 3. TimeFinder command summary (continued)**

Command	Description
	<ul style="list-style-type: none"> <li>● Creates and activates a copy session</li> <li>● Modifies the mode in which a copy session is operating.</li> <li>● Activates a copy session to make data instantly accessible to multiple target hosts.</li> <li>● Copies (incrementally) all subsequent changes made to a source device to a target device, after a clone session is fully copied.</li> <li>● Restores data from a target device back to a source device or to another device.</li> <li>● Terminates a copy session to remove holds on target devices and delete device pair information from the array.</li> <li>● Queries information about the state of mirroring for multiple copy sessions.</li> <li>● Verifies the state for selected devices.</li> <li>● Lists all copy sessions that have been created on the array.</li> </ul> <p>Performs TimeFinder VP Snap control operations:</p> <ul style="list-style-type: none"> <li>● Creates space-efficient snaps for thin devices</li> <li>● Incrementally restores data back to the original source device without requiring that the source device is fully copied</li> </ul>
<p>symsnap</p>	<p>Performs Snap control operations for virtual copy sessions from normal devices to virtual devices. The source device can be either a standard or a BCV device and the target device must be a virtual device (VDEV).</p> <ul style="list-style-type: none"> <li>● Creates a virtual copy session for making multiple data copies between a source device and up to 15 target devices <ul style="list-style-type: none"> <li>- Enginuity version 5876 supports up to 14 target devices.</li> <li>- Multivirtual snap supports up to 128 target devices.</li> </ul> </li> <li>● Specifies a particular SAVE pool for use in a virtual copy session.</li> <li>● Activates a virtual copy session to make data instantly accessible to multiple target hosts.</li> <li>● Recreates a snap session on existing VDEVs to prepare to active a new point-in-time image and is only valid when issued against previously activated sessions.</li> <li>● Terminates a virtual copy session to remove holds on target devices and delete device pairing information from the array.</li> <li>● Queries information about the state of mirroring for multiple copy sessions.</li> <li>● Verifies device states.</li> <li>● Attaches and detaches target devices as the preferred devices to use in a requested Snap operation.</li> <li>● Restores a virtual device to another device, or to the original device.</li> <li>● Duplicates a point-in-time copy of a virtual device, which is paired in a previously activated snap session, to another virtual device.</li> <li>● Lists all virtual copy sessions that have been created on the array.</li> </ul>
<p>symbcv</p>	<p>Performs operations on one or more BCV devices:</p> <ul style="list-style-type: none"> <li>● Associates a device pair.</li> </ul>

**Table 3. TimeFinder command summary (continued)**

Command	Description
	<ul style="list-style-type: none"> <li>● Disassociates a device pair.</li> <li>● Lists all BCV devices in the array.</li> <li>● Moves a BCV device from one group to another.</li> <li>● Removes all BCV devices from the specified device group.</li> </ul>
symmir	<p>Performs control operations on BCV device pairs including:</p> <ul style="list-style-type: none"> <li>● Establishes (mirror) one or all standard devices with one or more BCV devices. The operation can be a full or incremental establish.</li> <li>● Restores one or all standard devices from one or more BCV devices that are associated locally or remotely. The operation can be a full or incremental restore.</li> <li>● Splits one or all BCV devices from one or more standard devices.</li> <li>● Returns information about the state of mirroring of one or all BCV device pairs.</li> <li>● Cancels the existing internal SDDF session between the specified standard and BCV devices.</li> <li>● Lists all BCV sessions created on an array.</li> </ul>

a. Supported in VMAX3 arrays with HYPERMAX OS in emulation mode.

# TimeFinder/Clone Operations

This chapter describes how to perform TimeFinder/Clone operations using the SYMCLI `symclone` command.

## Topics:

- [TimeFinder/Clone overview](#)
- [Create TimeFinder clone copy session](#)
- [Activate a TimeFinder clone copy session](#)
- [Modify TimeFinder clone copy session](#)
- [Recreate TimeFinder clone copy device](#)
- [Restore data from target device](#)
- [Split a clone device pair](#)
- [Terminate TimeFinder clone copy session](#)
- [Query TimeFinder clone copy session pairs](#)
- [Verify TimeFinder clone copy session pair states](#)
- [TimeFinder cascaded clone copy session](#)
- [Using a BCV as the clone source](#)
- [Creating multiple clone copies from a standard device](#)
- [Cloning a copy on a remote array](#)
- [Cloning copies of the same data locally and remotely](#)
- [Cloning multiple copies locally and remotely](#)
- [Cloning a copy at the tertiary site of a cascaded SRDF configuration](#)
- [Using composite groups to manage clone pairs across arrays](#)
- [Command options with device groups](#)
- [Command options with composite groups](#)
- [Command options with device files](#)

## TimeFinder/Clone overview

For a high-level overview of TimeFinder/Clone functionality, refer to the *EMC Symmetrix TimeFinder Product Guide*.

TimeFinder/Clone operations are performed using the `symclone` command to create clone copies of a source device on one or multiple target devices.

A single source device can have up to 16 clone copy sessions. Eight full data copies can be created simultaneously, without disruption to database production activity, and eight more can be created once the first eight copies are complete. [Copy Session Limits](#) on page 16 provides additional details about the allowable number of copies that can be created.


 **NOTE:** Data Domain devices are not supported as TimeFinder/Clone source or target devices.

## Create TimeFinder clone copy session

### Description

The `symclone create` command defines the clone copy session requirements and sets the track protection bitmap on the source device to detect which tracks are being accessed by the target host or written to by the source host.

For clone copying, the default setting for background copying is `-copy` option. Data begins copying in the background when the clone session is activated and a full copy will become available to the host. While background copying, the state of the device pair is *CopyInProgress*. When the operation completes, the state goes to *Copied*. The copy session must be activated before the target host can access the data. However, once the session is activated, the data is available immediately to the target host.

 **NOTE:** The `-differential` option is specified by default. Use the `-nodifferential` flag to create a nondifferential session, which cannot be recreated.

## Examples

To create a clone copy session between source device `DEV001` and target device `DEV005` in group `ProdDB`, enter:

```
symclone -g ProdDB create DEV001 sym ld DEV005
```

## Rules and restrictions

The following rules and restrictions apply to a clone copy:

- The target device is made Not Ready to its host and placed on hold status for clone copy session activity. This prevents other control operations from using the device.
- The device pair state transitions from `CreateInProgress` to `Created` when complete.
- The clone copy does not become accessible to its host until the copy session is activated. [Activate a TimeFinder clone copy session](#) on page 24 contains greater detail.
- A device pair cannot be verified that it is in the `CreateInProgress` state. After the copy session completes, issue a `symclone verify -created` command to verify that the clone pair is successfully created.
- If a copy session is created and not activated, it can be terminated. However, the data on the target device should be considered invalid.

## Create TimeFinder clone copy session in nocopy mode

### Description

When activating a copy session in `nocopy` mode, the default device pair state is `CopyOnAccess`. After activating the copy session, only those tracks that have been written to the source or written/read from the target are copied to the target device. A full data copy to the target device does not occur unless all of the device tracks are accessed or written to while participating in the active session.

If a write occurs to the source device, old data is copied to the target device. If a write occurs to the target device, new data is written to the target device. When Engenuity detects that a source-protected track was written, it copies the track to the target device and unprotects the track before accepting the new write. Data from the source then becomes available to a target-connected host during the active session.

The `CopyOnAccess` device pair state can be modified to `CopyOnWrite` by setting the following parameter in the Options file, or environment variable to `ENABLE`. The environment variable will override the default settings specified in the options file.

```
SYMAPI_CLONE_COPY_ON_WRITE = ENABLE | DISABLE
```

Once the `CopyOnWrite` is enabled as the default pair state and the copy session is activated, all reads are handled from the source device, and writes to the source device or target device during the active copy session result in the data being copied to a target device.

### Examples

To create a clone copy session in `nocopy` mode, and define the clone target device `DEV005` from the source device `DEV001` in group `ProdDB`, enter:

```
symclone -g ProdDB create DEV001 sym ld DEV005 -nocopy
```

## Create TimeFinder clone copy session in precopy mode

### Description

The *Precopy* mode starts copying tracks in the background, before activating a copy session, and allows the early movement of data before the point-in-time clone copy is established. The precopy process checks for any new writes to copy to the target device until the copy session is activated. Once activated, the normal background copy mechanism starts and the precopy operation ends. When using the *Precopy* mode, the target device is not ready to the host until the session is activated.

### Examples

To create a clone copy session using the `-precopy` option, enter:

```
symclone -g ProdDB create -precopy DEV001 sym ld DEV005
```

## List TimeFinder clone copy session copy mode

### Description

To see a list of sessions that are using a particular copy mode, specify the copy option with the `symclone list` command.

### Options

`-copy`

Lists acitvated sessions with background copy active.

`-nocopy`

Lists activated sessions with no background copy.

`-precopy`

Lists session with precopying active. Precopy mode starts copying tracks in the background before the session is activated.

### Examples

To see a list of sessions with the background copy active, enter:

```
symclone list -copy
```

## Copy only changed data to a full copy TimeFinder clone

### Description

Differential copying (subsequent cloning to the same target) copies only those device tracks that have changed since the full clone was performed (that is, only new writes to the source device will be copied). A differential clone operation requires that the copy session that existed for the full clone still exists. Because a full clone is required, the `-differential` option must be specified with the `-copy` or `-precopy` option. The `-nocopy` option is not allowed.

## Examples

To copy only changed data to a full copy clone, enter:

```
symclone -g ProdDB create -copy -differential DEV001 sym ld DEV005
```

The `-differential` option creates a SDDF (Symmetrix Differential Data Facility) session for the source.

## Larger target device for TimeFinder clones

A target device can be larger than the source device, and requires the following SYMCLI environment variable be set:

```
SYMCLI_CLONE_LARGER_TGT = ENABLED
```

The following limitations apply:

- Restore is not allowed.
- Full copy support only; must use `-nodifferential`.
- VP Snap is not supported.
- Concatenated metadevices are not supported.
- When using this feature on striped metadevices, the source and target devices must contain the same number of metamembers. However, the target device members can be larger than the source device members.
- Exact pairing are the only operations allowed, as follows:
  - file
  - g or -cg with -exact
  - g or --cg with source and target ldev name supplied

## Create TimeFinder clone session using the establish command


### Description

Use the `symclone establish` command, to create and then immediately activate a copy session with a single command.

### Examples

To create and then activate a copy session, enter:

```
symclone -g ProdDB establish DEV001 sym ld DEV005 -full
```

 **NOTE:** The `symclone establish` command sets the target device to *Not Ready* for a short period time. If using a filesystem, unmount the target host before performing the `establish` command.

## Create concurrent target device for each source device in a group

### Description

When working with a composite or device group, use the `symclone create` or `symclone establish` command with the option `-concurrent` option to pair an additional target device with each source device in the group. When the copy session is created, an additional target device is paired with each source device in the group. For example, if there are two target devices paired with each source device in the group before creating the session, after the session is created there will be three target devices paired with each source device.

## Examples

To pair an additional target device with each source device in group `ProdDB`, enter:

```
symclone -g ProdDB create -concurrent
```

To verify that each source device in group `ProdDB` has multiple targets, enter:

```
symclone -g ProdDB verify -created -concurrent
```

## Perform operations on devices in TimeFinder clone device list

### Description

When working with a composite or device group, use the `-tgt` option to use devices from a local target list as targets for the specified action. See options below that can be paired with the `-tgt` option. See *EMC Solutions Enabler Array Management CLI Product Guide* for more information on creating and managing clone target lists.

The `-tgt` option works with all `symclone` actions, except for `query` and `verify`, as these actions are source device oriented and list all target devices paired with source devices by default, including TGT and RTGT.

When working with specific pairs, the `symclone` command supports the following target devices:

```
sym ld LdevName
sym dev SymDevName
sym pd PdevName
```

### Syntax

For device groups, to copy from a local standard device to a local target, use the following syntax:

```
symclone -g DgName action [-tgt [-bcv] | -rdf [-bcv | -tgt] | -rbcv -tgt | -rrbcv |
-hop2 [-tgt]]
```

For composite groups, to copy from a local standard device to a local target, use the following syntax::

```
symclone -cg CgName action [-tgt [-bcv] | -rdf [-bcv | -tgt] | -rbcv -tgt | -rrbcv |
-hop2 [-tgt]]
```

### Options

**-rdf**

Specifies remote attached devices (RTGTs) as the target devices.

**-hop2**

Specifies devices remotely associated on the second hop of a cascaded SRDF configuration (2TGTs) as the target devices.

## Activate a TimeFinder clone copy session

### Description

Activating the copy session starts the copy from the source device to the target device, and places the target device in the Read/Write state. The target host can access the cloned data and has access to data on the source host until the copy session is terminated.



**NOTE:** Cloned data is made available as a point-in-time copy at the time of activation and not at the time that the session was created.

To activate the clone copy session between target device DEV005 and source device DEV001, enter:

```
symclone -g ProdDB activate DEV001 sym ld DEV005
```

## Make TimeFinder clone target device not ready to target host

### Examples

To activate the clone copy session between target device DEV005 and source device DEV001 and make the target device *Not Ready* to it's host, enter:

```
symclone -g ProdDB activate DEV001 sym ld DEV005 -not_ready
```

The clone copy can be made read/write enabled to the host using either the `symdg ready` or `symdev ready` command.

## TimeFinder clone copy session consistency

The `symclone activate` command is used with the `-consistent` option to create clone copies that are consistent with the database up to the point where activation occurs. This feature is implemented using either the Enginuity Consistency Assist (ECA) feature or SRDF/A.

**NOTE:** If the R2 is in a consistent state and the copy session is pre-copying data, setting the consistent option invokes SRDF/A to maintain consistency, instead of ECA.

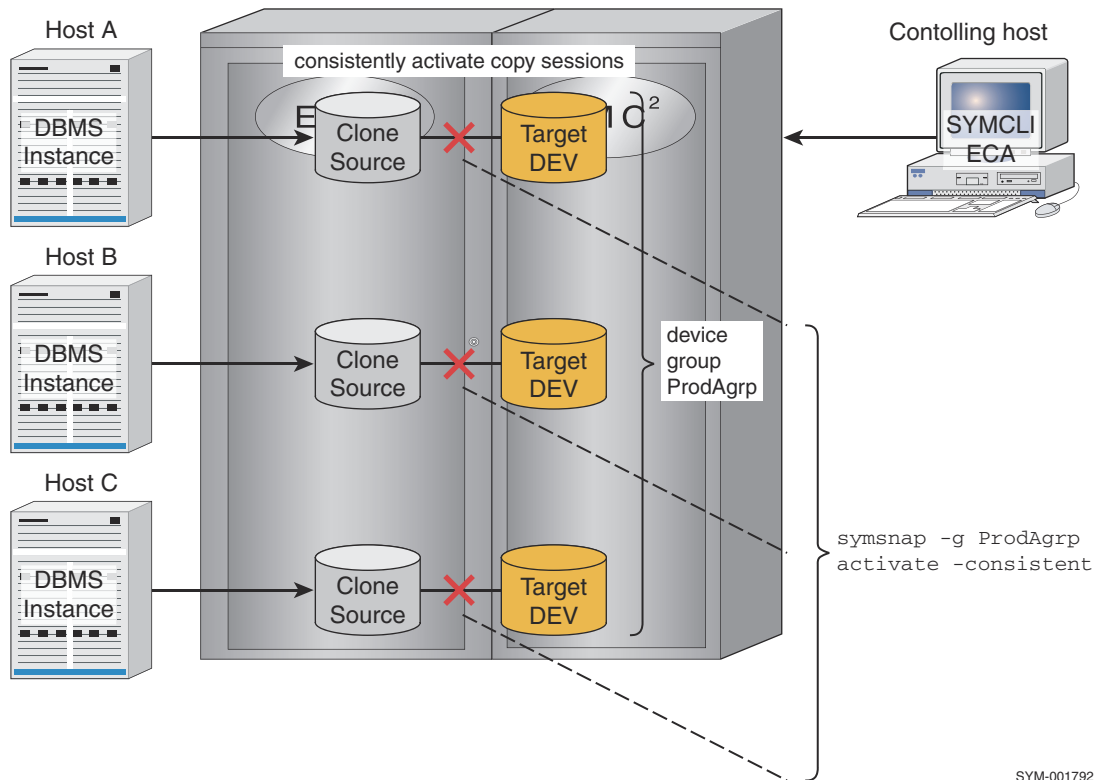
This feature is used to create clone copies that are consistent with the database up to the point in time that the activation occurs. The feature suspends writes to the source devices during the activation. When the activation has completed, writes are resumed and the target device contains a consistent production database copy of the source device at the time of activation.

The ECA feature is used to consistently activate copy sessions across multiple, heterogeneous hosts. ECA requires either a control host with no database, or a database host with a dedicated channel to the gatekeeper devices. In a SAN environment, gatekeepers and data devices may share the same FA port on the array but the gatekeepers must be available on a separate host HBA from the data devices. This requires a dedicated channel from a host HBA to the switch used to access only gatekeepers and not devices that contain host data. In this configuration, write intensive environments SYMAPI are able to freeze and then thaw I/O to the devices in the device group within the ECA window, regardless of the number of outstanding I/Os held by the HBA.

For detailed information on gatekeeper management, refer to the *EMC Solutions Enabler Installation Guide*.

The following figure shows how a control host can consistently activate a copy session that uses three database hosts that access devices on an array.

**NOTE:** When activating a copy session from an R2 device, if the SRDF pair is in adaptive copy mode, the `-consistent` option is not allowed.



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**Figure 1. TimeFinder/Clone consistent activate using ECA**

A device group, composite group, or a device file must be created on the controlling host for the target database to be consistently activated. Device groups can be created to include all of the devices being accessed or defined by database host access.

As shown in the above example, consistent activation of all copy sessions for Hosts A, B, and C can be done with a single command using a device group (`ProdAgrp`) that includes all devices accessed by the three hosts. However, for consistent activation of copy sessions for a single host (Host A), without affecting other hosts, use a device group that includes only the devices accessed by the single host.

## Activate TimeFinder clone copy session consistency

### Examples

To activate a consistent copy of the devices in group `ProdDB`, enter:

```
symclone -g ProdDB activate -consistent
```

## Activate TimeFinder clone copy session for additional pair in a group

### Examples

To activate a copy session for an additional clone pair in group `ProdDB`, enter:

**NOTE:** The copy session must exist prior to issuing the command.

```
symclone -g ProdDB activate -concurrent
```

# Modify TimeFinder clone copy session

## Description

Use the `set mode` command to modify the clone copy session operating mode.

## Options

### copy

Initiates a copy once the session is activated, or starts a copy immediately if the session is already activated.

### nocopy

Session becomes *CopyOnWrite/CopyOnAccess* once the session is activated and there is no full device copy, or the copy stops if the session is already activated.

 **NOTE:**

### precopy

Starts copy in the background before session is activated. If the session is created without the `precopy` option then changing to this mode immediately puts it immediately into effect.. Once in *Precopy* mode the session mode cannot be changed to *Nocopy* mode. Once the session is activated the session changed to *Copy* mode. For more information on *Precopy* mode refer to [Create TimeFinder clone copy session in precopy mode](#) on page 22.

## Examples


To change a copy session from *Copy* mode to *Nocopy* mode, enter:

```
symclone -g ProdDB set mode nocopy
```

# Recreate TimeFinder clone copy device

## Description

Use the `symclone recreate` command to incrementally copy all subsequent changes made to the source device (made after the point-in-time copy was activated) to the target device.

 **NOTE:** With Engenuity 5876.159.102 and higher, clone copy sessions can be recreated without terminating TimeFinder/Snap or VP Snap sessions that are cascading off of the clone target. [TimeFinder State Rules Reference](#) on page 160 provides additional details.

## Example

To recreate the copy session between target device `DEV005` and source device `DEV001` in group `ProdDB`, enter: , enter:

```
symclone -g ProdDB recreate DEV001 sym ld DEV005
```

## Restrictions

The following restrictions apply for the `symclone recreate` operation:

- The copy session must not have been created with the `-nocopy` or `-nodifferential` option.

- The session must have been activated to establish the new point-in-time copy.
- While in the *Recreated* state, the target device remains *Not Ready* to the host.

## Recreate TimeFinder clone copy session in precopy mode

### Description

The `-precopy` option is used with the `symclone recreate` command to start copying tracks in the background, before the copy session is activated. When using this option, a point-in-time copy is established when the session is activated.

While in the *Recreated* state, the precopy process never fully completes. Instead, the process keeps checking for new writes to be pre-copied to the target device until the session is activated. Once activated, the normal background copy mechanism takes over and the pre-copy operation ceases.

The `-precopy` option must be used with the `recreate` operation if the session was initially created as a *Precopy* session.

### Examples

To recreate a clone copy session using the `-precopy` option, enter:

```
symclone -g ProdDB recreate DEV001 sym ld DEV005 -precopy
```

## Recreate TimeFinder clone copy session using the establish command

### Description

Use the `symclone establish` command, to recreate and then immediately activate a copy session with a single command.

### Options


`-concurrent`

Activates an existing clone session for an additional clone pair in a group.

### Examples

To recreate and then activate a previous copy session, enter:

```
symclone -g ProdDB establish DEV001 sym ld DEV005
```

 **NOTE:** The `symclone establish` command sets the target device to *Not Ready* for a short period time. If using a filesystem, unmount the target host before performing the `establish` command.

To recreate and then activate a copy session for an additional clone pair in group `ProdDB`, enter:

```
symclone -g ProdDB establish -concurrent
```

## Recreate TimeFinder clone copy session for each pair in a group

When working with either a composite or device group, use the `-concurrent` option with the `recreate` action to recreate a clone session for each clone pair in a group.

## Examples

To recreate a copy session for each clone pair in group **ProdDB**, enter:

```
symclone -g ProdDB recreate -concurrent
```

## Restore data from target device

Use the `symclone restore` command to copy target data to another device (*full restore*), or back to the original source device (*incremental restore*). The restore operation requires that the session is differential and the device pair is in the *Copied* state.

With a full restore (`-full`), the original session terminates and a copy session to the target of the restore starts.

With an incremental restore, the original session copy direction reverses and changed data is copied from the target device to the source device.

## Examples

To fully restore data from the original target device (DEV005) to a device (DEV006) that was not involved in the original clone session, enter:

```
symclone -g ProdDB restore -full DEV006 sym ld DEV005
```

**i** **NOTE:** When constructing a `symclone restore` command, the device receiving the data always appears first in the command, followed by the device from which the data is being copied. In the above command, DEV006 is the target of the data being copied from DEV005.

## Split a clone device pair

### Description

Use the `symclone split` command to *split* a clone device pair that is in the *Restored* state. The original source device becomes the source device for a future copy, and the `establish` or `recreate` command can be used.

## Examples

To split the device pair DEV001 and DEV005, enter:

```
symclone -g ProdDB split DEV001 sym ld DEV005
```

## Terminate TimeFinder clone copy session

### Description

Terminating a copy session deletes the pairing information in the array and removes any hold on the target device. Terminating a session while the device pairs are in the *CopyOnAccess*, *CopyOnWrite*, or *CopyInProg* state causes the session to end. If the application has not finished accessing all of the data, the target copy is not a full copy.

The `symclone terminate` command is allowed for all clone pair states.

## Examples

To terminate the copy session for device pair DEV001 and DEV005, enter:

```
symclone -g ProdDB terminate DEV001 sym ld DEV005
```

**NOTE:** A created and activated copy session may be terminated, but the data on the target device is not valid unless the device state is *COPIED*.

If the state is *CopyInProg*, then apply the `-symforce` option to terminate the session. This leaves the target copy as an incomplete copy.

If the `-not_ready` option is applied to the copy session, Solutions Enabler leaves the target devices in their prior *Ready* or *NotReady* state at the completion of the terminate operation. If the `-not_ready` option is not applied to the copy session, Solutions Enabler leaves the target devices in the *Ready* state at the completion of the terminate, regardless of their state prior to the terminate operation.

## Query TimeFinder clone copy session pairs

### Description

The `symclone query` command is sent through a gatekeeper device to the array and returns information about the state of a clone pair, all clone pairs in a device group, a composite group, or a device file.

### Syntax

To query target devices in a device group, composite group, or device file use the following syntax:

```
symclone -g DgName query
symclone -cg CgName query
symclone -f[file] FileName query
```

### Options

#### **-offline**

Retrieves target device information for the host database.

## Examples

To query the state of the clone pairs in the `prod` device group, enter:

```
symclone -g prod query
```

To query the state of SRDF-connected clone pairs in the `prod` device group, enter any of the following:

```
symclone -g prod query -rdf
```

```
symclone -g prod query -rdf -bcv
```

```
symclone -g prod query -rrbcv
```

```
symclone -g prod query -hop2
```

The results of the query include the following information for each member of a clone pair in a device group:

- Logical device name
- Device name
- Number of invalid tracks
- Clone pair state

## Query TimeFinder clone copy session pairs using the `-summary` option

### Description

Use the `-summary` option with the `symclone query` command, to report the following results:

- Number of clone pairs in each clone pair state
- Number of invalid tracks

### Options

`-i, -c` Reports the synchronization rate and estimated time to complete a copy, for a specified time period (`-c`) and at specified time intervals (`-i`)

### Examples

To view the number of clone pairs in the `prod` device group that are in each state, and to view the estimated time to completion, enter:

```
symclone -g prod query -summary -i 60
```

The `-summary` option can be used with the `symclone verify` command.

## Verify TimeFinder clone copy session pair states

### Description


Use the `symclone verify` command to verify that one or all clone pair(s) in a device group, composite group, or device file are in a particular state. The command can be used in scripts to verify that the clone device pair(s) are in a particular state prior to executing subsequent Solutions Enabler commands. If no device state qualifiers are specified, the default for the `symclone verify`, is to check for the *Copied* state.

### Syntax

To verify target devices in a device group, composite group, or device file, use the following syntax:

```
symclone -g DgName verify
symclone -cg CgName verify
symclone -f[file] FileName verify
```

### Options

 **NOTE:** Add the `-concurrent` option with each of the following options to verify a concurrent clone pair.

`-copied`

	Verifies that the copy sessions are in the <i>Copied</i> state (default).
<b>-copyinprog</b>	Verifies that the copy sessions are in the <i>CopyInProgress</i> state.
<b>-copyonaccess</b>	Verifies that the copy sessions are in the <i>CopyOnAccess</i> state.
<b>-copyonwrite</b>	Verifies that the copy sessions are in the <i>CopyOnWrite</i> state.
<b>-created</b>	Verifies that the copy sessions are in the <i>Created</i> state.
<b>-precopy</b>	Verifies that the copy sessions are in the <i>Precopy</i> state.
<b>-cycled</b>	Verifies that the copy sessions have completed one precopy cycle. This options requires the <code>-precopy</code> option.
<b>-recreated</b>	Verifies that the copy sessions are in the <i>Recreated</i> state.
<b>-restored</b>	Verifies that the copy sessions are in the <i>Restored</i> state.
<b>-split</b>	Verifies that the copy sessions are in the <i>Split</i> state.

## Examples

**NOTE:** For a multi-clone or concurrent clone device group, specifying the clone on the command line ensures that the verify operation checks the status of the clone. Otherwise, the verify operation checks the status of the standard device, which may no longer be established with the clone that you want to verify.

To return the status of standard device `DEV001` with its last paired clone, enter:

```
symclone -g ProdBgrp verify DEV001
```

To return the status of a specific clone pair (`DEV001` with `DEV005`), enter:

```
symclone -g ProdBgrp verify DEV001 sym ld DEV005
```

To return the status every 30 seconds until all clone pairs in the device group (`ProdBgrp`) or composite group (`MyConGrp`) are in the *Copied* state, enter:

**NOTE:** If no device state qualifier is specified the command checks for the *Copied* state.

```
symclone -g ProdBgrp -i 30 verify
```

```
symclone -cg MyConGrp -i 30 verify
```

Possible return codes at 30-second intervals are zero (code symbol `CLI_C_SUCCESS`) if the verify criteria is met, or one of the return codes if none or not all of the devices meet the verify criteria. Refer to [Return codes for TimeFinder clone copy verify session query](#) on page 32 for return codes.

## Return codes for TimeFinder clone copy verify session query

**Table 4. Return codes for verifying TimeFinder clone copy session**

Options used with Verify command	Code number	Code symbol
<code>-copied</code>	55	<code>CLI_C_NOT_ALL_COPIED</code>



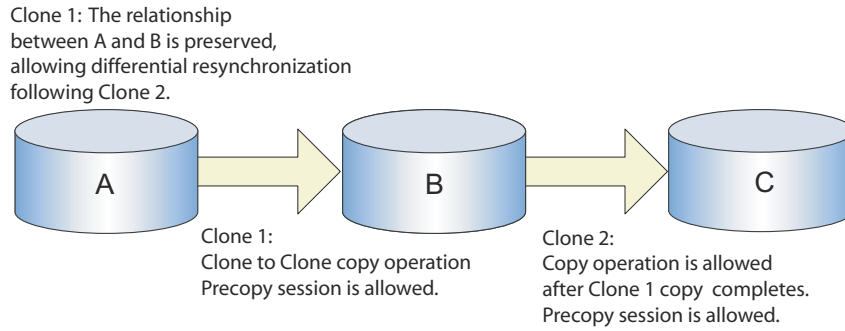
**Table 4. Return codes for verifying TimeFinder clone copy session (continued)**

Options used with Verify command	Code number	Code symbol
-copied	56	CLI_C_NONE_COPIED
-copyinprog	53	CLI_C_NOT_ALL_COPYINPROG
-copyinprog	54	CLI_C_NONE_COPYINPROG
-copyonaccess	57	CLI_C_NOT_ALL_COPYONACCESS
-copyonaccess	58	CLI_C_NONE_COPYONACCESS
-copyonwrite	66	CLI_C_NOT_ALL_COPYONWRITE
-copyonaccess	67	CLI_C_NONE_COPYONWRITE
-created	60	CLI_C_NOT_ALL_CREATED
-created	61	CLI_C_NONE_CREATED
-cycled	75	CLI_C_NOT_ALL_PRECOPY_CYCLED
-cycled	76	CLI_C_NONE_PRECOPY_CYCLED
-precopy	73	CLI_C_NOT_ALL_PRECOPY
-precopy	74	CLI_C_NONE_PRECOPY
-recreated	68	CLI_C_NOT_ALL_RECREATED
-recreated	69	CLI_C_NONE_RECREATED
-restored	12	CLI_C_NOT_ALL_RESTORED
-restored	13	CLI_C_NONE_RESTORED
-split	25	CLI_C_NOT_ALL_SPLIT
-split	26	CLI_C_NONE_SPLIT

## TimeFinder cascaded clone copy session

In environments running Enginuity 5876, the target device of a clone session can be used as the source for one or more clone sessions. This cascading clone capability allows a clone operation to take place with a device that is already involved in a clone operation without ending the first clone session.

As the figure below shows, cascaded sessions are accepted from left to right. This means you can use TimeFinder to clone device A to device B. Then, while the relationship between A and B is preserved, you can clone device B to device C. If you have session A -> B -> C, then session B -> C can only be activated after session A -> B has been activated. Precopy sessions are allowed.



**Figure 2. Clone from clone target (both sessions are cascaded clone)**

Cascaded clone on thin devices is supported in environments running Enginuity 5876.

Incremental restores of clone targets to source devices with active TimeFinder/Snap or VP Snap sessions is supported with Enginuity 5876.159.102 and higher with Solutions Enabler version 7.5 and higher.

Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.

## TimeFinder clone Restore to Target (incremental restore to cascaded clone target)

Restore to Target (RTT) allows you to perform an incremental restore to a cascaded clone target. For example, devices in an A -> B -> C cascaded clone session can copy data from device C to device A (through device B).

## TimeFinder clone Persistent Restore to Target (restore Snap to Clone target)

Persistent Restore to Target (PTT) allows you to perform a TimeFinder/Snap restore to a TimeFinder/Clone target. For example, devices in an A -> B -> C cascaded session (where A -> B is TimeFinder/Clone and B -> C is TimeFinder/Snap) can copy data from device C to device A (via device B).

This operation can be performed without terminating the TimeFinder/Clone session or any existing TimeFinder/Snap sessions off of the TimeFinder/Clone target. PTT is supported in environments running Enginuity 5876.159.102 and higher with Solutions Enabler version 7.5 and higher.

## TimeFinder cascaded clone configuration rules

When using a clone from a clone target, the following rules apply:

- If the session state is *CopyInProgress*, *SyncInProgress* or *RestoreInProgress*, the `-symforce` flag is required.
- The `Recreate` and `incremental clone establish` commands are allowed only on differential sessions.
- The mode `nocopy` can only be set on nondifferential sessions.
- The mode `precopy` can only be set in created and recreated states.
- Enginuity 5876 only allows a 2 hop (device A -> target device B -> target device C) cascaded relationship provided the following interactions rules are followed. Any attempt to establish a 3 hop relationship (D -> C when A -> B -> C or Z -> A when A -> B -> C) will fail. Although circular cascading A -> B -> A is not allowed, devices A and B can have additional multiple targets. For example: A -> B(1) -> C(1) and A -> B(2) and A -> B(3) -> C(2). With two separate clone pairs like A-B and C-D, Enginuity 5876 allows a create, full establish, or full restore between B and C.

The table below lists the configuration rules for using a clone from a clone target. The `terminate` and `cancel` operations are allowed for all session states.

**Table 5. Clone from clone target session states (both sessions are cascaded clone)**

B->C session state	Clone A -> Clone B -> Clone C session state
--------------------	---

**Table 5. Clone from clone target session states (both sessions are cascaded clone) (continued)**

	A→B No session	A→B Created Recreated	A→B Precopy	A→B CopyInProgress CopyOnAccesses CopyOnWrite	A→B Copied Split	A→B RestoreInProgress	A→B Restored
B→C No session	Create A→B Full Establish A→B Full Restore A→B Create B→C Full Establish B→C Full Restore B→C	Activate A→B Set Mode A→B Create B→C	Activate A→B Set Mode A→B Create B→C (precopy)	Recreate A→B Establish A→B Set Mode A→B Create B→C	Recreate A→B Establish A→B Restore A→B Set Mode A→B Create B→C Full Establish B→C	Create B→C Full Establish B→C	Split A→B Create B→C Full Establish B→C Full Restore B→C
B→C Created Recreated	Create A→B (no precopy) Full Establish A→B Full Restore A→B Activate B→C Set Mode B→C	Activate A→B Set Mode A→B (no precopy) Set Mode B→C	Not proper state	Recreate A→B (no precopy) Establish A→B Set Mode A→B (no precopy) Set Mode B→C	Recreate A→B (no precopy) Establish A→B Restore A→B Set Mode A→B (no precopy) Activate B→C Set Mode B→C	Activate B→C Set Mode B→C	Split A→B Activate B→C Set Mode B→C
B→C Precopy	Create A→B Full Establish A→B Full Restore A→B Activate B→C Set Mode B→C	Activate A→B Set Mode A→B Set Mode B→C	Activate A→B Set Mode A→B	Recreate A→B Establish A→B Set Mode A→B Set Mode B→C	Recreate A→B Establish A→B Set Mode A→B Restore A→B Activate B→C Set Mode B→C	Activate B→C Set Mode B→C	Split A→B Activate B→C Set Mode B→C
B→C CopyInProgress CopyOnAccesses CopyOnWrite	Full Restore A→B Recreate B→C Establish B→C Set Mode B→C	Not proper state	Not proper state	Not proper state	Restore A→B Set Mode A→B (no precopy) Recreate B→C Establish B→C Set Mode B→C	Recreate B→C Establish B→C Set Mode B→C	Split A→B Recreate B→C Establish B→C Set Mode B→C

**Table 5. Clone from clone target session states (both sessions are cascaded clone) (continued)**

B→C Copied Split	Create A→B Full Establish A→B Full Restore A→B Recreate B→C Establish B→C Restore B→C Set Mode B→C	Activate A→B Set Mode A→B Recreate B→C Set Mode B→C	Activate A→B Set Mode A→B Recreate B→C (precopy) Set Mode B→C	Recreate A→B Establish A→B Set Mode A→B Recreate B→C Set Mode B→C	Recreate A→B Establish AB Restore A→B Set Mode A→B Recreate B→C Establish B→C Set Mode B→C Incr. Restore B→C	Recreate B→C Establish B→C	Split A→B Recreate B→C Establish B→C Restore B→C
B→C RestoreInProg		Not proper state	Not proper state	Not proper state	Not proper state	Not proper state	
B→C Restored	Full Restore A→B Split B→C	Not proper state	Not proper state	Not proper state	Split B→C Incr. Restore B→C	Split B→C	Split B→C

## Cascaded clone with VP Snap

Cascaded clone is supported with VP Snap with the following restrictions:

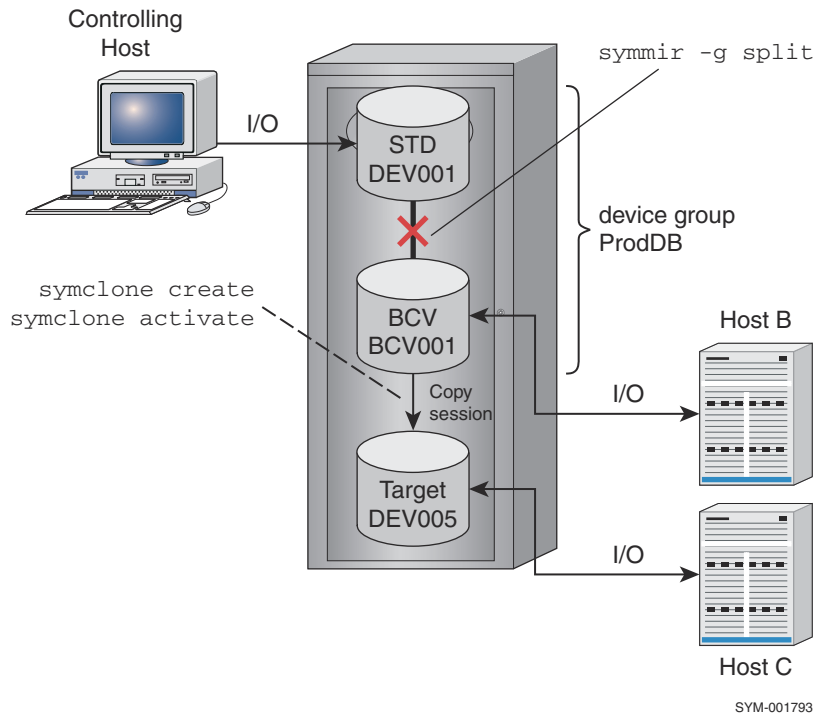
- Clone sessions must be in the *Copied* or *Split* state before you can create a VP Snap session from the target device.
- Incremental restore of VP Snap sessions is not permitted.
- The clone session must exist before the target device is used as a VP Snap source. Creating a clone session using a VP Snap source as the target device is not permitted.
- The target of a VP Snap session cannot be used as the source for any other clone or snap session.
- VP Snap is not supported with Clone Emulation mode.

## VP Snap Restore to Target

VP Snap Restore to Target (VRTT) allows you to perform a VP Snap restore to a TimeFinder/Clone target. For example, devices in an A -> B -> C cascaded session (where A -> B is TimeFinder/Clone and B -> C is VP Snap) can copy data from device C to device A (via device B). VRTT is supported in environments running Engenuity 5876.159.102 with Solutions Enabler version 7.5.

## Using a BCV as the clone source

As [Creating a TimeFinder/Clone from a BCV source](#) on page 37 shows, you can create a copy session between a BCV device and a target device. The controlling host performs I/O to the standard device that is established with a BCV as part of a BCV pair. At some point, when the BCV is synchronized with the standard device, you can split the BCV from the standard and create a copy session between the BCV and a target device that might be accessed by Host C. The split operation must be entirely complete, including the background phase, before you can create a copy session on it.



**Figure 3. Creating a TimeFinder/Clone from a BCV source**

For additional information on using the `symmir` command and how to perform an instant split operation, refer to [TimeFinder/Mirror Operations](#) on page 94.

## Pair states ruling clone operations

Because various other ongoing operations can conflict with a clone session, certain rules must be considered. The availability of some clone copy operations depends on the current state of SRDF and BCV pairs. The following rules apply to certain BCV pair states:

- If the source or target of a `symclone create` or `activate` operation is a BCV, the BCV pair state must be split. The split must be totally complete before the operation is allowed.
- Available with Enginuity 5876, a source device A to a target device B (BCV device) clone session is in Emulation Mode state and the source device B to target device C is a clone session.
- A TimeFinder standard device cannot be created or activated in a clone session if the BCV pair state is *SplitBfrRest* or *RestInProg*.
- The `symclone terminate` command is allowed for all TimeFinder pair states.

### **NOTE:**

[TimeFinder State Rules Reference](#) on page 160 explains the TimeFinder pair states that apply to TimeFinder/Clone copy sessions. [State rules for TimeFinder/Clone operations](#) on page 196 contains specific information regarding possible SRDF pair state conflicts.

## Example: Creating a clone from a source device

### About this task

The following example creates a copy session between source device **BCV001** in device group `ProdDB` and target device `DEV005` on the same array.

Once the copy session is activated, Host C can access target device tracks. If the accessed target tracks have not yet been copied, Enginuity software copies them for immediate access for Host C. If Host B writes to BCV device tracks that have not yet been copied, the Enginuity software immediately copies the tracks before allowing new data to overwrite those BCV tracks.

### **NOTE:**

In this example, where multiple hosts have access to the BCV source, consider using the `-not_ready` option with the `split` command to make the BCV not ready. This keeps the same data on the BCV and clone. If you decide to use this option, you may need to release any Not Ready state imposed on any devices once the session completes.

The following steps outline the example shown in [Creating a TimeFinder/Clone from a BCV source](#) on page 37:

### Steps

1. Perform an instant split on the BCV pair. Use the `-not_ready` option to prevent the BCV's host from writing to it prior to the clone operation:

```
symmir -g ProdDB split DEV001 -not_ready -noprompt
```

2. Verify that the background split is complete. The following command does a check every 5 seconds:

```
symmir -g ProdDB verify DEV001 -split -bg -i 30
```

3. Begin a copy session between the BCV source device **BCV001** and the standard target device **DEV005**:

```
symclone -g ProdDB create BCV001 sym ld DEV005
```

4. Activate the copy session to Host C:

```
symclone -g ProdDB activate BCV001 sym ld DEV005
```

5. Make the BCV device ready to its host:

```
symdg -g ProdDB ready -bcv BCV001 -noprompt
```

6. Query the state of the copy session and verify the CopyInProg state:

```
symclone -g ProdDB query
```

```
symclone -g ProdDB verify BCV001 -copyinprog
```

7. When the application has finished accessing the data, the copy session and pair relationship can be terminated:

```
symclone -g ProdDB terminate BCV001 sym ld DEV005 -noprompt
```

8. Incrementally reestablish the BCV pair:

```
symmir -g ProdDB establish DEV001 -noprompt
```

## Creating multiple clone copies from a standard device

[Creating multiple clone copies from a standard device](#) on page 39 illustrates creating multiple clone copies from a standard source device **DEV001** on four standard target devices (**DEV005**, **DEV006**, **DEV007**, and **DEV008**) with various hosts accessing them.

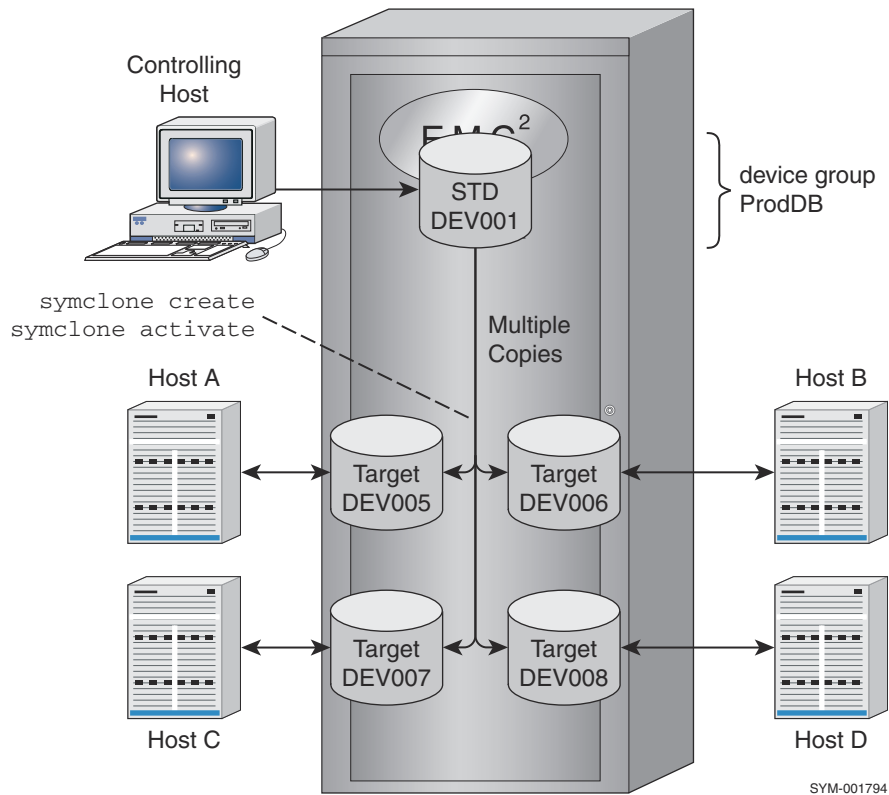


Figure 4. Creating multiple clone copies from a standard device

**NOTE:**

A separate copy session must be created between the source device (**DEV001**) and each target device (**DEV005**, **DEV006**, **DEV007**, and **DEV008**).

## Cloning a copy on a remote array

This section explains how to use SRDF to clone devices on a remote array.

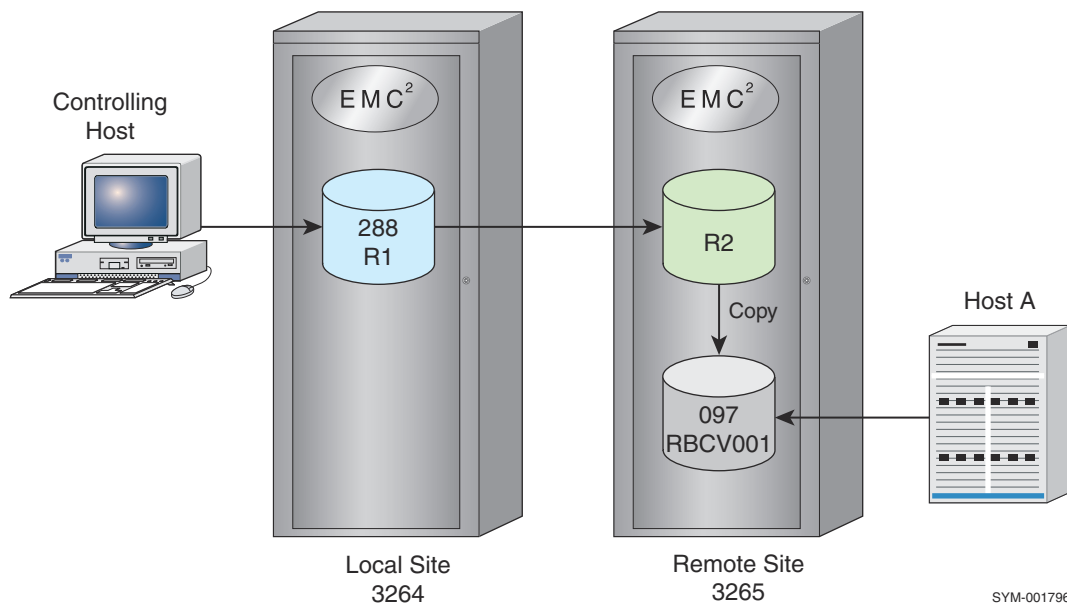
**NOTE:**

Refer to the *EMC Solutions Enabler SRDF Family Version CLI User Guide* for details about which SRDF features are supported with your platform.

## Cloning a local R1 standard device

**About this task**

[Cloning a copy of a local R1 standard device on a remote array](#) on page 40 illustrates how to clone a copy of a local R1 standard device on a remote array. Performing SYMCLI commands from the controlling host allows the remote target device to receive a copy of the data from the R2 device. The cloned data can be accessed by the remote host.



