Dell EMC Solutions Enabler SRDF Family

Version 9.0

CLI User Guide

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CONTENTS

FIGURES

TABLES

PREFACE

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

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

Note

This document was accurate at publication time. Go to Dell EMC Online Support (https://support.emc.com) to ensure that you are using the latest version of this document.

Purpose

This document describes how to use Solutions Enabler SYMCLI to manage SRDF®.

Audience

This document is for advanced command-line users and script programmers to manage various types of control operations on arrays and devices using Solutions Enabler's SYMCLI commands.

Special notice conventions used in this document

Dell EMC uses the following conventions for special notices:

DANGER

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.

NOTICE

Addresses practices not related to personal injury.

Note

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

Typographical conventions

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

Bold	Used for names of interface elements, such as names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user specifically selects or clicks)
Italic	Used for full titles of publications referenced in text
`Monospace`	Used for: • System code • System output, such as an error message or script • Pathnames, filenames, prompts, and syntax • Commands and options
`Monospace italic`	Used for variables
`Monospace bold`	Used for user input
[ ]	Square brackets enclose optional values
|	Vertical bar indicates alternate selections - the bar means “or”
{ }	Braces enclose content that the user must specify, such as x or y or z
...	Ellipses indicate nonessential information omitted from the example

Where to get help

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

Product information

For documentation, release notes, software updates, or information about Dell EMC products, go to Dell EMC Online Support at https://support.emc.com.

Technical support

Go to Dell EMC Online Support and click Service Center. You will see several options for contacting Dell EMC Technical Support. Note that to open a service request, you must have a valid support agreement. Contact your Dell EMC sales representative for details about obtaining a valid support agreement or with questions about your account.

Your comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Send your opinions of this document to techpubcomments@emc.com.

Revision history

The following table presents the revision history of this document:

Table 1 Revision history

Solutions Enabler	Description and/or change
9.0	Removed references to Enginuity 5773. Support added for PowerMaxOS 5978. PowerMaxOS 5978 enhancements include: • Added support for devices with Mobility IDs. • Added ability to move devices to and from an Active SRDF/Metro session while retaining data already on the devices during the operation. Support added for split action for SRDF device pairs that are in the FailedOver RDF pair state, provided that the R1 device is mapped to a host. Support added to suspend SRDF/Metro devices without using the `-force` option. The `-rdf_metro` CLI option is now replaced by the new `-metro` option. Support is added to allow SRDF/Metro configurations with GCM devices. The `-cons_exempt` CLI option is now replaced by the new `-exempt` option.

CHAPTER 1

SRDF CLI overview

This chapter describes the following topics:

Introduction to SRDF

The Dell EMC Symmetrix® Remote Data Facility (SRDF®) family of products offers a range of array based disaster recovery, parallel processing, high availability, and data migration solutions for VMAX® Family and VMAX All Flash systems, including:

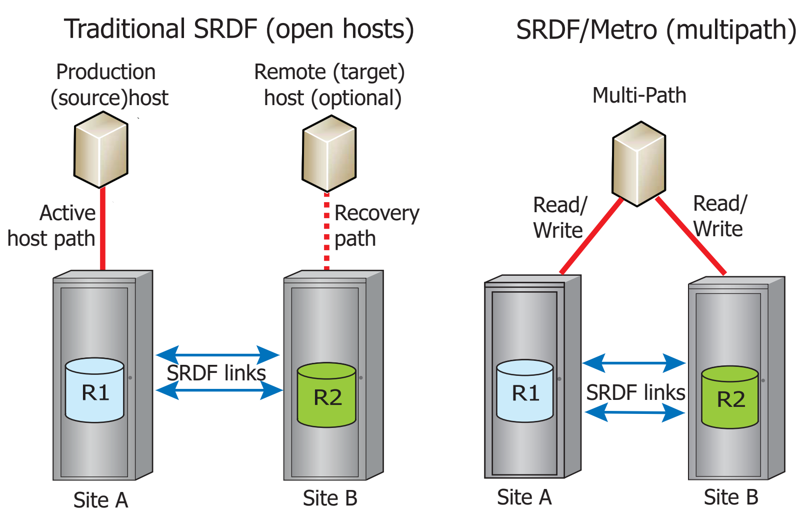
- HYPERMAX OS for VMAX3 Family 100K, 200K, 400K arrays, VMAX All Flash 250F, 450F, 850F, 950F arrays
- Enginuity 5876 for VMAX 10K, 20K, and 40K arrays

SRDF replicates data between 2, 3 or 4 arrays located in the same room, on the same campus, or thousands of kilometers apart. Replicated volumes may include a single device, all devices on a system, or thousands of volumes across multiple systems.

HYPERMAX OS 5977.691.684 introduces an additional SRDF configuration; SRDF/Metro.

The following image shows two-site SRDF configurations, one traditional and one SRDF/Metro.

Figure 1 2-site SRDF configurations



In *traditional* SRDF configurations:

- A host at the production site is connected to the local array.
- SRDF device pairs are designated as the R1 side (local to the host) and R2 side (remote)
- R1 and R2 device pairs are connected over SRDF links.
- The production host writes I/O to the R1 side of the device pair at the primary site.
- SRDF mirrors the production I/O to the R2 side of the device pair at the secondary site(s).

In *SRDF/Metro* configurations:

- R2 devices acquire the personality (geometry, device WWN) of the R1 device .
- R1 and R2 devices to appear to hosts(s) as a single virtual device across the two SRDF paired arrays
- The host (multiple hosts in clustered configurations) can read and write to both the R1 and R2 devices.

- For single host configurations, host I/Os are issued by a single host. Multi-pathing software directs parallel reads and writes to each array.
- For clustered host configurations, host I/Os can be issued by multiple hosts accessing both sides of the SRDF device pair.

HYPERMAX OS

VMAX 100K/200K/400K arrays (referred to as VMAX3™ arrays), or VMAX All Flash arrays, running HYPERMAX OS can use SRDF to replicate to:

- VMAX3 arrays running HYPERMAX OS.
- VMAX 10K/20K/40K arrays running Enginuity™ version 5876 with applicable ePack.

Enginuity 5876

Refer to the *SRDF Two-site Interfamily Connectivity* tool for information about SRDF features supported between arrays running Enginuity 5876.

SRDF documentation

Table 2 SRDF documentation

For information on	See
Technical concepts and operations of the SRDF product family. Topics include: • SRDF Solutions • SRDF interfamily connectivity • SRDF concepts and terminology • SRDF/DM, SRDF/AR, SRDF/Concurrent • SRDF integration with other products	*EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS* and *Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS*
Configure and manage arrays using the SYMCLI.	*Dell EMC Solutions Enabler Array Controls and Management CLI User Guide*
Install, configure, and manage Virtual Witness instances for SRDF/Metro.	*Dell EMC SRDF/Metro vWitness Configuration Guide*
Determine which SRDF replication features are supported between two or three arrays running Enginuity 5876, HYPERMAX OS, or PowerMaxOS.	*SRDF Interfamily Connectivity Information*

Table 2 SRDF documentation (continued)

For information on	See
Securing your configuration	*EMC VMAX All Flash and VMAX3 Family Security Configuration Guide* and *EMC VMAX All Flash and VMAX3 Family Security Configuration Guide*
Host connectivity	Dell EMC Host Connectivity Guides for your operating system.
Managing legacy versions of SRDF using SYMCLI	Download the SolVe Desktop and load the VMAX Family and DMX procedure generator. Select VMAX 10K, 20K, 40K, DMX -> Customer procedures -> *Managing SRDF using SYMCLI*.