**Figure 5. Cloning a copy of a local R1 standard device on a remote array**

The following steps outline the example shown in [Cloning a copy of a local R1 standard device on a remote array](#) on page 40:

### Steps

1. Create an RDF1 type device group:

```
symdg create Rdf1Grp -type rdf1
```

2. Add to the device group an R1 standard device (288) on the local array (sid 3264) to be the source device. Associate a target BCV device (097) on the remote array to hold the clone copy. Note that to perform a remote operation you will need to use a remote target list (RTGT or RBCV list). This example uses an RBCV list.

```
symdg -g Rdf1Grp -sid 3264 add dev 288
```

```
symbcv -g Rdf1Grp associate dev 097 -rdf
```

3. Clone an immediate full copy from the source device (DEV001) to the remote BCV target device (RBCV001). DEV001 is the logical device name for device 288, and RBCV001 is the logical device name for BCV 097:

```
symclone -g Rdf1Grp establish -full DEV001 bcv ld RBCV001 -rdf
```

4. To query the progress of the clone operation or verify when the copy is completed, issue the following commands that examine the clone pair (source and target):

```
symclone -g Rdf1Grp query -rdf
```

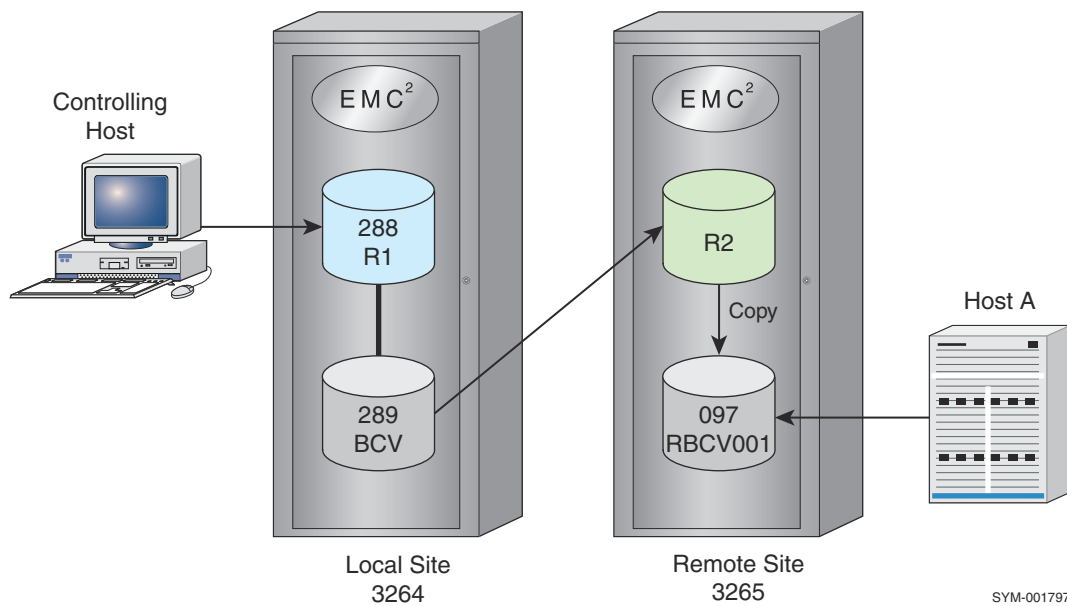
```
symclone -g Rdf1Grp verify -copied -rdf
```

## Cloning a copy of a local BCV device on a remote array

### About this task

[Cloning a copy of a local BCV device on a remote array](#) on page 41 illustrates how to clone a copy of a local BCV device on a remote array. Performing SYMCLI commands from the controlling host allows the remote target device to receive a copy of the data from the R2 device. The cloned data can be accessed by remote Host A.





**Figure 6. Cloning a copy of a local BCV device on a remote array**

The following steps outline the example shown in [Cloning a copy of a local BCV device on a remote array](#) on page 41:

### Steps

1. Create an RDF1 type device group:

```
symdmg create Rdf1Grp -type rdf1
```

2. Add to the device group a BCV device (289) on the local array (`-sid 3264`) to be the source device. Associate a target BCV device (289) on the local array. Associate a target BCV device (097) on the remote array to hold the clone copy. In this case, the remote target device must be a BCV:

```
symdmg -g Rdf1Grp -sid 3264 add dev 288
```

```
symbcv -g Rdf1Grp -sid 3264 associate dev 289 -rdf
```

```
symbcv -g Rdf1Grp associate dev 097 -rdf
```

3. Clone an immediate full copy from the BCV device (BCV001) to the remote BCV target device (RBCV001). DEV001 is the logical device name for device 288, and RBCV001 is the logical device name for BCV 097:

```
symclone -g Rdf1Grp establish -full BCV001 bcv ld RBCV001 -rdf -bcv
```

4. To query the progress of the clone operation or verify when the copy is completed, issue the following commands that examine the clone pair (source and target):

```
symclone -g Rdf1Grp query -rdf -bcv
```

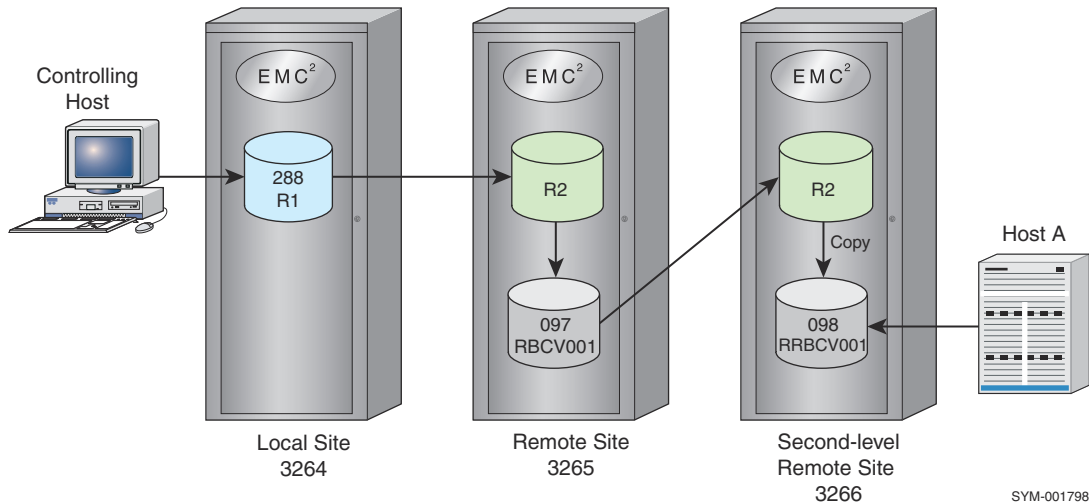
```
symclone -g Rdf1Grp verify -copied -rdf -bcv
```

## Cloning a copy on a hop-2 array

### About this task

[Cloning a copy of a local R1 standard device on a Hop-2 array](#) on page 42 illustrates how to clone a copy of a local R1 standard device on a remote array in the second level of a multihop environment. Performing SYMCLI commands from the controlling

host allows the remote target device to receive a copy of the data from the R2 device. The cloned data can be accessed by remote Host A.



**Figure 7. Cloning a copy of a local R1 standard device on a Hop-2 array**

The following steps outline the example shown in [Cloning a copy of a local R1 standard device on a Hop-2 array](#) on page 42:

### Steps

1. Create an RDF1 type device group:

```
symdg create Rdf1Grp -type rdf1
```

2. Add to the device group an R1 standard device (288) on the local array (-sid 3264) to be the source device. Associate a BCV device (097) on the Hop-1 array. Associate a BCV device (098) on the second-level (Hop-2) remote array to hold the clone copy. To perform a remote operation, you must use a remote target list (RTGT or RBCV list). Our example uses an RBCV list:

```
symdg -g Rdf1Grp -sid 3264 add dev 288
```

```
symbcv -g Rdf1Grp associate dev 097 -rdf
```

```
symbcv -g RDF1GRP associate dev 098 -rrdf
```

3. Clone an immediate full copy from the source device (DEV001) to the remote BCV target device (RRBCV001). DEV001 is the logical device name for device 288, and RRBCV001 is the logical device name for BCV 098:

```
symclone -g Rdf1Grp establish -full RBCV001 bcv ld RRBCV001 -rrbcv
```

Instead of specifying the device level, you can also specify the device group:

```
symclone -g Rdf1Grp establish -full -rrbcv
```

4. To query the progress of the clone operation or verify when the copy is completed, you can issue the following commands that examine the clone pair (source and target):

```
symclone -g Rdf1Grp query -rrbcv
```

```
symclone -g Rdf1Grp verify -copied -rrbcv
```

# Cloning copies of the same data locally and remotely

## About this task

Copies of the same data can be cloned to devices on a local and remote array at the same time so that their target devices have the same originator data.

Note that in the examples that follow, the procedures are very similar. The only differences are the device types used for the local copy (local target and local BCV target) and the command arguments used for the respective device type.

Example 1

Cloning copies of a local R1 standard to a local target and to a remote BCV target on page 43 illustrates how you can clone copies of a local R1 standard device to a local target device and to a remote BCV target device on a remote array.

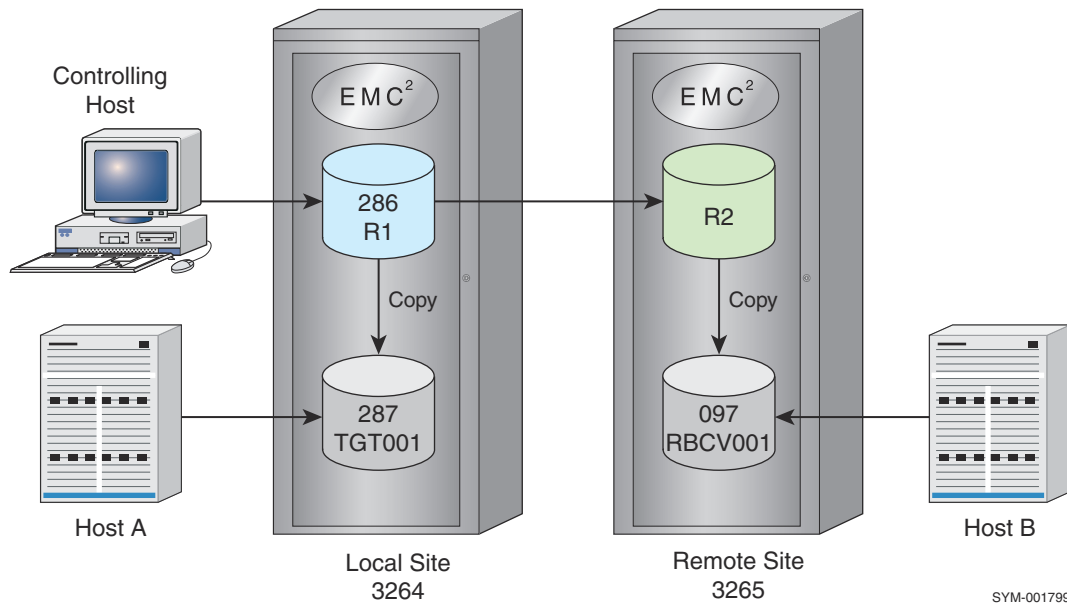


Figure 8. Cloning copies of a local R1 standard to a local target and to a remote BCV target

## Steps

1. Create an RDF1 type device group:

```
symdg create Rdf1Grp -type rdf1
```

2. Add to the device group an R1 standard device (286) on the local array (-sid 3264) to be the source device. Add a standard device target (287) on the local array. Associate a remote BCV target (097) on the remote array. To perform a remote operation, you must use a remote target list (RTGT or RBCV list). This example uses an RBCV list:

```
symdg -g Rdf1Grp -sid 3264 add dev 286
```

```
symdg -g Rdf1Grp -sid 3264 add dev 287
```

```
symbcv -g Rdf1Grp associate dev 097 -rdf
```

3. Clone an immediate full copy from the source device (DEV001) to the local and remote target devices (DEV002 and RBCV001, respectively). If there is no I/O to the source R1 device between these two commands, the same data will exist on both the local and remote target devices:

```
symclone -g Rdf1Grp establish -full
```

```
symclone -g Rdf1Grp establish -full -rdf
```

- To query the progress of the local clone operation or verify when the local copy is completed, you can issue the following commands that examine the local cloned pair (source and target):

```
symclone -g Rdf1Grp query
```

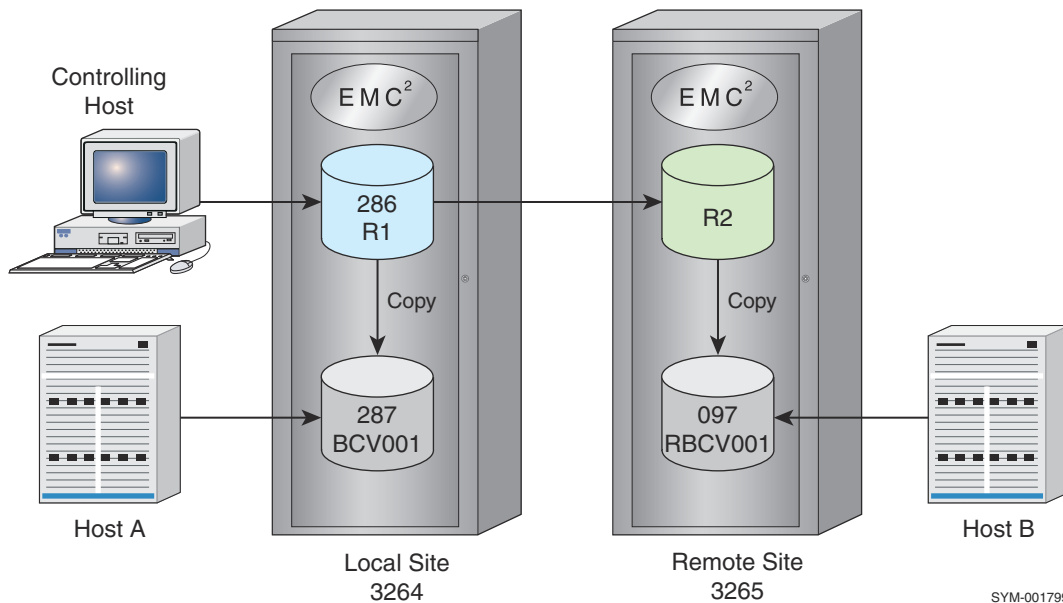
```
symclone -g Rdf1Grp verify -copied
```

- To query the progress of the remote clone operation or verify when the remote copy is completed, you can issue the following commands:

```
symclone -g Rdf1Grp query -rdf
```

```
symclone -g Rdf1Grp verify -copied -rdf
```

Cloning copies of a local device to a local BCV target and to a remote BCV target on page 44 illustrates how to clone copies of a local R1 standard device to a local BCV target device and to a BCV target device on a remote array.



**Figure 9. Cloning copies of a local device to a local BCV target and to a remote BCV target**

- Create an RDF1 type device group:

```
symdmg create Rdf1Grp -type rdf1
```

- Add to the device group an R1 standard device (286) on the local array (`-sid 3264`) to be the source device. Add a BCV target (287) on the local array. Associate a remote BCV target (097) on the remote array. To perform a remote operation, you must use a remote target list (RTGT or RBCV list). This example uses an RBCV list:

```
symdmg -g Rdf1Grp -sid 3264 add dev 286
```

```
symdmg -g Rdf1Grp -sid 3264 add dev 287 -tgt
```

```
symbcv -g Rdf1Grp associate dev 097 -rdf
```

- Clone an immediate full copy from the source device (DEV001) to the local and remote target devices (BCV001 and RBCV001, respectively). If there is no I/O to the source R1 device between these two commands, the same data will exist on both the local and remote target devices:

```
symclone -g Rdf1Grp establish -full -tgt
```

```
symclone -g Rdf1Grp establish -full -rdf
```

- To query the progress of the local clone operation or verify when the local copy is completed, you can issue the following commands that examine the local cloned pair (source and target):

```
symclone -g Rdf1Grp query
```

```
symclone -g Rdf1Grp verify -copied
```

- To query the progress of the remote clone operation or verify when the remote copy is completed, you can issue the following commands:

```
symclone -g Rdf1Grp query -rdf
```

```
symclone -g Rdf1Grp verify -copied -rdf
```

## Cloning multiple copies locally and remotely

Multiple copies of the same data can be cloned to devices on a local and remote array at the same time so that their target devices have the same originator data.

The configuration in [Cloning multiple copies on local and remote arrays](#) on page 45 is basically the same as the configuration in [Cloning copies of a local R1 standard to a local target and to a remote BCV target](#) on page 43 and [Cloning copies of a local device to a local BCV target and to a remote BCV target](#) on page 44 except that this configuration uses a single symclone command to clone copies from a source device to four target devices on each array instead of cloning copies to one target on each array. In this configuration, eight hosts have access to copies of the same target data.

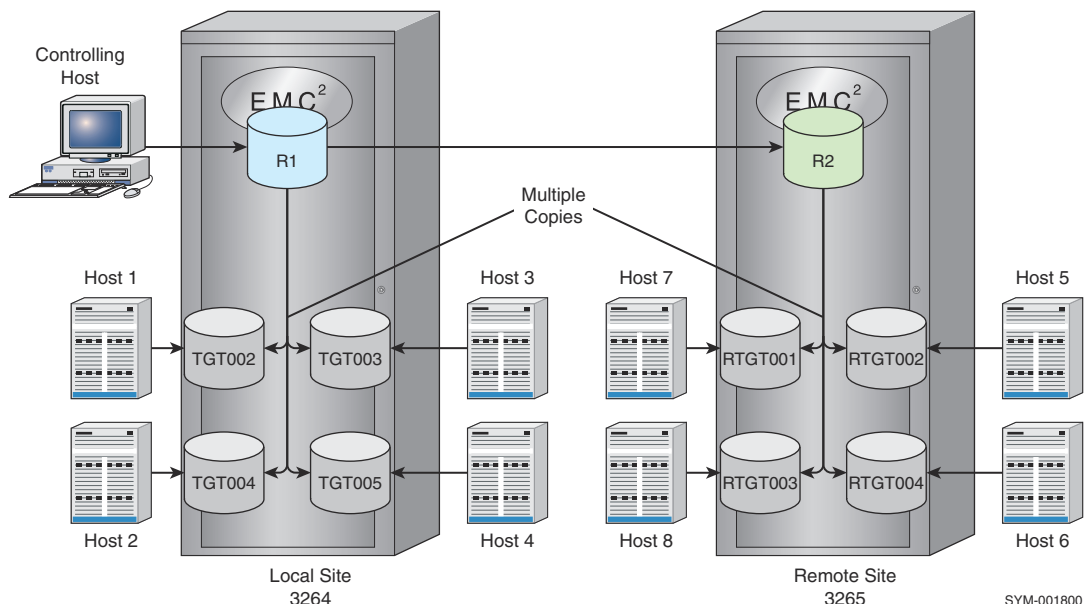


Figure 10. Cloning multiple copies on local and remote arrays

The process for building an RDF1 type device group is similar to the previous section. To add a source standard R1 device, a range of four standard device targets from the local array, and a range of four targets from the remote array:

```
symdmg -g Rdf1Grp -sid 3264 add dev 100
```

```
symdmg -g Rdf1Grp addall -devs 101:104 -tgt -sid 3264
```

```
symdmg -g Rdf1Grp addall -devs 214:218 -rdf -tgt -sid 3265
```

What is different about this configuration is the cloning of copies from a single source to multiple target devices. To clone the four local target devices (TGT002, TGT003, TGT004, and TGT005) from the local source device (DEV001), you need to issue four symclone establish commands, specifying the same source device with each of the four targets:

```
symclone -g Rdf1Grp establish -full DEV001 sym ld TGT002
```

```
symclone -g Rdf1Grp establish -full DEV001 sym ld TGT003
```

```
symclone -g Rdf1Grp establish -full DEV001 sym ld TGT004
```

```
symclone -g Rdf1Grp establish -full DEV001 sym ld TGT005
```

To display the progress of all devices involved in the local clone operation, perform a clone query with the `-multi` option:

```
symclone -g Rdf1Grp query -multi
```

To verify the clone completion of one or more clone pairs in the device group specifically, or all clone devices, enter:

```
symclone -g Rdf1Grp verify -copied DEV001 sym ld DEV002
```

```
symclone -g Rdf1Grp verify -copied
```

To clone the four remote target devices (RTGT001, RTGT002, RTGT003, and RTGT004) from the source device (DEV001), issue four symclone establish commands with the `-rdf` option:

```
symclone -g Rdf1Grp establish -full -rdf DEV001 bcv ld RTGT001
```

```
symclone -g Rdf1Grp establish -full -rdf DEV001 bcv ld RTGT002
```

```
symclone -g Rdf1Grp establish -full -rdf DEV001 bcv ld RTGT003
```

```
symclone -g Rdf1Grp establish -full -rdf DEV001 bcv ld RTGT004
```

To display the progress of all devices involved in the remote clone operation, perform a clone query with the `-multi` option and the `-rdf` option:

```
symclone -g Rdf1Grp query -multi -rdf
```

To verify the clone completion of one or more remote clone pairs in the device group specifically, or all remote clone devices, add the `-rdf` option:

```
symclone -g Rdf1Grp verify -copied -rdf DEV001 sym ld RTGT004
```

```
symclone -g Rdf1Grp verify -copied -rdf
```

# Cloning a copy at the tertiary site of a cascaded SRDF configuration

## About this task

Using SRDF technology and the TimeFinder hop2 flag (-hop2 option), you can clone devices on an array located at the tertiary site of a cascaded SRDF configuration ([Cloning a copy at the tertiary site of a cascaded SRDF configuration](#) on page 47). Performing SYMCLI commands from the controlling host allows the tertiary target device to receive a copy of the data from the R2 device. The cloned data can be accessed by remote Host A.

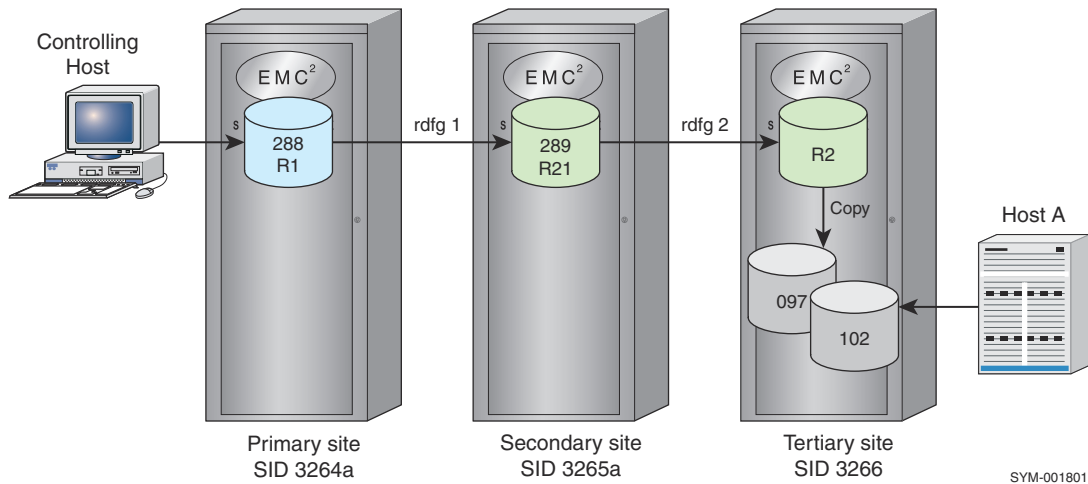


Figure 11. Cloning a copy at the tertiary site of a cascaded SRDF configuration

The following steps outline an example of cloning devices on an array located at the tertiary site of a cascaded SRDF configuration:

### **NOTE:**

The following procedure provides examples of device group and composite group commands.

## Steps

1. Create an RDF1-type device group or composite group (for example, a group named Rdf1Grp):

To create an RDF1-type device group:

```
symdg create Rdf1Grp -type rdf1
```

To create an RDF1-type composite group:

```
symcg create Rdf1Grp -type rdf1
```

2. Add devices to the group. From the primary site array, add an R1 standard device to be the source device. From the tertiary site array, add a target BCV device (097) to hold the clone copy:

To add devices to a device group:

```
symdg -g Rdf1Grp -sid 3264 add dev 288
```

```
symbcv -g Rdf1Grp -hop2 -rdfg 1 -remote_rdfg 2 add dev 097
```

To add devices to a composite group:

```
symcg -cg Rdf1Grp -sid 3264 add dev 288
```

```
symbcv -cg Rdf1Grp -sid 3264 -hop2 -rdfg 1 -remote_rdfg 2 add dev 097
```

To add target devices to a device group using the `-tgt` option:

```
symdg -g Rdf1Grp -hop2 -rdfg 1 -remote_rdfg 2 -tgt add dev 102
```

To add devices to a composite group using the `-tgt` option:

```
symbcv -cg Rdf1Grp -sid 3264 -hop2 -rdfg 1 -remote_rdfg 2 -tgt add dev 102
```

3. Clone an immediate full copy from the source device to the remote BCV target device:

```
symclone -g Rdf1Grp -hop2 create -precopy
```

Or, you can use the `-tgt` option:

```
symclone -g RdfGrp1 -hop2 create -precopy -tgt
```

4. To query the progress of the clone operation or verify when the copy is completed, you can issue the following commands that examine the clone pair (source and target):

```
symclone -g Rdf1Grp query -hop2
```

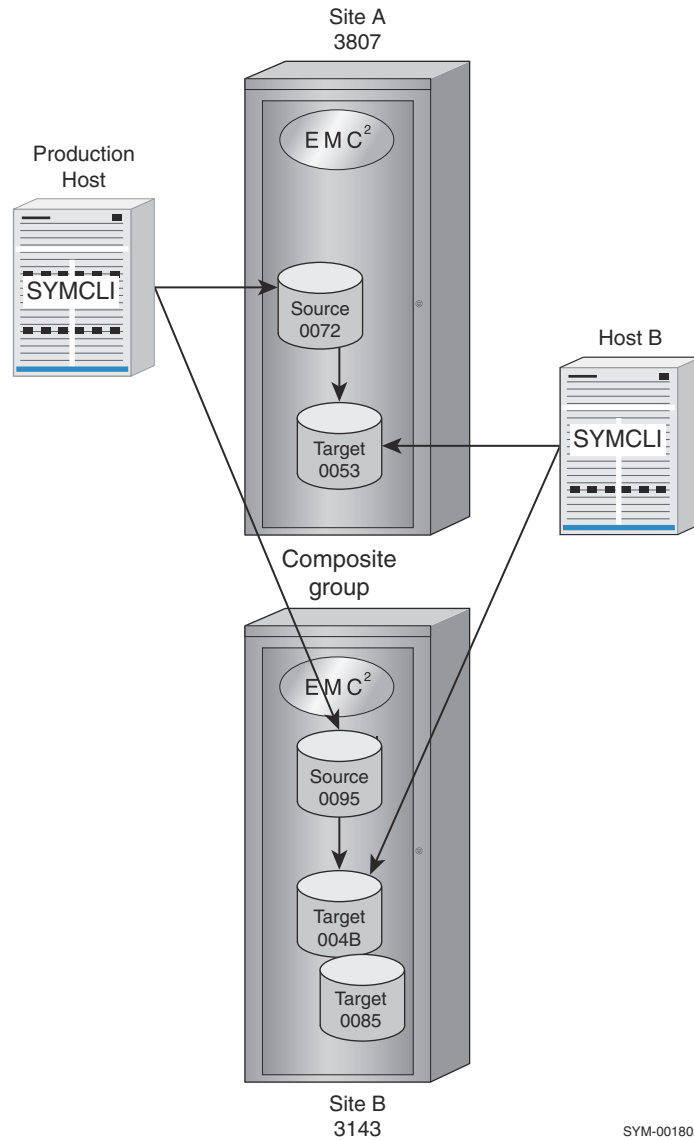
```
symclone -g Rdf1Grp verify -copied -hop2
```

## Using composite groups to manage clone pairs across arrays

### About this task

[Using a composite group when a set of devices spans two arrays](#) on page 49 shows a production host locally connected to two arrays (A and B). A composite group is defined on the production host and includes source devices and target devices from each array. The target devices can be standard devices or BCV devices. Another locally connected host allows access to the clone targets.





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**Figure 12. Using a composite group when a set of devices spans two arrays**

Although clone copy operations might normally be performed from the production host ([Using a composite group when a set of devices spans two arrays](#) on page 49) because the composite group is defined there in its SYMAPI database, there are methods that would allow you to control clone operations from another locally connected host like the target host. One way is to copy the composite group definition to another host. A more efficient method is to enable Group Naming Services (GNS), which automatically propagates the composite group definition to the arrays and other locally attached hosts that are running the GNS daemon.

The following steps explain how to setup a composite group that spans two arrays as shown in [Using a composite group when a set of devices spans two arrays](#) on page 49:

### Steps

1. From the production host, create a Regular type composite group (for example, MyGrp):

```
symcg create MyGrp -type regular
```

2. Add to the composite group those standard devices on array A (3087) and array B (3143) that are the source devices:

```
symcg -cg MyGrp -sid 3087 add dev 0072
```

```
symcg -cg MyGrp -sid 3143 add dev 0095
```

3. Associate a BCV target device from each array with the composite group:

```
symbcv -cg MyGrp -sid 3087 associate dev 0053
```

4. Create clone pair sessions from those devices in the composite group:

```
symclone -cg MyGrp create
```

5. Activate these clone pair sessions:

```
symclone -cg MyGrp activate
```

Once you have setup the composite group, you can control specific clone pairs within it, as long as the devices reside in the same array. To create and activate only the DEV001 and DEV002 clone pair from all devices in the group:

```
symclone -cg MyGrp create DEV001 sym ld DEV002
```

```
symclone -cg MyGrp activate DEV001 sym ld DEV002
```

Or using the one-step method:

```
symclone -cg MyGrp establish -full DEV001 sym ld DEV002
```

## Command options with device groups

[symclone -g control arguments and possible options](#) on page 50 lists the **symclone** control operations and the possible options to use when targeting a specified device group.

**Table 6. symclone -g control arguments and possible options**

Option	Argument action										
	create	activate	establis h -full	establis h	recreat e	split	restore -full	restore	termina te	query	verify
-bcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-both_s ides		Y	Y	Y							
-c, -i	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-concur rent	Y	Y	Y	Y	Y						Y
-consis tent		Y	Y	Y							

**Table 6. symclone -g control arguments and possible options (continued)**

Option	Argument action										
	create	activate	establis h -full	establis h	recreat e	split	restore -full	restore	termina te	query	verify
-copied											Y
-copy	Y										
-copyin prog											Y
-copyon access											Y
-copyon write											Y
-create d											Y
-cycled											Y
-differ ential	Y										
-exact	Y		Y				Y	Y			
-force	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
-hop2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-multi										Y	
-noprom pt	Y	Y	Y	Y	Y	Y	Y	Y	Y		
-not_re ady		Y	Y	Y			Y	Y			
-offlin e										Y	Y
-opt	Y		Y								
-preact ion,		Y	Y	Y							

**Table 6. symclone -g control arguments and possible options (continued)**

Option	Argument action											
	create	activate	establis h -full	establis h	recreat e	split	restore -full	restore	termina te	query	verify	
-postaction												
-precopy	Y				Y							Y
-preserve tlocks, -lockid	Y	Y	Y	Y	Y	Y	Y	Y	Y			
-rbcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-rrbcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-rdf	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-recreated												Y
-restored												Y
-restin prog												Y
-skip	Y	Y			Y	Y			Y			
-split												Y
-star	Y	Y	Y	Y	Y	Y	Y	Y	Y			
-summary										Y		Y
-symforce									Y			
-tgt	Y	Y	Y	Y	Y	Y	Y	Y	Y			
-v	Y	Y	Y	Y	Y	Y	Y	Y	Y			

# Command options with composite groups

`symclone -cg` control arguments and possible options on page 53 lists the `symclone` control operations and the possible options to use when targeting a specified composite group.

**Table 7. `symclone -cg` control arguments and possible options**

Option	Argument action									
	create	activate	establish -full	establish	recreate	restore -full	restore	terminat e	query	verify
-bcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-both_sides		Y	Y	Y						
-c, -i	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-concurrent	Y	Y	Y	Y	Y					Y
-consistent		Y	Y	Y						
-copied										Y
-copy	Y									
-copyinprog										Y
-copyonaccess										Y
-copyonwrite										Y
-created										Y
-cycled										Y
-differential	Y									
-exact	Y		Y			Y	Y			
-force	Y	Y	Y	Y	Y	Y	Y	Y		
-hop2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-multi									Y	

**Table 7. symclone -cg control arguments and possible options (continued)**

Option	Argument action									
	create	activate	establish -full	establish	recreate	restore -full	restore	terminat e	query	verify
-nopr mpt	Y	Y	Y	Y	Y	Y	Y	Y		
-not_rea dy		Y	Y	Y		Y	Y			
-offline									Y	Y
-opt	Y		Y							
-opt_rag	Y		Y							
-preacti on, - postacti on		Y	Y	Y						
-precopy	Y				Y					Y
-preserv etgtloc ks, - lockid	Y	Y	Y	Y	Y	Y	Y	Y		
-rbcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-rrbcv	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-rdf	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
-recreat ed										Y
-restinp rog										Y
-restore d										Y
-skip	Y	Y						Y		
-star	Y	Y	Y	Y	Y	Y	Y	Y		
-split										Y

**Table 7. symclone -cg control arguments and possible options (continued)**

Option	Argument action									
	create	activate	establish -full	establish	recreate	restore -full	restore	terminat e	query	verify
-summary									Y	Y
-symforce								Y		
-tgt	Y	Y	Y	Y	Y	Y	Y	Y		
-v	Y	Y	Y	Y	Y	Y	Y	Y		

## Command options with device files

[symclone -file control arguments and possible options](#) on page 55 lists the **symclone** control operations and the possible options to use when targeting device pairs specified in a device file of a given array.

**Table 8. symclone -file control arguments and possible options**

Option	Argument Action								
	create	activate	establish	recreate	restore	terminate	query	verify	
-both_sides		Y	Y						
-c, -i	Y	Y	Y		Y	Y	Y	Y	
-consistent		Y	Y						
-copied								Y	
-copy	Y								
-copyinprog								Y	
-copyonaccess								Y	
-copyonwrite								Y	
-created								Y	
-cycled								Y	
-differential	Y								

**Table 8. symclone -file control arguments and possible options (continued)**

Option	Argument Action							
	create	activate	establish	recreate	restore	terminate	query	verify
-exact			Y					
-force	Y	Y	Y	Y	Y	Y		
-multi							Y	
-noprompt	Y	Y	Y	Y	Y	Y		
-not_read y		Y	Y		Y			
-preaction, -postaction		Y	Y					
-precopy	Y			Y				Y
-preserve tgtlocks, -lockid	Y	Y	Y	Y	Y	Y		
-recreated								Y
-restinprog								Y
-restored								Y
-sid	Y	Y	Y	Y	Y	Y	Y	Y
-skip	Y	Y				Y		
-star	Y	Y	Y	Y	Y	Y		
-split								Y
-summary							Y	Y
-symforce						Y		
-v	Y	Y	Y	Y	Y	Y		



# TimeFinder/Snap Operations

This chapter describes how to control copy sessions for virtual devices using the SYMCLI **symsnap** command.

## Topics:

- TimeFinder/Snap overview
- Creating a virtual copy session
- Activating a virtual copy session
- Recreating a virtual copy session (Enginuity 5876)
- Restoring data from virtual devices
- Terminating a virtual copy session
- Querying snap pairs
- Verifying snap pair states
- Using a BCV as the snap source
- Creating multiple virtual copies
- Attaching source and target virtual devices
- Using composite groups to manage snap pairs across arrays
- Snapping a copy on a remote array
- Snapping a copy from a remote BCV
- Snapping copies of a source device's data locally and remotely
- Snapping multiple copies
- Snapping a copy at the tertiary site of a cascaded SRDF configuration
- Snapping a copy from a clone target device
- Command options with device groups or composite groups
- Command options with device files

## TimeFinder/Snap overview

For a high-level overview of TimeFinder/Snap functionality, refer to the *EMC Symmetrix TimeFinder Product Guide*.

### NOTE:

TimeFinder/Snap is not supported on the VMAX 10K platform. Refer to your product guide for details about supported features.

Snap operations are controlled from the host by using the **symsnap** command to **create**, **activate**, **terminate**, and **restore** the snap copy sessions. The snap operations described in this chapter explain how to manage the devices participating in a copy session using the SYMCLI.

### NOTE:

Data domain devices are not supported as TimeFinder/Snap source or target devices.

[Copy of a standard device to a virtual device \(VDEV\)](#) on page 58 illustrates a virtual copy session where the controlling host creates a copy of standard device **DEV001** on target device **VDEV005**.

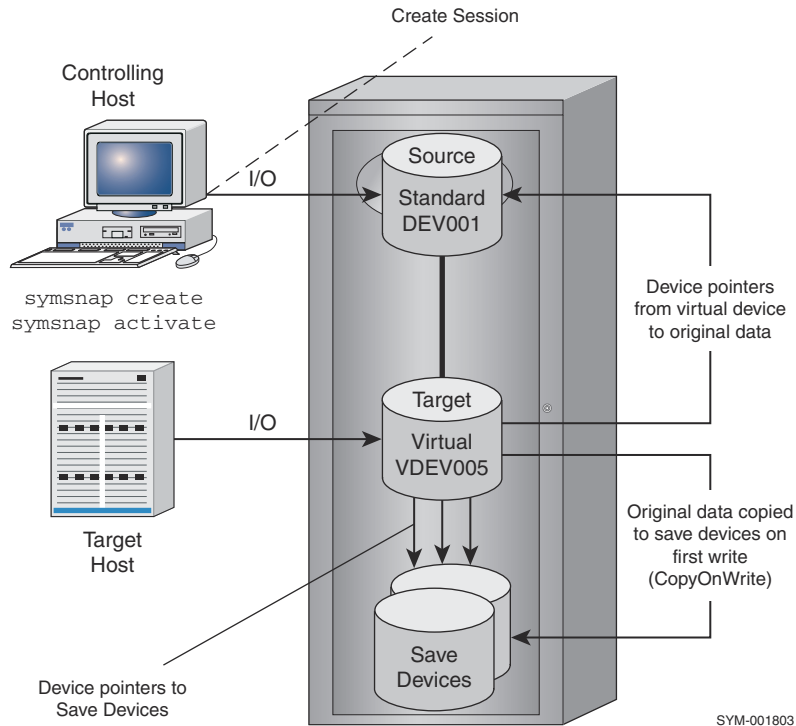


Figure 13. Copy of a standard device to a virtual device (VDEV)

## Creating a virtual copy session

Initially, you must create a virtual copy session that defines and sets up the snap devices you have selected for the snap operation. For example, to begin a copy session and define a specified target device `VDEV005` to be the copy of source device `DEV001` in group `ProdDB`, enter:

```
symsnap -g ProdDB create DEV001 vdev ld VDEV005
```

The **symsnap create** action defines the copy session requirements and sets the track protection bitmap on the source device to protect all tracks and detect which tracks are being accessed by the target host or written to by the source host. The target virtual device remains Not Ready to its host and placed on hold status for copy session usage.

This prevents other control operations from using the device. The device pair state will transition from `CreateInProg` to `Created` when complete. The virtual data becomes accessible to its host when the copy session is activated. Refer to [Activating a virtual copy session](#) on page 60 for more information.

[Copy Session Limits](#) on page 16 provides details about the number of virtual copy sessions that you can create.

## Multivirtual snaps

With multivirtual snaps enabled, Solutions Enabler supports up to 128 snaps from a source device. This support requires that you enable the following SYMCLI environment variable:

```
SYMCLI_MULTI_VIRTUAL_SNAP = ENABLED
```

### **i** NOTE:

TimeFinder/Snap sessions on VMAX 40K systems always use multi-virtual mode regardless of how this variable is set.

This setting appears in the snap device output from **symdev show**. The Snap State Flags value will be *MultiVirtual*.

A single source device can only have snaps of one type.

The SYMCLI Auto Terminate policy does not apply to multivirtual snaps. Even if the SYMCLI\_SNAP\_PAIR\_POLICY environment variable is set to TERM\_OLDEST, you cannot create a new multivirtual snap session after the maximum number of sessions has been reached.

**NOTE:**

Starting with Enginuity 5876.159.102, multivirtual snap operations are supported with CKD devices. Snap **recreate** for multivirtual snap operations is supported in environments running Enginuity 5876.

## Specifying a SAVE device pool

VMAX supports the creation of multiple named SAVE device pools, allowing **symsnap** commands to use a particular pool.

The **-svp** option can be used with the **create** action to specify which SAVE device pool to use for an operation. For example, to instruct the copy session created in the example on [Creating a virtual copy session](#) on page 58 to use the SAVE device pool **Accounting**, use the following **symsnap** command:

```
symsnap -g ProdDB create DEV001 vdev ld VDEV005 -svp Accounting
```

**NOTE:**

The specified pool must exist and contain at least one enabled device before creating the copy session.

In addition to the **-svp** option, you can also set the environment variable SYMCLI\_SVP to a poolname to be used when **-svp** is not present in the command line. If **-svp** and SYMCLI\_SVP are not used, the operation will use the default pool, **DEFAULT\_POOL**.

**NOTE:**

SAVE devices can also be organized into Delta Set Extension pools for use with SRDF/A. Refer to the *EMC Solutions Enabler SRDF Family CLI User Guide* for more information on using SAVE devices in this way.

## Monitoring SAVE device usage

Using virtual copies requires proper planning to prevent the SAVE devices from filling up with pre-updated data. If the SAVE devices fill up, you will begin to lose the pre-update images of the newly changed tracks in the virtual copy session, the virtual device will be set to Not Ready, and the session will fail (only sessions with I/O activity will be in a failed state, sessions without I/O activity will continue to operate normally).

Should this happen, you must terminate the failed sessions to clear the tracks on the SAVE devices. Once a session is terminated, the virtual data is lost and the SAVE device space associated with the session is freed and returned to the SAVE device pool for TimeFinder/Snap use. In addition, you should also examine how you are using the SAVE device pools and consider adding more SAVE devices.

You can monitor SAVE devices by using the **symcfg show** command to display SAVE device pool details. For more information, refer to the *EMC Solutions Enabler Array Management CLI User Guide*.

## Pairing an additional target device with each source device in a group

When working with either a composite or device group, you can use the **-concurrent** option with the **create** action to pair an additional target device with each source device in a group.

To pair an additional target device with each source device in group **ProdDB**, enter:

```
symsnap -g ProdDB create -concurrent
```

When the copy session is created, an additional target device will be paired with each source device in the group. For example, if there were two target devices paired with each source device in the group before activating the session, there will be three target devices paired with each source device after the session is activated.

To verify that each source device in the group has multiple targets, enter:

```
symsnap -g ProdDB verify -created -concurrent
```

## Copying a virtual device to another virtual device (duplicate snap)

Duplicate snap functionality, supported with (Engenuity 5876, allows you to duplicate a point-in-time copy of a virtual device, which is paired in a previously activated snap session, to another virtual device. This second point-in-time copy session resides with the source device of the original snap session and is charged as part of the maximum number of sessions for that source device.

Use the `-duplicate` option with the `-create` command to begin a copy session that will take one or more source virtual devices and create a copy of the point-in-time data to one or more target virtual devices. For example, to begin a copy session and define virtual device `VDEV002` to be the copy of source device `VDEV001` in group **ProdDB**, enter:

```
symsnap -g ProdDB create -duplicate VDEV001 vdev ld VDEV002
```

In this example, `VDEV001` is the target of an activated snap session and `VDEV002` is not snap paired. The resulting duplicate session is the same point-in-time as the original virtual device, but the time stamp is not inherited from the original virtual device's session. The newly created session has its own time stamp indicating the time of its creation.

The following restrictions apply to the duplicate snap functionality:

- Snap create and activate operations cannot be mixed between normal snap sessions and duplicate snap sessions within the same operation.
- Two is the maximum number of duplicated sessions in the Created state.
- When a duplicate snap session is in the Created state, the original session cannot be terminated or recreated until the duplicate session is activated.

## Activating a virtual copy session

To create a point-in-time image, you must activate the create copy session. To activate the copy session created in the example in [Creating a virtual copy session](#) on page 58, use the following `symsnap` command:

```
symsnap -g ProdDB activate DEV001 vdev ld VDEV005
```

This activates the copy operation from the source device to the virtual target device. Activating the copy session starts the copy on first write mechanism and places the target device in the Read/Write state. The target host can access the copy and has access to data on the source host until the copy session is terminated.

### NOTE:

Virtual data is made available as a point-in-time copy at the time of activation and not at the time that the session was created.

## Using the establish command

With Solutions Enabler 7.4 and higher, you can use the `symsnap establish` command to create and then immediately activate a copy session with a single command.

To create and then activate the copy session shown in the example in [Creating a virtual copy session](#) on page 58, enter:

```
symsnap -g ProdDB establish DEV001 vdev ld VDEV005 -full
```

## Making the target device not ready to the host

The Not Ready (`-not_ready`) option can be used with the **activate** action to start the CopyOnWrite mechanism but causes the target device to remain not ready to its host, as follows:

```
symsnap -g ProdDB activate DEV001 vdev ld VDEV005 -not_ready
```

The copy session will be activated and the target device will be placed in the Not Ready state. The snap copy can later be Read/Write enabled to the host using the `symsg ready` command.

## Activating copy sessions consistently

You can consistently activate multiple virtual copy sessions involving a database using the Enginuity Consistency Assist (ECA) feature. These features allow snap copy sessions to be activated with a consistent, restartable copy of the database.

### Using ECA

You can use the Enginuity Consistency Assist (ECA) feature to activate virtual copy sessions that are consistent with the database up to the point in time that the activation occurs. The feature suspends writes to the source device during the activation.

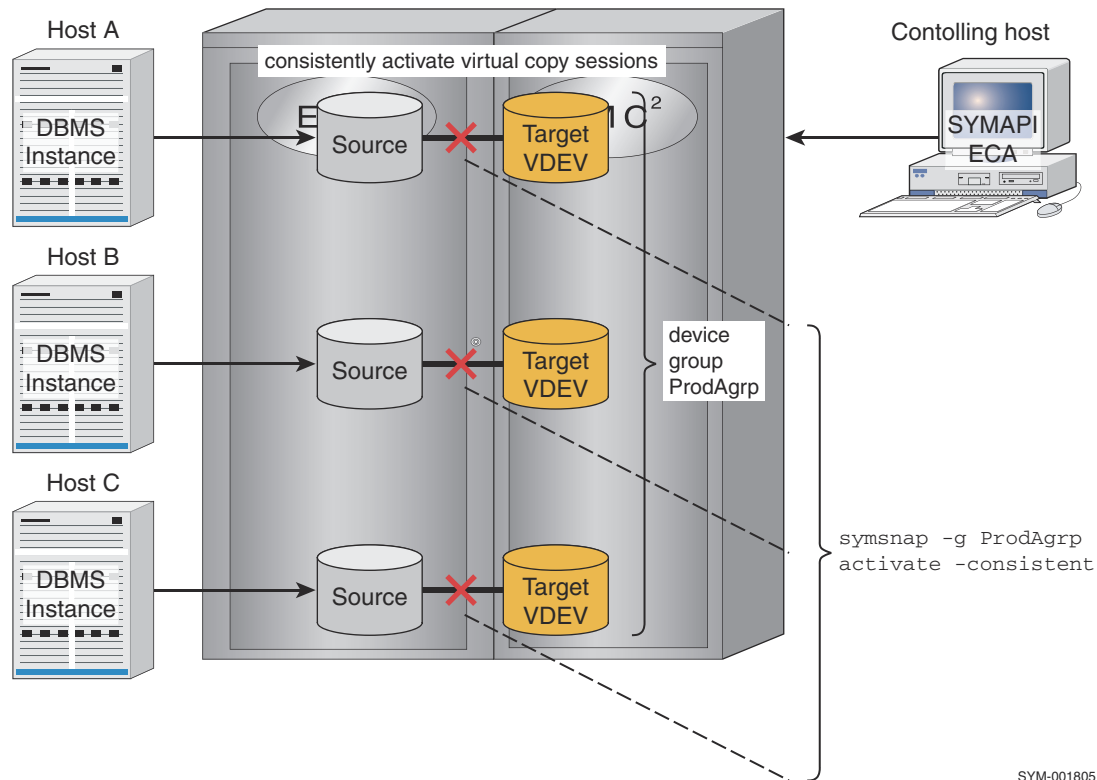
Use the `symsnap activate` command with the consistent (**`-consistent`**) option to invoke ECA. When the activation has completed, writes are resumed and the target device contains pointers for a consistent production database copy of the source device at the time of activation.

To consistently activate copy sessions using ECA, you must have either a control host with no database or a database host with a dedicated channel. This will ensure that in write intensive environments SYMAPI will be able to activate the copy sessions within the ECA window, regardless of the number of outstanding I/Os held by the HBA. Refer to [TF/Snap consistent activate using ECA](#) on page 62, for a depiction of how a control host can consistently activate a copy session involving three database hosts that access devices on an array.

A device group, composite group, or a device file must be created on the controlling host for the target database to be consistently activated. Device groups can be created to include all of the devices being accessed or defined by database host access. For example, if you define a device group that includes all of the devices being accessed by Hosts A, B, and C ([TF/Snap consistent activate using ECA](#) on page 62), then you can consistently activate all of the copy sessions related to those hosts with a single command. However, if you define a device group that includes only the devices accessed by Host A, then you can activate those copy sessions related to Host A without affecting the other hosts.

#### NOTE:

When activating a copy session from an R2 device, if the SRDF pair is in adaptive copy mode, the `-consistent` option is not allowed.



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Figure 14. TF/Snap consistent activate using ECA

## Activating an additional copy session for each device pair in a group

When working with either a composite or device group, you can use the `-concurrent` option with the **activate** action to activate an additional copy session for each device pair in a group.

To activate an additional copy session for each device pair in group `ProdDB`, enter:

```
symsnap -g ProdDB activate -concurrent
```

## Activating a duplicate snap session

Once a duplicate snap session is activated, the copied session works like a normal snap session between the original source device and the duplicated virtual device. This session may be used for restore, recreate, and terminate operations.

Use the `-duplicate` option with the `-activate` command to activate a duplicate snap session. For example, to activate the copy session between target device `VDEV002` and source device `VDEV001` in group `ProdDB`, enter:

```
symsnap -g ProdDB activate -duplicate VDEV001 vdev ld VDEV002
```

In this example, the result is an activated session between `DEV001` and `VDEV002`, which is in addition to the original session between `DEV001` and `VDEV001`.

## Combining the create and activate commands for a duplicate snap

You can combine the `symsnap create -duplicate` and `symsnap activate -duplicate` commands into a single action by using the **symsnap duplicate** command. For example, to create and activate a copy session between target device `VDEV002` and source device `VDEV001` in group `ProdDB`, enter:

```
symsnap -g ProdDB duplicate VDEV001 vdev ld VDEV002
```

## Recreating a virtual copy session (Engenuity 5876)

Snap sessions can be recreated on an existing virtual device (VDEV) in preparation of activating a new point-in-time image. Snap `recreate` is only valid when issued against sessions that have been previously activated. This process makes it more convenient to reuse a virtual device to acquire a new point-in-time image. This feature is supported with Engenuity 5876.

Since the **recreate** operation replaces the previous point-in-time image with a new one, the used tracks in the SAVE devices that were associated with the previous session are freed during the processing of this command.

Recreating a virtual snap copy session requires the following steps:

1. Create a snap session. (Refer to [Recreating a virtual copy session \(Engenuity 5876\)](#) on page 63.)
2. Activate a snap session. (Refer to [Activating a virtual copy session](#) on page 60.)
3. Recreate a snap session.
4. Activate a snap session. (Refer to [Activating a virtual copy session](#) on page 60.)
5. Repeat the recreate/activate a snap session, as necessary.
6. Terminate the snap session when no longer needed. (Refer to [Terminating a virtual copy session](#) on page 66.)

To recreate the copy session activated in the example on [Activating a virtual copy session](#) on page 60 use the following `symsnap` command:

```
symsnap -g ProdDB recreate DEV001 vdev ld VDEV005
```

With Solutions Enabler 7.4 and higher, you can use the `symsnap establish` command to recreate and then immediately activate a copy session with a single command.

To combine steps 3 and 4 described above, enter:

```
symsnap -g ProdDB establish DEV001 vdev ld VDEV005
```

The snap recreate functionality is supported with the `symsnap query` and `symsnap verify` commands. For example:

```
symsnap -g TestDg query -multi
```

```
symsnap -g TestDg verify -recreated
```

### NOTE:

You can use the **-recreated** parameter in combination with other verify states when verifying for multiple states. When multiple verify states are listed, the states are evaluated in a logical OR fashion so the result will be true if the session is in any of the listed states.

The following restrictions apply to the snap recreate functionality:

- The session to be recreated must be in a CopyOnWrite or Copied state.
- Any restore session that exists on the device must be terminated prior to issue the recreate operation.
- Snap `recreate` for multivirtual snap operations is supported in environments running Engenuity 5876.

## Restoring data from virtual devices

Three types of restore operations can be performed for virtual device copy sessions:

- Incremental restore back to the original source device.
- Incremental restore to a BCV, which has been split from its original standard source device but maintains the incremental relationship with the source.
- Full restore to any standard or split BCV device outside of the existing copy session. The target device of the restore must be of the same size and emulation type as the source device.

A new restore copy session between the source device and the restore target device is created. A restore operation can only be performed if an additional copy session (two for Engenuity 5876) is available for use.

By default, any existing copy sessions persist until manually terminated by using the `symsnap terminate` command. After the virtual device has been restored to another device, the restore copy session must be terminated first, before another

restore operation is allowed from that virtual device. Use the `symsnap query -multi` command to view all existing targets paired with a source device. The original snap copy session displays as being in the CopyOnWrite state, and the restore copy session displays as being either in the RestInProg or Restored state.

## Incrementally restoring to a source

The following command-line entry shows an incremental restore operation back to the original source device DEV001 from the virtual device VDEV005:

```
symsnap restore DEV001 vdev ld VDEV005
```

In this example, through the use of device pointers to the SAVE device, the virtual device **VDEV005** will be incrementally restored back to **DEV001**. Any changes made to the virtual device tracks during the active copy session will be restored back to the original source device.

### NOTE:

Any changes written to the original source device during the copy session will be overwritten by the virtual device tracks when the source device is restored.

The restore target device (source device DEV001) and virtual device (VDEV005) are automatically set to the Not Ready state while the track protection bitmaps are set up to copy any changed tracks. DEV001 automatically becomes available for use (Ready state) as soon as the track protection bitmap completes. The changed tracks then begin copying and will continue to copy in the background until all the protected tracks have been restored.

If you want to continue using the original copy session, the virtual device must be manually set to the Ready state after the restore operation has completed (all tracks are copied back to the source). Use one of the following commands to set the virtual device to the Ready state after the above restore operation:

```
symdmg -g Group1 ready -vdev VDEV005
```

```
symmdev -sid SymmID ready 001C
```

Once the restore completes, both the original and restore copy sessions are maintained and must be terminated manually if not needed for future use. When a original session is terminated, the device pointers are deleted from the virtual device and the SAVE device space is freed for future use.

### NOTE:

The restored copy session must be terminated first, before the original copy session is allowed to be terminated.

To terminate the restored copy session, enter:

```
symsnap terminate DEV001 vdev ld VDEV005 -restored
```

To terminate the original copy session, enter:

```
symsnap terminate DEV001 vdev ld VDEV005
```

## Incrementally restoring to a BCV

The following command-line entry shows an incremental restore operation to a split BCV device BCV001 from the virtual device VDEV005:

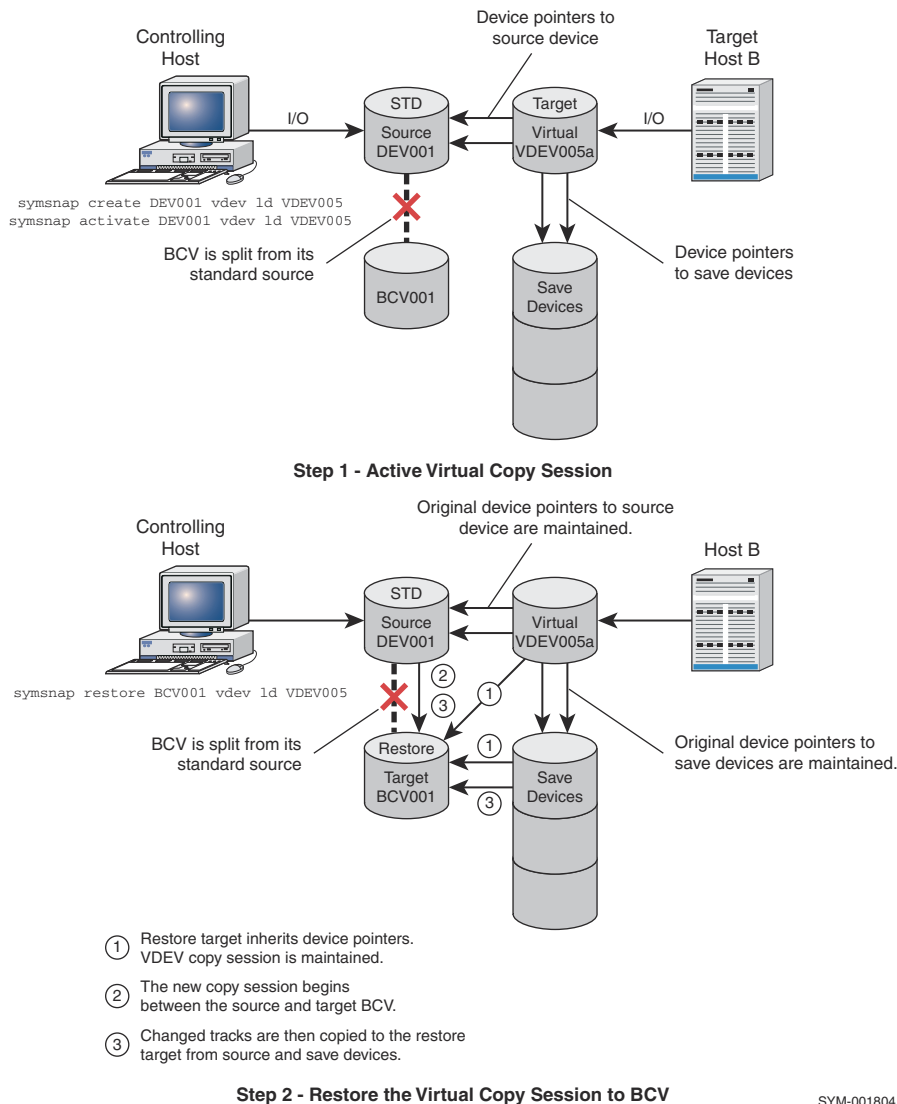
```
symsnap restore BCV001 vdev ld VDEV005
```

To restore to a BCV device, the BCV device must be split from its standard device. The point-in-time snap copy is restored to the BCV as shown in [Incremental restore to a BCV](#) on page 65 . However, any further changes made to the point-in-time snap copy (from the attached host to the VDEV), during the active copy session, will also be included in the restore action to the split BCV device (BCV001). A new copy session begins between the source and target BCV and any changed tracks pointed to by the pointers are then copied to the split BCV from the source and SAVE devices. (Only the tracks that are different between



the BCV and VDEV are copied.) Once the restore completes, both the original and restore copy sessions are maintained until manually terminated.

**NOTE:** You cannot restore to a BCV running in emulation mode.



**Figure 15. Incremental restore to a BCV**

The target device (BCV001) and the virtual device (VDEV005) are automatically set to the Not Ready state while the track protection bitmaps are set up to copy any changed tracks. **BCV001** automatically becomes available for use (Ready state) as soon as the track protection bitmap completes. The changed tracks then begin copying and will continue to copy in the background until all protected tracks have been restored.

If you want to continue using the original copy session, the virtual device must be manually set to the Ready state after the restore operation has completed (all tracks are copied to the split BCV). Use one of the following commands to set the virtual device to the Ready state after the above restore operation:

```
symdg -g Group1 ready -vdev VDEV005
```

```
symdev -sid SymmID ready 001D
```

**NOTE:**

The restored copy session must be terminated first, before the original copy session is allowed to be terminated.

To terminate the restored copy session, enter:

```
symsnap terminate DEV001 bcv ld BCV001 -restored
```

To terminate the original copy session, enter:

```
symsnap terminate DEV001 vdev ld VDEV005
```

Optionally, after terminating the copy session, you can also issue a TimeFinder **symmir restore** operation from the restored BCV back to the standard source device. For information on reestablishing and restoring BCV pairs, refer to [TimeFinder/Mirror Operations](#) on page 94.

## Fully restoring to anywhere

A full device restore operation from the virtual device is allowed to any device of the same size and emulation type as the source device. The following example uses the `restore` command with the `-full` option to fully restore a virtual device `VDEV005` to another standard device `DEV004`:

```
symsnap -full restore DEV004 vdev ld VDEV005
```

Any changes made to the virtual device (`VDEV005`) during the active copy session will be restored to the specified device (`DEV004`). The restore target inherits the virtual device pointers. A new copy session begins between the source and target device and any changed tracks pointed to by the pointers are then copied to the target device from the source and SAVE devices. Upon completion of the restore operation, both the original and restore copy sessions are maintained until manually terminated.

The target device (`DEV004`) and the virtual device (`VDEV005`) are automatically set to the Not Ready state while the track protection bitmaps are set up to copy any changed tracks. **DEV004** automatically becomes available for use (Ready state) as soon as the track protection bitmap completes. The changed tracks then begin copying and will continue to copy until all protected tracks have been restored.

If you want to continue using the original copy session, the virtual device must be manually set to the Ready state after the restore operation has completed (all tracks are copied to the restore target). Use one of the following commands to set the virtual device to the Ready state after the above restore operation:

```
symdbg -g Group1 ready -vdev VDEV005
```

```
symdev -sid SymmID ready 001E
```

When a session is terminated, all device pointers are deleted from the virtual device and the SAVE device space is freed for future use.

### NOTE:

The restored copy session must be terminated first, before the original copy session is allowed to be terminated.

To terminate the restored copy session, enter:

```
symsnap terminate DEV001 sym ld DEV004 -restored
```

To terminate the original copy session for a virtual device, enter:

```
symsnap terminate DEV001 vdev ld VDEV005
```

## Terminating a virtual copy session

To terminate the copy session activated in the example in [Activating a virtual copy session](#) on page 60 use the following **symsnap** command:

```
symsnap -g ProdDB terminate DEV001 vdev ld VDEV005
```

Terminating a copy session deletes the pairing information in the array and removes any hold on the target device. Terminating the session causes the target host to lose access to data pointed to by the virtual device.

Terminating a session while the device pairs are in the CopyOnWrite state will cause the session to end. Once the virtual copy session is terminated, the information is no longer available on the virtual device.

If a copy session has been restored, the restored session must be terminated first, before the original copy session is allowed to be terminated.

### NOTE:

If the state is RestInProg, then the `-symforce` option must be applied to terminate the session.

## Terminating a duplicate snap session

You can terminate a duplicate snap session in the Created state using the `symsnap terminate -duplicate` command. For example, enter:

```
symsnap -g ProdDB terminate -duplicate VDEV001 vdev ld VDEV002
```

Once a duplicate snap session is activated, the session appears as normal snap session and is terminated using the **terminate** command without the `-duplicate` option.

## Querying snap pairs

You can perform a query to determine the state of a snap pair or all snap pairs in a device group, composite group, or device file. The query is sent through the gatekeeper device to the array, returning with information about the state of the snap pair(s).

The following forms enable you to target devices in a device group, composite group, or device file:

```
symsnap -g DgName query
```

```
symsnap -cg CgName query
```

```
symsnap -f[file] FileName query
```

## Examples

To query the state of the snap pairs in the `prod` device group, enter:

```
symsnap -g prod query
```

You can also obtain results using the `-offline` option, which looks at your configuration based on the host database.

The results of the query include the following information for each member of a snap pair in a device group:

- Logical device name
- Device name
- Number of invalid tracks
- Snap pair state

## Using the `-summary` option

If you use the `-summary` option with the **query** argument, the results of the query will include the following information:

- Number of snap pairs in each snap pair state
- Number of invalid tracks
- Synchronization rate
- Estimated time to completion

The synchronization rate and estimated time to completion are shown only when `-i` or `-c` is specified and there has been a change in the number of invalid tracks since the previous iteration.

The `-summary` option also works with the **verify** argument.

## Example

To view the number of snap pairs in the `prod` device group that are in each state, and to view the estimated time to completion, enter:

```
symsnap -g prod query -summary -i 60
```

## Verifying snap pair states

You can use the `symsnap verify` command to verify whether one or all snap pair(s) in a device group, composite group, or device file are in a particular state. The command can be used in scripts to guarantee that the snap device pair(s) are in a particular state prior to executing subsequent SYMCLI commands. If you do not specify any qualifiers with `symsnap verify`, the default is to check for the Copied state.

The following forms enable you to target devices in a device group, composite group, or device file:

```
symsnap -g DgName verify
```

```
symsnap -cg CgName verify
```

```
symsnap -f[file] FileName verify
```

The following options qualify the `symsnap verify` command. If you need to verify a concurrent snap pair, include `-concurrent` with the option (for example, `-copied -concurrent`):

- `-copied` verifies that the copy sessions are in the Copied state.
- `-copyonwrite` verifies that the copy sessions are in the CopyOnWrite state.
- `-created` verifies that the copy sessions are in the Created state.
- `-recreated` verifies that the copy sessions are in the Recreated state.
- `-restinprog` verifies that the copy sessions are in the RestInProg state
- `-restored` verifies that the copy sessions are in the Restored state.

## Examples

For a multi-snap or concurrent snap device group, specifying the snap on the command line ensures that the verify operation checks the status of the snap. Otherwise, the verify operation checks the status of the standard device, which may no longer be established with the snap that you want to verify. For example, the following command returns the status of standard device `DEV001` with its last paired snap:

```
symsnap -g ProdBgrp verify DEV001
```

But the following command returns the status of a specific snap pair (`DEV001` with `DEV005`):

```
symsnap -g ProdBgrp verify DEV001 sym ld DEV005
```

The following command checks status every 30 seconds until all snap pairs in the device group (`ProdBgrp`) or composite group (`MyConGrp`) are in the Copied state (the default when no state is specified on the command line):

```
symsnap -g ProdBgrp -i 30 verify
```

```
symsnap -cg MyConGrp -i 30 verify
```

Possible outputs at 30-second intervals can be that none, not all, or all devices are copied.

The verify action returns a value of zero (code symbol CLI\_C\_SUCCESS) if the verify criteria are met, or one of the unique codes in [Using options to verify a snap pair state](#) on page 69 if the verify criteria are not met.

**Table 9. Using options to verify a snap pair state**

Options used with Verify	Code number	Code symbol
-copied	55	CLI_C_NOT_ALL_COPIED
-copied	56	CLI_C_NONE_COPIED
-copyonwrite	66	CLI_C_NOT_ALL_COPYONWRITE
-copyonwrite	67	CLI_C_NONE_COPYONWRITE
-created	60	CLI_C_NOT_ALL_CREATED
-created	61	CLI_C_NONE_CREATED
-recreated	68	CLI_C_NOT_ALL_RECREATED
-recreated	69	CLI_C_NONE_RECREATED
-restinprog	29	CLI_C_NOT_ALL_RESTINPROG
-restinprog	30	CLI_C_NONE_RESTINPROG
-restored	12	CLI_C_NOT_ALL_RESTORED
-restored	13	CLI_C_NONE_RESTORED

## Using a BCV as the snap source

As shown in [Creating a virtual copy from a BCV](#) on page 71, you can create a virtual copy session between a BCV source device and a virtual target device. The controlling host performs I/O to the standard device that is established with a BCV as part of a BCV pair. At some point, when the BCV is synchronized with the standard device, you can split the BCV from the standard and create a point-in-time copy of the BCV. The split operation must be entirely complete including the background phase before you can create a copy session on it.

[TimeFinder/Mirror Operations](#) on page 94 provides additional information on using the `symmir` command and how to perform an instant split operation.

## Pair states ruling snap operations

Because other operations can conflict with your copy session, certain rules must be considered. The availability of some snap copy operations depends on the current SRDF state, clone state, and BCV pair state. The following rules apply to certain BCV pair states:

- If the source of a `symsnap create` or `activate` operation is a BCV, the BCV pair state must be Split. The Split must be totally complete before the operation is allowed.

**NOTE:**

The existing BCV snap copy session must be terminated before the BCV can be reestablished or restored again with its standard device.

- A TimeFinder standard source device cannot be created, activated or restored in a copy session if the BCV pair state is SplitBfrRest or RestInProg.

**NOTE:**

If you have an active snap copy session from a standard device that also has an established BCV and you attempt to restore the standard from the BCV, the restore operation may fail due to insufficient space on the SAVE device. In this case it may be best to first restore and terminate the snap copy session, then attempt the BCV restore operation.

- The `symsnap terminate` command is allowed for all BCV pair states.

For the TimeFinder pair states that rule TimeFinder/Snap copy sessions, refer to [TimeFinder State Rules Reference](#) on page 160.

For information regarding possible SRDF pair state conflicts, refer to [State rules for TimeFinder/Snap operations](#) on page 199.

For a description of each BCV pair state, refer to [BCV pair states](#) on page 146.

## Example: Creating a virtual copy from a BCV

### About this task

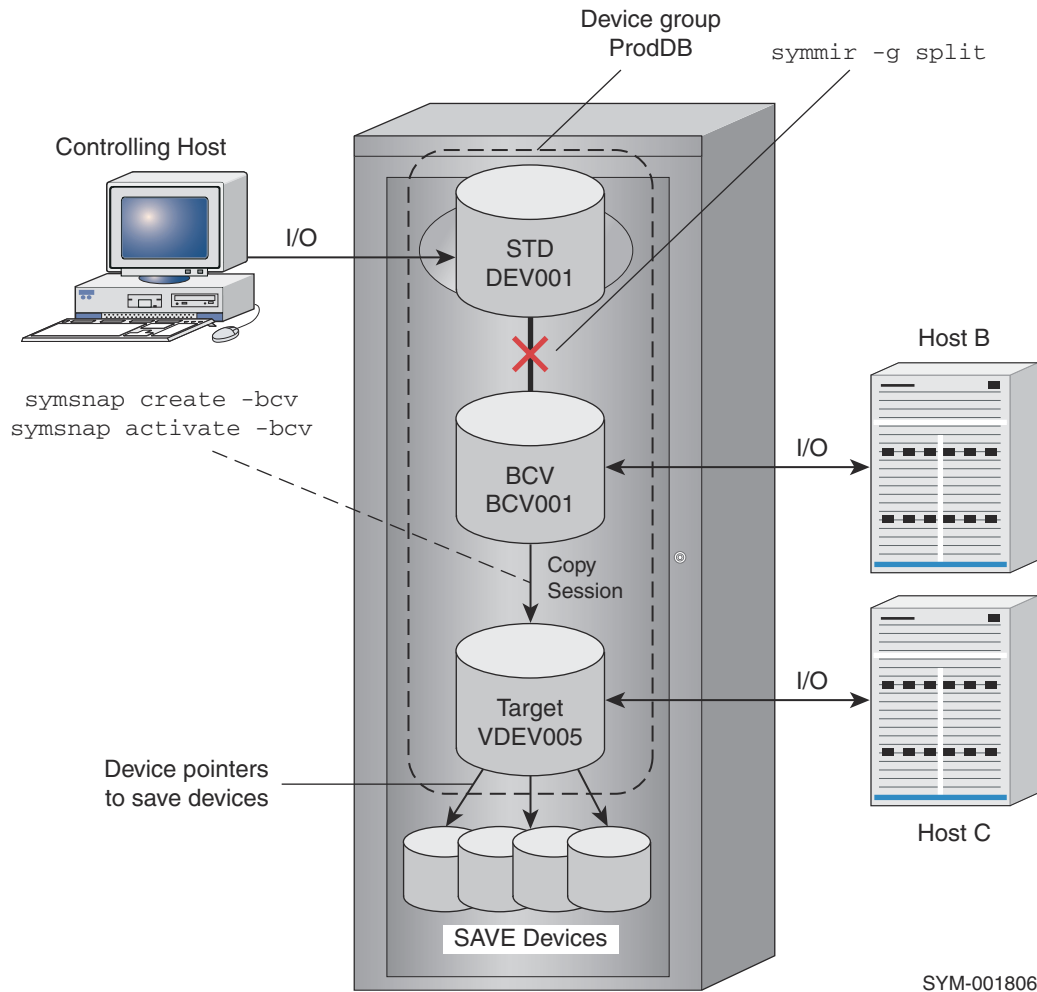
The following example creates a copy of source device BCV001 in device group `ProdDB` on an array to target device `VDEV005` on the same array.

Once the copy session is activated, Host C can access the virtual target device tracks containing the device pointers to the point-in-time copy. If Host B writes to BCV device tracks, TimeFinder immediately copies the original tracks to the SAVE device before allowing new data to overwrite those BCV tracks.

### NOTE:

In this example, where multiple hosts have access to the BCV source, consider using the `-not_ready` option with the `split` command to make the BCV not ready. This enables you to keep the same data on the BCV and virtual devices.

If you decide to use this option, you may need to release any Not Ready state imposed on any devices after the session completes.



**Figure 16. Creating a virtual copy from a BCV**

For this example, the device pair was set in the Not Ready state.

The following steps outline the example shown in [Creating a virtual copy from a BCV](#) on page 71:

**Steps**

1. Perform an instant split on the BCV pair. Use the `-not_ready` option to prevent the BCV's host from writing to it:

```
symmir -g ProdDB split DEV001 -not_ready -noprompt
```

2. Verify that the background split is complete. The following command checks every five seconds:

```
symmir -g ProdDB verify DEV001 -split -bg -i 30
```

3. Create a copy session between the BCV source device BCV001 and the virtual target device VDEV005:

```
symmsnap -g ProdDB create BCV001 vdev ld VDEV005
```

or

```
symmsnap -g ProdDb create -bcv
```

**NOTE:**

Using the `-bcv` option applies the command within the device group to use BCV devices as the source and VDEV devices as the target.

4. Activate the copy session to Host C:

```
symsnap -g ProdDB activate BCV001 vdev ld VDEV005
```

or

```
symsnap -g ProdDb activate -bcv
```

5. Query the state of the copy operation and verify the CopyOnWrite state:

```
symsnap -g ProdDB query
```

```
symsnap -g ProdDB verify BCV001 -copyonwrite
```

6. When the application has finished accessing the data, the copy session and pair relationship can be terminated:

```
symsnap -g ProdDB terminate BCV001 vdev ld VDEV005 -noprompt
```

or

```
symsnap -g ProdDb terminate -bcv
```

7. Incrementally re-establish the BCV pair:

```
symmir -g ProdDB establish DEV001 -noprompt
```

## Creating multiple virtual copies

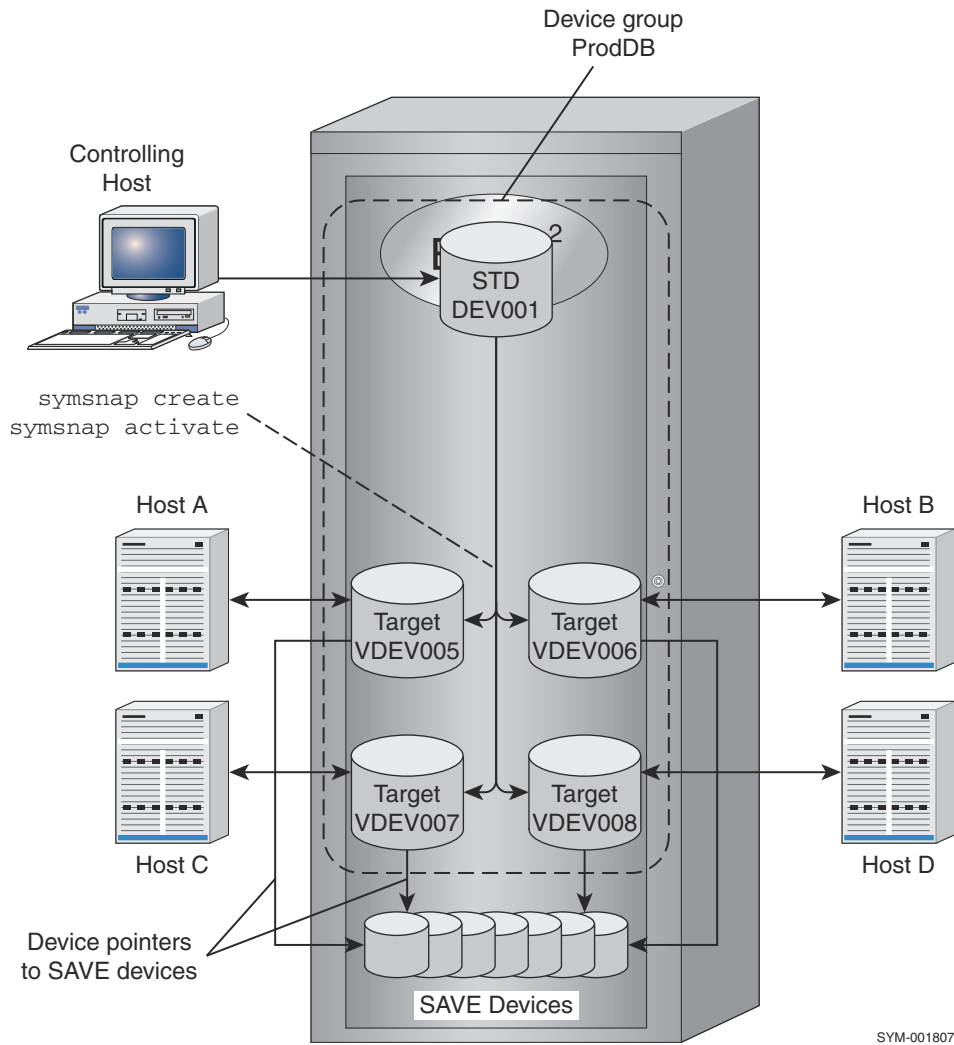
This section describes how to create multiple virtual copies from a standard device and a BCV device.

### Creating multiple virtual copies from a standard device

#### About this task

[Creating multiple virtual copies from a standard device](#) on page 73 illustrates creating copy sessions for multiple targets from a standard source device **DEV001** to four virtual target devices (**VDEV005**, **VDEV006**, **VDEV007** and **VDEV008**) with various hosts accessing them.





SYM-001807

**Figure 17. Creating multiple virtual copies from a standard device**

**NOTE:**

A separate copy session must be created between the source device (DEV001) and each target device (VDEV005, VDEV006, VDEV007, and VDEV008).

The following steps outline the example shown in [Creating multiple virtual copies from a standard device](#) on page 73:

**Steps**

1. Create a copy session between the standard source device **DEV001** and each of the four virtual target devices VDEV005, VDEV006, VDEV007, and VDEV008:

```
symsnap -g Proddb create DEV001 vdev ld VDEV005
```

```
symsnap -g Proddb create DEV001 vdev ld VDEV006
```

```
symsnap -g Proddb create DEV001 vdev ld VDEV007
```

```
symsnap -g Proddb create DEV001 vdev ld VDEV008
```

2. Activate the copy operation with one command to activate all sessions simultaneously:

<pre>symsnap -g ProdDB activate</pre>	<pre>DEV001 vdev ld VDEV005 DEV001 vdev ld VDEV006 DEV001 vdev ld VDEV007 DEV001 vdev ld VDEV008</pre>
---------------------------------------	--

3. Using the **query** argument, you can display the state of all devices involved in the copy operation by including the `-multi` option:

```
symsnap -g ProdDB query -multi
```

4. When the host devices have finished using the copy sessions, the pair relationships can be terminated individually as needed:

```
symsnap -g ProdDB terminate DEV001 vdev ld VDEV005 -noprompt
```

```
symsnap -g ProdDB terminate DEV001 vdev ld VDEV006 -noprompt
```

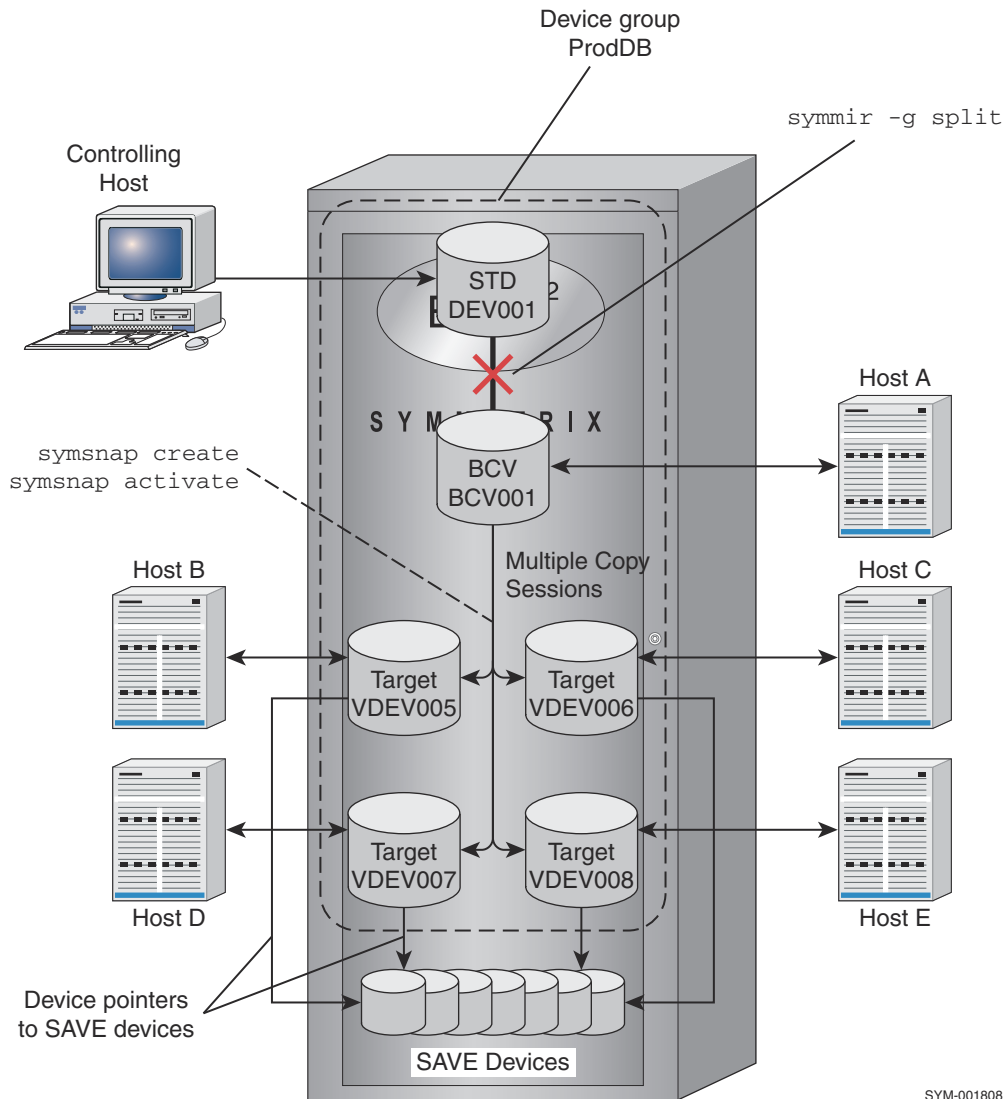
```
symsnap -g ProdDB terminate DEV001 vdev ld VDEV007 -noprompt
```

```
symsnap -g ProdDB terminate DEV001 vdev ld VDEV008 -noprompt
```

## Creating multiple virtual copies from a BCV device

### About this task

[Creating multiple virtual copies from a BCV device](#) on page 75 illustrates how to create multiple copy sessions from a BCV source device **BCV001** to four virtual target devices (VDEV005, VDEV006, VDEV007, and VDEV008) with various hosts accessing them.



SYM-001808

**Figure 18. Creating multiple virtual copies from a BCV device**

The following steps outline the example shown in [Creating multiple virtual copies from a BCV device](#) on page 75:

**Steps**

1. Perform an instant split on the BCV pair. Use the `-not_ready` option to prevent the BCV's host from writing to the device:

```
symmir -g ProdDB split DEV001 -not_ready -noprompt
```

[TimeFinder/Mirror Operations](#) on page 94 provides additional information on using the `symmir` command and performing an instant split operation.

2. Verify that the background split is complete. The following command checks every five seconds:

```
symmir -g ProdDB verify DEV001 -split -bg -i 30
```

3. Create a copy session between the BCV source device BCV001 and each of the four virtual target devices VDEV005, VDEV006, VDEV007, and VDEV008:

```
symsnap -g ProdDB create BCV001 vdev ld VDEV005
```

```
symsnap -g ProdDB create BCV001 vdev ld VDEV006
```

```
symsnap -g ProdDB create BCV001 vdev ld VDEV007
```

```
symsnap -g ProdDB create BCV001 vdev ld VDEV008
```

4. Activate the copy operation with one command to activate all sessions simultaneously

```
symsnap -g ProdDB activate
```

```
BCV001 vdev ld VDEV005  
BCV001 vdev ld VDEV006  
BCV001 vdev ld VDEV007  
BCV001 vdev ld VDEV008
```

5. Using the **query** argument, you can display the state of all devices involved in the copy operation by including the `-multi` option:

```
symsnap -g ProdDB query -multi -BCV
```

6. When the host devices have finished accessing the data, the copy sessions and pair relationships can be terminated individually as needed:

```
symsnap -g ProdDB terminate BCV001 vdev ld VDEV005 -noprompt
```

```
symsnap -g ProdDB terminate BCV001 vdev ld VDEV006 -noprompt
```

```
symsnap -g ProdDB terminate BCV001 vdev ld VDEV007 -noprompt
```

```
symsnap -g ProdDB terminate BCV001 vdev ld VDEV008 -noprompt
```

7. Incrementally reestablish the BCV pair (**DEV001** and **BCV001**):

```
symmir -g ProdDB establish DEV001 -noprompt
```

## Attaching source and target virtual devices

Use the **symsnap attach** and **detach** commands to set up preferred device pairs. Pre-determining attached device pairs eliminates the need to specify copy session target devices from within the device group for the `create` and `activate` arguments. The attached pairs will be used whenever a **symsnap** operation is requested for the specified device group. If a `symsnap create` or `activate` command does not specify a device pair from within the device group, the attached pair will automatically be used for the operation.

### NOTE:

The **attach** option can only be used when attaching a standard source device with a target VDEV device. You cannot use `symsnap attach` if the source device is a BCV device.

To set up a preferred attached device pair between source device DEV001 in device group ProdDB and target device VDEV002, enter:

```
symsnap -g ProdDB attach DEV001 vdev ld VDEV002
```

To invoke a copy session operation from within a specified device group `ProdDB` using the pre-determined device pairs, enter:

```
symsnap -g ProdDB create
```

```
symsnap -g ProdDB activate
```

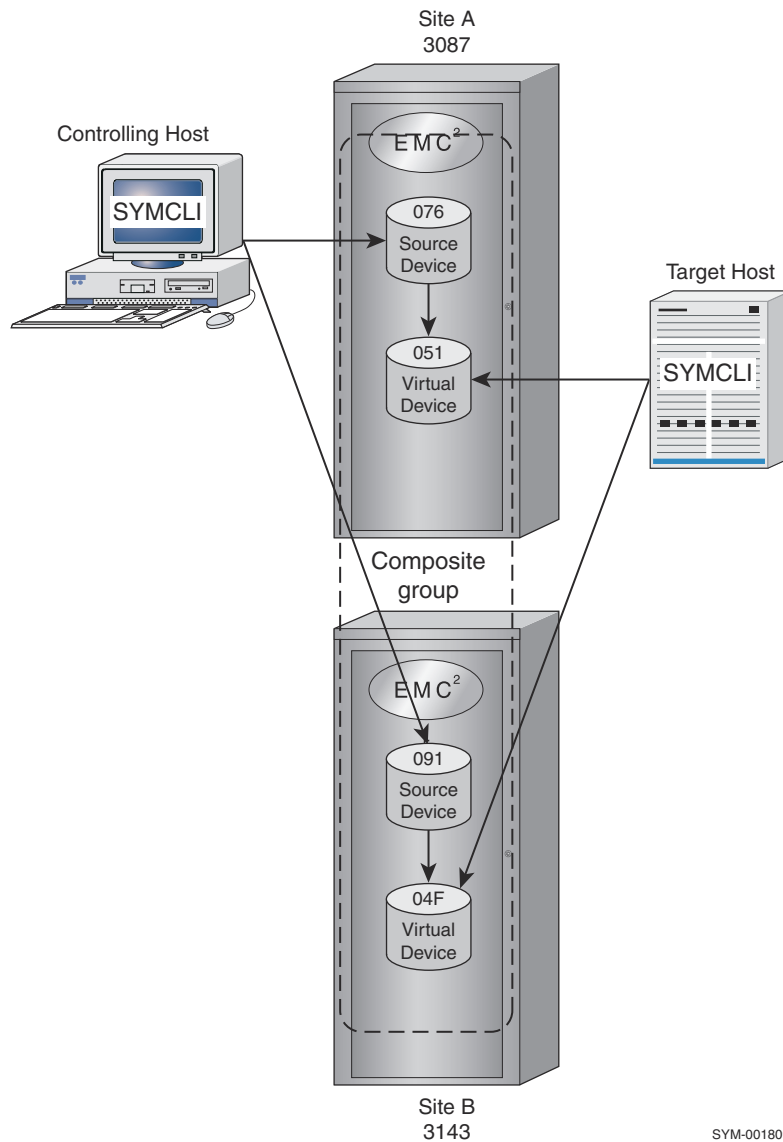
To detach (undo) the preferred device pair relationship, enter:

```
symsnap -g ProdDB detach DEV001 vdev ld VDEV002
```

## Using composite groups to manage snap pairs across arrays

### About this task

Using a composite group when a set of devices spans two arrays on page 77 illustrates a production host that is locally connected to two arrays (A and B). A composite group is defined on the production host and includes source devices and target devices from these arrays. The target devices are virtual devices.



SYM-001809

Figure 19. Using a composite group when a set of devices spans two arrays

Although snap operations might normally be performed from the production host because the composite group is defined there in its SYMAPI database, there are methods that would allow you to initiate copy sessions from another locally connected host like the target host. One way is to copy the composite group definition to another host.

A more efficient method is to enable Group Name Services (GNS), which automatically propagates the composite group definition to the arrays and other locally attached hosts that are running the GNS daemon.

The following steps outline the setup required for controlling a set of snap pairs that span two arrays, as shown in [Using a composite group when a set of devices spans two arrays](#) on page 77:

## Steps

1. From the production host, create a Regular type composite group (for example, `MyGrp`):

```
symcgr create MyGrp -type regular
```

2. Add to the composite group those standard devices on array A (3087) and array B (3143) that are the source devices:

```
symcgr -cg MyGrp -sid 3087 add dev 0076
```

```
symcgr -cg MyGrp -sid 3143 add dev 0091
```

3. Add a virtual device from each array to the composite group:

```
symcgr -cg MyGrp -sid 3087 add dev 0051 -vdev
```

```
symcgr -cg MyGrp -sid 3143 add dev 004F -vdev
```

4. Create snap pair sessions from those devices in the composite group:

```
symsnap -cg MyGrp create
```

5. Activate the snap pair sessions:

```
symsnap -cg MyGrp activate
```

Composite group support allows the source of a snap operation to be a standard device (as shown in step 2 above) or a BCV device. If you add BCV devices to the composite group for the purpose of being snap sources, you must use the `-bcv` option with the `symsnap` commands. For example, the following command creates snap pairs in the composite group using the BCVs as source devices:

```
symsnap -cg MyGrp create -bcv
```

You can add nonsource BCV devices to the composite group for the purpose of restore operations. Composite group support allows you to restore to either the original source standard device or to a BCV that has been split from its paired standard device. The following commands split all BCV pairs in the composite group and perform a restore operation from the virtual devices to the BCVs:

```
symmir -cg MyGrp split
```

```
symsnap -cg MyGrp restore -bcv
```

For more information about performing an incremental restore to a BCV that is split from the original source device, refer to [Incrementally restoring to a BCV](#) on page 64.

You can control specific snap pairs within the composite group. To create and activate the DEV001 and VDEV002 snap pair from devices in the group:

```
symsnap -cg MyGrp create DEV001 vdev ld VDEV002
```

```
symsnap -cg MyGrp activate DEV001 vdev ld VDEV002
```

## Snapping a copy on a remote array

### About this task

You can use a device group or composite group to snap devices on a remote array as shown in [Snapping a copy on a remote array](#) on page 79. Performing SYMCLI commands from the controlling host allows the remote virtual device to receive a copy of the data from the R2 device. Remote Host A can access the snap data.

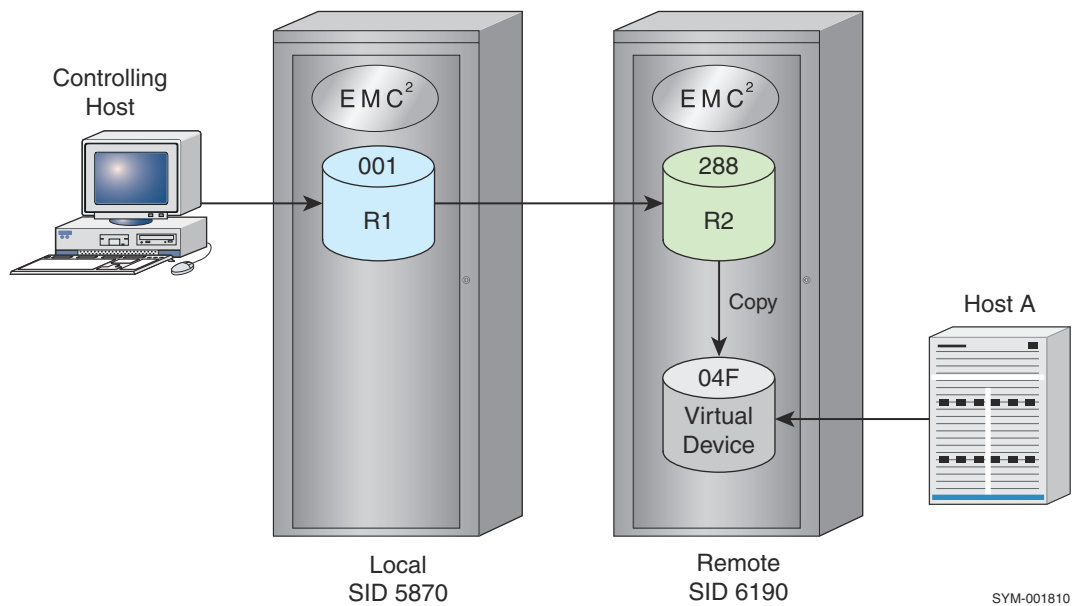


Figure 20. Snapping a copy on a remote array

The following steps outline an example of snapping local device data on a remote array:

### Steps

1. Create an RDF1-type device group or composite group (for example, a device group named `remotesnaps`).

```
symdg create remotesnaps -type rdf1
```

2. Add to the device group an R1 standard device (001) to hold the production data. Add a virtual device (04F) on the remote to hold the snap copy:

```
symdg -g remotesnaps add dev 001 -sid 5870
```

```
symdg -g remotesnaps add dev 04F -rdf -vdev
```

If the local array has more than one RDF group (that is, concurrent RDF) linking the remote array, include the RDF group option (for example, `-rdfg 2`) when adding the remote virtual device.

3. Create a snap pair session from the devices in the device group:

```
symsnap -g remotesnaps create -rdf DEV001 vdev ld RVDEV001
```

4. Activate the snap pair session:

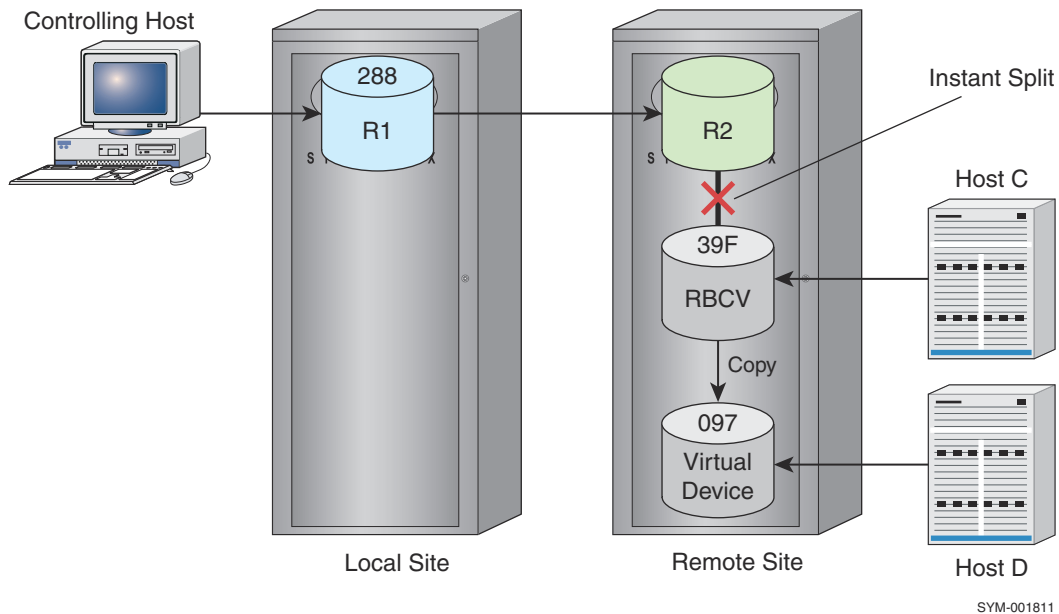
```
symsnap -g remotesnaps activate -rdf DEV001 vdev ld RVDEV001
```

5. To query the progress of the remote snap operation:

```
symsnap -g remotesnaps query -rdf
```

## Snapping a copy from a remote BCV

Using SRDF technology and the TimeFinder **-rdf** option, you can snap a copy from a BCV located on a remote array ([Snapping from a remote BCV source device](#) on page 80). By doing this, the remotely associated BCV is synchronized with the R2 device until you decide to split the BCV pair and snap a copy from the BCV to the virtual device.



**Figure 21. Snapping from a remote BCV source device**

The following steps outline an example of creating a copy session between a remote BCV source device and a remote virtual device:

1. Create an RDF1-type device group or composite group (for example, a device group named `Rdf1Grp`):

```
symdg create Rdf1Grp -type rdf1
```

1. Add to the device group an R1 standard device on the local array to hold production data. Add a virtual device on the remote array to hold the snap copy:

```
symdg -g Rdf1Grp add dev 288
```

```
symdg -g Rdf1Grp add dev 097 -rdf -vdev
```

1. Associate with the device group an RBCV to be the snap source on the remote array:

```
symbcv -g Rdf1Grp associate dev 39F -rdf
```

1. Establish standard device 288 (**DEV001**) with the RBCV:

```
symmir -g Rdf1Grp establish -full DEV001 -rdf
```



1. When the remote BCV pair is fully synchronized, perform an instant split on the BCV pair:

```
symmir -g Rdf1Grp split -rdf
```

1. When the background split is complete, create and activate a copy session between the remote BCV source device and the remote virtual device:

```
symsnap -g Rdf1Grp snap create -rbcv RBCV001 vdev ld RVDEV001
```

```
symsnap -g Rdf1Grp snap activate -rbcv RBCV001 vdev ld RVDEV001
```

1. To query the progress of the remote snap operation or verify the copy session, you can issue the following commands that examine the snapped pair (the RBCV source device and the virtual device):

```
symsnap -g Rdf1Grp query -rbcv
```

```
symsnap -g Rdf1Grp verify -rbcv
```

## Snapping copies of a source device's data locally and remotely

### About this task

Snapping copies on local and remote arrays on page 81 combines elements of Snapping a copy on a remote array on page 79 and Snapping a copy from a remote BCV on page 80 to illustrate how to snap copies of a source device's data to devices on two arrays. By splitting the BCV pairs on both sides at the same time with a consistent split operation, the BCVs on both sides contain data that is consistent with the R1 source data up to the time of the split.

The controlling host can then perform a local snap and a remote snap, resulting in the virtual devices on both sides having copies of the source device's data (provided that the BCVs were not written to by their hosts prior to the snap operation).