What's new in Solutions Enabler 9.0

- Support added for PowerMaxOS 5978.
- Added support for devices with Mobility IDs.
- Added ability to move devices to and from an Active SRDF/Metro session while retaining data already on the devices during the operation.
- Support added for split action for SRDF device pairs that are in the FailedOver RDF pair state, provided that the R1 device is mapped to a host.
- Support added to suspend SRDF/Metro devices without using the `-force` option.
- The `-rdf_metro` CLI option is now replaced by the new `-metro` option.
- Support is added to allow SRDF/Metro configurations with GCM devices.
- The `-cons_exempt` CLI option is now replaced by the new `-exempt` option.

SRDF backward compatibility to Enginuity 5876 - Replication between Enginuity 5876, HYPERMAX OS 5977 and PowerMaxOS 5978

SRDF/Metro
5876 arrays with the applicable ePack can participate only as Witness arrays in SRDF/Metro configurations.

Witness SRDF groups can be created between two VMAX3 arrays running HYPERMAX OS 5977.691.684 or later and a 5876 array.

An SRDF/Metro configuration between the two VMAX3 arrays can then use Witness protection, provided by the 5876 array.

Solutions Enabler 8.0.1
You can use SRDF features in Solutions Enabler 8.0.1/HYPERMAX OS to replicate to/from:

- VMAX 3 arrays also running HYPERMAX OS.

- VMAX 10K/20K/40K arrays running Enginuity 5876 with the applicable ePack.

When one array in an SRDF configuration is running HYPERMAX OS, and one or more other arrays are running Enginuity 5876, the following rules and restrictions apply:

- All SRDF groups and devices must be dynamic.
- SRDF/A sessions use legacy mode. See SRDF/A cycle modes on page 135.
- Directors on arrays running HYPERMAX OS support up to 16 ports and 250 SRDF groups. If a port on the array running HYPERMAX OS is connected to an array running Enginuity 5876:
  - The port supports a maximum of 64 RDF groups.
  - The director associated with the port supports a maximum of 186 RDF groups.
- SRDF device pairs with meta-devices on one side are allowed if the meta-devices are on the array running Enginuity 5876.
  Output of the `symrdf query`, `symrdf list`, and `symdev show` commands has been enhanced to display RDF mode as MIXED when a meta head device on an array running Enginuity 5876 has different RDF modes than its members.

  When you see a device in MIXED mode, you can use the `set mode` command to choose the appropriate mode for the device pair.
- The `symcfg list -ra` command has been modified to report the remote SID when the RDF Pair State is Partitioned.
- Adaptive copy write pending is not supported in HYPERMAX OS.
  - For `swap` and `failover` operations - If the R2 device is on an array running HYPERMAX OS, and the mode of the R1 is adaptive copy write pending, SRDF sets the mode to adaptive copy disk.
  - For `migrate -replace R1` operations - If the R1 (after the replacement) is on an array running HYPERMAX OS, and the mode of the R1 is adaptive copy write pending mode, SRDF sets the mode of the migrated pair to adaptive copy disk.

Geometry Compatible Mode

Track size for FBA devices increased from 64K in Enginuity 5876 to 128K in HYPERMAX OS. Geometry Compatibility Mode supports full SRDF functionality for devices on arrays running Enginuity 5876 with an odd number of cylinders paired with devices on arrays running HYPERMAX OS.

An array running HYPERMAX OS cannot create a device that is exactly the same size as a device with an odd number of cylinders on an array running Enginuity 5876. However, SRDF requires that R1 and R2 devices in a device pair be the same size.

HYPERMAX OS manages the device size difference automatically, using the device attribute, Geometry Compatible Mode (GCM). A device with GCM set is presented as half a cylinder smaller than its true configured size, enabling full migration functionality between HYPERMAX OS and Enginuity 5876 for SRDF. For most operations, Solutions Enabler sets it automatically when required. For example, Solutions Enabler automatically sets the GCM attribute when restoring from a physically larger R2.

NOTICE

The GCM flag should be cleared on the device before mapping it to a host, otherwise, in order to clear the flag it must be unmapped from the host, which results in a data outage.

Also, the `symdev, symdg, symcg, symsg` commands can manually set or unset GCM for a device or group using the `set/unset -gcm` option. Refer to the *Solutions*

Enabler CLI Reference Guide for more information on using these commands with the –gcm attribute.

The `symrdf createpair` command transparently sets/unsets the GCM attribute as part of the create pair operation, as follows:

- Sets the GCM attribute for a target device that is configured ½ cylinder larger. The source of the copy can be:
  - A device on an array running Enginuity 5876 with an odd number of cylinders and capacity that matches the GCM size of the target device.
  - A GCM device on an array running HYPERMAX OS.
- Unsets the GCM attribute for a target device that is configured the exact same size as the source of the copy. The source of the copy can be:
  - A source device on an array running Enginuity 5876 with even number of the cylinders and capacity that matches the size of the target device on the array running HYPERMAX OS
  - A source device on the array running HYPERMAX OS without the GCM attribute.

The `symdev show`, `symdev list -v`, `symdg show ld`, `symdg list ld -v`, `sympd show`, and `sympd list -v` commands have been enhanced to report the GCM attribute.

GCM Rules and restrictions:

- The GCM setting for a device cannot be changed if the target of the data device is already part of another replication session.
- Do not set GCM on devices that are mounted and under Local Volume Manager (LVM) control.

Mobility ID

Devices in VMAX arrays running HYPERMAX OS 5977 or PowerMAXOS 5978 can have either a Compatibility ID or a Mobility ID. The `symdev show` and `symdev list` commands can be used to report the device ID type for arrays running PowerMaxOS 5978.

The example output of the `symdev show` command below shows a device carrying Mobility ID on array 084.

```
symdev show 0325C -sid 084

    Device Physical Name      : Not Visible

    Device Symmetrix Name     : 0325C
    Device Serial ID          : N/A
    Symmetrix ID              : 000197100084

      . . .
    Vendor ID                 : EMC
    Product ID                : SYMMETRIX
    Product Revision          : 5977
    Device WWN                : 600009700BBF82341FA1006E00000017
    Device ID Type            : Mobility
Device Emulation Type     : FBA
      . . .

    Device External Identity
        {
```

```
        Device WWN            : 600009700BBF82341FA1006E00000017

        Front Director Paths (0): N/A

        Geometry              : Native
            {
            Sectors/Track          :          256
            Tracks/Cylinder        :           15
            Cylinders              :        10925
            512-byte Blocks        :     41952000
            MegaBytes              :        20484
            KiloBytes              :     20976000
            }
        }
      . . .
```

To filter devices based on ID type, use the `symdev list` command with the following syntax:

```
symdev -sid <SymmID> list -device_id <compatibility | mobility>
```

Converting Device ID

To covert device ID types between Compatibility ID and Mobility ID on a FBA devices, use the following syntax:

```
symdev -sid <SymmID> -devs <<SymDevStart>:<SymDevEnd> |
<SymDevName> set -device_id <compatibility | mobility>
```

SYMCLI for SRDF

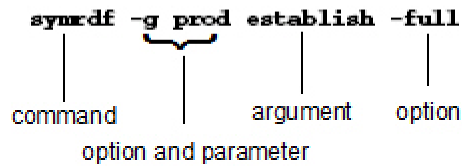
This section describes:

- SYMCLI command syntax on page 29
- Get command help on page 30
- Set environmental variables on page 30
- Preset names and IDs on page 31
- Table 3 on page 31 lists the four main SRDF SYMCLI commands to establish, maintain and monitor SRDF configurations.
- Table 4 on page 33 lists options for the symrdf command.
- Table 5 on page 37 lists a variety of commands to display, query and verify your SRDF configuration.
- Table 6 on page 44 lists options for the symrdf list command

SYMCLI command syntax

The following example shows the command syntax for initiating a full establish for the SRDF pairs in the prod device group.

Figure 2 SYMCLI command syntax



Get command help

Description

Type *command* -h to display command line help for the specified command.

On UNIX hosts, type man *command* to display the man page for the specified command.

Examples

To display help for the symrdf command, enter:

```
symrdf - h
```

To display the man page for the symrdf command, enter:

```
man symrdf
```

- **On UNIX hosts**: specify the SYMCLI man page directory (/usr/symcli/man/) in the SYMCLI_MANPATH environment variable.
- **On Windows hosts**: the default directory for man pages is C:\Program Files\EMC \symcli\man

Set environmental variables

Description

SYMCLI includes variables to streamline command line sessions.

Examples

To display a list of variables that can be set for your SYMCLI session, enter:

```
symcli -env
```

To view the variables that are set, enter:

```
symcli - def
```

To set a variable, type setenv *VARIABLE_NAME value*:

```
setenv SYMCLI_VERBOSE 1
```

To turn off a variable, type `unsetenv` *`VARIABLE_NAME`*:

```
unsetenv SYMCLI_VERBOSE
```

Preset names and IDs

Description

Use the SYMCLI environmental variables to preset the identity of objects, such as SID. Once the object's identity is defined, you do not need to type them in the command line.

Examples

To set the SID for all `-sid` arguments, enter:

```
set env SYMCLI_SID 000192601365
```

To view a list of environment variables that can be set for a given SYMCLI session, enter:

```
symcli -env
```

To view the current setting for all environment variables, enter:

```
symcli -def
```

SYMCLI SRDF commands

Table 3 SYMCLI SRDF commands

Command	Description	For more information
`symrdf`	Control operations on SRDF devices, including: • Establishes (mirrors) an SRDF pair by initiating a data copy from the source (R1) side to the target (R2) side. This operation can be a full or incremental establish. • Restores remote mirroring. Initiates a data copy from the target (R2) side to the source (R1) side. This operation can be a full or incremental restore. • Splits an SRDF pair, which stops mirroring for the SRDF pairs in a device group. • Fails over and back from the source (R1) side to the target	See: • Summary on page 62 • Basic SRDF Control Operations on page 61 • `symrdf` man page.

Table 3 SYMCLI SRDF commands (continued)

Command	Description	For more information
	(R2) side, switching data processing to the target (R2) side. • Updates the source (R1) side after a failover, while the target (R2) side may still be operational to its local host(s). • Swaps the source (R1) and target (R2) destinations between the target and the source. • Creates, deletes, or swaps dynamic SRDF device pairs. • Performs dynamic SRDF group controls to add, modify, and remove dynamic groups. • Enables link domino locally or remotely when creating dynamic groups. • Enables auto link recovery locally or remotely when creating dynamic groups. • Enables/disables consistency for SRDF/A capable devices operating in asynchronous mode that are managed by a device group or file.	
`symstar`	Uses concurrent SRDF/ Synchronous and SRDF/ Asynchronous links to replicate source data synchronously to a nearby regional site and asynchronously to a distant remote site.	See: • SRDF/Star Operations on page 269 • `symstar` man page.
`symrecover`	Monitor the session state during attempts to restart a group session if it enters the suspended or partitioned state.	See: • SRDF Automated Recovery Operations on page 439 • `symrecover` man page.

symrdf command options

The following table summarizes the options for the `symrdf` command. Refer to the `symrdf` man page for more detailed descriptions of the command's options.

Table 4 symrdf command options

Option	Description
-all	Targets the SRDF action at all devices in the device group, which includes standard SRDF devices and any BCV SRDF devices that are locally associated with the device. When used with list , the -all option shows all SRDF mirrors of the selected devices. The -all flag is not supported for SRDF control operations on device groups or composite groups with type ANY.
-autostart	Specifies whether SRDF/A DSE is automatically activated when an SRDF/A session is on (Enabled) or off (Disabled) for the SRDF group. Valid values are on (Enabled) or off (Disabled). **Note** AutoStart for DSE is enabled by default in HYPERMAX OS.
-bcv	Targets the specified BCV devices associated with a device or composite group and are configured as SRDF BCV devices. By default, only the SRDF standard devices are affected by the SRDF control operations.
-bias	Sets the bias to the R1 or R2 device. The device that has the bias set, will be exported as the R1. When the RDF link becomes Not Ready (NR), the bias device will be made accessible to the host and the non-bias device will be made not accessible to the host. This action can only be executed if the SRDF devices in the group are in the ActiveBias RDF pair state.
-brbcv	Targets the SRDF action at the specified remotely associated SRDF (Hop 2) BCV devices that can be paired with the remote mirrors of the local BCV devices.
-both_sides	Targets the SRDF control operation at both sides of an SRDF link.
-bypass	Causes the SRDF control operation to bypass existing exclusive locks. Use this option ONLY if no other SRDF operation is in progress at either the local and/or remote arrays.
-c	Counts the number of times to display or to attempt acquiring exclusive locks on the host database, the local array, and the remote arrays. If the -c option is not specified and an interval -i is specified, the program loops continuously to produce infinite redisplays, or until the SRDF control or set operation starts.
-cg	Specifies the composite group for SRDF operations.
-exempt	Allows devices to be added, removed, or suspended without affecting the state of the SRDF/A or SRDF/Metro session or requiring that other devices in the session be suspended.

Table 4 symrdf command options (continued)

Option	Description
	Used for an SRDF group supporting an active SRDF/A session or an active SRDF/Metro session. When used with list operations, lists devices that are consistency exempt or that are paired with devices that are consistency exempt, and lists devices that are exempt within an SRDF/Metro session.
`-fibre`	Uses the Fibre Channel communication protocol.
`-file` *`Filename`*	Specifies the device file for SRDF operations.
`-force`	Performs the control operations on SRDF devices that are not in the expected state for a control operation. By using this option, the control operation is attempted, regardless of the pair state of the SRDF devices, and according to the rules in Control operations for R1 - R2 pair states.
`-format`	Used with `createpair` to clear all tracks on the R1 and R2 sides, ensuring no data exists on either side. In configurations other than SRDF/Metro the option also makes the R1 read write to the host. In SRDF/Metro configurations, the option enables the addition of device pairs to an active group, and makes both sides of the pair read write to the host.
`-full`	Requests a full establish or restore operation.
`-g` *`GroupName`*	Specifies the device group for SRDF operations.
`-h`	Provides brief, online help.
`-hop2`	For cascaded configurations, specifies a group's second-hop devices.
`-hop2_rdfg`	Used with the createpair command that specifies a storage group. Specifies the SRDF group number at the second hop. Used only with createpair -hop2 when creating pairs using storage groups.
`-hwcomp`	Enables or disables hardware compression, which minimizes the amount of data to transmit over an SRDF link.
`-i`	Executes a command at repeat intervals to display information or to attempt to acquire an exclusive lock on the host database, the local array, and the remote arrays. The default interval is 10 seconds. The minimum interval is 5 seconds.
`-immediate`	Applies only to SRDF/A-backed devices. Causes failover, split, and suspend actions to drop the SRDF/A session immediately.
`-keep`	Sets the winner side of the SRDF/Metro group to the R1 or the R2 side, as specified. When the RDF link becomes Not Ready (NR), devices on the winner side will be made accessible to the host and devices on the loser (non-winner) side will be made inaccessible to the host. This option can only be used when the SRDF devices in the group are in the Active RDF mode.