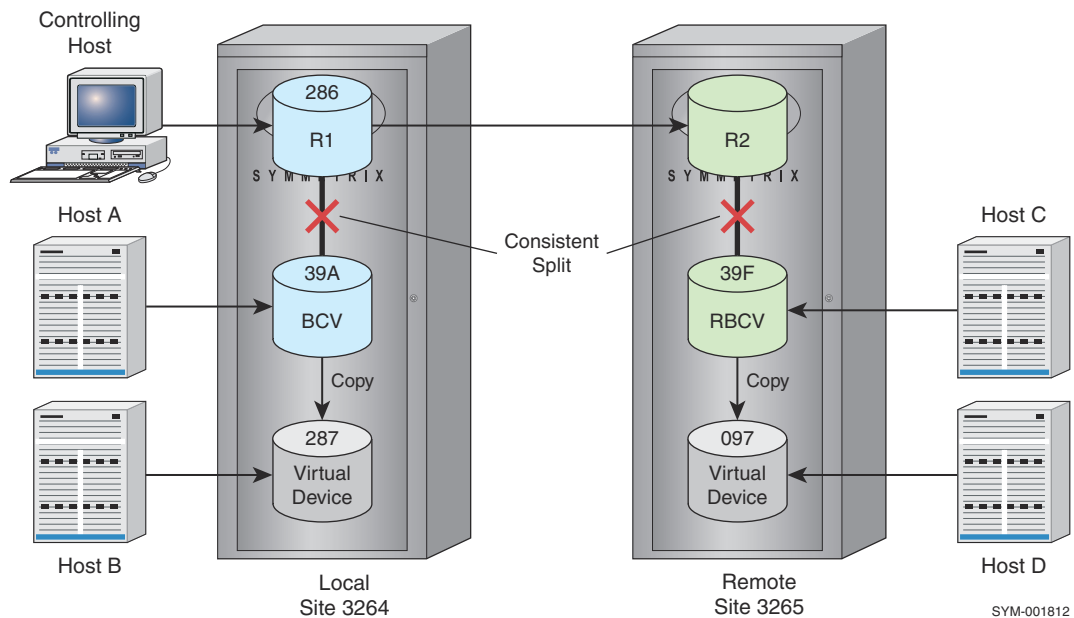


Figure 22. Snapping copies on local and remote arrays

The following steps outline the example shown in Snapping copies on local and remote arrays on page 81:

## Steps

1. Create an RDF1-type device group or composite group (for example, a device group named Rdf1Grp):

```
symdmg create Rdf1Grp -type rdf1
```

2. Add to the device group an R1 standard device (**286**) on the local array (`-sid 3264`) to hold production data. Add local virtual device **287** and remote virtual device **097** to hold the snap copies:

```
symdmg -g Rdf1Grp -sid 3264 add dev 286
```

```
symdmg -g Rdf1Grp -sid 3264 add dev 287 -vdev
```

```
symdmg -g Rdf1Grp -sid 3264 add dev 097 -rdf -vdev
```

3. Associate with the device group local BCV 39A and remote BCV 39F:

```
symbcv -g Rdf1Grp -sid 3264 associate dev 39A
```

```
symbcv -g Rdf1Grp -sid 3264 associate dev 39F -rdf
```

4. Establish the BCV pairs on both arrays. DEV001 is the logical device name of the R1 source device (286):

```
symmir -g Rdf1Grp establish -full DEV001
```

```
symmir -g Rdf1Grp establish -full DEV001 -rdf
```

5. When the BCV pairs are fully synchronized, perform a consistent split on both BCV pairs. You can perform this operation with one command, using the `-both_sides` option. For example:

```
symmir -g Rdf1Grp split -consistent -both_sides
```

### NOTE:

To use the `-consistent` and `-both_sides` options, the SRDF pairs must be synchronized and in SRDF mode SYNCHRONOUS.

6. When the background split is complete, create the local and remote snap pairs:

```
symsnap -g Rdf1Grp create -bcv BCV001 vdev ld VDEV001
```

```
symsnap -g Rdf1Grp create -rbcv RBCV002 vdev ld RVDEV002
```

7. Activate the copy sessions for the local and remote snap pairs:

```
symsnap -g Rdf1Grp activate -bcv BCV001 vdev ld VDEV001
```

```
symsnap -g Rdf1Grp activate -rbcv RBCV002 vdev ld RVDEV002
```

8. To query the progress of the local snap operation or verify when the local copy is complete, you can issue the following commands that examine the local snap pair:

```
symsnap -g Rdf1Grp query -bcv
```

```
symsnap -g Rdf1Grp verify -bcv
```

9. To query the progress of the remote snap operation or verify when the remote copy is complete, you can issue the following commands that examine the remote snap pair:

```
symsnap -g Rdf1Grp query -rbcv
```

```
symsnap -g Rdf1Grp verify -rbcv
```

10. When subsequent snaps are no longer required, you can terminate the copy sessions by issuing commands that end copy sessions for the local and remote snap pairs:

```
symsnap -g Rdf1Grp terminate -bcv BCV001 vdev ld VDEV001 -bcv
```

```
symsnap -g Rdf1Grp terminate -rbcv RBCV002 vdev ld RVDEV002
```

## Snapping multiple copies

This configuration snaps from a BCV source to four virtual devices on each array instead of to one virtual device on each array. This illustrates how a single **symsnap** command can create an image of a source device (a BCV in this case) on four virtual devices simultaneously.

As mentioned previously, by splitting the BCV pairs on both sides of an SRDF configuration at the same time, the BCVs on both sides contain data that is consistent with the R1 source data up to the time of the split. The controlling host can then perform a local snap and a remote snap, resulting in virtual devices on both sides having copies of the source device's data (provided that the BCVs were not written to by their hosts prior to the snap operation). In this configuration, 10 hosts can have access to copies of the source device's data (two copies on BCVs, and eight copies on virtual devices).

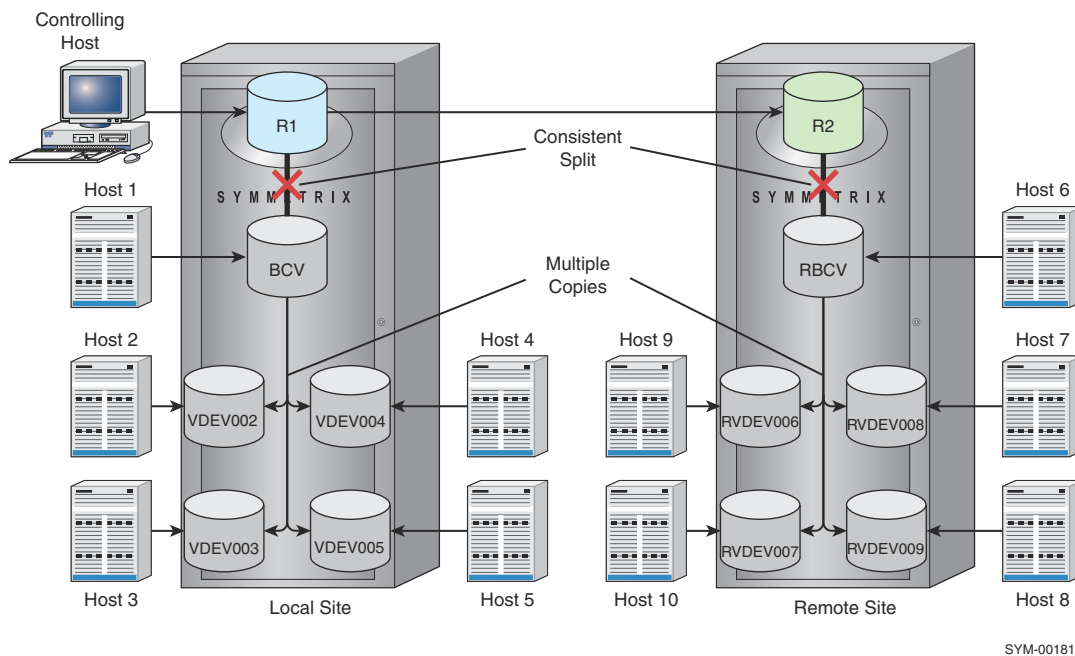


Figure 23. Snapping multiple copies on local and remote arrays

The process for building an RDF1-type device group is similar to the previous section. The difference is that a device group for this configuration contains the R1 standard device, two BCVs, and eight virtual devices. Establishing and splitting both BCV pairs is the same as the previous section.

What is different about this configuration is the ability to snap copies from a single source to multiple virtual devices simultaneously with a single command. Before initiating the snap operation, however, you must wait for completion of the BCV-pair background split involving the BCV that will be the source for the snap.

To snap copies to the four local virtual devices (DEV002, DEV003, DEV004, and DEV005) from the local BCV source device (BCV001), issue the `symsnap create` and the `symsnap activate` commands:

```
symsnap -g Rdf1Grp create -bcv BCV001 vdev 1d VDEV002
symsnap -g Rdf1Grp create -bcv BCV001 vdev 1d VDEV003
symsnap -g Rdf1Grp create -bcv BCV001 vdev 1d VDEV004
symsnap -g Rdf1Grp create -bcv BCV001 vdev 1d VDEV005
```

<pre>symsnap -g Rdf1Grp activate -bcv</pre>	<pre>BCV001 vdev 1d VDEV002</pre>
	<pre>BCV001 vdev 1d VDEV003</pre>
	<pre>BCV001 vdev 1d VDEV004</pre>
	<pre>BCV001 vdev 1d VDEV005</pre>

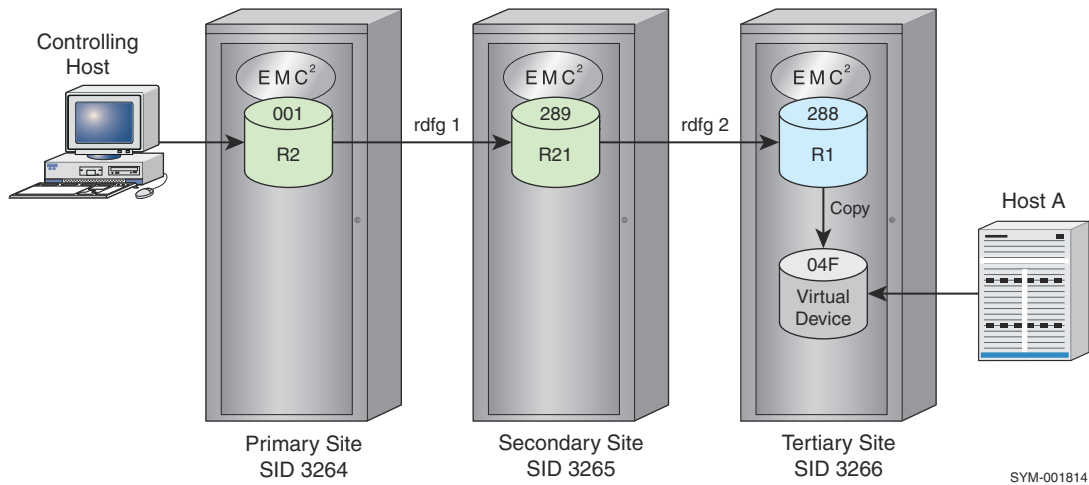
To snap copies to the four remote virtual devices (DEV006, DEV007, DEV008, and DEV009) from the remotely associated BCV source device (BCV002), issue the **symsnap** commands with the `-rbcv` option:

```
symsnap -g Rdf1Grp create -rbcv RBCV002 vdev 1d RVDEV006
symsnap -g Rdf1Grp create -rbcv RBCV002 vdev 1d RVDEV007
symsnap -g Rdf1Grp create -rbcv BCV002 vdev 1d RVDEV008
symsnap -g Rdf1Grp create -rbcv BCV002 vdev 1d RVDEV009
```

## Snapping a copy at the tertiary site of a cascaded SRDF configuration

### About this task

Using SRDF technology and the TimeFinder **-hop2** option, you can snap devices on an array located at the tertiary site of a cascaded SRDF configuration ([Snapping a copy at the tertiary site of a cascaded SRDF configuration](#) on page 85). Performing SYMCLI commands from the controlling host allows the remote virtual device to receive a copy of the data from the R1 device. Remote Host A can access the snap data.



**Figure 24. Snapping a copy at the tertiary site of a cascaded SRDF configuration**

The following steps outline an example of snapping local device data on an array located at the tertiary site of a cascaded SRDF configuration:

**Steps**

1. Create an RDF2-type device group or composite group (for example, a group named `remotesnaps`):

To create an RDF2-type device group:

```
symdmg create remotesnaps -type rdf2
```

To create an RDF2-type composite group:

```
symcgm create remotesnaps -type rdf2
```

2. Add devices to the group. From the array at the primary site, add an R2 standard device. From the array at the tertiary site, add a virtual device to hold the snap copy.

To add devices to a device group:

```
symdmg -g remotesnaps -sid 3264 add dev 001
```

```
symdmg -g remotesnaps -hop2 -rdfg 1 -remote_rdfg 3 -vdev add dev 04f
```

To add devices to a composite group:

```
symcgm -cg remotesnaps -sid 3264 add dev 001
```

```
symcgm -cg remotesnaps -sid 3264 -hop2 -rdfg 1 -remote_rdfg 3 -vdev add dev 04f
```

3. Create a snap pair session from the devices in the group:

```
symsnap -g remotesnaps -exact -hop2 create
```

4. Activate the snap pair session:

```
symsnap -g remotesnaps -hop2 activate
```

5. To query the progress of the remote snap session:

```
symsnap -g remotesnaps query -hop2
```

6. To terminate the remote snap session:

```
symsnap -g remotesnaps -hop2 terminate
```

## Snapping a copy from a clone target device

You can perform snap operations from clone target devices. This feature allows the target device of a clone session to be used as a source device for one or more snap sessions.

The following restrictions apply to snap from clone target devices:

- The original clone session (`symclone`) must be in the Copied or Split state.
- After one or more snap sessions begin using the original clone devices, the only action permitted on the original clone session is **terminate**. All other actions are blocked until all of the snaps are terminated.

The only actions permitted on a snap session with a clone session target as their source are activate and terminate. All other actions are blocked until the original clone session is terminated.

For example:

```
symclone -g DgName create
```

```
symclone -g DgName activate
```

```
symsnap -g DgName -bcv create
```

```
symsnap -g DgName -bcv activate
```

```
symsnap -g DgName -bcv terminate
```

```
symclone -g DgName recreate
```

## Command options with device groups or composite groups

Options to the **symsnap -g** and **-cg** command line arguments provide more action flexibility to control copy sessions when you are operating on device(s) of a specified device group or composite group. [symsnap -g and -cg control arguments and possible options](#) on page 86 lists the **symsnap** control operations and the possible options to use when targeting a specified device group or composite group.

**Table 10. symsnap -g and -cg control arguments and possible options**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-bcv	Y	Y		Y	Y	Y	Y	Y		
-both_sides		Y	Y							
-c, -i	Y	Y		Y	Y	Y	Y	Y	Y	Y
-concurrent	Y	Y	Y	Y				Y		

**Table 10. symsnap -g and -cg control arguments and possible options (continued)**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-consistent		Y	Y							
-copied								Y		
-copyonwrite								Y		
-created								Y		
-duplicate	Y	Y		Y	Y					
-exact	Y									
-force	Y	Y		Y	Y	Y				
-full						Y				
-hop2	Y	Y		Y	Y	Y	Y	Y	Y	Y
-multi							Y			
-noprompt	Y	Y		Y	Y	Y			Y	Y
-not_ready		Y	Y		Y	Y				
-offline							Y	Y		
-preaction, -postaction		Y	Y							
-preservetgtlocks1-lockid <sup>a</sup>	Y	Y		Y	Y	Y				
-rcbv	Y	Y		Y	Y	Y	Y	Y	Y	Y
-rdf	Y	Y		Y	Y	Y	Y	Y	Y	Y
-restinprog								Y		

**Table 10. symsnap -g and -cg control arguments and possible options (continued)**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-restore							Y			
-restore d					Y			Y		
-skip	Y	Y	Y	Y	Y					
-star	Y	Y		Y	Y	Y				
-summary							Y	Y		
-svp	Y									
-symforce					Y					
-v	Y	Y		Y	Y	Y			Y	Y

a. The -preservetgtlocks and -lockid option is not supported for -cg commands.

**NOTE:**

For command syntax and descriptions of the symsnap options, refer to the EMC Solutions Enabler CLI Command Reference.

## Command options with device files

With the **symsnap -file** command, you can perform snap control operations on device pairs defined in a device file. The device file includes a source device number, a target virtual device number, and the Symmetrix ID. [symsnap -file control arguments and possible options](#) on page 88 lists the **symsnap** control operations and the possible options to use when targeting device pairs specified in a device file.

**Table 11. symsnap -file control arguments and possible options**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-c, -i	Y	Y		Y	Y	Y	Y	Y	Y	Y
-concurrent	Y	Y		Y				Y		
-consistent		Y	Y							
-copied								Y		



**Table 11. symsnap -file control arguments and possible options (continued)**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-copyonwrite								Y		
-created								Y		
-duplicate	Y	Y			Y					
-force	Y	Y		Y	Y	Y				
-full						Y				
-multi							Y			
-noprompt	Y	Y		Y	Y	Y				
-not_ready		Y	Y		Y	Y				
-preaction, -postaction		Y	Y							
-preservetgtlocks, -lockid	Y	Y		Y	Y	Y				
-restinprog								Y		
-restore							Y			
-restored					Y			Y		
-sid	Y	Y			Y	Y	Y	Y	Y	Y
-skip	Y	Y		Y	Y					
-star	Y	Y		Y	Y	Y				
-symforce					Y					

**Table 11. symsnap -file control arguments and possible options (continued)**

Options	Argument action									
	create	activate	duplicate	recreate	terminate	restore	query	verify	attach	detach
-summary							Y	Y		
-v	Y	Y		Y	Y					

# TimeFinder VP Snap Operations

This chapter describes how to perform TimeFinder VP Snap operations.

## Topics:

- [TimeFinder VP Snap overview](#)
- [Creating a VP Snap copy session](#)
- [Activating a VP Snap session](#)
- [Restoring a VP Snap session](#)
- [Terminating a VP Snap copy session](#)

## TimeFinder VP Snap overview

For a high-level overview of TimeFinder VP Snap functionality, refer to the *EMC VMAX Family Product Guide*.

VP Snap leverages TimeFinder/Clone technology to create space-efficient snaps for thin devices by allowing multiple sessions to share capacity allocations within a thin pool. VP Snap provides the efficiency of Snap technology with improved cache utilization and simplified pool management. With VP Snap, tracks can be stored in the same thin pool as the source, or in another pool of your choice.

VP Snap sessions copy data from the source device to the target device only if triggered by a host I/O. Read I/Os to protected tracks on the target device do not result in data being copied.

The figure below shows several VP Snap sessions sharing allocations within a thin pool

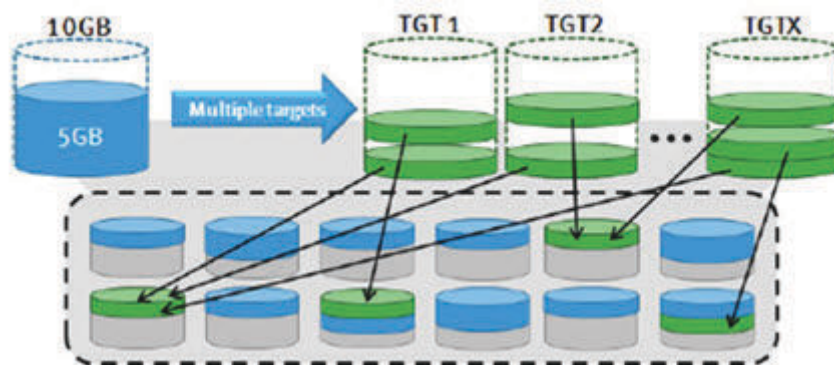


Figure 25. VP Snap sessions sharing allocations within a thin pool

## Creating a VP Snap copy session

### Example

To begin a VP Snap session and define DEV001 as the source device and DEV005 as the target device, enter:

```
symclone -g ProdDB create DEV001 sym ld DEV005 -vse
```

The following restrictions apply to VP Snap:

- - The -vse attribute may only be applied during the creation of the session.
  - Both the source device and the target device must be thin devices.

- All of the VP Snap target devices for a particular source device must be bound to the same thin pool.
- A rebind operation is not allowed for devices that are the target of a VP Snap session.
- Once created, VP Snap sessions cannot be changed to any other mode.
- The source device and the target device must be the same size.
- VP Snap sessions cannot be combined with TimeFinder/Clone nocopy sessions on the same source device.
- If a FAST VP target extent is part of a VP Snap session, the shared tracks cannot be moved between tiers.
- TimeFinder/Snap sessions and VP Snap sessions cannot coexist on a source device.

## Activating a VP Snap session

### Example

To activate the VP Snap session created in [Creating a VP Snap copy session](#) on page 91, enter:

```
symclone -g ProdDB activate DEV001 sym ld DEV005
```

This activates the copy operation from the source device to the target device. Activating the copy session places the target device in the Read/Write state. The target host can access the copied data and has access to data on the source host until the copy session is terminated.

#### NOTE:

Copied data is made available as a point-in-time copy at the time of activation and not at the time that the session was created.

## Using the establish command

To create and then immediately activate a copy session with a single command, you can use the **symclone establish** command.

### Example

To create and then activate the copy session shown in the example in [Creating a VP Snap copy session](#) on page 91, enter:

```
symclone -g ProdDB establish DEV001 sym ld DEV005 -full -vse
```

#### NOTE:

The **symclone establish** command sets the target device to Not Ready for a short time. If you are using a filesystem, unmount the target host before performing the establish command.

## Restoring a VP Snap session

VP Snap supports incremental restore operations back to the original source device. Unlike TimeFinder/Clone restore operations, the source device does not have to be fully copied and the original session between the source device and the target device is maintained. The following restrictions apply:

- ○ Only one restore session is allowed for the source device.
- Because the original session is maintained, a VP Snap restore operation uses two session slots on the source device (one for the original session and one for the restore session).
- If you have concurrent sessions off of a source device, all of the concurrent sessions must be in the Copied or CopyOnWrite state.
- Splitting a clone device pair is not supported for VP Snap restored sessions.
- Starting from the time of the initiation of the incremental restore command until the restore copy is complete, the following restrictions apply:
  - None of the existing sessions may be changed from one mode to another.

- None of the existing sessions may perform a differential recreate or incremental establish operation.
- No new sessions may be created with another create or full establish command.

In the case of an incremental restore, the original session copy direction is reversed and changed data is copied from the target device to the source device.

## Example

To incrementally restore data from the target device (**DEV005**) created in the example [Creating a VP Snap copy session](#) on page 91 to the original source device (DEV001), enter:

```
symclone -g ProdDB restore DEV001 sym ld DEV005
```

### NOTE:

When constructing a **symclone restore** command, the device receiving the data always appears first in the command, followed by the device from which the data is being copied. Therefore, in the above command, **DEV001** is actually the target of the data being copied from **DEV005**.

## Terminating a VP Snap copy session

Terminating a copy session deletes the pairing information in the array and removes any hold on the target device.

VP Snap restore operations maintain the original session, so when a VP Snap session is restored, both the original CopyOnWrite session and the restore session exist. In this case, the restored session must be terminated before the original session. This is done by specifying the **-restored** switch on the terminate command. Once the restored session is terminated, the original session may be terminated with a normal terminate command without the **-restored** switch.

## Example

To terminate the restore session in the example in [Restoring a VP Snap session](#) on page 92 using the `symclone` command, enter:

```
symclone -g ProdDB terminate DEV001 sym ld DEV005 -restored
```

## Example

To terminate the original session in the example in [Creating a VP Snap copy session](#) on page 91 using the `symclone` command, enter:

```
symclone -g ProdDB terminate DEV001 sym ld DEV005
```

# TimeFinder/Mirror Operations

This chapter describes the business continuance model and explains how to manage and control TimeFinder/Mirror (BCV) devices.

## NOTE:

For configurations running Engenuity 5876, TimeFinder/Mirror functions are performed through TimeFinder/Clone software using a process called Clone Emulation. Clone Emulation mode makes the use of RAID-protected BCVs transparent to the TimeFinder/Mirror user.

## Topics:

- [Clone Emulation mode and TimeFinder/Mirror](#)
- [TimeFinder operations overview](#)
- [Listing BCV devices](#)
- [Associating BCV devices with a device group](#)
- [Disassociating BCV devices from a device group](#)
- [Moving BCV devices from one device group to another device group](#)
- [Managing BCV devices with composite groups](#)
- [Establishing BCV pairs](#)
- [Incrementally establishing BCV pairs](#)
- [Splitting BCV pairs](#)
- [Fully restoring BCV pairs](#)
- [Incrementally restoring BCV pairs](#)
- [Protecting BCV data during full or incremental restores](#)
- [Cancelling BCV pairs](#)
- [Querying BCV pairs](#)
- [Verifying BCV pair states](#)
- [Using composite groups to manage BCV pairs across arrays](#)
- [Preferred attachment of BCVs \(optional operations\)](#)
- [BCV pair states](#)
- [Command options with device groups](#)
- [Command options with composite groups](#)
- [Command options with device files](#)
- [Various remote multihop configurations](#)

## Clone Emulation mode and TimeFinder/Mirror

Clone Emulation mode is a mapping procedure that allows you to use RAID-protected BCV devices in a way that is transparent to TimeFinder/Mirror users. In Clone Emulation mode, Solutions Enabler CLI functions convert TimeFinder/Mirror commands to TimeFinder/Clone commands.

## NOTE:

For environments using Engenuity 5876, TimeFinder/Mirror uses Clone Emulation mode for all operations.

[TimeFinder/Clone Emulation](#) on page 96 contains greater detail.

## NOTE:

Data Domain devices are not supported as TimeFinder/Mirror source or target devices.

## TimeFinder/Mirror

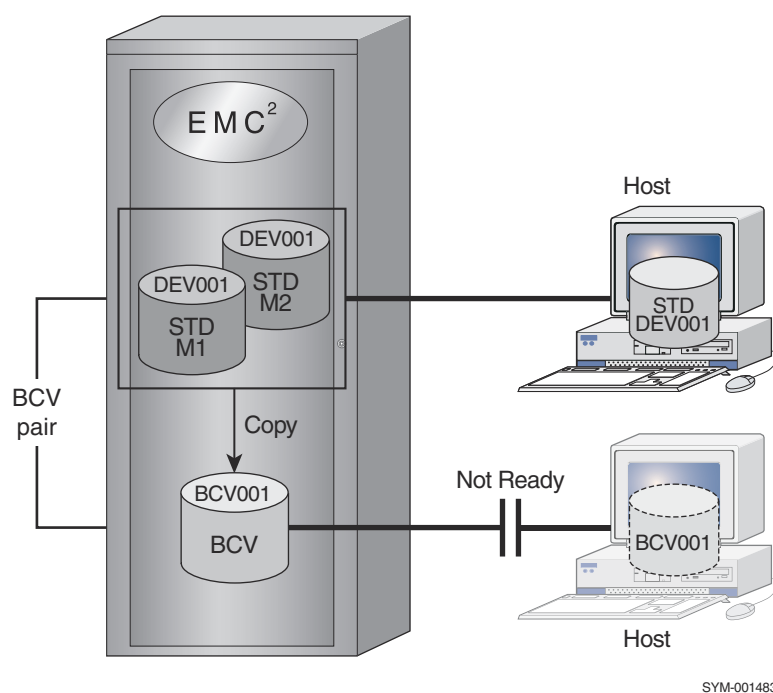
TimeFinder/Mirror is essentially a business continuance solution that allows the use of special *business continuance volume* (BCV) devices. Copies of data from a standard device (which are online for regular I/O operations from the host) are sent and stored on BCV devices to mirror the primary data. Uses for the BCV copies can include backup, restore, decision support, and applications testing. Each BCV device has its own host address, and is configured as a stand-alone device.

TimeFinder/Mirror involves *associating* and *establishing* the BCV device as a mirror of a specific standard device. As a result, the BCV device becomes inaccessible (*Not Ready* in [Establishing a BCV pair](#) on page 95) using its original device address while it is in an established pair. Once the BCV device is synchronized with its source, you can separate (*split*) it from the standard device with which it is paired, thereby making it available again to its host for backup or other host processes through its original device address.

After host processing on the BCV device is complete, the BCV may again be mirrored to a standard device (either the same device with which it was previously paired, or with a different device).

### NOTE:

Unless noted otherwise, all references to arrays discussed in the context of TimeFinder/Mirror indicate a DMX running Engenuity 5773 and lower.



**Figure 26. Establishing a BCV pair**

A DMX array allows up to four mirrors for each logical volume. The mirror positions are commonly designated M1, M2, M3, and M4. A single BCV can be the second, third, or fourth mirror of the standard device. In [Establishing a BCV pair](#) on page 95, because standard device DEV001 is configured with two mirrors, BCV001 functions as the third mirror. A host logically views the M1/M2 mirrored devices as a single device.

## SRDF-connected sites

SRDF is a Business Continuance solution that maintains a mirror image of data at the device level in arrays located in physically separate sites. In an SRDF configuration, the individual devices are designated as either a *source* or *target* to synchronize and coordinate SRDF activity.

## Remotely mirroring the local standard

There are multiple types of SRDF-connected BCV devices. An SRDF-connected BCV can be paired with the R1 mirror or R2 mirror of the local RDF standard devices (RBCV) as shown in [SRDF: Mirroring the local standard](#) on page 96.

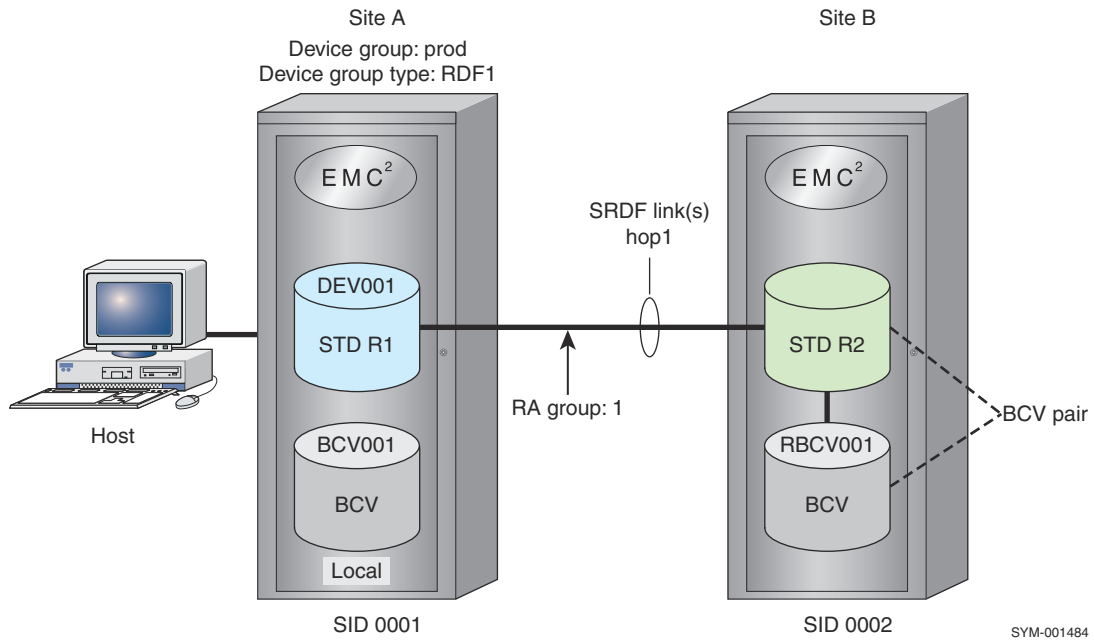


Figure 27. SRDF: Mirroring the local standard

## Mirror types

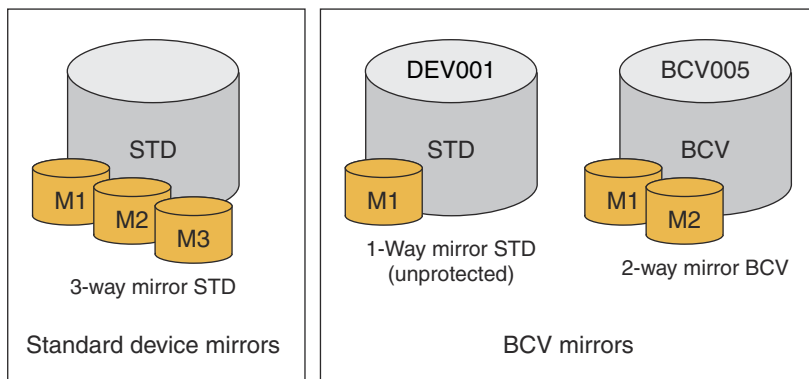
Once a BCV device is established as a mirror of a standard device, those two devices together are referred to as a *BCV pair*. The pair consists of two types of mirrors: the standard device mirror(s) and the BCV mirror.

The standard device mirrors contain copies of the data contained in their associated standard devices. There can be up to three standard device mirrors (M1, M2, M3).

A *BCV mirror* is a standard device mirror. It can be a two-way mirror (M1, M2) that is assigned upon creation of the BCV pair.

**NOTE:**

Mirroring tasks such as establish, split, and restore use the `symmir` command and are described later in this chapter.



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Figure 28. Mirror configuration types

## TimeFinder/Clone Emulation

TimeFinder automatically maps a TimeFinder/Mirror command to the executable of the appropriate TimeFinder/Clone command when it encounters a BCV that is a RAID 5 or RAID 6 protected device. Under Clone Emulation mode, TimeFinder/Clone initiates the pre-copying of data.

**NOTE:**



While Clone Emulation mode is primarily a RAID 5 BCV implementation, it can also be used with any other BCV protection. Clone Emulation is available with the TimeFinder/Clone license and can be used with existing TimeFinder/Mirror scripts.

When you establish a BCV pair under Clone Emulation, the `symmir establish -full` command maps to the `symclone create -precopy -differential` command. This action causes copying to begin while still checking for new writes. The `symmir split` command maps to the `symclone activate` command. This action causes the data to become available to the host as an instant point-in-time copy.

[TimeFinder commands mapped to clone operation](#) on page 97 details the mapping of TimeFinder/Mirror operations to their TimeFinder/Clone operational equivalents.

**Table 12. TimeFinder commands mapped to clone operation**

TimeFinder /Mirror symmir operations	TimeFinder/Clone symclone operations
FULL ESTABLISH	CREATE with pre-copy and differential
SPLIT	ACTIVATE or SPLIT
INCREMENTAL ESTABLISH	RECREATE
FULL RESTORE	FULL RESTORE
INCREMENTAL RESTORE	INCREMENTAL RESTORE
VERIFY	VERIFY
ATTACH	ATTACH
DETACH	DETACH
CANCEL	TERMINATE
PROTECT RESTORE	Default feature
PROT BCV ESTAB	Default feature <sup>a</sup>
QUERY	QUERY
List	List

a. Only after the completion of split is the target device fully synchronized as in a protected BCV Establish.

To operate in a mixed BCV set of RAID 5 BCVs and non-RAID 5 BCVs, you must set the Clone Emulation environment variable to ENABLED:

```
SYMCLI_CLONE_EMULATION=ENABLED
```

In a mixed BCV set, if Clone Emulation is disabled (the default), any control operation produces an error when a RAID 5 BCV is encountered.

When in Clone Emulation mode, a standard device can be paired with as many as eight concurrent BCVs (RAID 5 or any other BCV protection). Issue the `symmir establish -concurrent` command for the same standard device up to eight times, adding one additional BCV each time.

The following limitations apply to TimeFinder/Clone Emulation:

- The TimeFinder reverse split feature is not allowed.
- Restores will always be protected restores.
- Incremental Restore (Reverse Re-Snap) will only be accepted if all tracks were originally copied from the source prior to the restore taking place.

**NOTE:**

With Clone Emulation mode, an incremental restore will only be accepted if the devices are in a Split state and there is no active split.

- The following option file settings will be ignored:

```
SYMAPI_DEFAULT_BCV_SPLIT_TYPE, SYMAPI_DEFAULT_BCV_RESTORE_TYPE  
SYMAPI_DEFAULT_BCV_ESTABLISH_TYPE
```

- The maximum number of BCVs that can be incrementally established with a standard device will be eight instead of the 16 allowed by TimeFinder. `SYMCLI_MAX_BCV_PAIRS` can at most be eight.
- The BCV states Split-Before-Sync and Split-Before-Restore are not valid states for an emulation device. In both cases, a forced split will complete the synchronization operation.

## TimeFinder operations overview

These management operations can safely be performed with SYMCLI on a copy of an actively changing set of the business data. Business Continuance management operations include backing up a static copy of a database, or preparing for application upgrades.

### Device external locks

SYMCLI/SYMAPI uses *device external locks* in the array to lock device pairs during SRDF and TimeFinder control operations. The *EMC Solutions Enabler Array Management CLI User Guide* provides more information on external locks.

### Skip locks

During TimeFinder/Mirror operations, you can choose to bypass the device external locks on standard devices by using the `-skip` option with the `symmir establish` and `split` commands. If the specified source devices are either all locked or all unlocked, this option will explicitly not lock those source devices.

### Preserve target locks

Device external locks are used to lock BCV device pairs and devices participating in a copy session during TimeFinder BCV, Snap, and Clone operations. For target devices that have been previously locked with the same lock holder ID, you can preserve the original lock for use in performing additional TimeFinder control operations.

Use the

```
-preservetgtlocks-lockid
```

options with the `symmir establish`, `restore`, and `split` commands to preserve the original device lock on target devices. You must specify the original lock holder ID number. This option causes the operation to not take out additional locks for the specified target devices.

### Disallow synchronization actions

For some sites, it may be desirable to block users on a specific host from performing either an establish or restore operation on any of the devices. The `SYMAPI_SYNC_DIRECTION` parameter in the options file allows you to confine TimeFinder and SRDF operations to either just establish or restore actions. In this way, you can block a user on a host from executing a restore or an establish action using the following form:

```
SYMAPI_SYNC_DIRECTION=ESTABLISH | RESTORE | BOTH
```

where:

`ESTABLISH` confines the possible operations to just establish actions.

`RESTORE` confines the possible operations to just restore actions, which includes (allows) restore, failback, and R1 update actions.

`BOTH` (default) does not restrict any TimeFinder or SRDF actions.

**NOTE:**

The *EMC Solutions Enabler CLI Command Reference* provides more details about the options file.

## Wait for synchronization actions to complete

By default, the **symmir establish** command initiates a series of tasks that begins the synchronization of one or more BCV pairs. SYMCLI returns control to the caller while the establish operation is still in progress. The `WAIT_FOR_BCV_SYNC` parameter in the options file enables you to delay returning control to the caller until the establish operation (or a restore operation) is complete:

```
SYMAPI_WAIT_FOR_BCV_SYNC = TRUE | FALSE
```

where:

`TRUE` waits for the operation to complete before returning control to the caller.

`FALSE` (default) returns control to the caller before the operation completes.

**NOTE:**

The *EMC Solutions Enabler CLI Command Reference* provides more details about the options file.

## Listing BCV devices

Configuration and status information is stored in the configuration database file for each device on every array, including BCV devices.

You can find all BCV devices on an array and view their physical and device names. In addition, you can display details about the BCV devices, including the BCV device name, the device name of the paired standard device, the number of invalid tracks for both the BCV device and the standard device, and the BCV pair state.

## Examples

To list all the BCV devices that are visible to the host, enter:

```
symbcv list pd
```

To list all the BCV devices, regardless of whether they are visible to the host, enter:

```
symbcv list dev
```

To list all the BCV devices that have SCSI reservations, regardless of whether they are visible to the host, enter:

```
symbcv -resv list
```

To list all the BCV sessions created on an array, enter:

```
symmir -sid SymmID list
```

To list all the BCV sessions created on array 3264:

```
symmir list -sid 3264
```

```
Symmetrix ID: 000000003264
```

Standard Device	BCV Device	State
-----	-----	-----
Invalid	Invalid	GBE
Sym	Tracks	Sym Tracks STD <=> BCV
-----	-----	-----
002B	0 0E0B	0 ... Synchronized
002E	0 0E00	0 ..X Synchronized
002E	0 0E0A	0 ... Synchronized
0032	0 0E0F	0 ... Split
00FF	0 00FD	0 ... Split
0DF5	0 0DA5	0 ..X Synchronized
0DF5	0 0DA4	0 ..X Synchronized
0F70	0 001B	3592 X.. SyncInProg
0F71	0 001C	4496 X.. SyncInProg
0F93	0 0DF9	0 ..X Split
1015	0 1069	0 X.. Synchronized
Total	-----	-----
Tracks	0	8088
MB(s)	0.0	505.5

Legend:

(G): X = The paired BCV device is associated with a group.

. = The paired BCV device is not associated with a group.

(B): X = The paired BCV device is splitting in the background.

. = The paired BCV device is not splitting in the background.

(E): X = The paired BCV device is emulation mode.

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. = The paired BCV device is not emulation mode.

# Associating BCV devices with a device group

Various compound (even multihop) remote configurations can be managed by your host using various SYMCLI control components. To perform operations on a BCV device using the SYMCLI, the BCV device must be associated with an existing device group or composite group (this is not a requirement when using a device file).

## NOTE:

For information on associating BCV devices with a composite group, refer to [Associating BCV devices with a composite group](#) on page 106.

When you associate a BCV device with a device group, you can assign it a logical device name. If you do not assign the BCV device a logical device name, a logical device name will be assigned automatically.

## NOTE:

Mirroring tasks such as establish, split, and restore use the `symmir` command and are described later in this chapter.

## Examples

You can associate BCV devices with a device group by using either the physical device name, or the device name. To associate a BCV device with a physical device name of `/dev/dsk/c0t2d0s2`, to a device group named **prod**, and naming the BCV device **BCV7**, enter:

```
symbcv -g prod associate pd c0t2d0 BCV7
```

To associate a BCV device, with a device name of `001F`, to a device group named `prod`, naming the BCV device `BCV5`, enter:

```
symbcv -g prod associate dev 001F BCV5
```

## Moving device groups

By default, a BCV device cannot be associated with more than one device group at the same time when you are using one SYMCLI configuration database file. However, you can change this default behavior by enabling the `SYMAPI_ALLOW_DEV_IN_MULT_GRP` parameter in the **options** file.

You can associate all BCV devices with a device group. Only BCV devices that are not already associated with a device group will be associated.

You can either associate all BCV devices that are visible to your host within a device group (the default), or are configured in an array.

To associate all BCV devices on array **123** with a device group **prod**, enter:

```
symbcv -g prod -sid 123 associateall dev
```

## Host-visible BCV devices

To associate all BCV devices visible to your host with the device group **prod**, enter:

```
symbcv -g prod associateall
```

You can also associate a range of BCV devices that are visible to your host. For example, to associate devices `039A` through `039F` with the device group **prod**, enter:

```
symbcv -g prod associateall -devs 039A:039F
```

You can associate remote BCV devices with a device group. The following options allow all remote BCV devices of a specific type to be associated with a device group:

- `-rdf` specifies remote attached BCVs (RBCVs).

- `-bcv` specifies remote BCVs that mirror local BCVs (BRBCVs). This option must be used with the `-rdf` option.
- `-rrdf` specifies BCVs that are remotely associated with remote BCVs (RRBCVs).
- `-hop2` specifies BCV devices (2BCVs) that are remotely associated on the second hop of a cascaded SRDF configuration.

## SRDF-connected BCV device

An SRDF-connected BCV device must be associated with a device group before it can be paired with a remote standard device. [Compounded remote configuration example](#) on page 103 shows a device group of type RDF1 (there are three other device group types, RDF2, RDF21, and REGULAR, which are not shown).

If the group is an RDF1 type, then the remote BCVs (RBCV) can only be paired with the R2 mirrors on the remote array. If the group is an RDF2 type, then the remote BCVs can only be paired with the R1 mirrors on the remote array. When dealing with concurrent RDF devices, you can only remotely associate with one RDF group.

To associate an SRDF-connected BCV device to a device group named `prod`, and assign it a logical device name of `RBCV001`, enter:

```
symbcv -sid 123 -g prod -rdf -RDFG 1 associate dev 000B
```

where:

123 is the ID of the local array.

`-rdf` specifies a remote attachment.

`-RDFG 1` specifies the RDF group number (or RA group number) **1** at the local array through which the remote BCV is reached.

`dev 000B` specifies the device name of the BCV on the remote array.

In this example, the remote BCV pair is mirroring the local standard device as shown in [Compounded remote configuration example](#) on page 103.

## SRDF-connected BCV mirror device

You can also associate a remote BCV pair that mirrors a local BCV device as shown in [Compounded remote configuration example](#) on page 103. For example:

```
symbcv -sid 123 -g prod -rdf -bcv -RDFG 2 associate dev 002A
```

where:

123 is the ID of the local array.

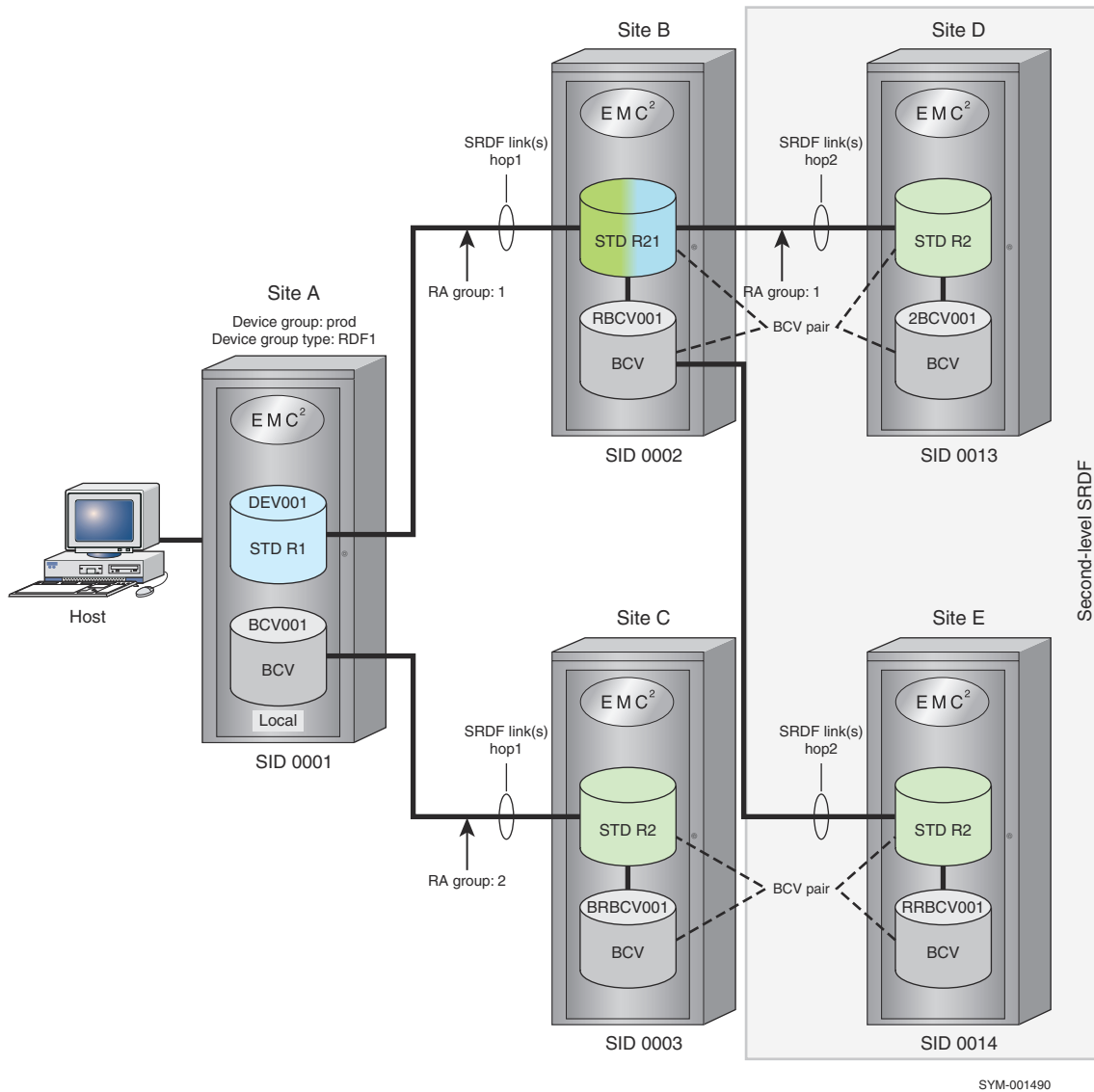
`-rdf` specifies a remote attachment.

`-bcv` specifies that it is a remote BCV that mirrors the local BCV.

`-RDFG 2` specifies an RDF group number **2**, through which the remote BCV is reached.

## Compounded remote configuration

[Compounded remote configuration example](#) on page 103 shows how devices in a compounded remote configuration can be associated.



**Figure 29. Compounded remote configuration example**

- At site A, the SRDF links remotely mirror a local array.
- The remote site B functions as the remote mirror to the standard devices at site A.
- Remote site C (third site) uses an SRDF link to remotely mirror the BCV devices in the array at site A.
- The second-level SRDF shows how:
  - SRDF can be cascaded where remote site D (the Tertiary site) functions as a remote partner of the R21 device, which is the remote partner of the local RDF standard device.
  - SRDF can include multiple sites, for example where remote site E functions as a remote mirror to the standard devices of site A.

## Disassociating BCV devices from a device group

Once a BCV device has been associated with a device group, you can disassociate it when the BCV device is in a state that allows it to be disassociated.

You can disassociate a BCV device by using either the physical device name, the device name, or the logical device name.