Table 4 symrdf command options (continued)

Option	Description
	When used with movepair, this option can be used when moving devices out of the SRDF/Metro group but not when moving devices into the group.
`-label`	Specifies a label for a dynamic SRDF group.
`-noecho`	Suppresses the display of progress status information.
`-noprompt`	Suppresses the message asking you to confirm an SRDF control operation.
`-nowd`	Bypasses the check to ensure the target of the operation is not writable by the host.
`-offline`	Obtains the data strictly from the configuration database. No connections are made to any arrays. The symrdf command uses information previously gathered from the array and held in the host database as opposed to interrogating the array directly. The offline option can alternatively be set by assigning the environment variable SYMCLI_OFFLINE to 1.
`-rdfa_devpace`	Indicates the operation affects the SRDF/A device-level write pacing feature.
`-rdfa_dse`	Indicates the operation affects the SRDF/A Delta Set Extension (DSE) feature.
`-metro`	When used with the createpair action, indicates the SRDF pairs will be created in an SRDF/Metro configuration.
`-rdfa_pace`	Indicates the operation affects both the group-level and the device-level components of the SRDF/A write pacing feature.
`-rdfa_wpace`	Indicates the operation affects the SRDF/A group-level write pacing feature.
`-rdfa_wpace_exempt`	Excludes the specified devices from SRDF/A group-level write pacing.
`-rdfg`	Targets a specific SRDF group number. When used -sg createpair -hop2, identifies the SRDF group associated with the specified storage group. **Note** -hop2_rdfg specifies the SRDF group used to create the hop2 pair.
`-rdf_mode`	Used in createpair to set the SRDF mode of device pairs to one of the following: synchronous (sync), semi-synchronous (semi), asynchronous (async), adaptive copy disk mode (acp_disk), or adaptive copy write pending mode (acp_wp).

Table 4 symrdf command options (continued)

Option	Description
	Note Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS.
`-refresh`	Marks the source (R1) devices or the target (R2) devices to refresh from the remote mirror.
`-remote`	Requests a remote data copy with the failback , restore , resume, createpair and update actions. When the concurrent links are ready, data is also copied to the concurrent SRDF mirror. For these actions to execute, use this option or suspend the concurrent links.
`-remote_rdfg`	Specifies the SRDF group number for the remote array.
`-remote_sg`	Specifies the remote storage group name. Used with createpair to specify the storage group. Used with createpair -hop2 to specify the storage group at the second hop.
`-remote_sid`	Specifies the remote array ID.
`-restore`	Used with failover to swap the R1 and R2 and restore the invalid tracks on the new R2 side (formerly R1) to the new R1 side (formerly R2). For more information, refer to Dynamic failover restore on page 130
`-rp`	Used with `-establish|-restore`, `createpair`, `failback`, `merge`, `restore`, `resume`, `update`, and `refresh` to allow the operation even when one or more devices are tagged for RecoverPoint. When used with refresh, only allowed for refresh R1.
`-rrbcv`	Targets the SRDF action at the specified remotely associated SRDF (Hop 2) BCV devices, which can be paired with the remote mirrors of the local standard devices.
`-sg`	Specifies a storage group for SRDF operations. **Note** To manage RDF using SGs, the SG being managed cannot have a mixture of R1 and R2 devices and the RDF group specified must exist on all of the devices in the SG.
`-sid`	Specifies the local array ID.
`-swcomp`	Enables or disables software compression, which minimizes the amount of data to transmit over an SRDF link.
`-symforce`	Requests that the array force an operation by overriding all instances causing the array to reject an operation. The SYMAPI_ALLOW_RDF_SYMFORCE setting in the options file

Table 4 symrdf command options (continued)

Option	Description
	must be set to TRUE to use -symforce. With -symforce, a split command executes on an SRDF pair, even during a sync in progress state. **Note** Use caution when applying this option as data can become lost or corrupted.
`-until`	Checks the number of invalid tracks that are allowed to build up from the active R2 local I/O before another update (R2 to R1) copy is retriggered. The update sequence loops until the invalid track count is less than the number specified for the `-until` value. Refer to Write disable R1 on page 93 for more information.
`-use_bias`	When used with `createpair -establish`, `createpair -restore`, `establish` or `restore` actions, indicates that SRDF/Metro configuration will use bias instead of Witness protection.
`-v`	Provides more detailed, verbose command output.
`-witness`	When used with `addgrp`, identifies the RDF group as a Witness SRDF group. When used with `removegrp` or `modifygrp`, specifies the action is targeted for an RDF group which is a Witness SRDF group.

Commands to display, query and verify SRDF configurations

The following table lists SYMCLI commands to display, query, and verify your SRDF configuration.

Note

The following table is intended to provide examples of the types of information displayed by the `list` and `verify` commands. It is NOT a complete list of all options and states that can be verified. For a complete list, refer to the Dell EMC Solutions Enabler CLI Reference Guide

Table 5 Commands to display and verify SRDF, devices, and groups

SYMCLI command	Description of command output
symcfg list	
`symcfg list`	Displays the connectivity (Local or Remote) of each array. Useful for verifying that only one array is connected to the host in a SRDF/Star configuration.

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

<table>
<tr><th>SYMCLI command</th><th>Description of command output</th></tr>
<tr><td><code>symcfg list -v</code></td><td>Displays a more detailed (verbose) listing, including:
• Concurrent SRDF Configuration State
• Dynamic SRDF Configuration State
• Concurrent Dynamic SRDF Configuration
• RDF Data Mobility Configuration State</td></tr>
<tr><td><code>symcfg list -sid SID -rdfg {all| RDFGrpNum</code></td><td>Displays SRDF group-level settings for a specific group or all groups on a array, such as:
• Group type
• Director configuration
• Group flags, including auto link recovery, link domino, SRDF/ Star mode, SRDF software and hardware compression, and SRDF single round trip
• SRDF flags, including consistency and SRDF status and mode</td></tr>
<tr><td><code>symcfg list -RA {all| Director }</code>
<code>symcfg list -RA {all| Director } -rdfg RDFGrpNum</code></td><td>Display all RDF directors, or a specified RDF director.
Display RDF directors associated with a specified SRDF group.</td></tr>
<tr><td><code>symcfg list -RA {all| Director } -p {all| Port</code></td><td>HYPERMAX OS only.
Display all ports or specified port for SRDF groups configured on all or the specified director:
• Port ID
• Negotiated speed (Gb/second)
• Maximum speed (Gb/second)
• Port status (online or offline)</td></tr>
<tr><td><code>symcfg list -RA {all| Director } -p {all| Port</code></td><td></td></tr>
<tr><td><code>symcfg list -sid SID -witness [-v] [-out xml] [-offline</code></td><td>Displays information about all vWitness definitions on an array. Use the -v option to display detailed (verbose) information.</td></tr>
</table>