To disassociate a BCV device named **BCV7** from the **prod** device group, enter:

```
symbcv -g prod disassociate ld BCV7
```

To disassociate a BCV device on device **000F** from the **prod** device group, enter:

```
symbcv -g prod disassociate dev 000F
```

If the BCV device that you want to disassociate from a device group is currently paired via TimeFinder, TimeFinder/Snap, or TimeFinder/Clone, the `-force` option must be used.

**NOTE:**

When you use the `-force` option, SYMCLI does not access the array (an offline operation). It disassociates the device from the device group without access to the array.

## SRDF-connected BCV pair

An SRDF-connected BCV device can be disassociated from a device group.

You can disassociate a BCV device using either the device name or the logical device name.

To disassociate a remote BCV device that has a logical device name of **RBCV001** from a device group named **SAMPLE1**, enter:

```
symbcv -g SAMPLE1 -rdf disassociate ld RBCV001
```

To disassociate a remote BCV device that has a device name of **002B** from a device group named **SAMPLE1**, enter:

```
symbcv -g SAMPLE1 -rdf disassociate dev 002B
```

If you are attempting to disassociate a remote BCV device from a device group, and the BCV device is in the synchronized, restored, or transient BCV state, you must use the `-force` option.

**NOTE:**

When you use the `-force` option, SYMCLI does not access the array (an offline operation). It disassociates the device from the device group without access to the array.

## Remote SRDF-connected BCV pair

You can disassociate a remote BCV pair that mirrors the local BCV device, which is shown associated in [Compounded remote configuration example](#) on page 103.

For example:

```
symbcv -sid 123 -g SAMPLE1 -rdf -bcv disassociate dev 002A
```

where:

`-rdf` specifies a remote attachment.

`-bcv` specifies that it is a remote BCV that mirrors the local BCV.

## Remote BCV or a remote BCV pair

You can disassociate a remote BCV that mirrors the remote BCV device, which is shown associated in [Compounded remote configuration example](#) on page 103. This option can be used to disassociate a BCV device that is accessible via SRDF links two hops away. The group must be an RDF group.

For example:

```
symbcv -sid 123 -g SAMPLE1 -rrdf disassociate dev 002A
```

where:

`-rrdf` specifies the BCV is being remotely disassociated with a remote BCV in the group.



## Remote BCV on the second hop of a cascaded SRDF configuration

You can disassociate a remote BCV on the second hop of a cascaded SRDF configuration, which is shown associated in [Compounded remote configuration example](#) on page 103. This option can be used to disassociate a BCV device that is accessible via SRDF links two hops away. The group must be an RDF group.

For example:

```
symbcv -sid 123 -g SAMPLE1 -hop2 disassociate dev 002A
```

where:

**-hop2** specifies the BCV is in the second hop of a cascaded SRDF.

## Moving BCV devices from one device group to another device group

The `symbcv` command can be used to move one or all BCV devices from one existing device group to another existing device group. The source and destination groups can be of different types. When moving a BCV device from one group to another, you can choose to have the device's logical name renamed to the default naming convention of the destination group. This helps to avoid naming conflicts that may be encountered.

Other options are available to limit a move to the devices that meet a specified set of criteria, which can be specified along with the `moveall` action. For a full description of these options, refer to `symbcv` in the *EMC Solutions Enabler CLI Command Reference*.

### Moving a specific device

To move BCV device `BCV001` from device group `prod` to the destination group `NewGroup` and rename the moved device, enter:

```
symbcv -g prod move ld BCV001 NewGroup -rename
```

### Moving all BCV devices

You can move all local BCV devices from one device group to another device group. The source and destination groups can be of different types.

To move all BCV devices that are visible to your host from device group `prod` to device group `NewGroup`, enter:

```
symbcv -g prod moveall NewGroup
```

### Moving remote BCV devices

Remote BCV devices can be moved from one device group to another device group. The following options allow all remote BCV devices of a specific type to be moved:

- `-rdf` specifies remote attached BCVs (RBCVs).
- `-bcv` specifies remote BCVs that mirror local BCVs (BRBCVs). This option must be used with the `-rdf` option.
- `-rrdf` specifies BCVs that are remotely associated with remote BCVs (RRBCVs).
- `-hop2` specifies BCV devices (2BCVs) that are remotely associated on the second hop of a cascaded SRDF configuration.

### Removing devices

The `symbcv` command also contains a remove all action (`rma11`), which will remove all devices meeting the specified criteria from the specified device group.

# Managing BCV devices with composite groups

When adding BCV devices to a composite group, consider the following:

- The user must specify a local array ID.
- If no devices have been added to the composite group yet, and if there is only one RDFG on the array, then that RDFG is assumed; otherwise, you must specify a RDFG when adding remote BCVs.
- The **-host**, **-SA**, and **-P** parameters are only valid when associating local BCV devices.
- If **-bcv** is specified, the BCV list affected is the BRBCV list (or the BCV of the remote BCV device).

## NOTE:

- **-rdf** is required when **-bcv** is specified.
- If **-rdf** is specified and **-bcv** is not specified, the BCV list affected is the RBCV list.
- If **-rrdf** is specified, the BCV list affected is the RRBCV list.
- If **-hop2** and **-remote\_rdfg** are specified, the BCV list affected is the 2BCV list.
- If **-rdf** and **-bcv** and **-rrdf** are not specified, the BCV list affected is the BCV list.

## Associating BCV devices with a composite group

Use the following syntax to associate a BCV using the given device name to the composite group:

```
symbcv -cg CgName -sid SymmID [[-rdf [-bcv]] | [-rrdf] | [-hop2]] [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]] associate dev SymDevName [LdevName]
```

Use the following syntax to associate all BCV devices for the SymmID to the composite group:

```
symbcv -cg CgName -sid SymmID [[-rdf [-bcv]] | [-rrdf] | [-hop2]] [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]] associateall [pd | -host HostName] [-sid SymmID]
```

```
[-SA # | ALL] [-p #] [-N #]
```

```
[-cap # [-captype mb | cyl]]
```

```
[-R1 | -NOR1] [-R2 | -NOR2]
```

```
[-sel_rdfg SelRdfGrpNum]
```

```
[-devs <SymDevStart:SymDevEnd | SymDevName
```

```
[,<SymDevStart:SymDevEnd | SymDevName>...]>]
```

## Disassociating BCV devices from a composite group

Use the following syntax to disassociate a BCV using the device name:

```
symbcv -cg CgName -sid SymmID [[-rdf [-bcv]] | [-rrdf] | [-hop2]] [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]] disassociate dev SymDevName [-force]
```

## Moving BCV devices to a composite group

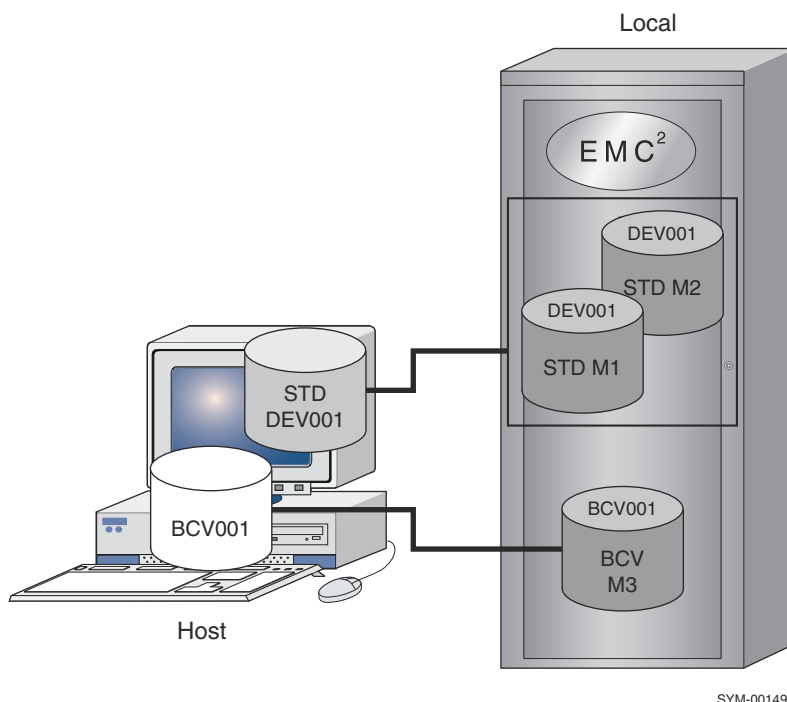
Use the following syntax to move the BCV that has the given device name to the destination composite group:

```
symbcv -cg CgName -sid SymmID [[-rdf [-bcv]] | [-rrdf] | [-hop2]] [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]] move dev SymDevName DestCgName [-force]
```

## Establishing BCV pairs

After configuration and initialization of an array, BCV devices contain no data. The BCV devices, like the standard devices, have unique host addresses and are online and ready to the hosts to which they are connected. The full establish must be used the first time the standard devices are paired with BCV devices.

[Initial BCV configuration](#) on page 107 illustrates the initial configuration prior to performing any TimeFinder BCV operations. In this figure, the host views the M1/M2 mirrored pair as a single standard device (DEV001) and the BCV device as BCV001.



**Figure 30. Initial BCV configuration**

To obtain a copy of the data on a standard device, a BCV pair must be established. A BCV pair consists of a BCV device and a standard device. The standard device can have various mirror structures (unprotected, two-way or three-way mirrored, RAID, RAID with SRDF), as long as the number of mirrors does not exceed three. This constraint is in place because establishing a BCV pair requires assigning the BCV device as the next available mirror of the standard device.

Since there is a maximum of four mirrors allowed per device in the array, a device already having four mirrors is not able to accommodate another one.

Optionally, you can target devices in a device group, composite group, or device file:

```
symmir -g DgName -full establish
```

```
symmir -cg CgName -full establish
```

```
symmir -f[file] FileName -full establish
```

To initiate a full establish on all the BCV pairs in the **prod** device group, enter:

```
symmir -g prod -full establish
```

To initiate a full establish on one BCV pair, **DEV001**, in the **prod** device group, enter:

```
symmir -g prod -full establish DEV001
```

To initiate a full establish on more than one BCV pair (list) in the **prod** device group with one command, enter:

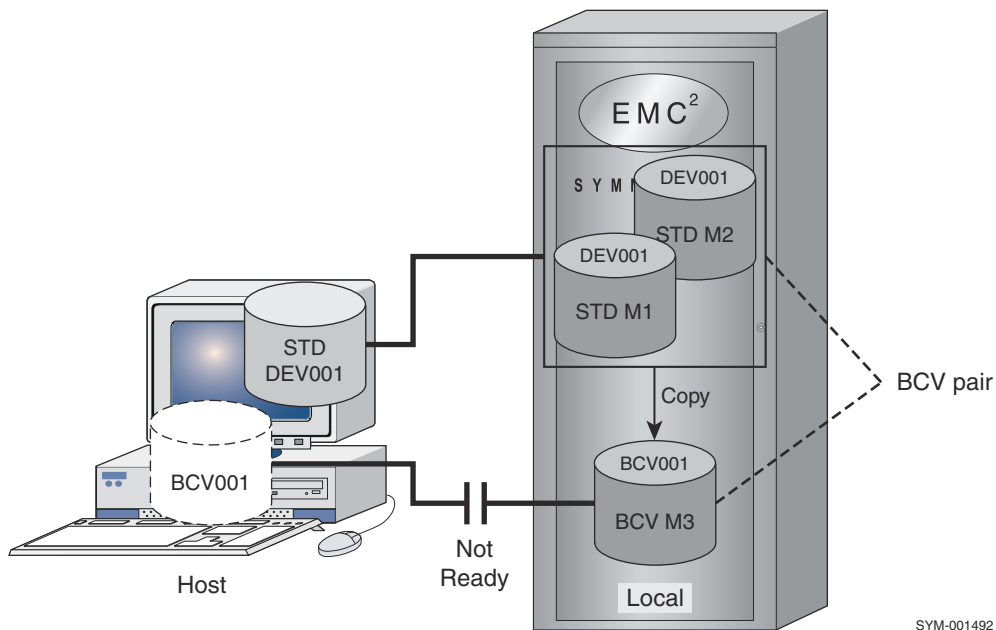
```
symmir -g prod -full establish
```

```
DEV001 BCV 1d BCV005
```

```
DEV002 BCV 1d BCV007
```

```
DEV003 BCV 1d BCV008
```

Fully establishing a BCV pair on page 108 illustrates the full establish of a BCV pair.



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**Figure 31. Fully establishing a BCV pair**

When a full establish is initiated for each specified BCV pair in a device group:

- Command validity is checked. For example, the array makes sure that both the standard device and the BCV device are the same size, the device specified as the BCV has the BCV attribute, the standard device does not already have a BCV device assigned to it, and so on.

If the standard device is a metahead device, the BCV must also share the same metadvice properties. All metamembers will be implicitly established along with the metahead device.

- The BCV device is set as Not Ready to the host.
- The BCV device is assigned as the next available mirror of the standard device. A BCV can be the second, third, or fourth mirror of the standard device. For example, in [Fully establishing a BCV pair](#) on page 108, it is the third mirror (M3).
- The contents of the standard device are copied to the BCV. For example, in [Fully establishing a BCV pair](#) on page 108, the BCV device receives its data from both the first fully valid mirror of the source.

The BCV pair is synchronized when the standard device mirrors and the BCV mirror contain identical data.

**NOTE:**

The BCV device is not available for host use during the time that it is assigned as a BCV mirror on a standard device. However, any new data written to the standard device is copied to the BCV device while the BCV pair exists.

By default, Solutions Enabler rejects establish commands for CKD online devices. You can allow the establish command for CKD online devices by disabling the SYMAPI\_TF\_CHECK\_ONLINE\_CKD option. For instructions on disabling or enabling this option, refer to the *EMC Solutions Enabler Installation Guide*.

## Specifying the default method for establishing BCV pairs

When specifying the default method for establishing BCV pairs, you can either set it at the system level by using an options parameter, or at the user level by using an environment variable.

### NOTE:

User level settings (environment variables) will override system level settings (options file parameters).

### NOTE:

Because of the load that establish operations place on an array, you should only change these settings under the direction of EMC. Please contact your EMC representative before changing these settings.

## Specifying at the system level

To specify the default method for establishing BCV pairs at the system level, set the SYMAPI\_DEFAULT\_BCV\_ESTABLISH\_TYPE parameter in the **options** file. Possible values are:

- SINGULAR specifies to issue an establish to a single device, including a metamember, at a time. This method allows other tasks access to the array when doing a large number of establishes.
- PARALLEL (default) specifies to issue an establish to each servicing disk adapter (DA) in parallel, and then wait for a DA to finish before issuing another establish to that DA.
- SERIAL specifies to issue establishes as fast as the Global Special Task (GST) queue can handle them. However, all members of a meta must be established before continuing to the next meta or device. This is the default method when using metadevices.

### NOTE:

The *EMC Solutions Enabler CLI Command Reference* contains information on changing the **options** file parameters.

## Specifying at the user level

To specify the default method for establishing BCV pairs at the user level, set the SYMCLI\_BCV\_EST\_TYPE environment variable. Possible values for this variable are SINGULAR, PARALLEL, or SERIAL, as described earlier.

When specifying the default method as SINGULAR or PARALLEL, you can also set the SYMCLI\_BCV\_EST\_DELAY environment variable to specify how long to wait between sending commands to the array. Possible value for this variable range from 0 to 30, with 0 being the default setting.

### NOTE:

The *EMC Solutions Enabler CLI Command Reference* contains information on changing environment variables.

## Instantly establishing multiple BCV pairs

The multi/instant establish option improves the performance of a typical establish operation by submitting multiple BCV pairs in a single system call to be established instantly.

You can enable (default)/disable this feature with the SYMAPI\_TF\_MULTI\_ESTAB\_REST environment variable. Setting the SYMAPI\_DEFAULT\_BCV\_ESTABLISH\_TYPE parameter to SERIAL or SINGULAR will cause this option to be ignored.

## Establishing multiple BCVs with a single standard device

You can fully establish (at different times) up to 16 BCV devices (8 when using emulation mode) associated with a single standard device. The BCV devices must also be associated to the same device group.

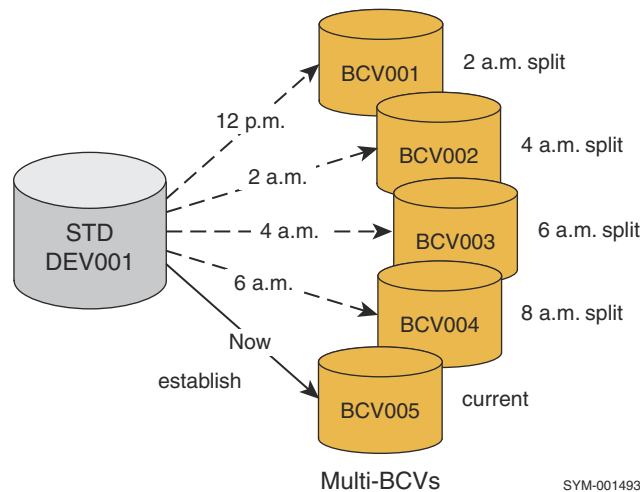
### NOTE:

Using the environment variable `SYMCLI_MAX_BCV_PAIRS`, the maximum number of pairs (established or restored) can be adjusted between 1 to 16 BCV devices.

With this feature, standard devices retain a relationship with multiple BCVs as long as those BCVs do not become paired with another standard. Here, the information about changed tracks is saved for a split BCV device when another BCV device is subsequently established and split from the same standard device. By invoking a series of `split` and `-full establish` commands over time (as shown in [Establishing a multi-BCV environment](#) on page 110), a multi-BCV environment becomes established that retains progressive historical images of the specified standard.

**NOTE:**

When the maximum number of multi-BCV pairs is reached, you can alter the BCV pair cancel policy that controls the round-robin device usage as you fully establish the next device beyond the set maximum pair count. Using environment variable `SYMCLI_BCV_PAIR_POLICY`, you can cancel the incremental relationship between the STD and the oldest BCV (default), cancel the newest, or don't cancel any BCV in the set.



**Figure 32. Establishing a multi-BCV environment**

To fully establish the standard with BCV005, enter:

```
symmir -g prod split DEV001
```

```
symmir -g prod -full establish DEV001 BCV 1d BCV005
```

In this environment, you can specify any one of these older BCVs to incrementally restore the standard back to a historical copy.

## Canceling a multi-BCV relationship

You can completely cancel the incremental relationship between the STD and any one of the split multi-BCV devices from the set using the `cancel` operation. This operation will put the BCV in either of the following states, depending on whether you are running TimeFinder in native or emulation mode:

**Table 13. BCV state**

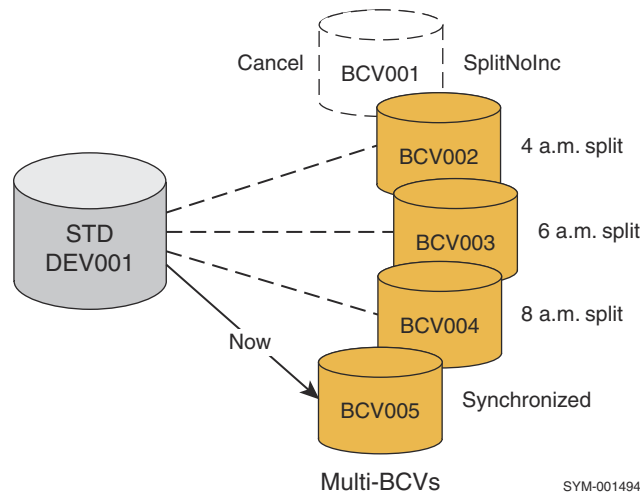
TimeFinder mode	BCV state
Native	SplitNoInc
Emulation	Never Establish

You cannot incrementally establish or incrementally restore that BCV pair again until you have performed another full establish operation or a full restore operation.

To remove BCV001 from the set, enter:

```
symmir -g prod cancel DEV001 BCV ld BCV001
```

As shown in [Canceling a multi-BCV](#) on page 111, once you cancel the specified BCV, all records of track changes between the STD and the canceled BCV are destroyed.



**Figure 33. Canceling a multi-BCV**

## SRDF-connected BCV pairs

You can specify an **establish** action to a remote array using the RDF flag (`-rdf`), which fully establishes the remote BCV pairs.

To perform a full establish operation in the remote array at site B when the RDF flag is specified, use the following command:

```
symmir -g prod -rdf -full establish
```

To initiate a full establish on one remote BCV pair, `DEV001`, in the `prod` group, enter:

```
symmir -g prod -rdf -full establish DEV001 bcv ld RBCV001
```

In this case, the flag indicates that the BCV device being established is an SRDF-connected BCV device, which will be established with the remote mirror of the local RDF standard device.

To perform a full establish operation in the remote array at site B when the RDF and BCV flags (`-rdf` and `-bcv`) are specified, use the following command:

```
symmir -g prod -rdf -bcv -full establish
```

To initiate a full establish on one remote BCV pair, `BCV001`, in the `prod` group, enter:

```
symmir -g prod -rdf -bcv -full establish BCV001 BCV ld BRBCV001
```

In this case, the `-rdf` parameter indicates that the BCV device being established is an SRDF-connected BCV device, which will be established with the remote standard mirror of the local R1 BCV device.

## Second-level remote BCV pairs

You can specify an **establish** action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which fully establishes second-level remote BCV pairs. To perform a full establish operation in the remote array at site C when the remotely attached remote BCV flag (`-rrbcv` option) is specified, use the following command:

```
symmir -g prod -rrbcv -full establish
```

To initiate a full establish on one remote BCV pair, RBCV001, in the **prod** group, enter:

```
symmir -g prod -rrbcv -full establish RBCV001 BCV 1d RRBCV001
```

In this case, the flag indicates that the BCV device being established is a second hop SRDF-connected BCV device, which will be established with the remote standard mirror of the remote BCV device.

## Hop 2 BCV pairs in a cascaded SRDF configuration

You can specify an **establish** action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform a full establish operation in the remote array at the tertiary site (C) when the hop 2 flag is specified, use the following command:

```
symmir -g prod -hop2 establish -full
```

In this case, the flag indicates that the SRDF-connected BCV device (2BCV001) is being established with the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Using cascaded Clone Emulation to cascaded clone (Engenuity 5876)

In environments running Engenuity 5876, the target device of a Clone Emulation session can be used as the source for one or more clone sessions and vice versa:

- Clone session to a Clone Emulation session
- Clone Emulation session to a clone session

Performing an incremental restore to a cascaded clone target is supported. For example, devices in an A -> B -> C cascaded clone session can copy data from device C to device A.

## Clone session to a Clone Emulation session

In this configuration, the source device A to target device B is a TimeFinder/Clone session, and source device B to target device C (BCV) is a TimeFinder/Clone Emulation session.

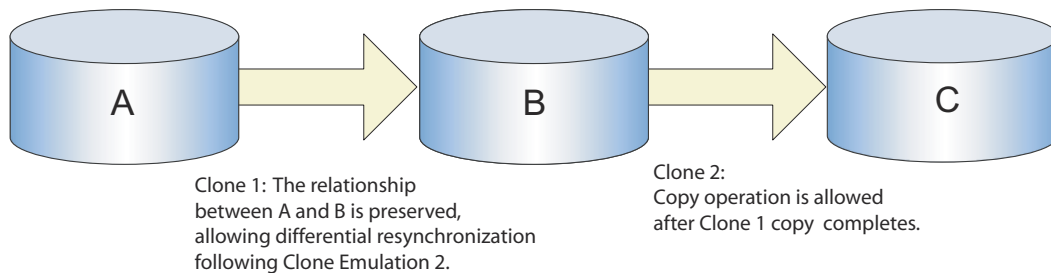


Figure 34. Cascaded Clone to a cascaded Clone Emulation session

Clone and B to C TimeFinder/Clone Emulation states on page 112 lists the Clone-to-Clone Emulation target session states.

**NOTE:**

When A→B session is SynclnProgress or RestoreInProgress, the -symforce flag is required when performing a B→C split operation.

Table 14. Clone and B to C TimeFinder/Clone Emulation states

B→C session state	Clone A → Clone B → Clone C session state						
	A→B No session	A→B Created, Recreated	A→B Precopy	A→B CopyInProg CopyOnAcces	A→B Copied Split	A→B RestoreInProg	A→B Restored



**Table 14. Clone and B to C TimeFinder/Clone Emulation states (continued)**

<b>B→C session state</b>	<b>Clone A → Clone B → Clone C session state</b>						
				s CopyOnWrite			
B→C No session	Create A→B Full Establish A→B Full Restore A→B Full Establish B→C	Activate A→B Set Mode A→B	Activate A→B Set Mode A→B	Recreate A→B Establish A→B Set Mode A→B	Recreate A→B Establish A→B Restore A→B Set Mode A→B	Full Establish B→C	Split A→B Full Establish B→C
B→C Synchronized	Create A→B Full Establish A→B Full Restore A→B Split B→C	Activate A→B Set Mode A→B	Activate A→B Set Mode A→B	Recreate A→B Establish A→B Set Mode A→B	Recreate A→B Establish A→B Restore A→B Set Mode A→B Split B→C	Split B→C	Split A→B Split B→C
B→C SynchInProgress	Full Restore A→B	Not proper state	Not proper state	Not proper state	Not proper state	Not proper state	Split A→B
B→C Split (BG Split In Progress)	Full Restore A→B Establish B→C	Activate A→B Set Mode A→B (no precopy)	Not proper state	Set Mode A→B (no precopy)	Restore A→B Set Mode A→B (no precopy)	Establish B→C	Split A→B Establish B→C
B→C Split (BG split done)	Create A→B Full Establish A→B Full Restore A→B Establish B→C Restore B→C	Activate A→B Set Mode A→B	Activate A→B Set Mode A→B	Recreate A→B Establish A→B Set Mode A→B	Recreate A→B Establish A→B Restore A→B Set Mode A→B	Establish B→C	Split A→B Establish B→C
B→C RestoreInProgress		Not proper state	Not proper state	Not proper state	Not proper state	Not proper state	Not proper state
B→C Restored	Full Restore A→B Split B→C	Not proper state	Not proper state	Not proper state	Not proper state	Split B→C	Split B→C

**Clone Emulation session to a clone target session**

In this configuration, the source device A to target device B (BCV) is a TimeFinder/Clone Emulation session, and source device B to target device C is a TimeFinder/Clone session. [Clone Emulation and clone target session states](#) on page 114 lists the Clone Emulation to Clone target session states.

**NOTE:**

When A→B session is SyncInProgress or RestoreInProgress, the -symforce flag is required when performing a A→B split.

**Table 15. Clone Emulation and clone target session states**

<b>B→C session state</b>	<b>Clone A → Clone B → Clone C session state</b>					
	A→B No session	A→B Synchronized SyncInProgress	A→B Split (BG Split In Progress)	A→B Split (BG split done)	A→B RestoreInProgress	A→B Restored
B→C No session	Full Establish A→B Create B→C Full Establish B→C Full Restore B→C	Split A→B	Establish A→B	Establish A→B Restore A→B Create B→C Full Establish B→C		Split A→B
B→C Created Recreated	Activate B→C Set Mode B→C	Not proper state	Not proper state	Activate B→C Set Mode B→C	Not proper state	Not proper state
B→C Precopy	Activate B→C Set Mode B→C	Not proper state	Not proper state	Activate B→C Set Mode B→C	Not proper state	Not proper state
B→C CopyInProgress CopyOnAccess CopyOnWrite	Recreate B→C Establish B→C Set Mode B→C	Not proper state	Not proper state	Recreate B→C Establish B→C Set Mode B→C	Not proper state	Not proper state
B→C Copied Split	Recreate B→C Establish B→C Restore B→C Set Mode B→C	Not proper state	Not proper state	Recreate B→C Establish B→C Set Mode B→C Incr. Restore B→C	Not proper state	Not proper state
B→C RestoreInProgress		Not proper state	Not proper state	Not proper state	Not proper state	Not proper state
B→C Restored	Split B→C	Not proper state	Not proper state	Split B→C	Not proper state	Not proper state

## Establishing concurrent BCV pairs

When you establish a BCV device as a mirror of a standard device, that relationship is known as a BCV pair. When you sequentially establish/split/establish a number of BCV devices over time with a specified standard, that is known as a multi-BCV relationship.

You can establish two BCV devices (eight when using emulation mode) as concurrent mirrors of a single standard device all within the same **symmir** command line. This relationship is known as a concurrent BCV pair. This feature allows you or an application script to instantly generate two synchronized copies of the standard data. When the two BCVs are split from the standard, the BCV's hosts can access the data on either BCV.

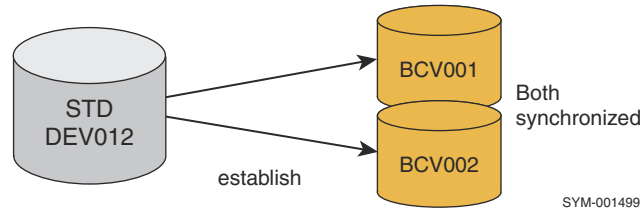
When establishing concurrent BCV pairs, you can either specify the BCVs, or use the **-concurrent** option to allow the array to select suitable (in terms of size, emulation, etc.) BCV(s) from the available BCV list.

## Example: Specifying the BCVs

To concurrently establish **BCV001** and **BCV002** with standard **DEV012** in device group **CncGrp**, enter:

```
symmir -g CncGrp establish -full DEV012 bcv ld BCV001
```

```
DEV012 bcv ld BCV002
```



**Figure 35. Establish concurrent BCV pairs**

After the concurrent BCVs become split at some point, you can then concurrently resynchronize the BCVs with an incremental establish:

```
symmir -g CncGrp establish DEV012 bcv ld BCV001
```

```
DEV012 bcv ld BCV002
```

While these examples pair both BCVs at the same time, you can also establish the first BCV device now and the second one later. In either case, the concurrent BCVs become synchronized to the standard and remain that way until you split the BCVs from the standard.

The following is a valid concurrent BCV pair example, provided there is no split action between these commands:

```
symmir -g CncGrp establish -full DEV012 bcv ld BCV001
```

```
.
```

```
.
```

```
.
```

```
symmir -g CncGrp establish -full DEV012 bcv ld BCV002
```

## Example

To instruct the array to select suitable BCV(s) to concurrently establish with standard **DEV012** in device group **CncGrp**, enter:

```
symmir -g CncGrp establish -full DEV012 -concurrent
```

In this case, if the standard is already synchronized with one BCV, the array will synchronize one other BCV with it. If the standard device is not yet synchronized with a BCV, the array will still only synchronize one BCV with it.

## Performing a protected BCV establish (moving all mirrors)

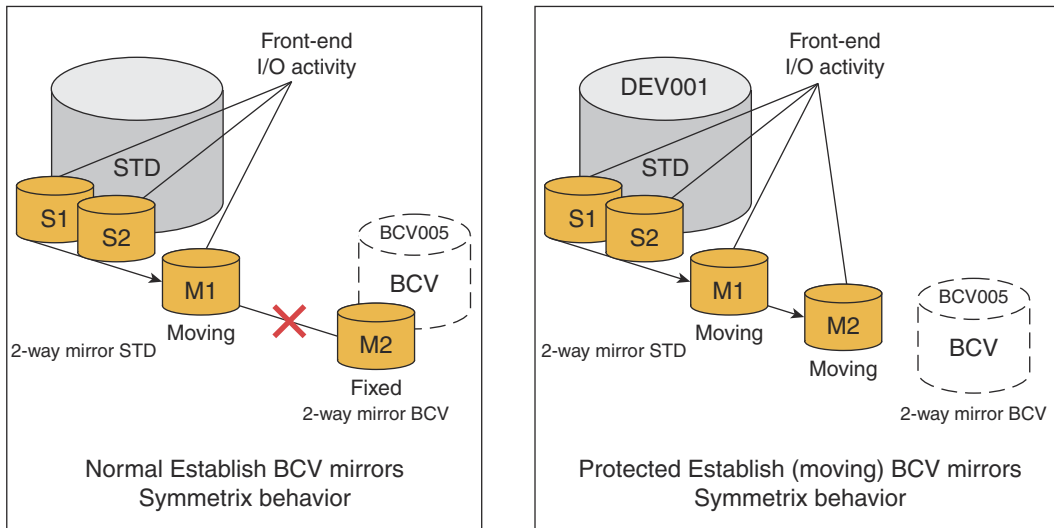
The protected BCV establish (**-protbcvest**) option (also called the moveall establish) can be used with the establish action to move all mirrors of locally mirrored BCV devices to join the mirrors of the standard device. This protected BCV moving mirror feature improves the availability of the BCV mirrors, particularly after a split operation where all BCV mirrors are instantly

synchronized. This feature, also known as instant BCV mirror sync, is available with full or incremental establish or restore operations. This feature is only useful in a native TimeFinder environment.

**NOTE:**

This feature is not supported if the standard device is a dynamic concurrent SRDF device or if TimeFinder is in emulation mode.

Establishing two-way BCV mirrors with protected establish on page 116 compares the array behavior between a normal and a moving protected establish action.



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**Figure 36. Establishing two-way BCV mirrors with protected establish**

In a 2-way BCV mirror configuration for a normal establish, M2 is fixed and can only be updated from M1 after a split. For a 2-way BCV mirror device for a protected establish, both M1 and M2 move to the standard device mirror set and become instantly synchronized and available for updates from I/O activity on the standard device.

To initiate a full **-protbcvest** establish on a 2-way BCV pair with 2-way standard **DEV001** in device group **Prod**, enter:

```
symmir -g Prod establish -full -protbcvest DEV001 BCV 1d BCV005
```

For more information about the affects of **-protbcvest** during a split operation, refer to [Splitting a protectively established BCV](#) on page 124.

## Incrementally establishing BCV pairs

Incrementally establishing a BCV pair accomplishes the same thing as the establish process, with a major time-saving exception: the standard device (DEV001) copies to the BCV device (BCV001) only the new data that was updated on the standard device while the BCV pair was split. Any changed tracks on the BCV are also overwritten by the data on the corresponding tracks on the standard device.

This process is useful if the data yielded from running an application on the BCV device is not needed or if a fresh copy of current data is needed.

Optionally, you can target devices in a device group, composite group, or device file:

```
symmir -g DgName establish
```

```
symmir -cg CgName establish
```

```
symmir -f[file] FileName establish
```

## Examples

To initiate an incremental establish on all the BCV pairs in the `prod` device group, enter:

```
symmir -g prod establish
```

To initiate an incremental establish on a BCV pair, `DEV001`, in the **prod** device group, enter:

```
symmir -g prod establish DEV001
```

To initiate an incremental establish on a list of specific BCV pairs in the **prod** device group, enter:

```
symmir -g prod establish DEV001
```

```
DEV002
```

```
DEV005
```

The establish defaults to re-establishing the previous BCV pairing, unless you use either the `-full` option.

## Automatically converting an incremental establish to a full establish

TimeFinder will automatically convert an incremental establish to a full establish when it determines that the requested devices (local or remote) have no prior relationship.

The `SYMAPI_DEFAULT_BCV_ESTAB_INC_TO_FULL` parameter in the options file allows you to enable this feature. Disabling this feature (default) will cause the SYMAPI to return the error `SYMAPI_C_DEVICE_IS_NOT_PAIRED`, as it did with previous versions.

### NOTE:

Enabling the `SYMAPI_DEFAULT_BCV_ESTAB_INC_TO_FULL` parameter does not eliminate the requirement to use the `-full` option with the `-opt` option.

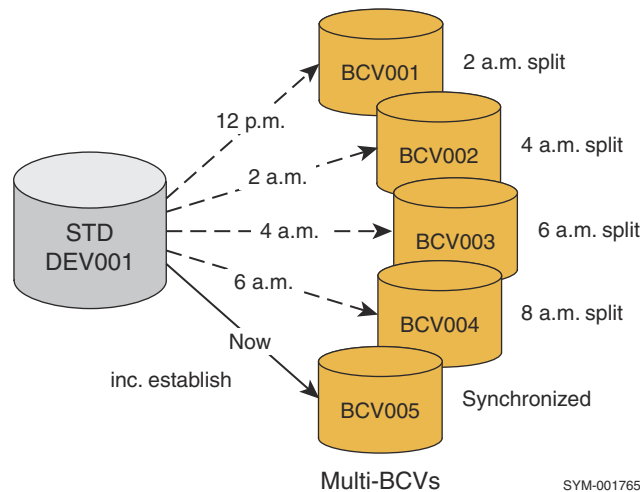
## Incrementally establishing multiple BCV pairs

You can incrementally establish (at different times) up to 16 (8 when using emulation) BCV devices associated with a single standard device. Note that initially, all the BCV devices must have been fully established before you perform any incremental establishes on them.

### NOTE:

Using the environment variable `SYMCLI_MAX_BCV_PAIRS`, the maximum number of pairs (established or restored) can be adjusted between 1 to 16 BCV devices.

With this feature, standard devices retain a relationship with multiple BCVs as long as those BCVs do not become paired with another standard. Here, the information about changed tracks is saved for a split BCV device if another BCV device is subsequently incrementally established and split from the same standard device. By invoking a series of **split/increment establish** commands over time ([Establishing a multi-BCV environment](#) on page 118), a multi-BCV environment becomes established that retains progressive historical images of the data on the specified standard.



**Figure 37. Establishing a multi-BCV environment**

To query for existing multi-BCVs that were originally all previously (full) established, and then to incrementally establish **BCV005** with the standard, enter:

```
symmir -g DgName query -multi
```

```
symmir -g DgName split DEV001
```

```
symmir -g DgName establish DEV001 BCV ld BCV005
```

In this environment, you can specify any one of these older BCVs to incrementally restore or establish the standard back to a historical copy.

## SRDF-connected BCV pairs

You can specify an incremental establish action to a remote site using the RDF flag (`-rdf` option), which incrementally establishes the remote BCV pairs.

To perform an incremental establish operation in the remote array at site B when the `-rdf` option is specified, use the following command:

```
symmir -g prod -rdf -establish
```

In this case, the `-rdf` option indicates that the BCV device being established is an SRDF-connected BCV device, which will be established with the remote standard mirror of the local RDF standard device.

## Second-level remote BCV pairs

You can specify an incremental establish action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which incrementally establishes second-level remote BCV pairs. An incremental establish operation in the remote array at site C when the remotely attached remote BCV flag (`-rrbcv` option) is specified with the following command:

```
symmir -g prod -rrbcv establish
```

To initiate an incremental establish on one remote BCV pair, **RBCV001**, in the **prod** group, enter:

```
symmir -g prod -rrbcv establish RBCV001 BCV ld RRBCV001
```

In this case, the flag indicates that the BCV device being established is a second Hop SRDF-connected BCV device, which will be established with the remote standard mirror of the remote BCV device.

## Hop 2 BCV pairs in a cascaded SRDF configuration

You can specify an incremental establish action to an array located at the tertiary site of a cascaded SRDF configuration. Perform an incremental establish operation in the remote at the tertiary site (C) when the hop 2 flag is specified with the following command:

```
symmir -g prod -hop2 establish
```

In this case, the flag indicates that the SRDF-connected BCV device is being established with the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Protected BCV incremental establish

The protected BCV establish (**-protbcvest**) option (also known as the moveall establish) can be used with the incremental establish action to move all mirrors of locally mirrored BCV devices to join the mirrors of the standard device. This moving of the mirrors feature improves availability of the BCV mirrors, particularly after a split operation where all mirrors are instantly synchronized.

To initiate a protected (**-protbcvest**) incremental establish on a 2-way BCV pair with 2-way standard **DEV001** in device group **Prod**, enter:

```
symmir -g Prod establish -protbcvest DEV001 BCV 1d BCV005
```

For more information about the protected BCV established environment, refer to [Performing a protected BCV establish \(moving all mirrors\)](#) on page 115.

## Splitting BCV pairs

After an establish operation and the standard device and BCV mirrors are synchronized, the BCV device becomes a mirror copy of the standard device. You can split the paired devices to where each holds separate valid copies of the data, but will no longer remain synchronized to changes when they occur. SYMCLI processes can then be executed with the BCV device once the split completes.

Optionally, you can target devices in a device group, composite group, or device file:

```
symmir -g DgName split
```

```
symmir -cg CgName split
```

```
symmir -f[file] FileName split
```

## Examples

To split all the BCV pairs in the `prod` device group, enter:

```
symmir -g prod split
```

To split a BCV pair, `DEV001`, in the `prod` device group, enter:

```
symmir -g prod split DEV001
```

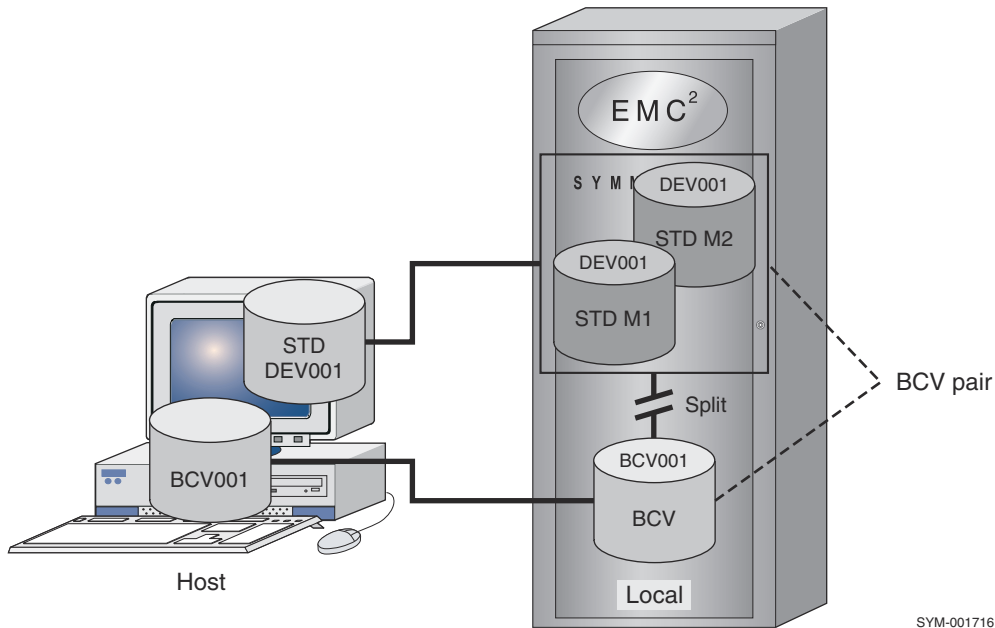
To split a list of standard devices in the `prod` device group, enter:

```
symmir -g prod split DEV001 DEV002 DEV003
```

[Split the BCV pair](#) on page 120 illustrates the splitting of a BCV pair.



Relabeling devices is sometimes required in situations where devices are under an MS Windows type volume manager's control. If a BCV (TimeFinder) device holds an identical copy of its standard (paired) device, and when the BCV device becomes ready to the Windows operating system, the volume manager will detect two identical volumes with different mount points. This can cause the volume manager on Windows to exit and bring down a system.



**Figure 38. Split the BCV pair**

When a *split* is initiated for each specified BCV pair in a device group, the following occurs:

- Command validity is checked. For example, the array makes sure that the standard device has an active BCV mirror and that the standard and BCV devices comprise a BCV pair.
- Any pending write transactions to the standard device and the BCV device are destaged.
- The BCV device is split from the BCV pair.
- If the device is a metadevice, all metamembers are implicitly split as well.
- The BCV device state is changed to Ready, enabling host access through its separate address (BCV001).
- Operation with the standard device is resumed and any tracks changed from write operations to the standard device are marked. (This is necessary for updating the BCV device if it is reestablished with the same standard device at a later time.)
- If the BCV device has any of its own mirrors, the mirrors are synchronized, unless protected establish or emulation is used.

Once you finish running any Business Continence processes on the BCV device, the following options are available:

- Incremental establish or reestablish of the BCV pair.
- Establish new using the same BCV devices with a different standard device.
- Restore data to a standard device from the BCV device.
- Incrementally restore data to the standard device from the BCV device (if the devices were previously paired).

## SRDF-connected BCV pairs

### About this task

You can specify a **split** action to a remote site using the RDF flag (`-rdf` option), which splits the remote BCV pairs.

To perform the splitting of a remote BCV pair, use the following command:

```
symmir -g prod -rdf split
```

In this case, the flag indicates that the BCV device being split is an SRDF-connected device, which will be split from the remote standard mirror of the local RDF standard device.

If a BCV device has its own mirrors (local or remote), these mirrors will become synchronized with its first mirror after the BCV pair is split.



## Second-level remote BCV pairs

You can specify a `split` action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which splits second-level remote BCV pairs. To perform a split operation in the remote array at site C when the remotely attached remote BCV flag (`-rrbcv` option) is specified, use the following command:

```
symmir -g prod -rrbcv split
```

To initiate a split on one remote BCV pair, RBCV001, in the `prod` group, enter:

```
symmir -g prod -rrbcv split RBCV001 BCV ld RRBCV001
```

In this case, the flag indicates that the BCV device being split is a second HOP SRDF-connected BCV device, which will be split from the remote standard mirror of the remote BCV device.

## Hop 2 BCV pairs in a cascaded SRDF configuration

You can specify a `split` action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform an establish operation in the remote array at the tertiary site (C) when the hop 2 flag is specified, use the following command:

```
symmir -g prod -hop2 split
```

In this case, the flag indicates that the SRDF-connected BCV device (2BCV001) is being split from the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Remote copy with BCV split

In addition to splitting a local BCV pair, you can further specify the remote (`-remote`) option which makes the R1 device ready on the link and propagates the R1 BCV copy across the SRDF link to the R2 that mirrors the BCV:

```
symmir -g prod split DEV001 -remote
```

## Performing a reverse split

The reverse (`-reverse`) option initiates a reverse data copy from the fixed BCV mirror to the primary (moving) mirror of the BCV upon the completion of the split operation.

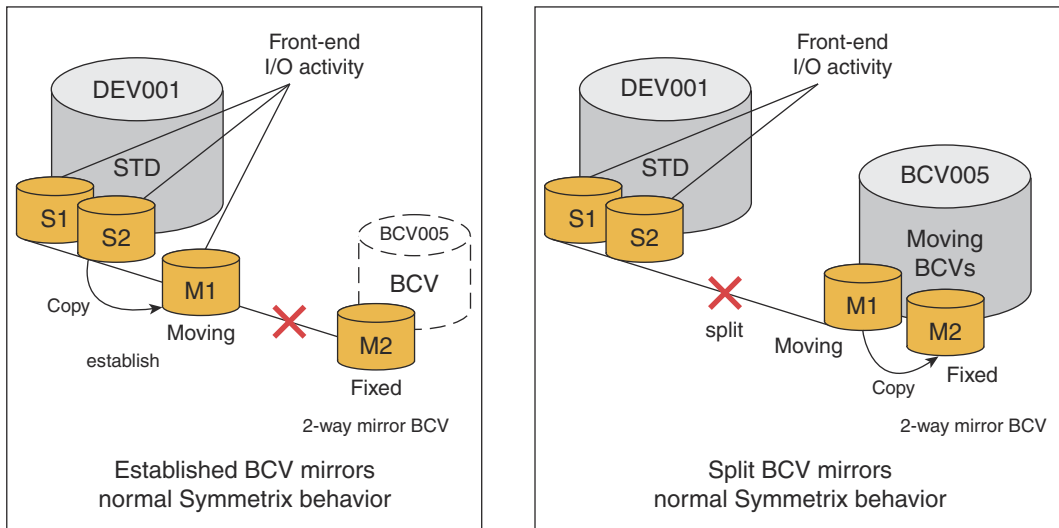
### NOTE:

A reverse split is not supported in TimeFinder/Clone Emulation mode.

## Normal split behavior

Normally, when a BCV has two mirrors, only the primary mirror (M1) joins the standard device in establish or restore operations. As shown in [Two-way mirror BCV establish/split normal behavior](#) on page 122, the content of the primary BCV mirror is refreshed by data from the standard, when the BCV is established. The secondary BCV mirror (M2) is refreshed by data from the primary BCV mirror (M1), after the BCV mirror is split from the standard. The primary BCV mirror is referred to as the *moving mirror*, because it moves between the standard and the secondary (fixed) mirror.

Usually, after a split, the fixed BCV mirror is refreshed from the moving BCV mirror. This can either be a full copy operation or a differential copy. In a differential copy, only the tracks that have changed on the moving mirror during the time it was synchronized with the standard are refreshed.

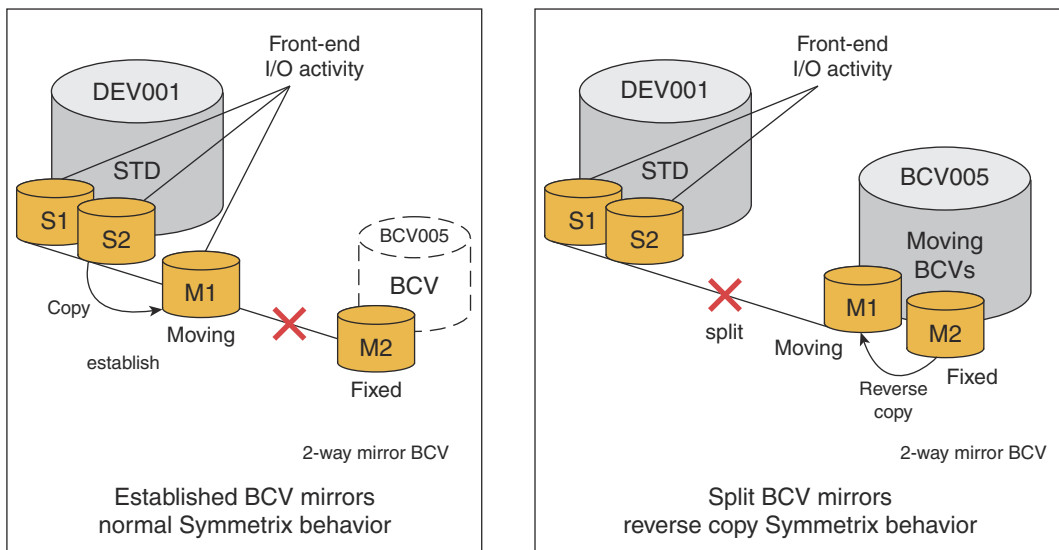


SYM-001722

Figure 39. Two-way mirror BCV establish/split normal behavior

## Reverse split behavior

In a reverse split operation, the direction of data flow between the BCV mirrors is reversed. As shown in [Two-way mirror reverse establish/split behavior](#) on page 122, during a reverse split, the fixed BCV mirror (M2) will refresh the moving mirror (M1) after the split operation. This behavior may be desirable when you need to revert to an older copy of the data that was on the BCV before it was established/restored with the standard.