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
`symcfg show -sid SID -witness WitnessName [-out xml] [-offline]`	Displays detailed information about a specific vWitness definition.
symdev list	
`symdev list -r1`	Displays only the R1 side of the SRDF configuration. R1 devices not in a device group are displayed as N/Grp'd.
`symdev list -sid SID -r1 -bcv`	Displays the RDF1 BCV devices for the specified array.
`symdev list -sid SID -devs Device:Device -lock`	Display devices with a device external lock. Displays a specified range of devices that have a device external lock.
symdev show	
`symdev show Device_number -sid SID`	Displays information about the specified SRDF devices, including: • SRDF device type and its group number • Whether the device is in an SRDF/Metro configuration • Whether the device is paired with a diskless or concurrent device • Whether the device has a standard/thin relationship • If the R2 device is larger than its R1 • Whether SRDF/A group-level and/or device-level write pacing is currently activated and supported for the SRDF/A session • Whether the device is pace-capable
symdg show	
`symdg show DgName`	Displays detailed information about device groups, including RDF groups.
symmir query	

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
`symmir -g DgName query`	Displays the BCV pairs in the specified device group and their state of mirroring.
symrdf list	
`symrdf list`	Displays the SRDF configuration, including source devices, remote target devices, and whether a device is an R1 or R2, SRDF group, replication method, pair state, invalid tracks, and the state of each device and the SRDF links that connect them. See Table 6 on page 44 for a list of symrdf list command options.
symrdf query	
`symrdf -g DgName query`	Displays the state of the SRDF devices and their SRDF links in the specified device group. During normal operations, the SRDF pair is Synchronized: • The R1 devices and SRDF links are read-writable. • The R2 devices are write disabled. • The link is in synchronous replication. During failed over operations: • The R1 devices are write disabled. • The R2 devices are read/write. • The SRDF links are suspended.
`symrdf -g DgName query -all`	Displays the SRDF pair state of all devices in the specified device group, regardless of the device type.
`symrdf -g DgName query -bcv`	Displays the SRDF pair state of the SRDF BCV devices in the specified device group.
`symrdf -g DgName query -summary`	Displays summarized information about the state of the SRDF devices and their SRDF links in the specified device group, including: • Pair state

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
	• Number of invalid tracks on the source and target • Synchronization rate • Estimated time remaining for SRDF pair synchronization.
`symrdf -cg` *`CgName`* `query`	Displays the state of the SRDF devices and their SRDF links in the specified composite group.
`symrdf -sid` *`SID`* `-rdfg` *`GrpNum`* `-sg` *`SgName`* `query`	Displays the state of the SRDF devices and their SRDF links in the specified storage group.
symrdf verify (file)	
`symrdf -f` *`Device_filename`* `verify`	Verifies/displays the state of devices in the specified device file.
`symrdf -f` *`Device_filename`* `verify -activeactive`	For SRDF/Metro configurations, verifies/displays whether any devices in the specified device file are in the 'ActiveActive' state.
`symrdf -f` *`Device_filename`* `verify -all -i 5 -synchronized`	Verifies/displays a message every 5 seconds as to whether any devices in the specified device file are in the 'Synchronized' state until all SRDF pairs are synchronized.
symrdf verify (group)	
`symrdf -g` *`DgName`* `verify`	Verifies/displays the state of devices in the specified device group.
`symrdf -g` *`DgName`* `verify -failedover`	Verifies/displays whether any devices in the specified device group are in the 'Failed Over' state.
`symrdf -g` *`DgName`* `verify -synchronized`	Verifies/displays whether any devices in the specified device group are in the 'Synchronized' state.
`symrdf -g` *`DgName`* `verify -i 30 -synchronized`	Verifies/displays a message every 30 seconds as to whether any devices in the specified device group are in the 'Synchronized' state.
`symrdf -g` *`DgName`* `verify -all -i 5 -synchronized`	Verifies/displays a message every 5 seconds as to whether any devices in the specified device group are in the 'Synchronized' state until all SRDF pairs are synchronized.

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
`symrdf -g DgName verify -split`	Verifies/displays whether any devices in the specified device group are in the 'Split' state.
`symrdf -g DgName verify -syncinprog`	Verifies/displays whether any devices in the specified device group are in the 'SyncInProg' state.
`symrdf -g DgName verify -activeactive`	For SRDF/Metro configurations, verifies/displays whether the SRDF device pairs are in the 'ActiveActive' state.
`symrdf -g DgName verify -activebias`	For SRDF/Metro configurations, verifies/displays whether the SRDF device pairs are in the 'ActiveBias' state.
symrdf verify (composite group)	
`symrdf -cg CgName verify`	Displays the state of devices in the specified composite group.
`symrdf -cg CgName verify -consistent`	Verifies/displays whether devices in the specified composite group are in the 'Consistent' state.
`symrdf -cg CgName verify -consistent -noinvalids -i 60`	Monitors and reports (one line message) the clearing of invalid tracks. Verifies/displays a one-line message every 60 minutes as to whether any devices in the specified composite group are in the 'Consistent with no invalid tracks' state until all SRDF pairs in the group are the "Consistent with no invalid tracks" state.
`symrdf -cg CgName verify -activeactive`	For SRDF/Metro configurations, verifies/displays whether devices in the specified composite group are in the 'ActiveActive' state.
`symrdf -cg CgName verify -activebias`	For SRDF/Metro configurations, verifies/displays whether devices in the specified composite group are in the 'ActiveBias' state.
`symrdf verify -summary -consistent -noinvalids -cg CgName -i 45`	Monitors and reports (detailed message) the clearing of invalid tracks. Verifies/displays a detailed message every 45 minutes as to whether any

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
	devices in the specified composite group are in the 'Consistent with no invalid tracks' state until all SRDF pairs in the group are the "Consistent with no invalid tracks" state.
symrdf verify (storage group)	
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify`	Verifies/displays the state of devices in the specified storage group.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -failedover`	Verifies/displays whether any devices in the specified storage group are in the 'Failed Over' state.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -synchronized`	Verifies/displays whether any devices in the specified storage group are in the 'Synchronized' state.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -i 30 -synchronized`	Verifies/displays a message every 30 seconds as to whether any devices in the specified storage group are in the 'Synchronized' state.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -all -i 5 -synchronized`	Verifies/displays a message every 5 seconds as to whether any devices in the specified storage group are in the 'Synchronized' state until all SRDF pairs are synchronized.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -split`	Verifies/displays whether any devices in the specified storage group are in the 'Split' state.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -activeactive`	For SRDF/Metro configurations, verifies/displays whether devices in the storage group are in the 'ActiveActive' state.
`symrdf -sg` *SgName* `-sid` *SID* `-rdfg` *RdfGrpNum* `verify -activebias`	For SRDF/Metro configurations, verifies/displays whether devices in the storage group are in the 'ActiveBias' state.
symstar list	
`symstar list`	Displays all the SRDF/Star composite groups visible to the host.
`symstar list -local`	Displays all the SRDF/Star composite groups local to your host.
symstat command options	

Table 5 Commands to display and verify SRDF, devices, and groups (continued)

SYMCLI command	Description of command output
`-rdfg #|ALL`	Collect/display statistics for SRDF/A sessions by specified RA group number or all groups.
`-RepType rdf|rdfa`	Collect/display statistics for the specified replication type.
`-type REQUESTS|CACHE|CYCLE|RDF`	Collect/display specified statistic type. REQUEST (default) -I/O requests and throughput for device(s) and director(s). CACHE - Cache activity for selected front-end or remote link director(s). CYCLE - Active SRDF/A sessions or sessions that have non-zero cache usage. RDF - SRDF/A sessions.
`-RE|-RA|ALL`	Collect/display statistics for the specified SRDF director (-RA), GigE SRDF director (-RE) or both (ALL).
`-rdflink`	Collect/display SRDF link-level statistics. **Note** This is no longer available from HYPERMAX OS 5977.
`-rdf_nw_comp`	Collect/display SRDF network compression (iSCSI statistics).
`-rdf_spdlmt`	Collect/display SRDF speed limit information (iSCSI statistics).

symrdf list command options

The following table lists options for the symrdf list command, and describes the resulting output.

Table 6 Options for symrdf list command

symrdf list option	Description of output
`-all`	Lists all mirrors of the selected SRDF devices.
`-bcv`	Lists only BCV devices.

Table 6 Options for symrdf list command (continued)

symrdf list option	Description of output
`-both`	Lists all SRDF devices that are RDF1 or RDF2 capable, when used with `-dynamic`.
`-c`	Specifies the number (count) of times to repeat the operation, displaying results appropriate to the operation at each iteration.
`-concurrent`	Lists concurrent SRDF (RDF11, RDF22, and RDF21) devices and the SRDF devices paired with a concurrent SRDF device. When used with `-R1`, lists RDF11 devices and RDF1 devices that are paired with a concurrent SRDF device. When used with `-R2`, lists RDF22 devices and RDF2 devices that are paired with a concurrent device.
`-consistency`	Displays the SRDF consistency state when listing SRDF devices. To show the consistency state in the list of all the SRDF devices in array 333, enter: `symrdf -sid 333 -consistency list`
`-cons_exempt`	Lists devices that are consistency exempt or are paired with devices that are consistency exempt.
`-dir`	Lists the local directors (separated by commas), such as, 1a, 1b, and so on.
`-diskless_rdf`	Lists diskless SRDF devices and the devices paired with diskless SRDF devices. When used with `-R1`, lists RDF1 devices that are either diskless or that are paired with a diskless device. When used with `-R2`, lists RDF2 devices that are either diskless or are paired with a diskless device. When used with `-R21`, lists RDF21 devices that are either diskless or that are paired with a diskless device.
`-dup_pair`	Lists SRDF devices that are paired with the same SRDF type. To list all of the duplicate pair devices in array 333, enter:

Table 6 Options for symrdf list command (continued)

symrdf list option	Description of output
	`symrdf -sid 333 -dup_pair list` **Note** Duplicate pair devices can result from an SRDF/Star failover scenario or a configuration change.
`-dynamic`	Lists devices configured as dynamic SRDF. Use the qualifiers of `-R1`, `-R2`, or `BOTH` to restrict the display to the specified device type.
`-half_pair`	Lists devices whose partner is not an SRDF device. To list all of the half pair devices in array 333, enter: `symrdf -sid 333 -halfpair list` **Note** Half pair devices can result from an SRDF/Star failover scenario, a `half_deletepair` operation, or a configuration change.
`-nobcv`	Lists standard SRDF devices only (excludes SRDF BCV devices).

`-R1`
`-R2`
`-R21`
	Lists devices of RDF1 types (`-R1`), RDF2 types (`-R2`), or RDF21 types (`-R21`), respectively.

`-metro`	List devices that are part of an SRDF/ Metro configuration.
`-rdfa`	Lists devices that are SRDF/A-capable.
`-rdfa_not_pace_capable`	Lists devices participating in the SRDF/A session that are not pace-capable.
`-rdfa_wpace_exempt`	Lists devices that are exempt from group-level write pacing.
`-rdfg`	Lists all devices within a specified SRDF group.
`-resv`	Lists SRDF devices with SCSI reservations. To list all the SRDF devices

Table 6 Options for symrdf list command (continued)

symrdf list option	Description of output
	in array 333 that have SCSI reservations, enter: `symrdf -sid 333 -resv list`
`-star_mode`	Lists device that are SRDF/Star protected. For more information, refer to the *EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS* and *Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS* .

ping command

Description

Use the `symrdf -rdf ping` command to determine if an array using SRDF links is up and running.

Example

To ping SID 123, enter:

```
symrdf -rdf -sid 123 ping
```

The return codes tell you whether some or all of the arrays were successfully pinged.

For more information on return codes, refer to the *Dell EMC Solutions Enabler CLI Reference Guide*.

verify command

Description

Use the `symrdf verify` command to verify the SRDF mode and pair states of device groups, composite groups, and device files.

Use the `symrdf verify -enabled` command to verify that device pairs are enabled for consistency protection.

Verify SRDF mode

When verifying two or more SRDF modes using one command, Solutions Enabler logically ORs each mode to determine the result.

In the following example, a device group named STAGING contains devices in synchronous (`-sync`), and adaptive copy disk (`-acp_disk`) modes, but no devices in asynchronous (`-async`) mode.

If the verify command specifies only asynchronous mode:

```
symrdf -g STAGING -rdfg 129 verify -async
```

None of the device pairs in STAGING are in asynchronous mode, and the following message is displayed:

```
None of the devices in the group 'STAGING' are in 'Asynchronous'
mode.
```

If the verify command specifies asynchronous, synchronous mode, OR adaptive copy disk mode:

symrdf -g STAGING -rdfg 129 verify -async -sync -acp_disk

All device pairs in STAGING are using synchronous OR adaptive copy disk mode. The following message is displayed, even though NO devices are in asynchronous mode:

```
All devices in the group 'STAGING' are in 'Asynchronous,
Synchronous, Adaptive Copy Disk' modes.
```

Verify SRDF pair states

When verifying two or more SRDF pair states using one command, Solutions Enabler logically ORs each pair state to determine the result.

In the following example, a device group named STAGING contains devices in -split, -suspended, and -synchronized states, but no devices in -consistent state.

If the verify command specifies only Consistent state:

symrdf -g STAGING -rdfg 129 verify -consistent

None of the device pairs in STAGING are in the Consistent state, and the following message is displayed:

```
None of the devices in the group 'STAGING' are in 'Consistent'
state.
```

If the verify command specifies Consistent OR Split state:

symrdf -g STAGING -rdfg 129 verify -consistent -split

Some of the device pairs are in the Split state, none are in the Consistent state, and the message is:

```
Not All devices in the group 'STAGING' are in 'Consistent, Split'
states.
```

If the verify command specifies Consistent, Split, Suspended, OR Synchronized states:

symrdf -g STAGING -rdfg 129 verify -consistent -split -suspended -synchronized

All device pairs in STAGING are in the Split, Suspended, OR Synchronized state. The following message is displayed, even though NO devices are in the Consistent state:

```
All devices in the group 'STAGING' are in 'Consistent, Split,
Suspended, Synchronized' states.
```

Verify both SRDF mode and pair state in one command line

When verifying both SRDF states and modes in the same command line, Solutions Enabler logically ORs the states, logically ORs the modes, and then logically ANDs the two results.

In the following example, a device group named STAGING has devices in:

- Synchronous, and adaptive copy disk modes
- Synchronized, suspended and split states, but NOT consistent state

If the verify command specifies synchronous, OR adaptive copy disk mode, AND Synchronized, Suspended, OR Split states:

symrdf -g STAGING -rdfg 129 verify -sync -acp_disk -synchronized -suspended -split

All device pairs in STAGING are using synchronous OR adaptive copy disk mode AND are in the Synchronized, Suspended, OR Split state, and the following message is displayed:

```
All devices in the group 'STAGING' are in 'Synchronized, Suspended,
Split' states and 'Synchronous, Adaptive Copy Disk' modes.
```

If the verify command specifies adaptive copy disk mode AND the Synchronized, Suspended, OR Split state:

symrdf -g STAGING -rdfg 129 verify -acp_disk -synchronized -suspended -split

Some device pairs in the STAGING group are using synchronous mode, and the following message is displayed:

```
Not All devices in the group 'STAGING' are in 'Synchronized,
Suspended, Split' states and 'Adaptive Copy Disk' modes.
```

If the verify command specifies synchronous, adaptive copy disk mode AND the Consistent state:

symrdf -g STAGING -rdfg 129 verify -sync -acp_disk -consistent

None of the device pairs in the STAGING group are in the Consistent state, and the following message is displayed:

```
None of the devices in the group 'STAGING' are in 'Consistent'
state and 'Synchronous, Adaptive Copy Disk' modes
```

SRDF pair states and links

NOTICE

Before you begin SRDF control operations, you must understand how SRDF devices and links work together to secure data within SRDF configurations.