SYM-001723

Figure 40. Two-way mirror reverse establish/split behavior

### **NOTE:**

Be sure this is the behavior you want before invoking the reverse split option since the primary BCV mirror data is refreshed with an older mirror of data.

A reverse split is permitted only if both BCV mirrors were completely synchronized before the moving BCV mirror was paired with the standard device. When you anticipate a need for future reverse split operations, the `-reverse` option is applied to an establish or restore operation. This option requests a verification check that the BCV's fixed mirror has valid data. You must verify that both mirrors are in the Ready state after the split.

To establish DEV001/BCV005 and later perform a reverse split on DEV001 in device group Prod, enter:

```
symmir -g Prod establish -reverse DEV001
```

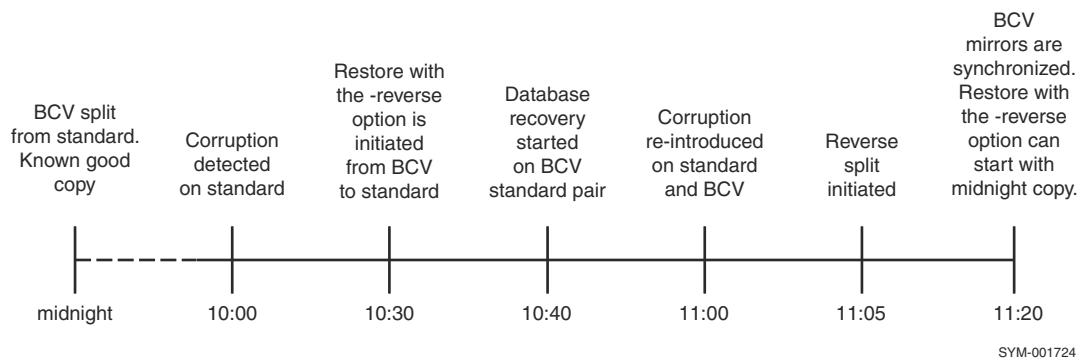
```
symmir -g Prod split -reverse DEV001
```

```
symmir -g Prod verify -bcv_mirrors -ready
```

**NOTE:** Data may not be immediately available. Use the `verify` command to check that both mirrors are in the Ready state for the data to be available.

[Practical use of a reverse split](#) on page 123 illustrates a practical use of a reverse split. At midnight a split results in a good point-in-time copy of a database. At 10 a.m. a corruption is discovered in the database, necessitating a database recovery. At 10:30 a.m. a restore operation is initiated from the BCV copy. Because the good data is immediately available to the BCV pair, the recovery begins shortly after initiating the restore process. At 11:00 a.m. during the recovery, one of the logs re-corrupts the database.

Though the data on the BCV's moving mirror has changed during the recovery process, a reverse split can be initiated. At 11:20 a.m. the BCV's fixed mirror refreshes its moving mirror, providing access to the good midnight copy of the data.



**Figure 41. Practical use of a reverse split**

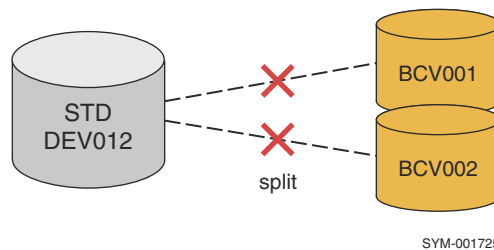
## Splitting concurrent BCV pairs

You can establish two BCV devices as concurrent mirrors of a single standard device. This relationship is known as a concurrent BCV pair. This feature allows you or an application to instantly generate two synchronized copies of the standard data (refer to [Establishing concurrent BCV pairs](#) on page 114).

When you apply a split action to a standard device that was concurrently established with two BCV mirrors, both BCVs become split from the standard.

To split concurrently established BCV001 and BCV002 with standard DEV012 in device group CncGrp, enter:

```
symmir -g CncGrp split DEV012
```



**Figure 42. Splitting concurrent BCV pairs**

## Concurrent BCVs

If you do not want both of the concurrent BCVs to simultaneously split together, you can individually target the split action by explicitly specifying the BCV with the standard as follows:

```
symmir -g CncGrp split DEV012 bcv ld BCV001
```

or:

```
symmir -g CncGrp split DEV012 bcv ld BCV002
```

## Concurrent splits

To display the status of the background concurrent split for both of these BCVs, enter:

```
symmir -g CncGrp query -multi -bg
```

Because invalid track tables are maintained, future concurrent incremental establish operations are possible on these split BCVs. After a concurrent split, it is possible to resynchronize just one BCV as follows:

```
symmir -g CncGrp establish DEV012
```

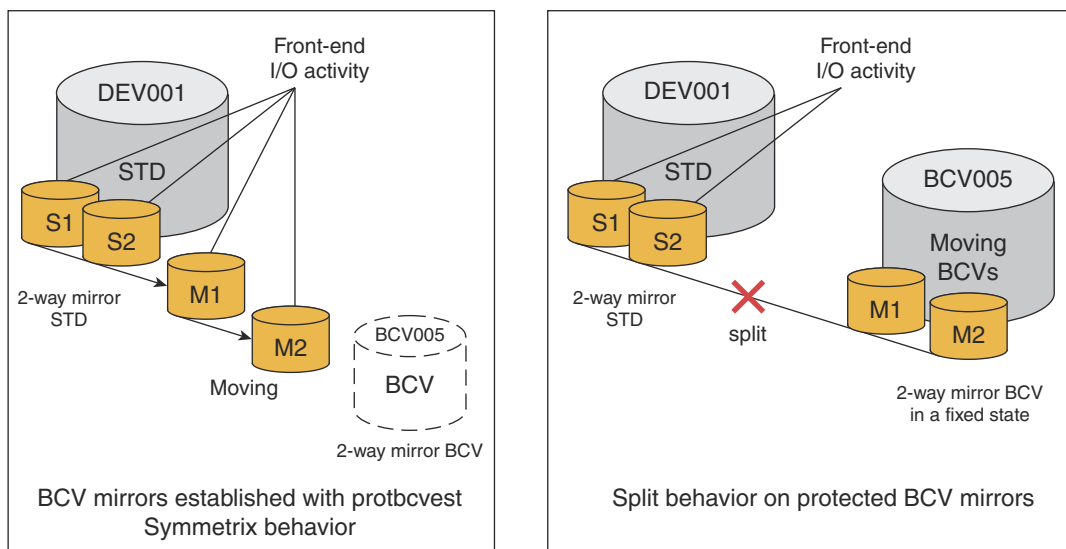
However, if you do not explicitly specify a BCV and you have not set an attachment preference, TimeFinder chooses the BCV to resynchronize, based on which of the two concurrent BCVs was split first.

You can also verify that the action has completed, as follows:

```
symmir -g CncGrp -split verify -bg DEV012 BCV ld BCV002
```

## Splitting a protectively established BCV

A split action splits both of the BCV mirrors away from the standard device that were previously established with a `-protbcvest` option. [Split behavior on two-way BCV mirrors](#) on page 124 illustrates the initial protected BCV established state and the resulting behavior of a split action on these BCV mirrors. For any split command, there is no need to apply the `-protbcvest` option to move all the mirrors away from the standard.



SYM-001726

Figure 43. Split behavior on two-way BCV mirrors

Before you split, you may need to query the array to examine the protected STD/BCV mirrored environment to identify the established moved devices for the split action, as follows:

```
symmir -g prod query -protbcvest
```

To perform a protected establish and later split (for example) on standard DEV001 with its BCV mirrors, in device group `prod`, enter:

```
symmir -g prod establish -protbcvest DEV001
```

```
.
```

```
.
```

```
.
```

```
symmir -g prod split DEV001
```

For more information about a protected BCV establish, refer to .

## TimeFinder consistent split

TimeFinder consistent split allows you to split off a consistent, restartable copy of a database management system within seconds with no interruption to online service. Consistency split helps to avoid inconsistencies and restart problems that can occur when splitting a database-related BCV without first quiescing the database. Consistent split can be implemented using Engenuity Consistency Assist (ECA) functionality or SRDF/A.

[Consistent split using Engenuity Consistency Assist](#) on page 125 contains greater detail. The EMC Solutions Enabler SRDF Family CLI User Guide provides complete details on SRDF/A.

### NOTE:

With Engenuity 5876, TimeFinder includes the TimeFinder/Consistency Group (TimeFinder/CG) option. You do not need a separate license for TimeFinder/CG. The *EMC Solutions Enabler Version Installation Guide* provides all of the licensing information.

## Consistent split using Engenuity Consistency Assist

### About this task

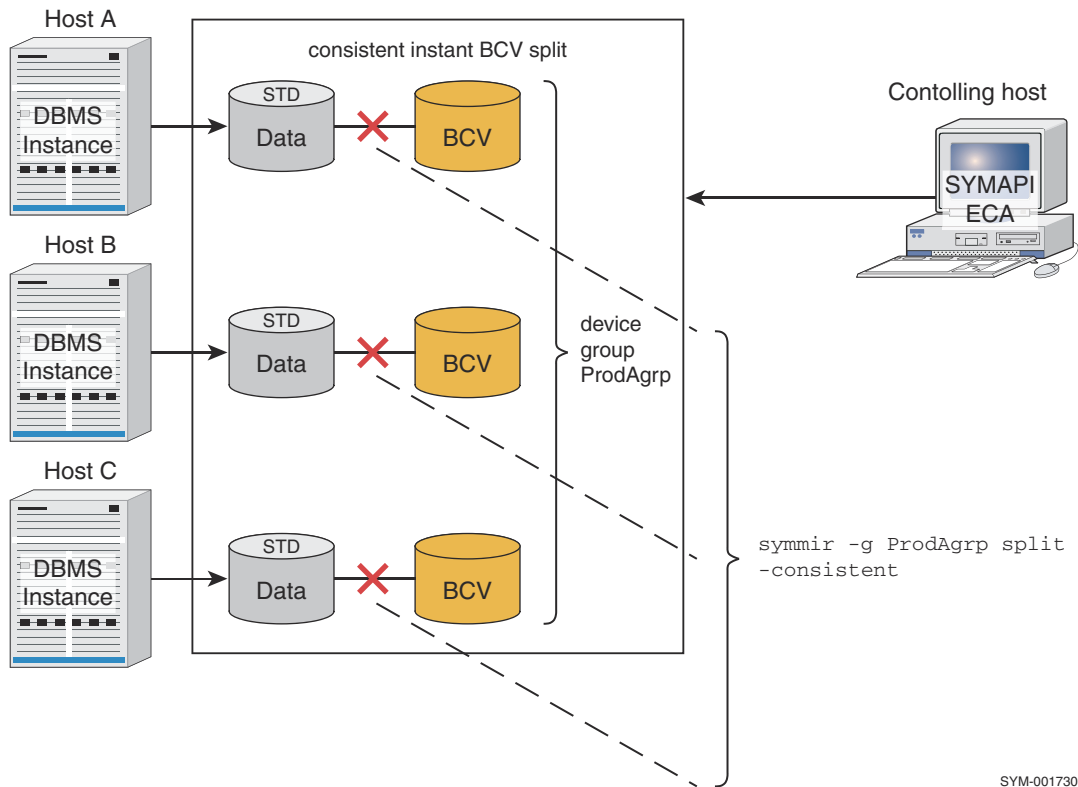
You can use Engenuity Consistency Assist (ECA) to perform consistent split operations across multiple, heterogeneous hosts.

### NOTE:

With Engenuity 5876, TimeFinder includes the TimeFinder/CG option. You do not need a separate license for TimeFinder/CG.

Using ECA to consistently split BCV devices from the standards, you must have either a control host with no database or a database host with a dedicated channel to the gatekeeper devices. The dedicated channel cannot be used for servicing other devices to freeze I/O.

[ECA consistent split](#) on page 126 depicts how a control host can perform ECA consistent splits for three database hosts that access devices on an array.



**Figure 44. ECA consistent split**

Device groups or composite groups must be created on the controlling host for the target database to be consistently split. Device groups can be created to include all of the devices being accessed or defined by database host access. For example, if you define a device group that includes all of the devices being accessed by Hosts A, B, and C (refer to [ECA consistent split](#) on page 126), then you can consistently split all of the BCV pairs related to those hosts with a single command. However, if you define a device group that includes only the devices accessed by Host A, then you can split those BCV pairs related to Host A without affecting the other hosts.

**NOTE:**

For information on performing a consistent split to BCVs in both the local and remote arrays, refer to [Consistent split for SRDF/A devices](#) on page 127.

The following steps explain the example in [ECA consistent split](#) on page 126 of how to create one device group including all database host accessed devices and perform a consistent split operation on all of the BCV pairs accessed by those hosts.

**Steps**

1. Create a REGULAR type device group:

```
symdg create ProdAgrp -type REGULAR
```

2. Add all of the standard devices holding the database for each host (A, B, and C) to the device group:

```
symdg -g ProdAgrp addall -devs 0286:028B
```

```
symdg -g ProdAgrp addall -devs 0266:026B
```

```
symdg -g ProdAgrp addall -devs 0246:024B
```

3. Associate the BCV devices that will hold the restartable copy of the database with the device group:

```
symbcv -g ProdAgrp associateall -devs 039A:039F
```

```
symbcv -g ProdAgrp associateall -devs 037A:037F
```

```
symbcv -g ProdAgrp associateall -devs 035A:035F
```

4. Fully establish all BCV pairs in the device group:

```
symmir -g ProdAgrp establish -full -noprompt
```

**NOTE:**

When the BCV pairs in device group ProdAgrp (Host A, B, and C - BCV pairs) are synchronized, you can perform the consistent split using the **symmir split** command to split all of the BCV pairs associated with those hosts.

5. Use the `-consistent` option to perform a consistent (instant) split on all BCV pairs in the device groups:

```
symmir -g ProdAgrp split -consistent
```

Once the `symmir split -consistent` command is issued, I/O to the device group is frozen and a 30-second Engenuity protection timer begins. After the split completes (or 30 seconds passes, whichever comes first), the I/O channels are thawed, granting (pent up) operations access to the standard devices. Splits across all devices in a group are considered consistent, if the BCV split execution is performed within that window.

If for some unknown host or I/O channel reason, not all devices are split within the 30-second window, **symmir** returns the following reply at completion:

```
Consistency window was closed on some devices before the operation completed.
```

At this point, the final successful split outside the window is no longer considered to be consistent in execution across the device group. For consistency and reliability sake, it is recommended that you reestablish the device group, and then (later) attempt the consistent split again.

## Consistent split for SRDF/A devices

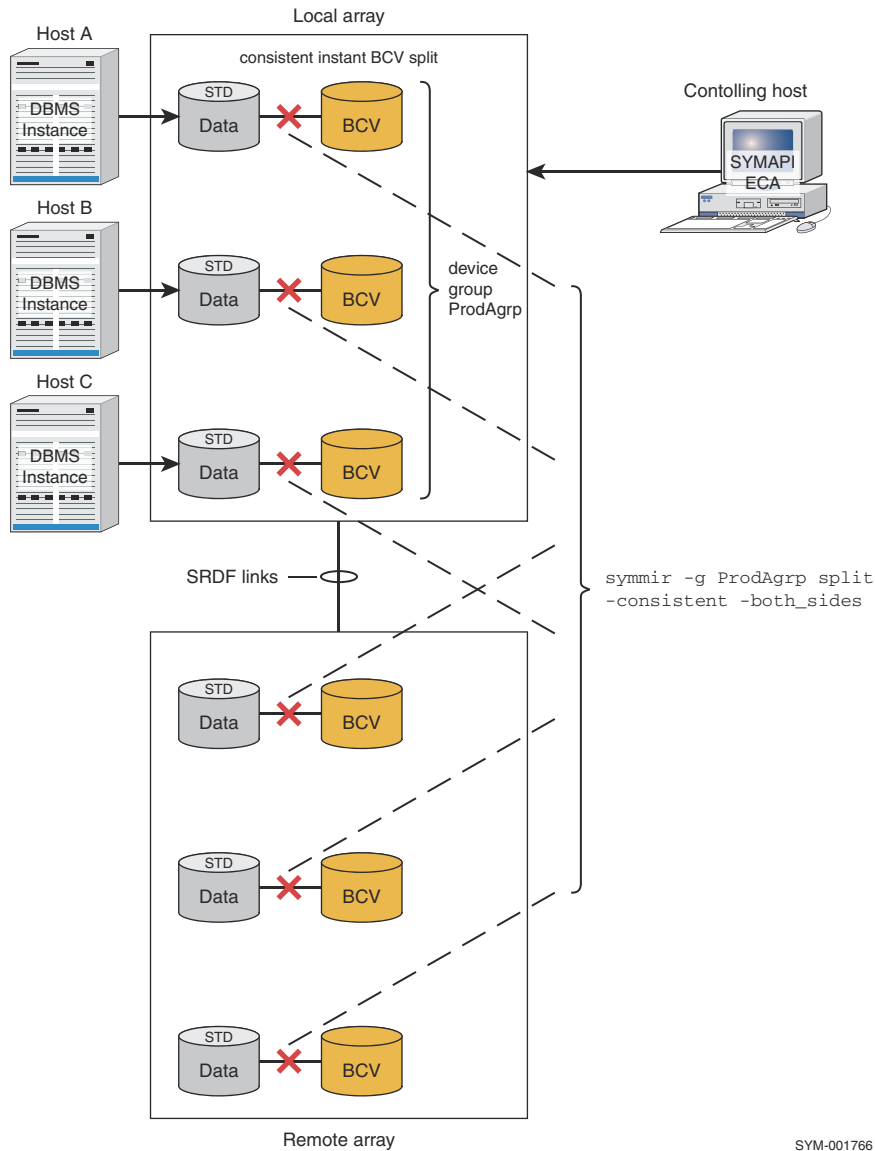
TimeFinder consistent split allows you to consistently split BCVs from R2 devices operating in asynchronous mode (SRDF/A).

Although not required for SRDF/A mode, it is recommended that you use TimeFinder BCVs at the remote site to mirror R2 devices and preserve a consistent image of data before resynchronization operations. Also, R2 device BCVs can be split off of the R2 without having to drop the RDF links and without disruption to the SRDF/A operational cycles. R2 BCVs can be controlled from the R1-side or the R2-side host as long as the device groups have been defined on that host. Controlling the R2 BCVs from the R1-side host requires using the `symmir` command with the `-rdf` option. To consistently split BCVs off the R2 RDF/A device in group **prod** from the R1 host, enter:

```
symmir -g prod split -rdf -consistent
```

## Split both local and remote RDF devices (-both\_sides)

In an RDF environment as shown in [Consistent splits on both SRDF sides using ECA](#) on page 128, you can perform a consistent split to the BCVs in both the local and remote arrays.



SYM-001766

**Figure 45. Consistent splits on both SRDF sides using ECA**

## Restrictions: splitting devices on both local and remote arrays

In the preceding example, `symmir -g GroupName split -consistent -both_sides` split devices on both the local and remote arrays. For the host to perform this operation:

- The SRDF links must be up,
- The RDF mode must be synchronous, and
- The devices must have an RDF state of Synchronized.

## Fully restoring BCV pairs

Like the full establish operation, a full restore operation copies the entire contents of the BCV devices to the standard device. Optionally, you can target devices in a device group, composite group, or device file:

```
symmir -g DgName -full restore
```



```
symmir -cg CgName -full restore
symmir -f[file] FileName -full restore
```

## Examples

To initiate a full restore on all the BCV pairs in the `prod` device group, enter:

```
symmir -g prod -full restore
```

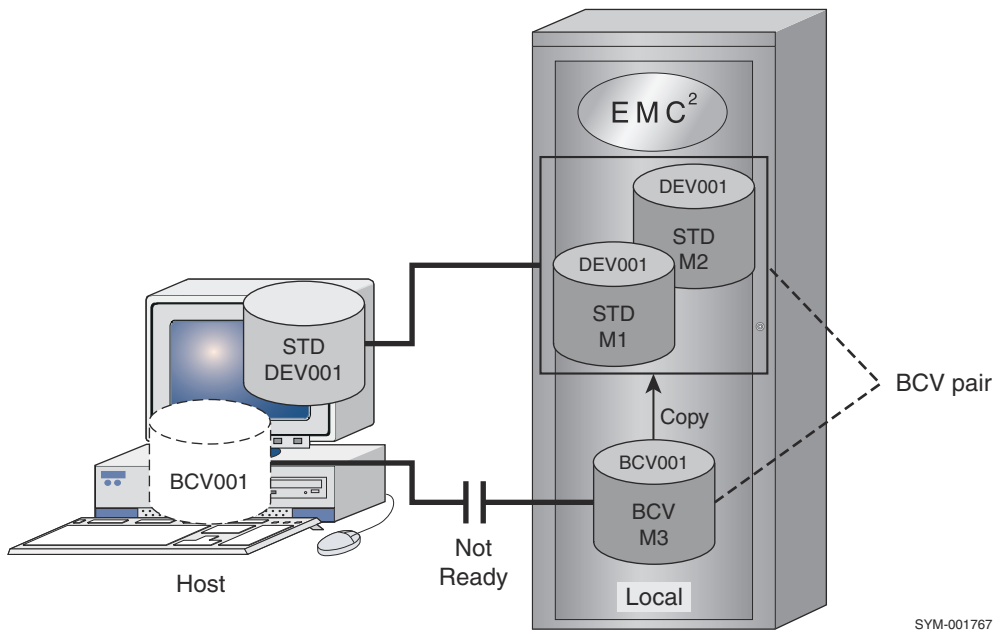
To initiate a full restore on a BCV pair, `DEV001`, in the `prod` device group, enter:

```
symmir -g prod -full restore DEV001
```

To initiate a full restore on more than one (list) of BCV pairs in the `prod` device group, enter:

<code>symmir -g prod -full restore</code>	DEV001 BCV 1d BCV001
	DEV002 BCV 1d BCV002
	DEV005 BCV 1d BCV003

The restoration process ([Full restore of the BCV pair](#) on page 129) is complete when the standard device and BCV device contain identical data.



SYM-001767

**Figure 46. Full restore of the BCV pair**

### **NOTE:**

The BCV device is not available for host use during the time that it is assigned as a BCV mirror on a standard device. However, unless the `-protect` option is used, any new data written to the standard device is copied to the BCV device while the BCV pair exists.

When a full restore is initiated for each specified BCV pair in a device group:

- Command validity is checked. For example, the command is rejected if the BCV device and the standard device are not the same size.
- The BCV device is set as Not Ready to the host.
- The BCV is assigned as the next available mirror of the standard device.

- The contents of the BCV device are copied to the standard device. For example, in [Full restore of the BCV pair](#) on page 129, the array copies the contents of M3 to both M1 and M2, overwriting the data present on those devices.

To use a BCV device for Business Continuity procedures, you must again split the BCV pair to make the BCV device available to its host. If you want to use a fully synchronized copy of the data, suspend all applications that are using the standard device, and make sure that all host buffering and intermediate caching is flushed to the appropriate device on the array prior to performing the split operation. If you do not require a synchronized copy of the data for running a Business Continuity process, this step is unnecessary.

Note that the base tasks performed with **symbcv** such as list, associate, and disassociate locally or remotely connected BCV devices, are described at the beginning of this chapter.

By default, Solutions Enabler rejects restore commands for CKD online devices. You can allow the restore command for CKD online devices by disabling the SYMAPI\_TF\_CHECK\_ONLINE\_CKD option. For instructions on disabling or enabling this option, refer to the *EMC Solutions Enabler Installation Guide*.

## Specifying the default method for restoring BCV pairs

The SYMAPI\_DEFAULT\_BCV\_RESTORE\_TYPE parameter in the options file enables you to specify the default method for restoring BCV pairs. Valid values are:

- SINGULAR specifies to issue the restore to one device at a time. This method allows other tasks access to the array when doing a large number of restores.
- PARALLEL (default) specifies to issue the restore to each servicing DA in parallel, and then wait for a DA to finish before issuing another restore to that DA.
- SERIAL specifies to issue restores as fast as the GST queue can handle them. However, all members of a meta must be restored before continuing to the next meta or device. This is the default method when using metadevices.

### NOTE:

The *EMC Solutions Enabler CLI Command Reference* contains information on changing the option file parameters.

## Instantly restoring multiple BCV pairs

The multi/instant restore option improves the performance of a typical restore operation by submitting multiple BCV pairs in a single system call to be restored instantly.

You can enable (default)/disable this feature with the SYMAPI\_TF\_MULTI\_ESTAB\_REST environment variable. Setting the SYMAPI\_DEFAULT\_BCV\_RESTORE\_TYPE to SERIAL or SINGULAR will cause this option to be ignored.

## SRDF-connected BCV pairs

You can also specify a full **restore** action to a remote site using the `-rdf` option, which fully restores the remote BCV pairs.

To perform a full restore operation in the remote array at site B when the RDF flag is specified with the following command:

```
symmir -g prod -rdf -full restore DEV001
```

In this case, the flag indicates that the BCV device being restored is an SRDF-connected BCV device, which will be established with the remote standard mirror of the local RDF standard device.

To perform a full restore operation in the remote array at site B when the `-rdf` and `-bcv` options are specified, use the following command:

```
symmir -g prod -rdf -bcv -full restore BCV001
```

In this case, the flags indicate that the BCV device being restored is an SRDF-connected BCV device, which will be established with the remote standard mirror of the local R1 BCV device.

## Second-level remote BCV pairs

You can specify a full restore action to a second remote site using the remotely attached remote BCV `-rrbcv` option, which restores second-level remote BCV pairs. To perform a restore operation in the remote array at site C when the `-rrbcv` option is specified, use the following command:

```
symmir -g prod -rrbcv restore -full
```

To initiate a restore on one remote BCV pair, RBCV001, in the **prod** group, enter:

```
symmir -g prod -rrbcv restore RBCV001 BCV 1d RRBCV001 -full
```

In this case, the flag indicates that the BCV device being restored is a second Hop SRDF-connected BCV device, which will be established with the remote standard mirror of the remote BCV device.

## Hop 2 BCV pairs in a cascaded SRDF configuration

You can specify a full restore action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform a restore operation in the remote array at the tertiary site (C) with the **-hop2** option, use the following command:

```
symmir -g prod -hop2 restore -full
```

In this case, the `-hop2` option indicates that the SRDF-connected BCV device (2BCV001) is being established with the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Performing a remote copy with restore

In addition to restoring the specified BCV pair, you can further specify the remote (`-remote`) option, which will propagate the restored copy from the BCV pair across the SRDF link from the R2 standard to its R1 BCV in one command step:

```
symmir -g prod restore -rdf -bcv -remote -full
```

### NOTE:

The **-remote** option is not supported for restoring from an R2 standard to an R1 BCV. Instead you should use the two step method.

### NOTE:

Be sure you want the R1 BCV device to be updated with the restored copy before issuing the `-remote` option along with this restore operation.

It is good practice to perform restore operation at the remote site in two command steps (restore the BCV pair first, and then restore the R1 from the R2):

```
symmir -g DgName restore -bcv -rdf -full
```

```
symrdf -g DgName restore -bcv
```

## Incrementally restoring BCV pairs

The incremental restore process ([Incremental restore the STD](#) on page 132) accomplishes the same thing as the restore process with a major time-saving exception: the BCV (BCV001) copies to the standard device (DEV001) only the new data that was updated on the BCV device while the BCV pair was split. Any changed tracks on the standard device are also overwritten by the data on the corresponding tracks on the BCV device. This maximizes the efficiency of the synchronization process.

This process is useful if the results from running a new application on the BCV device were desirable, and the user wants to port the data and the new application to the standard device.

The following forms enable you to target devices in a device group, composite group, or device file:

```
symmir -g DgName restore
```

```
symmir -cg CgName restore
```

```
symmir -f[file] FileName restore
```

To initiate an incremental restore on all the BCV pairs in the **prod** device group, enter:

```
symmir -g prod restore
```

**NOTE:**

It might be desirable for your site to set external device locks on all standard and BCV devices you are about to restore; refer to [Device external locks](#) on page 98.

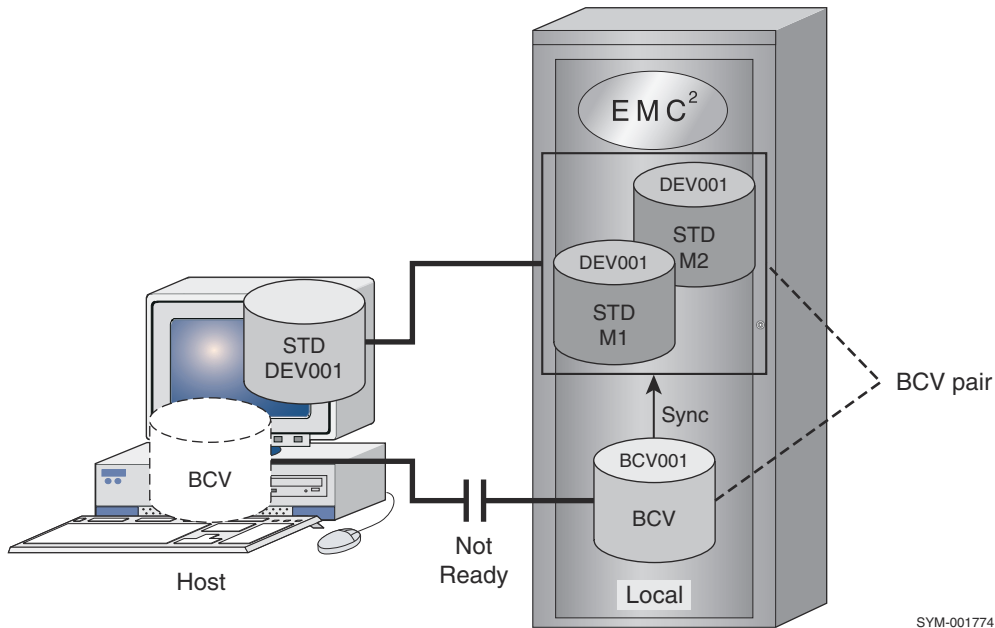
To initiate an incremental restore on a BCV pair, DEV001, in the **prod** device group, enter:

```
symmir -g prod restore DEV001
```

To initiate an incremental restore on more than one (list) BCV pair in the **prod** device group, enter:

```
symmir -g prod restore DEV001 DEV002 DEV003
```

[Incremental restore the STD](#) on page 132 illustrates an incremental restore of a BCV pair.



**Figure 47. Incremental restore the STD**

When an incremental restore is initiated for each specified BCV pair in a device group, the following occurs:

- Command validity is checked. For example, the command is rejected if the BCV device and the standard device were not previously paired.
- The BCV device is set as Not Ready to the host.
- The BCV device is assigned as the next available mirror of the standard device.
- The tracks are copied from the BCV device to the standard device. Any new data written to the BCV device while the BCV pair was split is written to the standard device. Any new data written to the standard device while the BCV pair was split is overwritten by the data on the corresponding track on the BCV device.

The BCV pair is synchronized when the standard device and the BCV device contain identical data.

**NOTE:**

The BCV device is not available for host use while it is assigned as a BCV mirror on a standard device. However, any new data written to the standard device is copied to the BCV device while the BCV pair exists.

## Multiple BCV pairs

You can incrementally establish or restore up to 16 BCV pairs (8 pairs when using emulation) associated with a single standard device. Using the environment variable `SYMCLI_MAX_BCV_PAIRS`, the maximum amount of pairs can be adjusted from 1 to 16 BCV devices. If a series of `split/increment establish` commands were invoked over time (refer to [Incrementally establishing multiple BCV pairs](#) on page 117), a multi-BCV environment becomes established that retains progressive historical images of the specified standard.

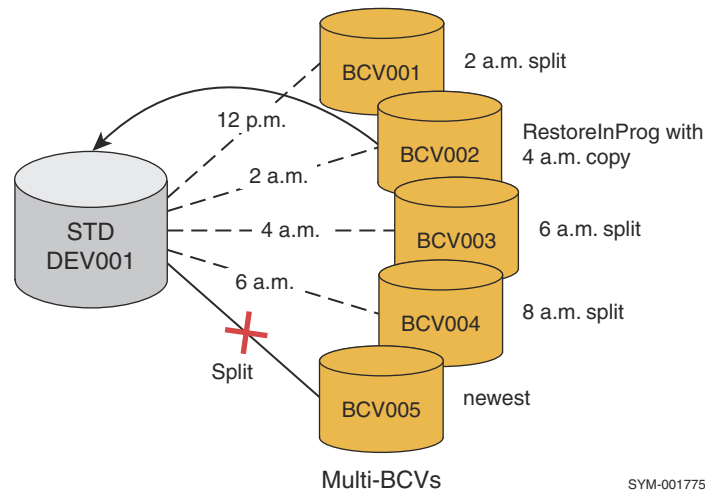
With the incremental restore command, you can specify any one of these older BCVs to incrementally restore the standard back to a specific historical copy. [Restoring a BCV in a multi-BCV environment](#) on page 133 shows the standard being restored by the **BCV002** copy, which was split at 4 a.m.

Before performing a restore, you may need to query the array to see which BCVs can be incrementally restored:

```
symmir -g DgName query -multi
```

### **i** NOTE:

Before invoking the restore command, be sure this is the data copy you want your standard restored to since this BCV is an older version of what is current.



**Figure 48. Restoring a BCV in a multi-BCV environment**

To restore the current standard with old data from BCV002, enter:

```
symmir -g DgName split DEV001symmir -g DgName restore DEV001 BCV ld BCV002
```

## SRDF-connected BCV pairs

You can also specify an incremental **restore** action to a remote site using the RDF flag (`-rdf` option), which incrementally restores the remote BCV pairs.

### **i** NOTE:

Be sure you want the standard R1 device to be updated with the restored copy before issuing the `-remote` option along with this restore operation.

To perform an incremental restore operation in the remote array at site B when the RDF flag is specified, use the following command:

```
symmir -g prod -rdf restore
```

In this case, the flag indicates that the BCV device being restored is an SRDF-connected BCV device, which will be established with the remote standard mirror of the local R1 standard device.

In addition to restoring the specified BCV pair, you can further specify the remote (`-remote`) option, which will propagate the restored copy from the BCV pair across the SRDF link to the R1 standard.

#### NOTE:

The `-remote` option is required when restoring to an R1 device that is ready on the link.

It is good practice to perform restore operations in two command steps (restore the BCV pair first, then restore the R1 from the R2):

```
symmir -g DgName restore -rdf
```

```
symmrdf -g DgName restore
```

## Second-level remote BCV pairs

You can specify an incremental **restore** action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which incrementally restores second-level remote BCV pairs.

To perform an incremental restore operation in the remote array at site C specifying the remotely attached remote BCV flag (`-rrbcv` option), use the following command:

```
symmir -g prod -rrbcv restore
```

To initiate a restore on one remote BCV pair, RBCV001, in the **prod** group, enter:

```
symmir -g prod -rrbcv restore RBCV001 BCV 1d RRBCV001
```

In this case, the flag indicates that the BCV device being restored is a second HOP SRDF-connected BCV device, which will be established with the remote standard mirror of the remote BCV device.

## Hop 2 BCV pairs in a cascaded SRDF configuration

You can specify a incremental **restore** action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform an incremental restore operation in the remote array at the tertiary site (C) specifying the hop 2 flag (`-hop2` option), use the following command:

```
symmir -g prod -hop2 restore
```

In this case, the flag indicates that the SRDF-connected BCV device (2BCV001) is being established with the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Protecting BCV data during full or incremental restores

Once you initiate a restore from the BCV to the standard device, data from the BCV is immediately available to a host accessing the standard device. During the time the pair are joined, writes are sent to the standard and the BCV, while reads are satisfied by the data on the BCV if the data on the standard has not yet been completely updated from the BCV. However, this process can alter the BCV data during the restore operation. If you want to retain the original BCV data, use the protected restore feature.

The protected restore feature allows the contents of a BCV to remain unchanged during and after a restore operation, even while the BCV and the standard are joined. Subsequently, any writes to the BCV pair are not propagated to the BCV while the standard and the BCV are joined in a RestInProg or Restored state. This protection offers the same advantage as a reverse split, but without the need for a mirrored BCV.

You can restore data from a BCV to a standard device without altering the contents of the BCV, by using the `protect(-protect)` option. It write-disables the BCV mirror(s) during and particularly after the restore operation.

## Examples

To initiate a protected *full* restore (for example) on the STD mirrors (DEV001) in the `Prod` group, enter:

```
symmir -g Prod -full restore -protect DEV001
```

To initiate a protected *incremental* restore (for example) on the STD mirrors (**DEV001**) in the **Prod** group, enter:

```
symmir -g Prod restore -protect DEV001
```

### NOTE:

If you ever need to split a device again that was protected restored, you must use the `-protect` option on the split command:

```
symmir -g Prod split -protect DEV001
```

To view device information for the protected restore operation, enter:

```
symmir -g Prod query -protect
```

### NOTE:

The standard invalid track count displayed in the query operation does not reflect any new writes while the device is in the RestInProg state. When the device state changes to Restored, the invalid track count displays as zero.

## Cancelling BCV pairs

The `symmir cancel` command allows you to cancel a BCV pair relationship on a device by device basis, or for all the devices in a device group or composite group.

When operating in native TimeFinder, cancelling a BCV pair cancels the existing relationship between the specified standard and BCV device(s). Once the relationship is cancelled, the corresponding BCV devices go into the SplitNoInc state, and the BCV pair can no longer be incrementally established or restored.

When operating in emulation mode, cancelling a BCV pair terminates the relationship between the specified standard and BCV device(s). Once the relationship is terminated, the corresponding BCV devices go into the Never Established state, and the BCV pair can no longer be incrementally established or restored.

When cancelling a multi-BCV relationship, only the primary BCV is cancelled. For information on cancelling a multi-BCV relationship, refer to [Canceling a multi-BCV relationship](#) on page 110.

The following forms enable you to target devices in a device group, composite group, or device file:

```
symmir -g DgName cancel
```

```
symmir -cg CgName cancel
```

```
symmir -f[file] FileName cancel
```

## Examples

To cancel the BCV relationship for all the devices in the `Prod` group, enter:

```
symmir -g Prod cancel
```

To cancel a specific standard/BCV pair relationship in the `Prod` group, enter:

```
symmir -g Prod cancel DEV001 BCV dev 009C
```

To cancel the relationship of SRDF-connected BCV pairs in the `Prod` device group, enter any of the following:

```
symmir -g prod cancel -rdf
```

Cancels the relationship between the remote mirror device(s) and the remote BCV device(s).

```
symmir -g prod cancel -rdf -bcv
```

Cancels the relationship between the SRDF-connected BCV pair remotely mirroring the local BCV device.

```
symmir -g prod cancel -rrbcv
```

Cancels the relationship between the remote mirror of the remotely attached BCV device (RBCV) and the remotely attached remote BCV (RRBCV).

```
symmir -g prod cancel -hop2
```

Cancels the relationship between the remote mirror and the BCV (2BCV) two hops away in a cascaded SRDF configuration.

## Querying BCV pairs

You can perform a query to determine the state of a BCV pair or all BCV pairs in a device group, composite group, or device file. The query is sent via the gatekeeper device to the array, returning with information about the state of the BCV pair(s).

The following forms enable you to target devices in a device group, composite group, or device file:

```
symmir -g DgName query
```

```
symmir -cg CgName query
```

```
symmir -f[file] FileName query
```

## Examples

To query the state of the BCV pairs in the `prod` device group, enter:

```
symmir -g prod query
```

To query the state of SRDF-connected BCV pairs in the **prod** device group, enter any of the following:

```
symmir -g prod query -rdf
```

```
symmir -g prod query -rdf -bcv
```

```
symmir -g prod query -rrbcv
```

```
symmir -g prod query -hop2
```



You can also obtain results using the `-offline` option, which looks at your configuration based on the host database.

The results of the query include the following information for each member of a BCV pair in a device group:

- Logical device name
- Device name
- Number of invalid tracks
- BCV pair state

To query the state of a split action on multi-BCVs or concurrent BCVs in a group `prod`, enter:

```
symmir -g prod query -multi
```

To query the state of any background split action on multi-BCVs or concurrent BCVs in a group `prod`, enter:

```
symmir -g prod query -multi -bg
```

To query the percent initiated on restore, establish, and split operations, enter:

```
symmir -g prod query -bg -percent
```

## Using the `-summary` option

If you use the `-summary` option with the `query` argument, the results of the query will include the following information:

- Number of BCV pairs in each BCV pair state
- Number of invalid tracks
- Synchronization rate
- Estimated time to completion

The synchronization rate and estimated time to completion are shown only when `-i` or `-c` is specified and their has been a change in the number of invalid tracks since the previous iteration.

The `-summary` option also works with the `verify` argument.

## Example

To view the number of BCV pairs in the `prod` device group that are in each state, and to view the estimated time to completion, enter:

```
symmir -g prod query -summary -i 60
```

## Verifying BCV pair states

You can use the `symmir verify` command to verify whether one or all BCV pair(s) in a device group, composite group, or device file are in a particular state. The command can be used in scripts to guarantee that the BCV device pair(s) are in a Synchronized, Restored, or Split state prior to executing subsequent SYMCLI commands. If you do not specify any qualifiers with the `symmir verify` command, the default is to check for the Synchronized or Restored states.

The following forms enable you to target devices in a device group, composite group, or device file:

```
symmir -g DgName verify
```

```
symmir -cg CgName verify
```

```
symmir -f[file] FileName verify
```

The following options qualify the `symmir verify` command. If you need to verify a concurrent BCV pair, include `-concurrent` with the option (for example, `-synchronized -concurrent`):

- `-synched` option verifies the Synchronized state.
- `-syncinprog` option verifies the SyncInProg state.
- `-split` option verifies the Split state. With an instant split, the system verifies the Split state immediately even though the background split is still in progress. To verify completion of a background split after an instant split, use the `-split -bg` option. Until the background split is complete, you cannot perform BCV control operations. You can use the `-split -bg` option to verify that the instant split is 100 percent complete in the background. For example:

```
symmir verify -g ProdBgrp -split -bg DEV001 bcv ld BCV002 -i 30
```

- `-restored` option verifies the Restored state. You can use the `-restored -protect` option to verify the Protected Restored state. In a concurrent BCV setup, you can use `-restored -concurrent` successfully only if the first BCV has already restored the standard and you are restoring now with the second BCV.
- `-restinprog` option verifies the RestInProg state.
- `-bcv_mirrors` option verifies that the mirrors of locally mirrored BCV devices are in the specified state. If you do not specify a state with this option, the default is to verify a Synchronized state.

## Examples

For a multi-BCV or concurrent BCV device group, specifying the BCV on the command line ensures that the verify operation checks the status of the BCV. Otherwise, the verify operation checks the status of the standard device, which may no longer be established with the BCV that you want to verify. For example, the following command returns the status of standard device DEV002 with its last paired BCV:

```
symmir -g ProdBgrp verify DEV002
```

But the following command returns the status of a specific BCV pair (DEV002 with BCV001):

```
symmir -g ProdBgrp verify DEV002 BCV ld BCV001
```

The following command checks status every 30 seconds until all BCV pairs in the device group (`ProdBgrp`) or composite group (`MyConGrp`) are in the Synchronized or Restored state (the default when no state is specified on the command line):

```
symmir -g ProdBgrp -i 30 verify
```

```
symmir -cg MyConGrp -i 30 verify
```

Possible outputs at 30-second intervals can be that none, not all, or all devices are synchronized or restored. The time to reach the Synchronized or Restored state varies with the number of devices being established or restored and the amount of data being copied.

The verify action returns a value of zero (code symbol `CLI_C_SUCCESS`) if the verify criteria are met, or one of the unique codes in [Using options to verify a BCV mirror state](#) on page 138 and [Using options to verify a BCV pair state](#) on page 139 if the verify criteria are not met:

**Table 16. Using options to verify a BCV mirror state**

Options used with Verify	Code number	Code symbol
<code>-bcv_mirrors</code>	4	<code>CLI_C_NOT_ALL_SYNCHRONIZED</code>
<code>-bcv_mirrors</code>	5	<code>CLI_C_NONE_SYNCHRONIZED</code>
<code>-bcv_mirrors -ready</code>	62	<code>CLI_C_NOT_ALL_READY</code>
<code>-bcv_mirrors -ready</code>	63	<code>CLI_C_NONE_READY</code>
<code>-bcv_mirrors -syncinprog</code>	27	<code>CLI_C_NOT_ALL_SYNCINPROG</code>
<code>-bcv_mirrors -syncinprog</code>	28	<code>CLI_C_NONE_SYNCINPROG</code>
<code>-bcv_mirrors -restinprog</code>	29	<code>CLI_C_NOT_ALL_RESTINPROG</code>

**Table 16. Using options to verify a BCV mirror state (continued)**

Options used with Verify	Code number	Code symbol
-bcv_mirrors -restinprog	30	CLI_C_NONE_RESTINPROG

Using options to verify a BCV pair state on page 139 lists the options to verify a BCV pair state.

**Table 17. Using options to verify a BCV pair state**

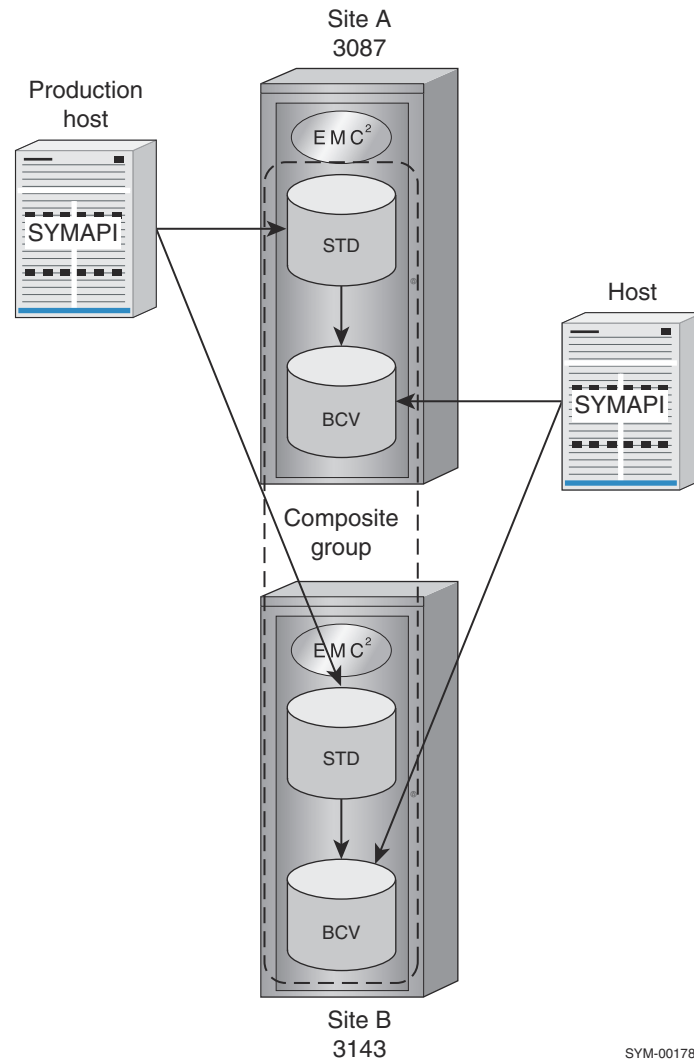
Options used with Verify	Code number	Code symbol
-syncd	10	CLI_C_NOT_ALL_SYNCED
-syncd	11	CLI_C_NONE_SYNCED
-restored	12	CLI_C_NOT_ALL_RESTORED
-restored	13	CLI_C_NONE_RESTORED
-split or -split -bg	25	CLI_C_NOT_ALL_SPLIT
-split or -split -bg	26	CLI_C_NONE_SPLIT
-syncinprog	27	CLI_C_NOT_ALL_SYNCINPROG
-syncinprog	28	CLI_C_NONE_SYNCINPROG
-restinprog	29	CLI_C_NOT_ALL_RESTINPROG
-restinprog	30	CLI_C_NONE_RESTINPROG

## Using composite groups to manage BCV pairs across arrays

### About this task

A composite group is a user-defined group of devices that can span multiple arrays. This feature provides greater flexibility than a device group, which can define devices only on a single array. You can control specific BCV pairs within the composite group instead of having to operate on the entire group as in previous versions.

[Using a composite group when a set of devices spans two arrays](#) on page 140 illustrates a production host that is locally connected to two arrays (A and B). A composite group is defined on the production host and includes BCV pairs from each array. Another locally connected host allows you to access the BCVs once the BCV pairs are split.



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**Figure 49. Using a composite group when a set of devices spans two arrays**

Although TimeFinder control operations on BCV pairs might normally be performed from the production host (as shown in [Using a composite group when a set of devices spans two arrays](#) on page 140) because the composite group is defined there in its SYMAPI database, there are methods that would allow you to initiate copy sessions from another locally connected host. One way is to copy the composite group definition to another host. A more efficient method is to enable Group Name Services (GNS), which automatically propagates the composite group definition to the arrays and other locally attached hosts that are running the GNS daemon. For more information, refer to the *EMC Solutions Enabler Array Management CLI Product Guide*.

If you do not create each BCV pair explicitly, certain options such as `-opt`, `opt_rag`, and `-exact` allow you to control how multiple devices in a composite group are paired. Otherwise, a device-pairing algorithm checks if there were any previous pair assignments among the devices and, if not, pairs standards and BCVs of equal sizes.

Used only with a full establish operation, the optimize option that you choose depends on whether you are establishing local BCV pairs or remote BCV pairs. The `-opt` option is for local. It optimizes pairings across the local array without regard for whether the devices belong to different RDF (RA) groups. The `-opt_rag` option is for remote and requires the `-rdf` option. It uses optimization rules to create remote BCV pairs from devices within the same RDF (RA) group on an array.

The following steps outline the setup required for controlling a set of BCV pairs that spans two arrays as shown in [Using a composite group when a set of devices spans two arrays](#) on page 140:

### Steps

1. From the production host, create a Regular type composite group (for example, `MyGrp`):

```
symcg create MyGrp -type regular
```

2. Add to the composite group those standard devices on array A (3087) and array B (3143) that are the source devices:

```
symcgv -cg MyGrp -sid 3087 add dev 0076
```

```
symcgv -cg MyGrp -sid 3143 add dev 0091
```

3. Add a BCV device from each array to the composite group:

```
symbcv -cg MyGrp -sid 3087 associate dev 0051
```

```
symbcv -cg MyGrp -sid 3143 associate dev 004F
```

4. Create the BCV pairs and initiate full copying from the standards to the BCVs:

```
symmir -cg MyGrp establish -full
```

5. When the BCV pairs are fully synchronized, you can split all BCV pairs in the composite group to access the BCVs:

```
symmir -cg MyGrp split
```

You can control specific BCV pairs within the composite group instead of having to control the group as a whole. To establish only the DEV001/BCV001 pair from all devices in the composite group MyGrp:

```
symmir -cg MyGrp establish DEV001 bcv ld BCV001
```

## Preferred attachment of BCVs (optional operations)

For advanced users, the preferred pair *attachment* (`attach` action) is an optional step in the management of BCV pairs that eliminates the need to specify a device for each subsequent full establish and full restore sequence in a script (for all Engenuity versions). It also applies to incremental establish and restore operations. It marks the specified BCV device as the preferred BCV to pair with the standard device.

After configuration and initialization of an array, BCV devices contain no data. The BCV devices, like the standard devices, have unique host addresses and are online and ready to the host(s) to which they are connected.

It is at this point, before any full establish or full restore operations are requested, you can validate your pairings as a preferred attachment before starting any data copy operations. The lists of individual standard devices and BCV devices can be examined, validated, and all devices sorted according to storage size, and subsequently, assigned as the preferred match (considering disk size) for attachment into BCV pairs.

### NOTE:

A full establish action with the `optimize (-opt)` or `exact (-exact)` option overrides the `attach` pairing scheme.

The following commands enable you to target devices in a device group, composite group, or a device file:

```
symmir -g DgName attach
```

```
symmir -cg CgName attach
```

```
symmir -f FileName attach
```

To initiate a preferred attachment on a BCV pair (DEV001) in the **prod** group, enter:

```
symmir -g prod attach DEV001 BCV ld BCV001
```

To initiate a preferred attachment on more than one BCV pair (list) in the **prod** group, enter:

<code>symmir -g prod attach</code>	<code>DEV001 BCV 1d BCV001</code>
	<code>DEV002 BCV 1d BCV002</code>
	<code>DEV002 BCV 1d BCV003</code>

**NOTE:**

The attach and detach preferred relationship are only known to the SYMAPI database on which you are operating.

The attach action checks command validity. For example, the array makes sure that both the standard device and the BCV device are the same size, the device specified as the BCV has the BCV attribute, the standard device does not already have a BCV device assigned to it, and so on.

If the standard device is a metahead device, then the BCV must also share the same metadvice properties. All metamembers are implicitly established along with the metahead device.

From this point forward, when you invoke the full establish or full restore control action with a BCV control operation, you will not need to specify the device names.

## Detaching BCV preferences from devices

The **detach** action allows you to remove the preferred matched-pair association from the devices that was initially defined with the **attach** action.

The following forms enable you to target devices in a device group, composite group, or device file:

```
symmir -g DgName attach
```

```
symmir -cg CgName attach
```

```
symmir -f FileName attach
```

To detach the existing preferred attachment of various BCVs from their standard devices in the `prod` group, enter:

```
symmir -g prod detach
```

To detach the attached BCV preference on standard device (`DEV001`) in the `prod` group, enter:

```
symmir -g prod detach DEV001
```

## Attaching remote devices as preferred pairs

For advanced usage, you can also specify an **attach** action to a remote site using the RDF flag (`-rdf` option), which attaches the remote mirror device(s) to the remote BCV device(s) as preferred pair(s).

To perform a preferred attachment operation in the remote array at site B with the RDF option (`-rdf`) specified, use the following command:

```
symmir -g prod -rdf attach DEV001 bcv 1d RBCV001
```

In this case, the RDF flag indicates that the BCV device being attached is an SRDF-connected BCV pair, which will provide remote mirroring to the local standard device.

To perform an attach operation in the remote array at site B with the RDF and BCV options (`-rdf` and `-bcv`) specified, use the following command:

```
symmir -g prod -rdf -bcv attach BCV001 BCV 1d BRBCV001
```

In this case, the flags indicate that the BCV pair being attached is an SRDF-connected BCV pair, which provides remote mirroring to the local BCV device.

## Detaching BCV preferences for remote devices

You can specify a **detach** preference action to a remote site using the RDF flag (`-rdf` option), which detaches the remote BCV(s) from the remote standard device(s) as preferred pair(s).

To perform a detach operation in the remote array at site B with the RDF option specified, use the following command:

```
symmir -g prod -rdf detach DEV001
```

In this case, the flag indicates that the preferred BCV device being detached is an SRDF-connected BCV, which provides remote mirroring to the local standard device.

To perform a detach operation in the remote array at site B with the RDF and BCV options (`-rdf` and `-bcv`) specified, use the following command:

```
symmir -g prod -rdf -bcv detach BCV001 BCV ld BRBCV001
```

In this case, the flags indicate that the BCV pair being detached is an SRDF-connected BCV pair, which would provide remote mirroring to the local BCV device.

## Attaching second-level remote devices as preferred pairs

You can specify an **attach** action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which attaches BCV preferences to second-level remote BCV pairs.

To perform an attach operation in the remote array at site C with the remotely attached remote BCV option (`-rrbcv`) specified, use the following command:

```
symmir -g prod -rrbcv attach
```

To initiate an attach on one remote BCV pair, RBCV001, in the **prod** group, enter:

```
symmir -g prod -rrbcv attach RBCV001 BCV ld RRBCV001
```

In this case, the flag indicates that the BCV device being attached is a second HOP SRDF-connected BCV device, which will be attached with the remote standard mirror of the remote BCV device.

## Detaching BCV preferences from second-level remote devices

You can specify a **detach** action to a second remote site using the remotely attached remote BCV flag (`-rrbcv` option), which detaches BCV preferences from second-level remote BCV pairs.

To perform a detach operation in the remote array at site C with the remotely attached remote BCV option (`-rrbcv`) specified, use the following command:

```
symmir -g prod -rrbcv detach
```

To initiate a detach on one remote BCV pair, RBCV001, in the **prod** group, enter:

```
symmir -g prod -rrbcv detach RBCV001 BCV ld RRBCV001
```

In this case, the flag indicates that the BCV device being detached is a second HOP SRDF-connected BCV device, which will be detached from the remote standard mirror of the remote BCV device.

## Attaching hop 2 devices as preferred pairs in a cascaded SRDF configuration

For advanced usage, you can specify an **attach** action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform an attach operation in the remote array at the tertiary site (C) when the hop2 (-hop2 option) is specified with the following command:

```
symmir -g prod -hop2 attach DEV001 bcv ld 2BCV001
```

In this case, the flag indicates that the SRDF-connected BCV device (2BCV001) is being attached with the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Detaching BCV preferences from hop 2 devices in a cascaded SRDF configuration

For advanced usage, you can also specify an **detach** preference action to an array located at the tertiary site of a cascaded SRDF configuration.

To perform a detach operation in the remote array at the tertiary site (C) with the hop 2 (-hop2 option) specified, use the following command:

```
symmir -g prod -hop2 detach DEV001 BCV ld 2BCV001
```

In this case, the flag indicates that the SRDF-connected BCV device (2BCV001) is being detached from the remote partner of the R21 device, which is the remote partner of the local RDF standard device.

## Script summary for typical TimeFinder operations

### About this task

The following is an example script of a set of typical operations using SYMCLI commands to manage a BCV environment:

### Steps

1. Create a device group:

```
symdbg create ProdBgrp
```

2. Add a standard device to a device group:

```
symdbg -g ProdBgrp add pd c0t2d4
```

Repeat for all devices, or use RANGE, etc.

3. Associate a BCV device with a device group:

```
symbcv -g ProdBgrp associate pd c4t2d4
```

Repeat for all BCVs.

4. Either establish the entire group:

```
symmir -g ProdBgrp -full establish -noprompt
```

Or establish explicitly:

```
symmir -g ProdBgrp -full establish DEV001 BCV ld BCV001 -noprompt
```



Repeat this command for all pairs.

Transfer a different BCV device to the standard device:

5. Identify the established BCV pair.

6. Split the pair:

```
symmir -g ProdBgrp split DEV001 -noprompt
```

7. Select a new BCV to establish with the standard device:

```
symmir -g ProdBgrp -full establish DEV001 BCV 1d BCV020 -noprompt
```

## Script example for multi-BCV environment

### About this task

The following is an example of a script for a multi-BCV environment:

You are tasked with testing business applications with incoming database data from certain anticipated peak periods in the day. Three copies of the database may be needed. To establish a multi-BCV environment, you must initially perform a full establish to each BCV device in the set.

### Steps

1. For example, you plan to have BCV001 through BCV003 in the set to pair with DEV001 that is the source of your test data:

```
symmir -g MultigrpA -full establish DEV001 BCV 1d BCV001
```

```
symmir -g MultigrpA split DEV001 #split at 3:10pm
```

```
symmir -g MultigrpA -full establish DEV001 BCV 1d BCV002
```

```
symmir -g MultigrpA split DEV001 #split at 3:20pm
```

```
symmir -g MultigrpA -full establish DEV001 BCV 1d BCV003
```

2. It is now 4:00 p.m. and BCV003 is still currently established with DEV001. At this point, you are testing your business applications and want to reset your database back to the business activity that was current up till 3:10 p.m. To incrementally restore DEV001 to the 3:10 p.m. business data:

```
symmir -g MultigrpA split DEV001 #split at 4:00pm
```

```
symmir -g MultigrpA restore DEV001 BCV 1d BCV001
```

3. You are now working successfully with the 3:10 p.m. data and want to continue test operations with this data and remove the second split BCV that occurred at 3:20 p.m. as this data will not be needed.

```
symmir -g MultigrpA cancel DEV001 BCV 1d BCV002
```

4. You decide to call it a day, keeping the remaining two multi-BCVs and need to reestablish (incrementally establish) BCV003 to the current standard data:

```
symmir -g MultigrpA split DEV001 #split at 4:50pm
```

```
symmir -g MultigrpA establish DEV001 BCV 1d BCV003
```

## BCV pair states

When you invoke BCV control commands on a single BCV device, or on a group of BCV pair(s) using the `symmir` command, the BCV state is changed as illustrated in [BCV pair states](#) on page 146. You will see the abbreviated BCV pair state listed using the SYMCLI commands.

**Table 18. BCV pair states**

BCV pair state	BCV pair state (abbreviated for display)	Description
Never Established	NeverEstab	The BCV device is available for use, and was never established. Only the BCV device name is valid.
Sync In Progress	SyncInProg	When the Establish action is executed, data is copied from the standard device to the BCV device until both devices contain identical data.
Restore In Progress	RestInProg	When the restore action is executed, data is copied from the BCV to the standard device until both devices contain identical data.
Synchronized	Synchronized	The BCV and standard devices have identical data. Any changes to the standard device are also written to the BCV. The BCV is unavailable to the host for BC processing.
Restored	Restored	The BCV and standard devices have identical data, although the data was originally on the BCV before being synchronized. Any changes to the standard device are also written to the BCV. The BCV is unavailable to the host for BC processing.
Split in Progress	SplitInProg	The BCV devices are in the process of being separated, or split from the standard devices.
Split	Split	The BCV devices are completely separated, or split from the standard devices allowing each device to be accessed separately by the host.
Split No Incremental	SplitNoInc	The BCV devices are completely separated, or split from the standard devices but cannot be incrementally established or restored.
Split Before Sync	SplitBfrSync	The split occurred when a BCV device was synchronizing. The BCV device is separated from the standard device although the BCV device is not completely synchronized.
Split Before Restore	SplitBfrRest	The split occurred when a BCV device was being restored to a standard device.

**Table 18. BCV pair states (continued)**

BCV pair state	BCV pair state (abbreviated for display)	Description
		The BCV device is separated from the standard device although the standard device is not completely synchronized.
Invalid	Invalid	Not all metamembers are in the same BCV state.

## Transient BCV pair states

When you initially invoke the `symmir` arguments for TimeFinder operations, BCV pairs enter a transient state and upon completion of the action, the BCV pairs enter a final BCV pair state ([Actions for BCV devices](#) on page 147).

**Table 19. Actions for BCV devices**

Argument	Transient state	Final state
<code>establish</code>	SyncInProg	Synchronized
<code>split</code>	SplitInProg	Split
<code>restore</code>	RestInProg	Restored

## BCV actions and applicable states

[BCV control actions and applicable states](#) on page 147 describes which BCV control operations can be invoked for a given BCV state. Invalid states can indicate that the devices in a BCV pair are in a different or *mixed* state. The `-symforce` option must be used (where noted in the table as F) to force a pair to a specified BCV state.

**Table 20. BCV control actions and applicable states**

Control Operation	Never Established	Sync in prog	Synchronized	SyncInProg	Split	Split no incremental	Split before sync	Split before restore	Restore in prog	Restored	Invalid
<code>establish - full</code>	Y				Y	Y	Y <sup>a</sup>	Y <sup>b</sup>			Y
<code>establish</code>					Y						
<code>split</code>		F <sup>c</sup>	Y						F <sup>c</sup>	Y	
<code>restore - full</code>	Y				Y	Y <sup>a</sup>	Y <sup>b</sup>	Y <sup>a</sup>			Y

**Table 20. BCV control actions and applicable states (continued)**

Control Operation	Never Established	Sync in prog	Synchronized	SyncInProg	Split	Split no incremental	Split before sync	Split before restore	Restore in prog	Restored	Invalid
restore					Y						
attach	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
detach	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
cancel					Y		Y	Y			

- a. The BVC must be specified or you must use the `-exact` or `-force` option.
- b. The BCV must be specified or you must use both the `-force` and `-symforce` options.
- c. The F denotes that you must use the `-symforce` option.

## Command options with device groups

`symmir -g control arguments and possible options` on page 148 lists the `symmir` control operations and the possible options to use when targeting a specified device group.

**Table 21. symmir -g control arguments and possible options**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
<code>-bcv</code>	Y	Y	Y	Y	Y	Y	Y	Y
<code>-both_sides</code>	Y	Y						
<code>-bypass</code>			Y	Y	Y			
<code>-c, -i</code>	Y	Y	Y	Y	Y	Y	Y	Y
<code>-concurrent</code>	Y	Y						
<code>-consistent</code>			Y					
<code>-diff</code>			Y					
<code>-exact</code>	Y			Y				

**Table 21. symmir -g control arguments and possible options (continued)**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
-force, - symforce	Y	Y	Y	Y	Y			Y
-hop2	Y	Y	Y	Y	Y	Y	Y	Y
- noprompt	Y	Y	Y	Y	Y	Y	Y	Y
- not_read y			Y	Y	Y			
-opt	Y							
- preactio n, - postacti on	Y	Y	Y	Y	Y			
- preserve tgtlocks , - lockid	Y	Y	Y	Y	Y			
- protbcve st	Y	Y						
-protect			Y	Y	Y			
-rdf	Y	Y	Y	Y	Y	Y	Y	Y
-remote	Y	Y	Y	Y	Y			
-reverse	Y	Y	Y	Y	Y			
-rrbcv	Y	Y	Y	Y	Y	Y	Y	Y
-star	Y	Y	Y	Y	Y			Y
- std_prot ect			Y					
-skip	Y	Y	Y					
-v	Y	Y	Y	Y	Y	Y	Y	Y

[symmir -g view arguments and possible options](#) on page 150 lists the `symmir` view arguments and the possible options to use when targeting a specified device group.

**Table 22. symmir -g view arguments and possible options**

Options	Argument action	
	query	verify
-attach	Y	
-bcv, -rrbcv	Y	Y
-bcv_mirrors		Y
-bg	Y	Y
-c, -i	Y	Y
-concurrent		Y
-force		Y
-hop2	Y	Y
-multi	Y	
-offline	Y	Y
-percent	Y	Y
-protbcvest	Y	
-protect	Y	Y
-rdf	Y	Y
-ready		Y
-restinprog		Y
-restored		Y
-sid	Y	Y
-split		Y
-summary	Y	Y
-synched		Y
-syncinprog		Y

**NOTE:**

The base tasks performed with `symbcv` such as `list`, `associate`, and `disassociate` locally or remotely attached BCV devices, are described at the beginning of this chapter.

## Command options with composite groups

Options to the `symmir -cg` command line arguments provide more action flexibility to control BCV pairs when you are operating on device(s) of a specified composite group. [symmir -cg control arguments and possible options](#) on page 151 lists the `symmir` control operations and the possible options to use when targeting a specified composite group.

**Table 23. symmir -cg control arguments and possible options**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
-bcv	Y	Y	Y	Y	Y	Y	Y	Y
-both_sides	Y	Y						
-bypass			Y	Y	Y			
-c, -i	Y	Y	Y	Y	Y	Y	Y	Y
-concurrent	Y	Y						
-consistent, -both_sides			Y					
-diff			Y					
-exact	Y			Y				
-force, -symforce	Y	Y	Y	Y	Y			
-hop2	Y	Y	Y	Y	Y	Y	Y	Y
-noprompt	Y	Y	Y	Y	Y	Y	Y	Y
-not_ready			Y	Y	Y			
-opt	Y							
-opt_rag	Y							
-preaction, -postaction	Y	Y	Y	Y	Y			
-protbcvest	Y	Y						
-protect			Y	Y	Y			
-rdf	Y	Y	Y	Y	Y	Y	Y	Y
-remote	Y	Y	Y	Y	Y			
-reverse	Y	Y	Y	Y	Y			

**Table 23. symmir -cg control arguments and possible options (continued)**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
-rrbcv	Y	Y	Y	Y	Y	Y	Y	Y
-sid	Y	Y	Y	Y	Y	Y	Y	Y
-skip	Y	Y	Y					
-star	Y	Y	Y	Y	Y			
-std_protect			Y					
-v	Y	Y	Y	Y	Y	Y	Y	Y

[symmir -cg view arguments and possible options](#) on page 152 lists the `symmir` view arguments and the possible options to use when targeting a specified composite group.

**Table 24. symmir -cg view arguments and possible options**

Options	Argument action	
	query	verify
-attach	Y	
-bcv, -rrbcv	Y	Y
-bcv_mirrors		Y
-bg	Y	Y
-c, -i	Y	Y
-concurrent		Y
-hop2	Y	Y
-force		Y
-multi	Y	
-offline	Y	Y
-percent	Y	Y
-protect	Y	
-rdf	Y	Y
-restored		Y
-sid	Y	Y
-split		Y
-synched		Y



**Table 24. symmir -cg view arguments and possible options (continued)**

Options	Argument action	
	query	verify
-syncinprog		Y
-ready		Y
-restinprog		Y
-protbcvest	Y	
-summary	Y	

## Command options with device files

With the `symmir -file` command, you can perform similar control operations on BCV device pairs defined in a device file of a specified array as you can when directing `symmir` to device groups (`-g`). These control operations (arguments) have similar options that allow flexibility in controlling STD/BCV pairs defined in a device file, as opposed to a device group. This command is particularly useful when operating on RDF BCV pairs in a remote array in the second-level multihop SRDF link.

[symmir -file control arguments and possible options](#) on page 153 lists the `symmir` control operations and the possible options to use when targeting pairs specified in a device file of a given array.

**Table 25. symmir -file control arguments and possible options**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
-bypass			Y	Y	Y			
-c, -i	Y	Y	Y	Y	Y	Y	Y	Y
-consistent			Y					
-diff			Y					
-force, -symforce	Y	Y	Y	Y	Y			Y
-noprompt	Y	Y	Y	Y	Y	Y	Y	Y
-not_ready			Y	Y	Y			
-preaction, -postaction	Y	Y	Y	Y	Y			
-preserve_tgtlocks, -lockid	Y	Y	Y	Y	Y			

**Table 25. symmir -file control arguments and possible options (continued)**

Options	Argument action							
	establish -full	establish	split	restore -full	restore	attach	detach	cancel
-protbcvest	Y	Y						
-protect			Y	Y	Y			
-remote	Y	Y	Y	Y	Y			
-reverse	Y	Y	Y	Y	Y			
-skip	Y	Y	Y					
-star	Y	Y	Y	Y	Y			Y
-std_protect			Y					
-v	Y	Y	Y	Y	Y	Y	Y	Y

[symmir -file view arguments and possible options](#) on page 154 lists the **symmir** view arguments and the possible options to use when targeting pairs specified in a device file of a given array.

**Table 26. symmir -file view arguments and possible options**

Options	Argument action	
	query	verify
-attach	Y	
-bcv_mirrors		Y
-bg	Y	Y
-c, -i	Y	Y
-concurrent		Y
-force	Y	Y
-multi	Y	
-offline	Y	Y
-percent	Y	Y
-protbcvest	Y	
-protect	Y	
-ready		Y
-restinprog		Y
-restored		Y

**Table 26. symmir -file view arguments and possible options (continued)**

Options	Argument action	
	query	verify
-split		Y
-summary	Y	
-synched		Y
-syncinprog		Y

**NOTE:**

The Symmetrix ID option (**-sid**) is required for all **symmir -file** commands.

## Various remote multihop configurations

Various compounded remote configurations can be managed by your host using both the TimeFinder and SRDF components of SYMCLI.

As [Control operations on multihop SRDF configurations](#) on page 157 shows, you can have multiple sites (for example, remote sites C, E, F, and H) on SRDF links to remotely mirror a local array at site A. Remote site F, functioning as a remote mirror to the standard devices at site A, is most typical. You then can have a third site on an SRDF link (remote site H) to remotely mirror just the BCV devices in the array at site A.

You can also multihop to a second level SRDF where Remote site G functions as a remote mirror to the standard devices of site A and Remote site I remotely mirrors Site A's BCV.

In addition, you can also create a cascaded SRDF configuration, where tertiary site B functions as a remote partner to the R21 device at Site C, which is the remote partner of the local RDF standard device at Site A; and tertiary site D functions as a remote partner to the R21 device at Site E, which is the remote partner of the local BCV device at Site A.

Command **symmir** manages each of the BCV pairs at any site while **symrdf** manages the SRDF pairs in the SRDF link.

## System-wide device groups

Before you begin applying any **symmir** operations, you must be working with an existing group of RDF devices. To create a device group containing STD and BCV RDF1 devices, enter:

```
symdbg create prod -type RDF1
```

```
symdbg -g prod add dev 0001 -sid 0001 DEV001
```

```
symbcv -g prod associate dev 000A BCV001
```

```
symbcv -g prod associate dev 000C -rdf RBCV001
```

```
symbcv -g prod associate dev 0009 -bcv -rdf BRBCV001
```

```
symbcv -g prod associate dev 0004 -rrdf RRBCV001
```

```
symbcv -g prod associate dev 0004 -hop2 2BCV001
```

At this point, all these devices must be established with the **symmir** and **symrdf** commands.

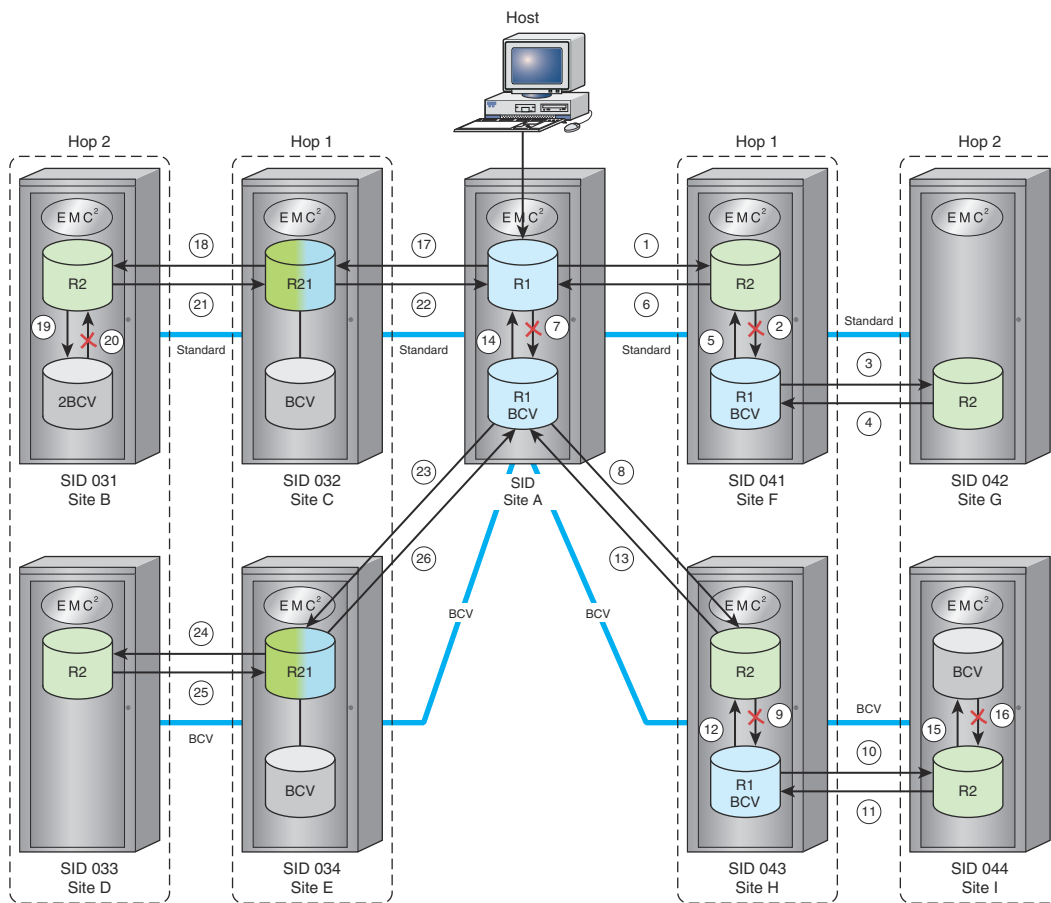
## Commands to various multihop devices and links

This section describes the command application of targeting the various devices and links in complex multihop SRDF environments.

The following sequence of commands steps through some basic control operations that touch every device and RDF link in a complex multihop configuration. The following numbering of commands directly associates with the bubble numbers shown in the [Control operations on multihop SRDF configurations](#) on page 157.

1	<code>symrdf -g &lt;&gt; establish</code>	Creates the standard-associated hop 1 copy.
2	<code>symmir -g &lt;&gt; split -rdf</code>	Splits the standard-associated hop 1 BCV device pair.
3	<code>symrdf -g &lt;&gt; establish -rbcv</code>	Creates the standard-associated hop 2 copy.
4	<code>symrdf -g &lt;&gt; restore -rbcv</code>	Restores the standard-associated hop 1 BCV with the hop 2 copy.
5	<code>symmir -g &lt;&gt; restore -rdf</code>	Restores the standard-associated hop 1 copy with the hop 1 BCV.
6	<code>symrdf -g &lt;&gt; restore</code>	Restores the standard device with the hop 1 copy.
7	<code>symmir -g &lt;&gt; split</code>	Splits the standard/BCV pair.
8	<code>symrdf -g &lt;&gt; establish -bcv</code>	Creates the BCV-associated hop 1 remote copy.
9	<code>symmir -g &lt;&gt; split -rdf -bcv</code>	Splits the BCV-associated hop 1 device pair.
10	<code>symrdf -g &lt;&gt; establish -brbcv</code>	Creates the BCV-associated hop 2 copy.
11	<code>symrdf -g &lt;&gt; restore -brbcv</code>	Restores the BCV-associated hop 1 BCV with the hop 2 copy.
12	<code>symmir -g &lt;&gt; restore -rdf -bcv</code>	Restores the BCV-associated hop 1 copy with the hop 1 BCV.
13	<code>symrdf -g &lt;&gt; restore -bcv</code>	Restores the BCV device with the hop 1 copy.
14	<code>symmir -g &lt;&gt; restore</code>	Restores the standard device with the BCV copy.
15	<code>symmir -file &lt;&gt; -sid 044 establish</code>	Creates the BCV-associated with the remote partner of the BRBCV (file only).
16	<code>symmir -file &lt;&gt; -sid 044 split</code>	Splits the BCV-associated with the remote partner of the BRBCV (file only).
17	<code>symrdf -g &lt;&gt; establish</code>	Creates the standard-associated hop 1 copy.
18	<code>symrdf -g &lt;&gt; establish -hop2</code>	Creates the standard-associated hop 2 copy.

19	<code>symmir -g &lt;&gt; establish -hop2</code>	Creates the BCV-associated hop 2 BCV copy.
20	<code>symmir -g &lt;&gt; split -hop2</code>	Splits the BCV-associated hop 2 device pair.
21	<code>symrdf -g &lt;&gt; restore -hop2</code>	Restores the standard with the hop 2 copy.
22	<code>symrdf -g &lt;&gt; restore</code>	Restores the standard device with the hop 1 copy.
23	<code>symrdf -g &lt;&gt; establish -bcv</code>	Creates the BCV-associated hop 1 remote copy.
24	<code>symrdf -g &lt;&gt; establish -bcv -hop2</code>	Creates the BCV-associated hop 2 copy.
25	<code>symrdf -g &lt;&gt; restore -bcv -hop2</code>	Restores the BCV-associated hop 2 copy.
26	<code>symrdf -g &lt;&gt; restore -bcv</code>	Restores the BCV device with the hop 1 copy.



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Figure 50. Control operations on multihop SRDF configurations

## Second-level controls for multihop SRDF environments

As previously described, second-level multihop control operations were accomplished using the device file (`-file`) option for managing RDF BCV device pairs. You can use the **symmir** command for device groups (`-g`) for BCV control capability in second-level multihop SRDF environments.

The remote RDF BCV (RRBCV) devices must have been previously associated with the device group using the `symbcv -rrdf` command. [Compounded remote configuration](#) on page 102 contains specific information about how to associate second-level multihop BCVs with a device group.

Once the RRBCV devices have been associated with the device group, you can use the **symmir** command with the `-rrbcv` option to perform control operations on the remote mirror of the remote BCV to become established, split, or restored from its BCV. Other second-level multihop BCV control operations available with the **symmir** command include `query`, `verify`, `attach`, `detach`, and `cancel`.

### Remote optimizing option

The remote optimize (`-opt_rag`) option only applies to the full Establish operation in a remote array that optimizes the disk I/O on the standard/BCV pair selection to achieve a high copy speed between them. (Basically, the device pair selection attempts to pair devices that are not on the same disk adapter to distribute I/O.) This option overrides all current pairing relationships.

#### NOTE:

This option is only applicable for remote array optimization targeting composite groups (`-cg`).

The command line must include the `-rdf` option, as follows:

```
symmir -cg CgName -full establish -rdf -opt_rag
```

### Using the `-remote` option on multihop split actions

This section describes the command application of targeting the various devices and links with the `-remote` option in complex multihop SRDF environments.

The following sequence of commands steps through some basic control operations that touch every device and RDF link in a complex multihop configuration. The following numbering of commands directly associates with the callouts shown in the [The `-remote` option on multihop configurations](#) on page 159.

1	<code>symrdf -g &lt;&gt; establish</code>	Creates the standard-associated hop 1 copy.
2	<code>symmir -g &lt;&gt; split -rdf -remote</code>	Splits the standard-associated hop 1 BCV device pair and creates a standard-associated hop 2 copy of the hop 1 BCV.
3	<code>symmir -g &lt;&gt; split -remote</code>	Splits the standard/BCV pair and creates a BCV-associated hop 1 copy of the local BCV.
4	<code>symmir -g &lt;&gt; split -rdf -bcv -remote</code>	Splits the BCV-associated hop 1 BCV device pair and creates a BCV-associated hop 2 copy of the hop 1 BCV.
5	<code>symmir -g &lt;&gt; split -rrbcv</code>	Splits the BCV-associated hop 2 BCV device pair. You cannot use the <code>-remote</code> option here.

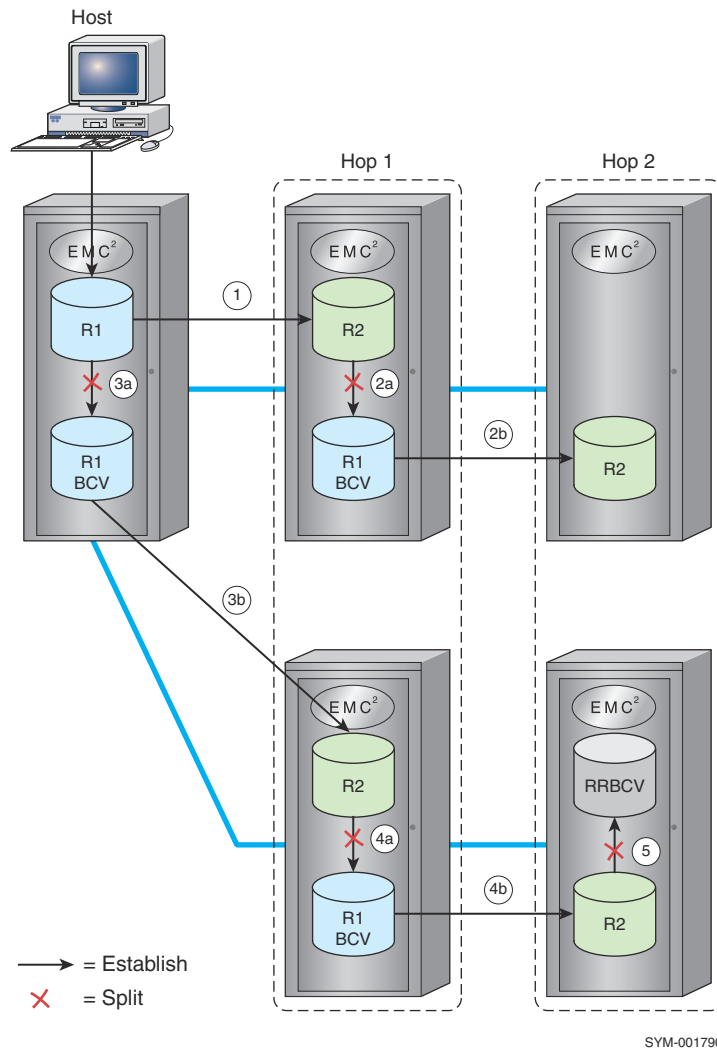


Figure 51. The -remote option on multihop configurations

# TimeFinder State Rules Reference

This appendix helps you determine if the TimeFinder operation you want to complete is supported for devices in a particular pair state.

## Topics:

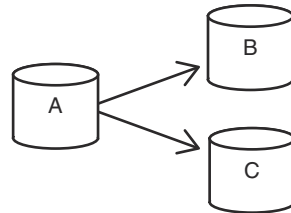
- [Using the tables for Clone, VP Snap, Snap, and Mirror](#)
- [TimeFinder/Clone operations](#)
- [VP Snap operations](#)
- [TimeFinder/Snap operations](#)
- [TimeFinder/Mirror operations](#)

## Using the tables for Clone, VP Snap, Snap, and Mirror

To determine which tables to view for a particular configuration:

1. Go to the appropriate section for the operation and look at the basic operations table. For example, to perform a TimeFinder/Clone operation, go to [TimeFinder/Clone operations](#) on page 161 and look at [Basic TimeFinder/Clone operations](#) on page 161. If the operation is supported on the device in its current pair state, go to the next step.
2. If the device is part of a concurrent copy operation, look at the appropriate table in the concurrent operations section. A concurrent copy operation occurs when multiple copies are made from the same source. These copies can be any combination of TimeFinder/Clone, TimeFinder/Mirror, and TimeFinder/Snap.

The following image shows a concurrent copy operation.

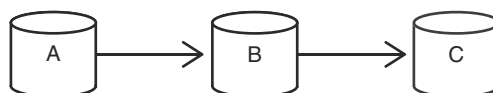


**Figure 52. Concurrent copy operation**

For example, to complete a TimeFinder/Clone operation on a device that is part of a concurrent copy operation in which both a clone and a snap are made from the same source device, look at [Concurrent TimeFinder/Clone operations: Clone and Snap](#) on page 166. If the operation is supported on the device in its current pair state, go to the next step.

3. If the device is part of a cascaded copy operation, look at the appropriate table in the cascaded operations section. A cascaded copy operation occurs when a device is both the source of a copy and the target of a copy, such that the devices are in the relationship of A -> B -> C. Examples of cascaded operations include Clone off Clone, Snap off Clone, and Snap off BCV.

The following image shows a cascaded copy operation.

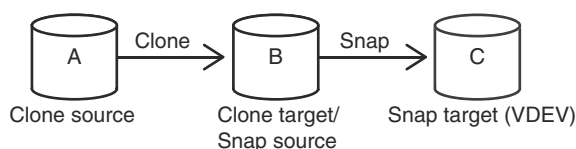


**Figure 53. Cascaded copy operation**

For cascaded operations, which hop in the cascade is required. For example, when the device is part of a Snap off Clone operation in which a device (B) is the target of a clone (A -> B) and the source of a snap (B -> C).

The following image shows this example.





**Figure 54. Cascaded copy example (Snap off Clone)**

The TimeFinder/Clone hop of the cascade is described in [Snap off Clone operations: Source - Target](#) on page 173 of the TimeFinder/Clone Operations section.

The TimeFinder/Snap hop of the cascade, is described in [Snap off Clone operations: B - VDEV](#) on page 186 of the TimeFinder/Snap Operations section.

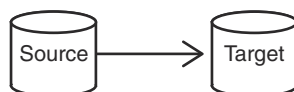
If the operation is listed as supported in each of the appropriate tables, then that operation is supported on the device.

## TimeFinder/Clone operations

This section describes the TimeFinder/Clone control operations that are allowed for devices in various pair states.

### Basic TimeFinder/Clone operations

The following image shows the relationship between devices for a basic TimeFinder/Clone operation.



**Figure 55. Basic TimeFinder/Clone device relationship**

In the following table:

- *Pair state* refers to the current state of the source-target pair.
- *Operation* refers to the intended control operation.
- Y indicates that the operation is allowable for that state.

**Table 27. Basic TimeFinder/Clone operations**

Time Finder/Clone Source -> Target Operation:	TimeFinder/Clone Source -> Target Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y														
Recreate <sup>b</sup>						Y	Y			Y					Y <sup>c</sup>
Activate			Y	Y	Y										
Full Establish	Y														
Incremental						Y	Y			Y					

**Table 27. Basic TimeFinder/Clone operations (continued)**

Time Finder/Clone Source -> Target Operation:	TimeFinder/Clone Source -> Target Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Establish															
Set Mode Copy <sup>d</sup>			Y	Y	Y			Y	Y						
Set Mode Noco <sup>d, e</sup>			Y	Y	Y										
Set Mode Precopy <sup>d</sup>			Y	Y											
Full Restore <sup>b</sup>	Y						Y			Y					
Incremental Restore <sup>b</sup>							Y			Y					
Split												Y			
Terminate		Y	Y	Y	Y	Y <sup>f, g</sup>	Y	Y	Y	Y	Y <sup>f, h</sup>	Y	Y	Y	Y

- a. Transient state.
- b. Session must be differential.
- c. Requires Engenuity 5876.163.105 and higher.
- d. If not already set to this mode.
- e. Cannot be differential.
- f. Requires -symmforce (not recommended).
- g. Target data will be incomplete.
- h. Source data will be incomplete.

## Concurrent TimeFinder/Clone operations

A concurrent copy occurs when a source device is copied to multiple different targets. These copy operations can be any combination of TimeFinder/Clone, TimeFinder Snap, and TimeFinder/Mirror copies.

### Concurrent TimeFinder/Clone

The following image shows the relationship between devices for a TimeFinder/Clone pairing of a source device with two targets.

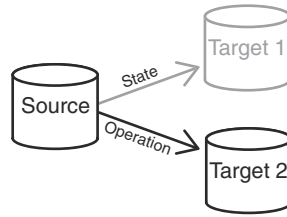


Figure 56. Concurrent TimeFinder/Clone device relationships

**NOTE:**

The positions of Target 1 and Target 2 are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the Source-Target 1 pair.
- *Operation* refers to the intended control operation on the Source-Target 2 pair.
- Y indicates that the operation is allowable for that state.

Table 28. Concurrent TimeFinder/Clone operations

Time Finder/Clone Source -> Target 2 Operation:	TimeFinder/Clone Source -> Target 1 Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y		Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>			
Recreate <sup>c</sup>			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y <sup>d</sup>
Activate			Y	Y	Y	Y	Y	Y	Y	Y		Y			
Full Establish	Y		Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>	Y <sup>b</sup>		Y <sup>b</sup>			
Incremental Establish			Y	Y	Y	Y	Y	Y	Y	Y		Y			
Set Mode Copy <sup>e</sup>			Y	Y	Y	Y	Y	Y	Y	Y		Y			
Set Mode Nocopy <sup>e, f</sup>			Y	Y	Y	Y	Y	Y	Y	Y		Y			
Set Mode Precopy <sup>e</sup>			Y	Y	Y	Y	Y	Y	Y	Y		Y			

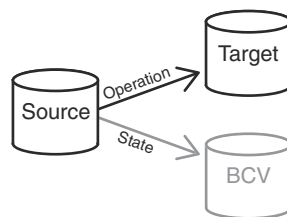
**Table 28. Concurrent TimeFinder/Clone operations (continued)**

Time Finder/Clone Source -> Target 2 Operation:	TimeFinder/Clone Source -> Target 1 Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Restore <sup>c</sup>	Y						Y			Y					
Incremental Restore <sup>c</sup>										Y					
Split			Y	Y			Y			Y					
Terminate		Y	Y	Y	Y	Y <sup>g, h</sup>	Y	Y	Y	Y	Y <sup>g, i</sup>	Y	Y	Y	Y

- a. Transient state.
- b. Requires -concurrent flag only for dgleg operations.
- c. Session must be differential.
- d. Requires Enginuity 5876.163.105 and higher.
- e. If not already set to this mode.
- f. Cannot be differential.
- g. Requires -symmforce (not recommended).
- h. Target data will be incomplete.
- i. Source data will be incomplete.

## Concurrent TimeFinder/Clone: Clone and Mirror

The following image shows relationship between devices for a concurrent pairing of a source device with a TimeFinder/Clone target and a TimeFinder/Mirror BCV.



**Figure 57. Concurrent TimeFinder/Clone device relationships: Clone and Mirror**

**NOTE:**

The positions of Target and BCV are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair.
- *Operation* refers to the intended control operation on the Source-Target pair.
- Y indicates that the operation is allowable for that state.

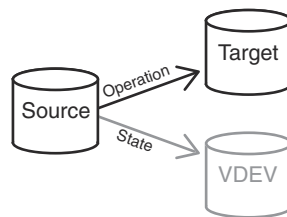
**Table 29. Concurrent TimeFinder/Clone operations: Clone and Mirror**

TimeFinder/Clone Source -> Target Operation:	TimeFinder/Mirror STD -> BCV Pair state:									
	Never Established	SyncInProg	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Create	Y	Y <sup>a</sup>	Y <sup>a</sup>	a	Y <sup>b, a</sup>	Y <sup>a</sup>		Y <sup>a</sup>	Y <sup>a</sup>	
Recreate <sup>c</sup>	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Activate	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Full Establish	Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a</sup>		Y <sup>a, bb,</sup>	Y <sup>a</sup>		Y <sup>a</sup>	Y <sup>a</sup>	
Incremental Establish	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Set Mode Copy <sup>d</sup>	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Set Mode Nocopy <sup>d, e</sup>	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Set Mode Precopy <sup>d</sup>	Y	Y	Y		Y <sup>b</sup>	Y		Y	Y	
Full Restore <sup>c</sup>	Y				Y <sup>b</sup>	Y		Y <sup>b</sup>	Y	Y
Incremental Restore <sup>c</sup>	Y				Y <sup>b</sup>	Y		Y <sup>b</sup>	Y	
Split	Y		b			Y		Y <sup>b</sup>	Y	
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Requires -concurrent flag only for dgleg operations.
- b. Native TimeFinder/Mirror only.
- c. Session must be differential.
- d. If not already set to this mode.
- e. Cannot be differential.

### Concurrent TimeFinder/Clone: Clone and Snap

The following image shows the relationship between devices for a concurrent pairing of a source device with a TimeFinder/Clone target and a TimeFinder/Snap VDEV.



**Figure 58. Concurrent TimeFinder/Clone device relationships: Clone and Snap**

**NOTE:**

The positions of Target and VDEV are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the Source-VDEV pair.
- *Operation* refers to the intended control operation on the Source-Target pair.
- Y indicates that the operation is allowable for that state.

**Table 30. Concurrent TimeFinder/Clone operations: Clone and Snap**

TimeFinder/Clone Source -> Target Operation:	TimeFinder/Snap Source -> VDEV Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y		Y	Y	Y	Y					
Recreate <sup>b</sup>	Y		Y	Y	Y	Y					Y <sup>c</sup>
Activate	Y		Y	Y	Y	Y					
Full Establish	Y		Y	Y	Y	Y					
Incremental Establish	Y		Y	Y	Y	Y					
Set Mode Copy <sup>d</sup>	Y		Y	Y	Y	Y					
Set Mode Nocopy <sup>d, e</sup>	Y		Y	Y	Y	Y					
Set Mode Precopy <sup>d</sup>	Y		Y	Y	Y	Y					
Full Restore <sup>b</sup>	Y										
Incremental Restore <sup>b</sup>	Y										
Split	Y										
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

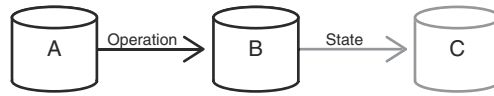
- a. Transient state.
- b. Session must be differential.
- c. Requires Engenuity 5876.163.105 and higher.
- d. If not already set to this mode.
- e. Cannot be differential.

## Cascaded TimeFinder/Clone operations

A cascaded copy operation occurs when a device is both the source of a copy and the target of a copy, such that the devices are in the relationship of A -> B -> C.

## Cascaded TimeFinder/Clone (Clone off Clone): A - B

The following image shows the relationship between devices for a Clone off Clone operation in which source device A is paired with target device B and an additional session uses device B as a source paired with target device C.



**Figure 59. Clone off Clone device relationship: A -> B**

### Limitations

- Cascading with thin devices is supported on Engenuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the B-C pair.
- *Operation* refers to the intended control operation on the A-B pair.
- Y indicates that the operation is allowable for that state.

**Table 31. Clone off Clone operations: A - B**

Time Finder/Clone A -> B Operation:	TimeFinder/Clone B -> C Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y		Y <sup>b</sup>	Y <sup>b</sup>	Y		Y			Y					
Recreate <sup>c</sup>	Y		Y <sup>b</sup>	Y <sup>b</sup>	Y		Y			Y					Y <sup>d</sup>
Activate	Y		Y	Y	Y		Y			Y					
Full Establish	Y		Y	Y	Y		Y			Y					
Incremental Establish	Y		Y	Y	Y		Y			Y					
Set Mode Copy <sup>e</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Set Mode Nocopy <sup>e, f</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Set Mode Precopy <sup>c</sup>	Y				Y		Y			Y					

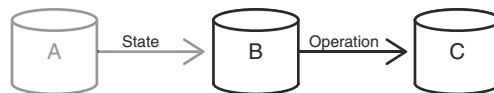
**Table 31. Clone off Clone operations: A - B (continued)**

Time Finder/Clone A -> B Operation:	TimeFinder/Clone B -> C Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Restore <sup>c</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y			
Incremental Restore <sup>c</sup>	Y		Y	Y	Y	Y	Y	Y	Y			Y <sup>g</sup>			
Split	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

- a. Transient state.
- b. Not allowed with the PRECOPY flag.
- c. Session must be differential.
- d. Requires Engenuity 5876.163.105 and higher.
- e. If not already set to this mode.
- f. Cannot be differential.
- g. Requires Engenuity 5876.

### Cascaded TimeFinder/Clone (Clone off Clone): B - C

The following image shows the relationship between devices for a Clone off Clone operation in which source device A is paired with target device B and an additional session uses device B as a source paired with target device C.



**Figure 60. Clone off Clone device relationship: B -> C**

Limitations:

- Cascading with thin devices is supported on Engenuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the A-B pair.
- *Operation* refers to the intended control operation on the B-C pair.
- Y indicates that the operation is allowable for that state.