Note

The following content assumes you understand SRDF devices, including R1, R11, R2, and R21. For a detailed description of SRDF devices, refer to the *EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS* and *Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS* .

An SRDF pair state encompasses:

- SRDF device state on the source (R1) device
- SRDF device state on the target (R2) device
- The number of tracks owed between the R1 and R2 devices (invalid tracks)
- Whether the device pair is part of an SRDF/Metro configuration, and
- The SRDF link state between the R1 and R2 devices

Note

See Invalid tracks in SRDF pairs on page 54.

The following image shows states SRDF devices and links can report for SRDF/A, SRDF/S and SRDF/Metro configurations.

Figure 3 SRDF device and link states

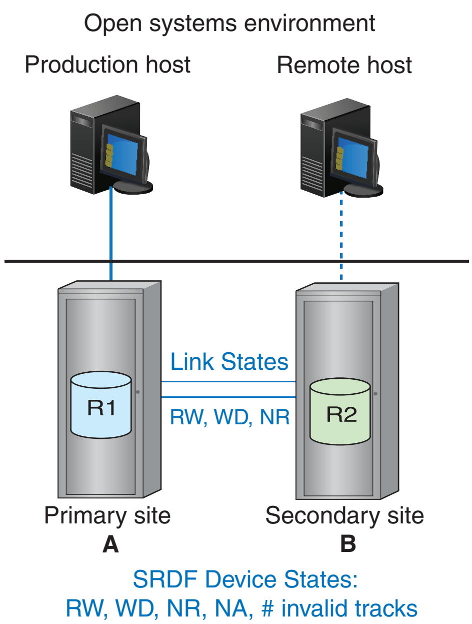


Table 7 SRDF device and link states

NR	Not Ready. Reads and writes are both disabled.
RW	Ready. Enabled for both reads and writes.
WD	Write Disabled. Enabled for reads but not writes.

Table 7 SRDF device and link states (continued)

NA	Not Available. Unable to report on correct state.
ActiveActive	• R1 SRDF state is Ready. • SRDF link state is Ready. • R2 SRDF state is Ready. • R1 and R2 invalid tracks are 0.
ActiveBias	• R1 SRDF state is Ready. • SRDF link state is Ready. • R2 SRDF state is Ready. • R1 and R2 invalid tracks are 0.

SRDF pair states

Device pairs that are subject to any SRDF operation need to be in the correct state. Otherwise, the operation fails.

Control operations for R1 - R2 pair states on page 456 lists control actions and the prerequisite SRDF pair state for each action, including:

- Concurrent SRDF operations and applicable pair states
- Consistency group operations and applicable pair states

Commands to display, query and verify SRDF configurations on page 37 describes the SYMCLI commands to verify pair states.

The following table lists the name and description of SRDF pair states.

Table 8 SRDF pair states

Pair State	Description
SyncInProg	Synchronization is currently in progress between the R1 and the R2 devices. There are existing invalid tracks between the two pairs, and the logical links between both sides of an SRDF pair are up.
Synchronized	The R1 and the R2 are currently in a synchronized state. The same content exists on the R2 as the R1, and there are no invalid tracks between the two pairs.

Table 8 SRDF pair states (continued)

Pair State	Description
Split	The R1 and the R2 are currently ready to their hosts. However, the links are not ready or, are write disabled.
Failed Over	The R1 is not ready or write disabled. Operations have been failed over to R2.
R1 Updated	The R1 is not ready or write disabled to the host. There are no local invalid tracks on the R1 side, and the links are ready or write disabled.
R1 UpdInProg	The R1 is not ready or write disabled to the host. There are invalid local (R1) tracks on the source side, so data is being copied from the R2 to the R1 device, and the links are ready.
ActiveActive	The R1 and the R2 are currently in the default SRDF/Metro configuration which uses an Array Witness or Virtual Witness: • There are no invalid tracks between the two pairs. • The R1 and the R2 are Ready (RW) to the hosts.
ActiveBias	The R1 and the R2 are currently in an SRDF/Metro configuration using bias: • The user has specified “use bias” during the establish/restore action or the desired Witness is not available • There are no invalid tracks between the two pairs. • The R1 and the R2 are Ready (RW) to the hosts.

Table 8 SRDF pair states (continued)

Pair State	Description
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 accumulates as invalid tracks owed to the R2.
Partitioned	The SYMAPI is currently unable to communicate through the corresponding SRDF path to the remote array. The Partitioned state may apply to devices within an RA group. For example, if SYMAPI is unable to communicate to a remote array from an RA group, devices in that RA group will be marked as being in the Partitioned state. A half pair and a duplicate pair are also reported as Partitioned.
Mixed	A composite SYMAPI device group SRDF pair state. There are different SRDF pair states within a device group.
Invalid	This is the default state when no other SRDF state applies. • The combination of the R1 device, the R2 device, and the SRDF link states do not match any other pair state. • This state may occur if there is a problem at the disk director level.
Consistent	The R2 SRDF/A capable devices are in a consistent state. The consistent state signifies the normal state of operation for device pairs operating in asynchronous mode.

Table 8 SRDF pair states (continued)

Pair State	Description
Transmit Idle	The SRDF/A session cannot send data in the transmit cycle over the link because the link is unavailable.

Invalid tracks in SRDF pairs

On both sides of an SRDF configuration, the array keeps an account of the tracks that are "owed" to the other side. *Invalid tracks* are tracks that are not synchronized between the two devices in an SRDF pair. *Remote invalids* are tracks owed to the remote member of the device pair.

For example:

- The logical connection between an R1 device and its R2 is suspended.
- If both devices are made write-accessible, hosts on both sides of the SRDF links write to their respective devices, without the writes being mirrored.
- This creates invalid tracks on the R1 side, and remote invalid tracks on the R2 side.
- Each invalid track represents a track of data that has changed since the two sides were split. To re-establish the logical links between the R1 and R2, the invalid tracks must first be resolved.

How you resolve invalid tracks depends on which control operation you perform. For example if you have remote invalids on both the R1 and R2 sides:

- An `establish` operation copies the modified R1 tracks to the R2 side.
  Any tracks that were modified on the R2 side are overwritten with data from corresponding tracks on the R1 side.
- A `restore` operation copies the modified R2 tracks to the R1 side.
  Any tracks that were modified on the R1 side are overwritten with data from corresponding tracks on the R2 side.

SRDF device and link state combinations

Control actions on an SRDF pair may change the SRDF pair state.

Additionally, the state of a device can change if its front-end or back-end directors change in the SRDF links.

The following table lists:

- SRDF pair states resulting from the combination of the states of the source and target devices and the SRDF links.
- The possible R1 or R2 invalid tracks for each SRDF pair state.