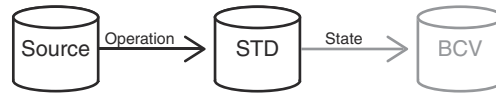
**Table 32. Clone off Clone operations: B - C**

Time Finder/Clone B -> C Operation:	TimeFinder/Clone A -> B Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y		Y	Y	Y <sup>b</sup>	Y	Y	Y	Y	Y	Y	Y			
Recreate <sup>c</sup>	Y		Y	Y	Y <sup>b</sup>	Y	Y	Y	Y	Y	Y	Y			Y <sup>d</sup>
Activate	Y						Y			Y	Y	Y			
Full Establish	Y						Y			Y	Y	Y			
Incremental Establish	Y						Y			Y	Y	Y			
Set Mode Copy <sup>e</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Set Mode Nocopy <sup>e, f</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Set Mode Precopy <sup>e</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Full Restore <sup>c</sup>	Y											Y			
Incremental Restore <sup>c</sup>	Y						Y <sup>g</sup>			Y <sup>g</sup>		Y			
Split	Y						Y <sup>g</sup>			Y	Y	Y			
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Transient state.
- b. Requires the PRECOPY flag.
- c. Session must be differential.
- d. Requires Engenuity 5876.163.105 and higher.
- e. If not already set to this mode.
- f. Cannot be differential.
- g. Requires Engenuity 5876.

## Mirror off Clone: Source - STD

The following image shows the relationship between devices for a Mirror off Clone operation in which the TimeFinder/Clone source device is paired with a target device and an additional session uses that device as the STD for TimeFinder/Mirror paired with a BCV.



**Figure 61. Mirror off Clone device relationship**

Limitations:

- Thin BCVs are only supported for Enginuity 5876.
- Cascading with thin devices is supported on Enginuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair.
- *Operation* refers to the intended control operation on the Source-STD pair.
- *Y* indicates that the operation is allowable for that state.

**Table 33. Mirror off Clone operations: Source - STD**

TimeFinder/Clone Source -> STD Operation:	TimeFinder Mirror STD -> BCV Pair state:									
	Never Established	SyncInProg	Synchronized	Restore in prog	Restored	Split no incremental	Split in prog	Split	Split before sync	Split before restore
Create	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Recreate <sup>b</sup>	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Activate	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Full Establish	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Incremental Establish	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Set Mode Copy <sup>c</sup>	Y		Y		Y <sup>a</sup>	Y	Y	Y	Y <sup>a</sup>	Y <sup>a</sup>
Set Mode Nocopy <sup>c, d</sup>	Y		Y		Y <sup>a</sup>	Y	Y	Y	Y <sup>a</sup>	Y <sup>a</sup>
Set Mode Precopy <sup>c</sup>	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	Y <sup>a</sup>
Full Restore <sup>b</sup>	Y		Y		Y	Y	Y	Y	Y <sup>a</sup>	
Incremental Restore <sup>b</sup>	Y		Y		Y <sup>e</sup>	Y	Y	Y	Y <sup>a</sup>	

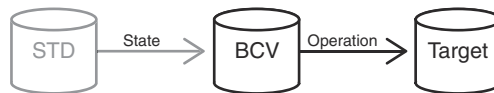
**Table 33. Mirror off Clone operations: Source - STD (continued)**

TimeFinder/Clone Source -> STD Operation:	TimeFinder Mirror STD -> BCV Pair state:									
	Never Established	SyncInProgress	Synchronized	Restore in prog	Restored	Split no incremental	Split in prog	Split	Split before sync	Split before restore
Split	Y		Y		Y <sup>a</sup>	Y		Y	Y <sup>a</sup>	
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Native TimeFinder/Mirror only.
- b. Session must be differential.
- c. If not already set to this mode.
- d. Cannot be differential.
- e. Requires Engenuity 5876 .

### Clone off Mirror: BCV - Target

The following image show the relationship between devices for a Clone off Mirror operation in which the TimeFinder/Mirror STD device is paired with a BCV device and an additional session uses that device as the source for TimeFinder/Clone paired with a target device.



**Figure 62. Clone off Mirror device relationship**

Limitations:

- Thin BCVs are only supported for Engenuity 5876.
- Cascading with thin devices is supported on Engenuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair.
- *Operation* refers to the intended control operation on the BCV-Target pair.
- Y indicates that the operation is allowable for that state.

**Table 34. Clone off Mirror operations: BCV - Target**

TimeFinder/Clone BCV -> Target Operation:	TimeFinder/Mirror STD -> BCV Pair state:									
	Never Established	SyncInProgress	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Create	Y					Y	Y	Y		
Recreate <sup>a</sup>	Y					Y	Y	Y		

**Table 34. Clone off Mirror operations: BCV - Target (continued)**

TimeFinder/ Clone BCV -> Target Operation:	TimeFinder/Mirror STD -> BCV Pair state:									
	Never Established	SyncInProg	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Activate	Y					Y		Y		
Full Establish	Y					Y		Y		
Incremental Establish	Y					Y		Y		
Set Mode Copy <sup>b</sup>	Y					Y	Y	Y		
Set Mode Nocopy <sup>b, c</sup>	Y					Y	Y	Y		
Set Mode Precopy	Y					Y	Y	Y		
Full Restore <sup>a</sup>	Y					Y		Y		
Incremental Restore <sup>a</sup>	Y					Y		Y <sup>d</sup>		
Split	Y					Y		Y		
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Session must be differential.
- b. If not already set to this mode.
- c. Cannot be differential.
- d. Requires Engenuity 5876.

## Snap off Clone: Source - Target

The following image shows the relationship between devices for a Snap off Clone operation in which the TimeFinder/Clone source device is paired with a target device and an additional session uses the target device as the source for TimeFinder/Snap paired with a VDEV.



**Figure 63. Snap off Clone device relationship**

**NOTE:**

The TimeFinder/Snap session is not considered to be a hop and does not contribute to the two hop maximum.

In the following table:

- *Pair state* refers to the current state of the Target-VDEV pair.
- *Operation* refers to the intended control operation on the Source-Target pair.

- Y indicates that the operation is allowable for that state.

**Table 35. Snap off Clone operations: Source - Target**

TimeFinder/Clone Source -> Target Operation:	TimeFinder/Snap Target -> VDEV Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y										
Recreate <sup>b</sup>	Y				Y <sup>c</sup>	Y <sup>c</sup>					Y <sup>d</sup>
Activate	Y				Y <sup>e</sup>	Y <sup>e</sup>					
Full Establish	Y										
Incremental Establish	Y										
Set Mode Copy <sup>f</sup>	Y										
Set Mode Nocopy <sup>f, g</sup>	Y										
Set Mode Precopy <sup>f</sup>	Y										
Full Restore <sup>b</sup>	Y										
Incremental Restore <sup>b</sup>	Y							Y			
Split	Y				Y	Y					
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

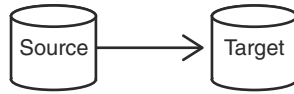
- a. Transient state.
- b. Session must be differential.
- c. If the TimeFinder/Clone target has a TimeFinder/Snap session in any state, recreate is allowed only with precopy mode.
- d. Requires Engenuity 5876.163.105 and higher.
- e. If the TimeFinder/Clone target has a TimeFinder/Snap session in any state, activate is allowed only after the precopy operation has completed one cycle. This can be verified with a symclone query.
- f. If not already set to this mode.
- g. Cannot be differential.

## VP Snap operations

VP Snap operations have rules not covered in the previous tables.

## Basic VP Snap operations

The following image shows the relationship between devices for a basic VP Snap operation.



**Figure 64. Basic VP Snap device relationship**

In the following table:

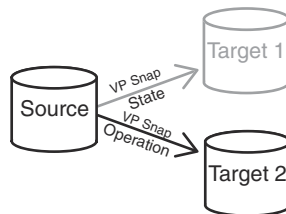
- *Pair state* refers to the current state of the Source-Target pair.
- *Operation* refers to the intended control operation on the Source-Target pair.
- Y indicates that the operation is allowable for that state.

**Table 36. Basic VP Snap operations**

VP Snap Source -> Target Operation :	VP Snap Source -> Target Pair state:								
	No session	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Invalid	Failed
Create	Y								
Recreate				Y	Y				
Activate		Y	Y						
Full Establish	Y								
Incremental Establish				Y	Y				
Incremental Restore				Y	Y				
Split									
Terminate		Y	Y	Y	Y	Y	Y	Y	Y

## Concurrent VP Snap: VP Snap with additional VP Snap

The following image shows the relationship between devices for a VP Snap pairing of a source device with two targets.



**Figure 65. Concurrent VP Snap device relationships**

In the following table:

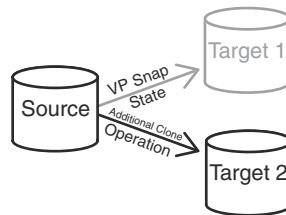
- *Pair state* refers to the current state of the Source-Target 1 pair.
- *Operation* refers to the intended control operation on the Source-Target 2 pair.
- Y indicates that the operation is allowable for that state.

**Table 37. Concurrent VP Snap: VP Snap with additional VP Snap**

Additional VP Snap Source -> Target Operation :	VP Snap Source -> Target Pair state:								
	No session	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Invalid	Failed
Create	Y	Y	Y	Y	Y			Y	Y
Recreate	Y	Y	Y	Y				Y	Y
Activate	Y	Y	Y	Y	Y			Y	Y
Full Establish	Y	Y	Y	Y	Y			Y	Y
Incremental Establish	Y	Y	Y	Y	Y			Y	Y
Incremental Restore	Y			Y	Y				
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y

## Concurrent VP Snap: VP Snap with additional TimeFinder/Clone

The following image shows the relationship between devices for a concurrent pairing of a source device with a VP Snap target and an additional TimeFinder/Clone target.



**Figure 66. Concurrent VP Snap: VP Snap with additional TimeFinder/Clone**

In the following table:

- *Pair state* refers to the current state of the VP Snap Source-Target 1 pair.
- *Operation* refers to the intended control operation on the TimeFinder/Clone Source-Target 2 pair.
- Y indicates that the operation is allowable for that state.

**Table 38. Concurrent VP Snap: VP Snap with additional TimeFinder/Clone**

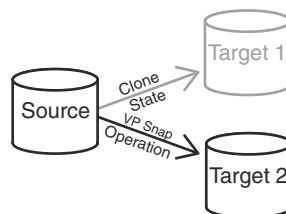
Additional TimeFinder/Clone Source -> Target Operation :	VP Snap Source -> Target Pair state:								
	No session	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Invalid	Failed
Create	Y	Y	Y	Y	Y			Y	Y
Recreate	Y	Y	Y	Y	Y				
Activate	Y	Y	Y	Y	Y			Y	Y
Full Establish	Y	Y	Y	Y	Y			Y	Y

**Table 38. Concurrent VP Snap: VP Snap with additional TimeFinder/Clone (continued)**

Additional TimeFinder/Clone Source -> Target Operation :	VP Snap Source -> Target Pair state:								
	No session	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Invalid	Failed
Incremental Establish	Y	Y	Y	Y	Y			Y	Y
Set Mode Copy	Y	Y	Y	Y	Y			Y	Y
Set Mode Nocopy	Y							Y	Y
Set Mode Precopy	Y	Y	Y	Y	Y			Y	Y
Full Restore	Y							Y	Y
Incremental Restore	Y			Y	Y			Y	Y
Split	Y	Y	Y	Y	Y			Y	Y
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y

## Concurrent VP Snap: TimeFinder/Clone with additional VP Snap

The following image shows the relationship between devices for a concurrent pairing of a source device with a VP Snap target and an additional TimeFinder/Clone target.



**Figure 67. Concurrent VP Snap: TimeFinder/Clone with additional VP Snap**

In the following table:

- *Pair state* refers to the current state of the TimeFinder/Clone Source-Target 1 pair.
- *Operation* refers to the intended control operation on the VP Snap Source-Target 2 pair.
- Y indicates that the operation is allowable for that state.

**Table 39. Concurrent VP Snap: TimeFinder/Clone with additional VP Snap**

Additional VP Snap Source -> Target Operation:	TimeFinder/Clone Source -> Target Pair state:											
	No session	Created	Recreated	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Invalid	Failed
Create	Y	Y	Y	Y	Y			Y		Y	Y	Y

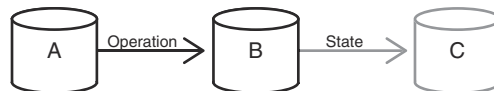


**Table 39. Concurrent VP Snap: TimeFinder/Clone with additional VP Snap (continued)**

Additional VP Snap Source -> Target Operation:	TimeFinder/Clone Source -> Target Pair state:											
	No session	Created	Recreated	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Invalid	Failed
Recreate	Y	Y	Y	Y	Y			Y		Y	Y	Y
Activate	Y	Y	Y	Y	Y			Y		Y	Y	Y
Full Establish	Y	Y	Y	Y	Y			Y		Y	Y	Y
Incremental Establish	Y	Y	Y	Y	Y			Y		Y	Y	Y
Set Mode Copy												
Set Mode Nocopy												
Set Mode Precopy												
Full Restore												
Incremental Restore	Y				Y			Y				
Split												
Terminate	Y	Y	Y	Y	Y			Y		Y	Y	Y

### Cascaded VP Snap (VP Snap off Clone): A - B

The following image shows the relationship between devices for a VP Snap off Clone operation in which source device A is paired with target device B and an additional VP Snap session uses device B as a source paired with target device C.



**Figure 68. VP Snap off Clone device relationship: A -> B**

In the following table:

- *Pair state* refers to the current state of the B-C pair.
- *Operation* refers to the intended control operation on the A-B pair.
- Y indicates that the operation is allowable for that state.

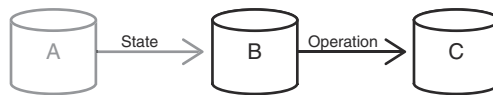
**Table 40. VP Snap off Clone operations: A - B**

TimeFinder/Clone A -> B Operation :	VP Snap B -> C Pair state:								
	No session	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Invalid	Failed
Create	Y								
Recreate	Y			Y <sup>a</sup>	Y <sup>a</sup>				
Activate	Y			Y <sup>b</sup>	Y <sup>b</sup>				
Full Establish	Y								
Incremental Establish	Y								
Set Mode Copy	Y								
Set Mode Nocopy	Y								
Set Mode Precopy	Y								
Full Restore	Y								
Incremental Restore	Y			Y	Y		Y		
Split	Y			Y	Y				
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. If device B has a VP Snap session in any state, recreate is allowed only with precopy mode.
- b. If device B has a VP Snap session in any state, activate is allowed only after the precopy operation has completed one cycle. This can be verified with a symclone query.

## Cascaded VP Snap (VP Snap off Clone): B - C

The following image shows the relationship between devices for a VP Snap off Clone operation in which source device A is paired with target device B and an additional VP Snap session uses device B as a source paired with target device C.



**Figure 69. VP Snap off Clone device relationship: B -> C**

In the following table:

- *Pair state* refers to the current state of the A-B pair.
- *Operation* refers to the intended control operation on the B-C pair.
- Y indicates that the operation is allowable for that state.

**Table 41. VP Snap off Clone operations: B - C**

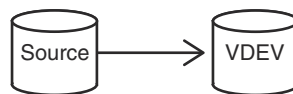
VP Snap B -> C Operation:	TimeFinder/Clone A -> B Pair state:											
	No session	Created	Recreated	Copy in prog	Copied	Copy on write	Copy on access	Restore in prog	Restored	Split	Invalid	Failed
Create	Y				Y					Y		
Recreate	Y				Y					Y		
Activate	Y				Y					Y		
Full Establish	Y				Y					Y		
Incremental Establish	Y				Y					Y		
Incremental Restore	Y				Y					Y		
Terminate	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y

## TimeFinder/Snap operations

This section describes the TimeFinder/Snap control operations that are allowed for devices in various pair states.

### Basic TimeFinder/Snap Operations

The following image shows the relationship between devices for a basic TimeFinder/Snap operation.



**Figure 70. Basic snap device relationship**

In the following table:

- *Pair state* refers to the current state of the Source-VDEV pair.
- *Operation* refers to the intended control operation.
- Y indicates that the operation is allowable for that state.

**Table 42. Basic TimeFinder/Snap operations**

TimeFinder/Snap Source -> VDEV Operation:	TimeFinder/Snap Source -> VDEV Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y										
Create - duplicate					Y	Y					
Duplicate					Y	Y					
Recreate <sup>b</sup>					Y	Y					
Activate			Y	Y							
Activate - duplicate			Y								
Full Restore <sup>c</sup>					Y	Y					
Incremental Restore					Y	Y					
Terminate		Y	Y	Y	Y	Y	Y <sup>d</sup>	Y	Y	Y	Y

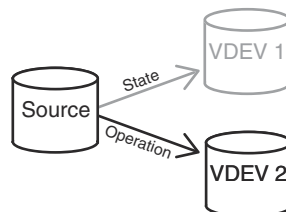
- a. Transient state.
- b. Requires Enginuity 5876.
- c. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.
- d. Requires -symforce (not recommended).

## Concurrent TimeFinder/Snap operations

A concurrent copy occurs when a source device is copied to multiple different targets. These copy operations can be any combination of TimeFinder/Clone, TimeFinder Snap, and TimeFinder/Mirror copies.

### Concurrent TimeFinder/Snap

The following image shows the relationship between devices for a TimeFinder/Clone pairing of a source device with two targets.



**Figure 71. Concurrent TimeFinder/Snap device relationships**

**NOTE:**

The positions of VDEV 1 and VDEV 2 are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the Source-VDEV 1pair.
- *Operation* refers to the intended control operation on the Source-VDEV 2 pair.
- Y indicates that the operation is allowable for that state.

**Table 43. Concurrent TimeFinder/Snap operations**

TimeFinder/Snap Source -> VDEV 2 Operation:	TimeFinder/Snap Source -> VDEV 1 Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog <sup>a</sup>	Restored	Terminate in prog	Invalid	Failed
Create	Y		Y	Y	Y	Y					
Create - duplicate	Y		Y	Y	Y	Y		Y			
Duplicate	Y		Y	Y	Y	Y		Y			
Recreate <sup>b</sup>	Y		Y	Y	Y	Y					
Activate	Y		Y	Y	Y	Y					
Activate - duplicate	Y		Y	Y	Y	Y		Y			
Full Establish <sup>c</sup>	Y		Y	Y	Y	Y					
Incremental Establish <sup>c</sup>	Y		Y	Y	Y	Y					
Full Restore <sup>d</sup>	Y		Y	Y	Y	Y					
Incremental Restore	Y				Y	Y					
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Transient state.

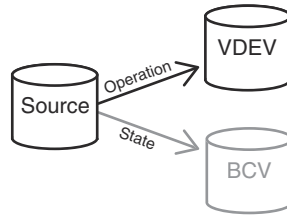
b. Requires Enginuity 5876.

c. Requires Solutions Enabler version 7.4 and higher.

d. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.

## Concurrent TimeFinder/Snap: Snap and Mirror

The following image shows the relationship between devices for a concurrent pairing of a source device with a TimeFinder/Snap VDEV and a TimeFinder/Mirror BCV.



**Figure 72. Concurrent TimeFinder/Snap device relationships: Snap and Mirror**

**NOTE:**

The positions of VDEV and BCV are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair.
- *Operation* refers to the intended control operation on the Source-VDEV pair.
- Y indicates that the operation is allowable for that state.

**Table 44. Concurrent TimeFinder/Snap operations: Snap and Mirror**

TimeFinder/Snap Source -> VDEV Operation:	TimeFinder/Mirror STD -> BCV Pair state:									
	Never Established	Sync in prog	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Create	Y	Y	Y			Y		Y	Y	
Create - duplicate	Y	Y	Y			Y		Y	Y	
Duplicate	Y	Y	Y			Y		Y	Y	
Recreate <sup>a</sup>	Y	Y	Y			Y		Y	Y	
Activate	Y	Y	Y			Y		Y	Y	
Activate - duplicate	Y	Y	Y			Y		Y	Y	
Full Establish <sup>b</sup>	Y	Y	Y			Y		Y	Y	
Incremental Establish <sup>b</sup>	Y	Y	Y			Y		Y	Y	
Full Restore <sup>c</sup>	Y	Y	Y			Y		Y	Y	
Incremental Restore	Y					Y		Y	Y	
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Requires Engenuity 5876.

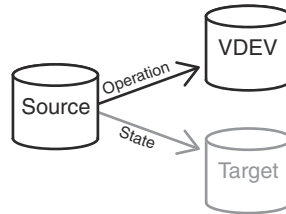
b. Requires Solutions Enabler version 7.4 and higher.

**Table 44. Concurrent TimeFinder/Snap operations: Snap and Mirror (continued)**

- c. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.

## Concurrent TimeFinder/Snap: Snap and Clone

The following image shows the relationship between devices for a concurrent pairing of a source device with a TimeFinder/Snap VDEV and a TimeFinder/Clone Target.



**Figure 73. Concurrent TimeFinder/Snap device relationships: Snap and Clone**

**NOTE:**

The positions of Target and VDEV are interchangeable in the illustration above.

In the following table:

- *Pair state* refers to the current state of the Source-Target pair.
- *Operation* refers to the intended control operation on the Source-VDEV pair.
- Y indicates that the operation is allowable for that state.

**Table 45. Concurrent TimeFinder/Snap operations: Snap and Clone**

Time Finder Snap Source -> VDEV Operation	TimeFinder/Clone -- Source -> Target -- Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Create - duplicate	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Duplicate	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Recreate <sup>b</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Activate	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Activate - duplicate	Y		Y	Y	Y	Y	Y	Y	Y	Y					

**Table 45. Concurrent TimeFinder/Snap operations: Snap and Clone (continued)**

Time Finder Snap Source -> VDEV Operation	TimeFinder/Clone -- Source -> Target -- Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish <sup>c</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Incremental Establish <sup>c</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Full Restore <sup>d</sup>	Y		Y	Y	Y	Y	Y	Y	Y	Y					
Incremental Restore	Y						Y			Y					
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

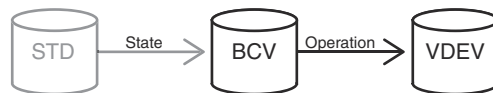
- a. Transient state
- b. Requires Enginuity 5876.
- c. Requires Solutions Enabler version 7.4 and higher.
- d. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.

## Cascaded TimeFinder/Snap operations

A cascaded copy operation occurs when a device is both the source of a copy and the target of a copy, such that the devices are in the relationship of A -> B -> C.

### Snap off Mirror: BCV - VDEV

The following image shows the relationship between devices for a Snap off Mirror operation in which the TimeFinder/Mirror STD device is paired with a BCV device and an additional session uses that device as the source for TimeFinder/Snap paired with a VDEV.



**Figure 74. Snap off Mirror device relationship**

Limitations:

- Cascading with thin devices is supported on Enginuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.



- The TimeFinder/Snap session is not considered to be a hop and does not contribute to the two hop maximum. Therefore, the STD -> BCV pairing could be preceded by a clone session such that the final cascade is Clone Source -> STD -> BCV -> VDEV.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair.
- *Operation* refers to the intended control operation on the BCV-VDEV pair.
- Y indicates that the operation is allowable for that state.

**Table 46. Snap off Mirror operations: BCV - VDEV**

TimeFinder/Snap BCV -> VDEV Operation:	TimeFinder Mirror STD -> BCV Pair State:									
	Never Established	SyncInProg	Synchronized	Restore in prog	Restored	Split no incremental	Split in prog	Split	Split before sync	Split before restore
Create	Y					Y		Y		
Create - duplicate	Y					Y		Y		
Duplicate	Y					Y		Y		
Recreate <sup>a</sup>	Y					Y		Y		
Activate	Y					Y		Y		
Activate - duplicate	Y					Y		Y		
Full Establish <sup>b</sup>	Y					Y		Y		
Incremental Establish <sup>b</sup>	Y					Y		Y		
Full Restore <sup>c</sup>	Y					Y		Y		
Incremental Restore <sup>a</sup>	Y					Y		Y		
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

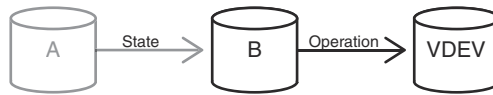
a. Requires Engenuity 5876.

b. Requires Solutions Enabler version 7.4 and higher.

c. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.

## Snap off Clone: B - VDEV

The following image shows the relationship between devices for a Snap off Clone operation in which the TimeFinder/Clone source device is paired with a target device and an additional session uses the target device as the source for TimeFinder/Snap paired with a VDEV.



**Figure 75. Snap off Clone device relationship**

Limitations:

- Cascading with thin devices is supported on Engenuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.
- The TimeFinder/Snap session is not considered to be a hop and does not contribute to the two hop maximum. Therefore, the STD -> BCV pairing could be preceded by a clone session such that the final cascade is Clone Source -> STD -> BCV -> VDEV.

In the following table:

- *Pair state* refers to the current state of the A-B pair.
- *Operation* refers to the intended control operation on the B-VDEV pair.
- Y indicates that the operation is allowable for that state.

**Table 47. Snap off Clone operations: B - VDEV**

Time Finder/ Snap B -> VDEV Operation:	TimeFinder/Clone A -> B Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Create	Y						Y			Y					
Create - duplicate	Y						Y			Y					
Duplicate	Y						Y			Y					
Recreate	Y						Y <sup>b</sup>			Y <sup>c</sup>					
Activate	Y						Y			Y					
Activate - duplicate	Y									Y					
Full Establish <sup>d</sup>	Y						Y			Y					
Incremental Establish <sup>d</sup>	Y						Y			Y <sup>c</sup>					
Full Restore <sup>e</sup>	Y			Y		Y	Y			Y				Y	Y

**Table 47. Snap off Clone operations: B - VDEV (continued)**

Time Finder/ Snap B -> VDEV Operation:	TimeFinder/Clone A -> B Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Incremental Restore	Y						Y			Y					
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

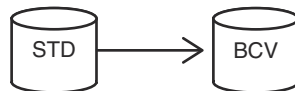
- a. Transient State
- b. Requires Engenuity 5876.
- c. Requires Solutions Enabler version 7.5 and higher and Engenuity 5876.
- d. Requires Solutions Enabler version 7.4 and higher.
- e. The restore to a third device must not be related to any session associated with the TimeFinder/Snap source device. The third device must be the same thick or thin configuration as the TimeFinder/Snap source device.

## TimeFinder/Mirror operations

This section describes the TimeFinder/Mirror control operations that are allowed for devices in various pair states.

### Basic TimeFinder/Mirror operations

The following image shows the relationship between devices for a basic TimeFinder/Mirror operation.



**Figure 76. Basic TimeFinder/Mirror device relationship**

Limitations:

- With Engenuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Engenuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.
- Thin BCVs are supported with Engenuity 5876.

In the following table:

- *Pair state* refers to the current state of the STD-BCV pair
- *Operation* refers to the intended control operation.
- Y indicates that the operation is allowable for that state.

**Table 48. Basic TimeFinder/Mirror operations**

TimeFinder Mirror STD -> BCV Operation:	TimeFinder/Mirror STD -> BCV Pair state:									
	Never Established	Sync in prog	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Full Establish	Y					Y		Y	Y	
Incremental Establish								Y		
Split		ya,b	Y	ya,c, d	Y					
Full Restore	Y					Y		Y		Y
Incremental Restore								Y		
Cancel								Y		

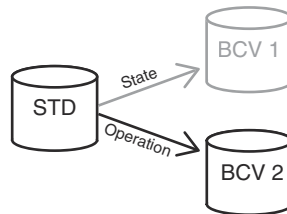
- a. Requires -symmforce (not recommended)
- b. With native TimeFinder/Mirror, this results in the Split Before Sync state, which indicates that the BCV data is not complete. With TimeFinder/Clone Emulation mode, this results in the Split state, which indicates that the BCV data is complete.
- c. Results in the Split Before Restore state, which indicates that the STD data is not complete.
- d. Native TimeFinder/Mirror only.

## Concurrent TimeFinder/Mirror operations

A concurrent copy occurs when a source device is copied to multiple different targets. These copy operations can be any combination of TimeFinder/Clone, TimeFinder/Snap, and TimeFinder/Mirror copies.

### Concurrent TimeFinder/Mirror

The following image shows the relationship between devices for a TimeFinder/Mirror pairing of a STD device with two BCVs.



**Figure 77. Concurrent TimeFinder/Mirror device relationships**

**NOTE:**

The positions of BCV 1 and BCV 2 are interchangeable in the illustration above.

Limitations:

- With Engenuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Engenuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.

- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.
- Thin BCVs are supported with Engenuity 5876.

In the following table:

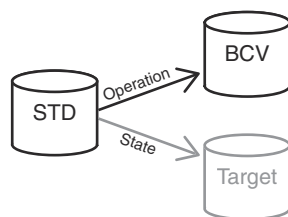
- *Pair state* refers to the current state of the STD-BCV 1 pair
- *Operation* refers to the intended control operation on the STD-BCV 2 pair
- Y indicates that the operation is allowable for that state.

**Table 49. Concurrent TimeFinder/Mirror operations**

TimeFinder/Mirror STD -> BCV 2 Operation:	TimeFinder/Mirror STD -> BCV 1 Pair state:									
	Never Established	Sync in prog	Synchronized	Restore in prog	Restored	Split no incremental	Split in progress	Split	Split before sync	Split before restore
Full Establish	Y	Y	Y			Y		Y	Y	
Incremental Establish	Y	Y	Y			Y		Y	Y	
Split	Y	Y	Y			Y		Y	Y	
Full Restore	Y					Y		Y	Y	Y
Incremental Restore	Y					Y		Y	Y	Y
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

## Concurrent TimeFinder/Mirror: Mirror and Clone

The following image shows the relationship between devices for a concurrent pairing of a STD device with a TimeFinder/Mirror BCV and a TimeFinder/Clone target.



**Figure 78. Concurrent TimeFinder/Mirror device relationships: Mirror and Clone**

### **NOTE:**

The positions of BCV and Target are interchangeable in the illustration above.

Limitations:

- With Engenuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Engenuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.
- Thin BCVs are supported with Engenuity 5876.

In the following table:

- *Pair state* refers to the current state of the STD-Target pair.

- Operation refers to the intended control operation on the STD-BCV pair.
- Y indicates that the operation is allowable for that state.

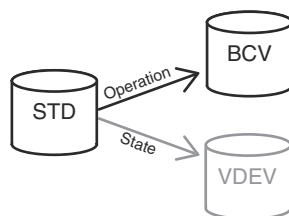
**Table 50. Concurrent TimeFinder/Mirror operations: Mirror and Clone**

Time Finder / Mirror STD -> BCV Operation:	TimeFinder/Clone STD -> TargetPair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Incremental Establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					
Split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y <sup>b</sup>			
Full Restore	Y														
Incremental Restore	Y														
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Transient state.
- b. Native TimeFinder/Mirror only.

## Concurrent TimeFinder/Mirror: Mirror and Snap

The following image shows the relationship between devices for a concurrent pairing of a STD device with a TimeFinder/Mirror BCV and a TimeFinder/Snap VDEV.



**Figure 79. Concurrent TimeFinder/Mirror device relationships: Mirror and Snap**

**NOTE:**

The positions of BCV and VDEV are interchangeable in the illustration above.

Limitations:

- With Engenuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Engenuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.
- Thin BCVs are supported with Engenuity 5876.

In the following table:

- *Pair state* refers to the current state of the STD-VDEV pair.
- *Operation* refers to the intended control operation on the STD-BCV pair.
- Y indicates that the operation is allowable for that state.

**Table 51. Concurrent TimeFinder/Mirror operations: Mirror and Snap**

TimeFinder/Mirror STD -> BCV Operation:	TimeFinder/Snap STD -> VDEV Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish	Y	Y	Y	Y	Y	Y					
Incremental Establish	Y	Y	Y	Y	Y	Y					
Split	Y	Y	Y	Y	Y	Y		Y <sup>b</sup>			
Full Restore	Y										
Incremental Restore	Y										
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Transient state.

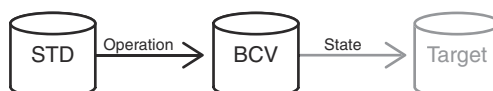
b. Native TimeFinder/Mirror only.

## Cascaded TimeFinder/Clone operations

A cascaded copy operation occurs when a device is both the source of a copy and the target of a copy, such that the devices are in the relationship of A -> B -> C.

### Clone off Mirror: STD - BCV

The following image shows the relationship between devices for a Clone off Mirror operation in which the TimeFinder/Mirror STD device is paired with a BCV and an additional session uses that device as the source for TimeFinder/Clone paired with a target device.



**Figure 80. Clone off Mirror device relationship**

Limitations:

- With Engenuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Engenuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.

- Thin BCVs are supported with Enginuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the BCV-Target pair.
- *Operation* refers to the intended control operation on the STD-BCV pair.
- Y indicates that the operation is allowable for that state.

**Table 52. Clone off Mirror operations: STD - BCV**

Time Finder/Mirror STD - BCV Operation:	TimeFinder/Clone BCV -> Target Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish	Y														
Incremental Establish	Y														
Split	Y														
Full Restore	Y														
Incremental Restore	Y														
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Transient state.

## Mirror off Clone: STD - BCV

The following image shows the relationship between devices for a Mirror off Clone operation in which the TimeFinder/Clone source device is paired with a target device and an additional session uses that device as the STD for TimeFinder/Mirror paired with a BCV.



**Figure 81. Mirror off Clone device relationship**

Limitations:

- With Enginuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Enginuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.



- Thin BCVs are supported with Enginuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the Source-STD pair
- *Operation* refers to the intended control operation on the STD-BCV pair.
- Y indicates that the operation is allowable for that state.

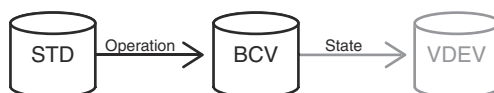
**Table 53. Mirror off Clone operations STD - BCV**

Time Finder/Mirror STD -> BCV Operation:	TimeFinder/Clone Source -> STD Pair state:														
	No session	Create in prog <sup>a</sup>	Created	Recreated	Precopy	Copy in progress	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish	Y										Y	Y			
Incremental Establish	Y										Y	Y			
Split	Y						Y			Y	Y	Y			
Full Restore	Y														
Incremental Restore	Y														
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Transient state.

## Snap off Mirror: STD - BCV

The following image shows the relationship between devices for a Snap off Mirror operation in which the TimeFinder/Mirror STD device is paired with a BCV device and an additional session uses the BCV device as the source for TimeFinder/Snap paired with a VDEV.



**Figure 82. Snap off Mirror device relationship**

Limitations:

- With Enginuity 5876, all TimeFinder/Mirror operations are done with TimeFinder/Clone Emulation. With Enginuity 5773, the default mode is native TimeFinder/Mirror, and TimeFinder/Clone Emulation is a selectable option.
- RAID5 and RAID6 BCVs automatically use TimeFinder/Clone Emulation.

- Thin BCVs are supported with Enginuity 5876.
- Mixed thick and thin devices are not supported. All devices in a cascaded session must be thick or thin.
- Cascaded sessions cannot exceed two hops.

In the following table:

- *Pair state* refers to the current state of the BCV-VDEV pair.
- *Operation* refers to the intended control operation on the STD-BCV pair.
- Y indicates that the operation is allowable for that state.

**Table 54. Snap off Mirror operations: STD - BCV**

TimeFinder/ Mirror STD -> BCV Operation:	TimeFinder/Snap BCV -> VDEV Pair state:										
	No session	Create in prog <sup>a</sup>	Created	Recreated	Copied	Copy on write	Restore in prog	Restored	Terminate in prog <sup>a</sup>	Invalid	Failed
Full Establish	Y										
Incremental Establish	Y										
Split	Y										
Full Restore	Y										
Incremental Restore	Y										
Cancel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Transient state.

# SRDF State Rules Reference

This appendix describes the applicable SRDF pair states that rule the TimeFinder SnapVX, TimeFinder/Clone, and TimeFinder/Snap copy session operations.

## Topics:

- [SRDF pair states](#)
- [State rules for TimeFinder/Clone operations](#)
- [State rules for TimeFinder/Snap operations](#)

## SRDF pair states

Certain TimeFinder copy operations are not allowed within arrays employing SRDF for remote mirroring as these operations can conflict with one another. 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 55. SRDF pair states**

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

**Table 55. SRDF pair states (continued)**

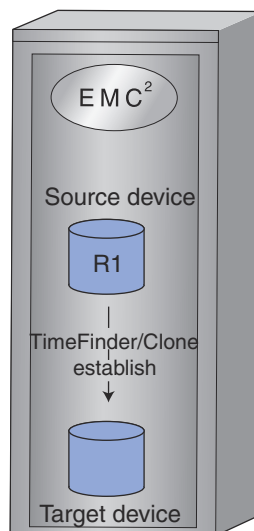
State	Description
R1 Updated	The R1 is currently Not Ready or write disabled to the host, there are no local invalid tracks on the R1 side, and the link is Ready or write disabled.
R1 UpdInProg	The R1 is currently Not Ready or write disabled to the host, there are invalid local (R1) tracks on the source 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.

## State rules for TimeFinder/Clone operations

This section identifies the **symclone** copy actions that are available for use within each of the SRDF pair states.

This section refers to the copy source and the copy target. It is important to note that “source” and “target” refer to the direction of the data flow. In this context, these terms do not refer to the TimeFinder/Clone device pair relationship.

The following image shows an establish operation for which the R1 device is the source of the data for the clone copy operation. In other words, the TimeFinder/Clone source device is the source for the clone copy.



**Figure 83. R1 device as TimeFinder/Clone copy source.**

The following image shows a restore operation for which the R1 device is the target of the data for the clone copy operation. In other words, for a restore, the TimeFinder/Clone source device is the target of the clone copy.

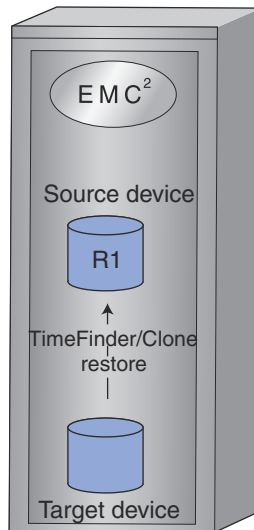


Figure 84. R1 device as TimeFinder/Clone copy target.

## TF/Clone operations R1 source

Table 56. TF/Clone operations allowed when R1 is source of clone copy data

Clone Control Operation:	SRDF State:													
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Create/recreate	Y	Y	Y	Y	Y	Y		Y			Y <sup>a</sup>	Y	Y	Y
Activate	Y <sup>a</sup>	Y	Y	Y	Y	Y		Y <sup>b</sup>	Y <sup>b</sup>		Y <sup>a</sup>	Y	Y	Y
Establish	Y <sup>a</sup>	Y	Y	Y	Y	Y		Y <sup>b</sup>	Y <sup>b</sup>		Y <sup>a</sup>	Y	Y	Y
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Restore	Y <sup>a</sup>	Y	Y	Y		Y		Y	Y		Y <sup>a</sup>	Y		
Split	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y <sup>c</sup>	Y <sup>c</sup>

- a. Action is not allowed if there are local R1 invalids or remote R2 invalids.
- b. Action is not allowed if the -consistent option is specified.
- c. Only applies for Solutions Enabler V9.0 and higher.

## TF/Clone operations R1 target

Table 57. TF/Clone operations allowed when R1 is target of clone copy data

Clone Control Operation:	SRDF State:													
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Create/recreate	Y <sup>a,b,c</sup>	Y <sup>b,c</sup>	Y	Y		Y					Y <sup>a,b,c</sup>	Y		
Activate	Y <sup>a,b,c</sup>	Y <sup>b,c</sup>	Y	Y		Y					Y <sup>a,b,c</sup>	Y		

**Table 57. TF/Clone operations allowed when R1 is target of clone copy data (continued)**

Clone Control Operation:	SRDF State:													
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 upinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Establish	Y <sup>a,b,c</sup>	Y <sup>b,c</sup>	Y	Y		Y					Y <sup>a,b,c</sup>	Y		
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Restore	Y <sup>a,b,c</sup>	Y <sup>b,c</sup>	Y	Y		Y					Y <sup>a,b,c</sup>	Y		
Split	Y <sup>a,b,c</sup>	Y <sup>b,c</sup>	Y	Y		Y	Y				Y <sup>a,b,c</sup>	Y		

- a. Action is not allowed if there are local R1 invalids or remote R2 invalids.
- b. The -force option must be applied.
- c. Action is not allowed with CopyOnAccess.

## TF/Clone operations R2 source

**Table 58. TF/Clone operations allowed when R2 is source of clone copy data**

Clone Control Operation:	SRDF State:													
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 upinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
Create/recreate	Y <sup>a</sup>	Y	Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a, b</sup>	Y		Y <sup>a, b</sup>	Y <sup>a, b</sup>		Y <sup>a, b</sup>	Y <sup>c</sup>	Y	Y
Activate	Y <sup>d</sup>	Y	Y	Y	Y	Y		Y	Y		Y <sup>e</sup>	Y <sup>e</sup>	Y	Y
Establish	Y <sup>a, d</sup>	Y	Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a, b</sup>	Y		Y <sup>a, b</sup>	Y <sup>a, b</sup>		Y <sup>a, b, e</sup>	Y <sup>c, e</sup>	Y	Y
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Restore		Y	Y	Y	Y	Y								
Split		Y	Y	Y	Y	Y	Y							

- a. If the precopy option is not applied, the action is not allowed if either of the following applies:
  1. SRDF/A device-level write pacing is not activated and supported on the SRDF/A session, or
  2. The SRDF pair is the R21-> R2 of a cascaded configuration and any of the following apply:
    - a. The R21 Symmetrix array is running an Enginuity level lower than 5876.159.102, or
    - b. The R2 Symmetrix array is running an Enginuity level lower than 5876, or
    - c. The R21 device is not pace-capable.
- b. With Enginuity 5773 and lower, the precopy option (-precopy) must be applied.
- c. The precopy option (-precopy) must be applied for SRDF/A.
- d. Action is not allowed if there are remote R1 invalids or local R2 invalids.
- e. Action is not allowed if there are local R1 invalids or remote R2 invalids.

## TF/Clone operations R2 target

Table 59. TF/Clone operations allowed when R2 is target of clone copy data

Clone Control Operation:	SRDF State:													
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	Transmitidle	ActiveActive	ActiveBias
Create/recreate			Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a,b</sup>	Y <sup>a</sup>								
Activate			Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a,b</sup>	Y <sup>a</sup>								
Establish			Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a,b</sup>	Y <sup>a</sup>								
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Restore			Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a,a</sup>	Y <sup>a</sup>								
Split			Y <sup>a</sup>	Y <sup>a</sup>	Y <sup>a,a</sup>	Y <sup>a</sup>								

- a. Action is not allowed if the target device is an R2 larger than the R1.
- b. Action is not allowed if the R2 target device is in asynchronous mode.

## State rules for TimeFinder/Snap operations

This section identifies what **symsnap** copy actions are available for use within each of the SRDF pair states.

### TimeFinder/Snap operations R1 source

Table 60. TimeFinder/Snap operations allowed when R1 is source of the snap

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	Transmitidle
Create/recreate	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y
Activate	Y <sup>a</sup>	Y	Y	Y	Y	Y		Y <sup>b</sup>	Y <sup>b</sup>		Y <sup>b</sup>	Y
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Incremental restore to source	Y <sup>a,c</sup>	Y <sup>c</sup>	Y	Y		Y					Y <sup>b,c</sup>	Y
Incremental restore to a split	Y	Y	Y	Y	Y	Y		Y <sup>b</sup>	Y <sup>b</sup>		Y	Y

**Table 60. TimeFinder/Snap operations allowed when R1 is source of the snap (continued)**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 upinprog	Invalid	Consistent	Transmitidle
BCV or full restore to any device												

- a. Action is not allowed if there are local invalids on the R1 side or remote invalids owed to the R1 on the R2 side.
- b. Action is not allowed if there are local R1 invalids or remote R2 invalids.
- c. The force option (-force) must be applied.

## TimeFinder/Snap operations R1 target

**Table 61. TimeFinder/Snap operations allowed when R1 is target of the snap**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 upinprog	Invalid	Consistent	Transmitidle
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Incremental restore to a split BCV or full restore to any device	Y	Y	Y	Y		Y				Y	Y	Y

## TimeFinder/Snap operations R2 source

**Table 62. TimeFinder/Snap operations allowed when R2 is source of snap**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 upinprog	Invalid	Consistent	Transmitidle
Create/recreate	Y <sup>a</sup>	Y	Y	Y <sup>b</sup>	Y <sup>b</sup>	Y		Y <sup>b</sup>	Y <sup>b</sup>		Y	
Activate	Y <sup>c</sup>	Y	Y	Y	Y	Y		Y	Y		Y	



**Table 62. TimeFinder/Snap operations allowed when R2 is source of snap (continued)**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Incremental restore to source		Y	Y	Y	Y	Y		Y <sup>d</sup>	Y <sup>d</sup>			
Incremental restore to a split BCV or full restore to any device	Y	Y	Y	Y	Y	Y		Y <sup>e</sup>	Y <sup>d</sup>			

- a. Action is not allowed if either of the following is true:
  1. SRDF/A device-level write pacing is not activated and supported on the SRDF/A session, or
  2. The SRDF pair is the R21-> R2 of a cascaded configuration, and any of the following apply:
    - a. The R21 Symmetrix array is running an Engenuity level lower than 5876.159.102, or
    - b. The R2 Symmetrix array is running an Engenuity level 5773, or
    - c. The R21 device is not pace-capable.
- b. Action is not allowed if the SRDF pair is operating in asynchronous mode and any of the following are true:
  1. SRDF/A device-level write pacing is not configured for autostart on the R1 side of the SRDF/A session, or
  2. The SRDF pair is the R21-> R2 of a cascaded configuration and either of the following applies:
    - a. The R21 Symmetrix array is running an Engenuity level lower than 5876 Q2012 SR, or
    - b. The R2 Symmetrix array is running Engenuity level 5773.
  3. The SRDF pair is not the R21-> R2 of a cascaded configuration and either the R1 or the R2 Symmetrix array is running Engenuity level 5773.
- c. Action is not allowed if there are remote invalids owed to the R2 on the R1 side or local invalids on the R2 side.
- d. Action is not allowed if the R2 target is in asynchronous mode.
- e. The force option (-force) must be applied.

## TimeFinder/Snap operations R2 target

**Table 63. TimeFinder/Snap operations allowed when R2 is target of the snap**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Incremental restore			Y	Y	Y	Y		Y	Y	Y		

**Table 63. TimeFinder/Snap operations allowed when R2 is target of the snap (continued)**

Snap Control Operation:	SRDF State:											
	Sync in prog	Synchronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	Transmitidle
to a split BCV or full restore to any device												

# ORS State Rules Reference

This appendix describes the interaction rules for TimeFinder SnapVX /snap/Clone operations with ORS `rcopy` states.

## Topics:

- [TimeFinder/Snap and TimeFinder/Clone operations](#)

## TimeFinder/Snap and TimeFinder/Clone operations

This section identifies the Snap and Clone control operations that are available in each of the `rcopy` pair states.

### Clone source with `rcopy` push

The following table identifies clone operations allowed when a TimeFinder Clone source device is the control device for a `rcopy` PUSH session.

**Table 64. TimeFinder Clone source device is control device for `rcopy` push session**

Clone Control Operation:	rcopy state:																	
	None	Create in prog	Created	Copy in progress	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restore in prog	Restored	Precopy	Sync in prog	Synchronized	Stopped
Create/recreate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Activate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Establish	Y	Y	Y	Y	Y	Y	Y	Y	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	Y	Y
Restore	Y				Y <sup>a</sup>													
Split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not supported for incremental restore on arrays running Enginuity less than 5876.

### Clone source with `rcopy` pull

The following table identifies clone operations allowed when a TimeFinder Clone source device is the control device for a `rcopy` PULL session.

**Table 65. TimeFinder Clone source device is control device for rcopy pull session**

Clone Control Operation:	rcopy state:																	
	None	Create in prog	Created	Copy in progress	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restore in prog	Restored	Precopy	Sync in prog	Synchronized	Stopped
Create/ recreate	Y													Y				
Activate	Y													Y				
Establish	Y													Y				
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Restore	Y													Y <sup>a,b</sup>				
Split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

- a. Not supported with Donor Update.
- b. Not supported for incremental restore on arrays running Engenuity less than 5876.

## Clone target with rcopy push

The following table identifies clone operations allowed when a TimeFinder Clone target device is the control device for a rcopy PUSH session.

**Table 66. TimeFinder Clone target device is control device for rcopy push session**

Clone Control Operation:	rcopy state:																	
	None	Create in prog	Created	Copy in progress	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restore in prog	Restored	Precopy	Sync in prog	Synchronized	Stopped
Create/ recreate	Y					Y												
Activate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Establish	Y					Y												

**Table 66. TimeFinder Clone target device is control device for rcopy push session (continued)**

Clone Control Operation:	rcopy state:																	
	None	Create in prog	Created	Copy in progress	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restore in prog	Restored	Precopy	Sync in prog	Synchronized	Stopped
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

## Clone target with rcopy pull

The following table identifies clone operations allowed when a TimeFinder Clone target device is the control device for a rcopy PULL session.

**Table 67. TimeFinder Clone target device is control device for rcopy pull session**

Clone Control Operation:	rcopy state:																	
	None	Create in prog	Created	Copy in progress	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restore in prog	Restored	Precopy	Sync in prog	Synchronized	Stopped
Create/Recreate	Y													Y <sup>a</sup>				
Activate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Establish	Y													Y <sup>a</sup>				
Terminate	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Restore	Y													Y				
Split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not supported with Donor Update.

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