Table 9 Possible SRDF device and link state combinations

SRDF pair state	Source (R1) SRDF state	SRDF link state	Target (R2) SRDF state	R1 or R2 invalid tracks
Synchronized	Ready (RW)	Ready (RW)	Not Ready or WD	0
Failed Over	Not Ready or WD	Not Ready	Ready (RW)	—
R1 Updated	Not Ready or WD	Ready (RW) or WD	Ready (RW)	0[a]
R1 UpdInProg	Not Ready or WD	Ready (RW) or WD	Ready (RW)	>0 [a]
ActiveActive	Ready (RW)	Ready (RW)	Ready (RW)	0
ActiveBias	Ready (RW)	Ready (RW)	Ready (RW)	0
Split	Ready (RW)	Not Ready or WD	Ready (RW)	—
SyncInProg	Ready (RW)	Ready (RW)	Not Ready or WD	>0
Suspended	Any status[b]	Not Ready or WD	Not Ready or WD	—
Partitioned[c]	Any status	Not Ready	Not Available	—
Partitioned[d]	Not Available	Not Ready	Any status	—
Mixed	e	e	e	—
Invalid [e]	Any status[f]	Any status	Any status	—
Consistent	Ready (RW) [f]	Ready (RW)	Not Ready or WD	0 or >0 [a]
Transmit Idle	Ready (RW) [f]	Ready (RW)	Not Ready or WD	—

a. Refers to invalid local (R1) tracks on source.
b. Any status value is possible (Ready, Not Ready, Write Disabled, or Not Available).
c. Viewed from the host locally connected to the source (R1) device
d. Viewed from the host locally connected to the target (R2) device.
e. When no other SRDF states apply, the state defaults to Invalid.
f. The combination of source SRDF, SRDF links, and target SRDF statuses does not match any other SRDF state; therefore, the SRDF state is considered Invalid.

Before you begin

This section includes the following topics:

Array access rights

Hosts must have specific access rights to an array to perform certain control operations. The following table lists common control operations and the required array access rights.

Table 10 Access rights required by an array

Operations	Required access rights
`symrdf set rdfg`	CFGSYM or SRDF
`symrdf set rdfa`	CFGSYM or SRDF
`symrdf set rdfa_dse`	CFGSYM or SRDF
`symrdf set rdfa_pace`	CFGSYM or SRDF
`symrdf addgrp`	CFGSYM
`symrdf modifygrp`	CFGSYM
`symrdf removegrp`	CFGSYM
`symqos set IO`	CFGSYM
`symqos reset IO`	CFGSYM

Device external locks

SYMAPI and SYMCLI use device external locks to lock BCV pairs during TimeFinder control operations and to lock SRDF device pairs during SRDF control operations.

When a `symrdf` control command is initiated, device external locks are set on all SRDF devices. Device external locks are automatically released when the control operation completes.

Manage locked devices on page 424 describes how to acquire, recover, and release external locks.

SRDF operations and copy sessions

Certain SRDF operations are not allowed for arrays employing either TimeFinder/Snap or TimeFinder/Clone operations, which use copy session pairs. The availability of some SRDF actions depends on the current pair state of the TimeFinder/Snap or TimeFinder/Clone copy session devices.

SRDF operations and TimeFinder sessions on page 479 describes the TimeFinder/Snap and TimeFinder/Clone pair states, and which SRDF operations are available in each state.

Mirror R1 to a larger R2 device

You can copy data from an R1 device to a larger R2 device with the following restrictions:

- SRDF/Metro configurations do not allow a larger R2 device.
- All swap and SRDF/Star operations are blocked.
- Set the `SYMAPI_RDF_CREATEPAIR_LARGER_R2` option in the options file to ENABLE.
  If the value of `SYMAPI_RDF_CREATEPAIR_LARGER_R2` is `DISABLE`, SRDF blocks all `createpair` operations.
- Data mirrored to a larger R2 device cannot be restored back to its R1 device.

Note

For some types of file arrays and attached hosts, host-dependent operations may be required to access data migrated to a larger R2 device.

Restrict synchronization

Restricting synchronization direction is not supported on arrays running HYPERMAX OS.

SRDF software and hardware compression

Compression minimizes the amount of data transmitted over an SRDF link.

Both software and hardware compression can be activated simultaneously for SRDF traffic over GigE and Fibre Channel.

Data is first compressed by software and then further compressed by hardware.

Hardware compression is available on Fibre Channel directors.

Software and hardware compression can be enabled on both the R1 and R2 sides, but the actual compression happens from the side initiating the I/O. So, ensure that compression is enabled on the R1 side.

Set compression for SRDF

Syntax

To set hardware and software compression for an SRDF group, use the following form:

```
symrdf -sid SymmID -rdfg GrpNum [-v] [-symforce]
    [-noprompt] [-i Interval] [-c Count]
.............
    set rdfg
        [-hwcomp {on|off}]
        [-swcomp {on|off}]>
        [-both_sides]
```

Set SRDF group attributes on page 103 provides more information about SRDF group attributes.

Options

on

Set the specified compression on.

off

Set the specified compression off.

Examples

To turn on software compression on both sides of SRDF group 12:

`symrdf -sid 134 -rdfg 12 set rdfg -swcomp on -both_sides`

To turn off hardware compression on both sides of SRDF group 12:

`symrdf -sid 134 -rdfg 12 set rdfg -hwcomp off -both_sides`

To list SRDF software and hardware compression status for all SRDF groups on SID 432:

`symcfg list -rdfg all -sid 432`

To list software or hardware compression status for a specified group (12) and specified SID (432):

`symcfg list -sid 432 -rdfg 12`

SRDF/A and the consistency exempt option

By default, control operations for an active SRDF/A session are targeted at all device pairs in the session.

The `-exempt` option marks devices targeted by the command as consistency exempt. Devices marked consistency exempt can be controlled independently of other devices in the active SRDF/A session.

Enginuity and HYPERMAX OS automatically clear the consistency exempt status when:

- The affected device pairs have become consistent, and
- When the data on the R1 gets applied to the R2.

Mixed-mode workloads on an SRDF director

For arrays running Enginuity 5876 or later and HYPERMAX OS, you can use the `symqos` command to set the percentage of the SRDF director (RA) CPU resources assigned to each workload type.

Workload percentages must add up to 100%, and can include:

- Synchronous I/Os
- Asynchronous I/Os
- Copy I/Os
  Workload settings for the director are used until you explicitly reset them. After reset, the array-level distributions are used.

  For detailed information on the `symqos` command syntax, see the *Dell EMC Solutions Enabler Array Controls and Management CLI User Guide*.

Set mixed-mode workloads

Syntax
Syntax for the symqos command:

```
symqos -RA -sid SID
   enable -io
   disable -io

symqos -RA -sid SID
   set IO -default
       -sync SyncPercent -async AsyncPercent-copy CopyPercent
   set IO -dir <# | ALL>
       -sync SyncPercent -async AsyncPercent-copyCopyPercent
   reset IO -dir <# | ALL>

symqos -RA [-sid SID]
   list -io
```

Examples
To enable the workload percentage settings for synchronous, asynchronous, and copy I/Os on SID 1234:

`symqos -RA -sid 1234 enable -io`

To set the default settings of the workload percentages for all directors on SID 1234 to 60% for Synchronous I/Os, 30% for asynchronous I/Os and 10% for copy I/Os:

`symqos -RA -sid 1234 set IO -default -sync 60 -async 30 -copy 10`

To set the settings of the workload percentages on director 8G of SID 1234 to 50% for synchronous I/Os, 30% for asynchronous I/Os, and 20% for copy I/Os:

`symqos -RA -sid 1234 -dir 8G set IO -sync 50 -async 30 -copy 20`

To reset the customized settings of the workload percentages to the default settings on director 8G of SID 1234:

`symqos -RA -sid 1234 -dir 8G reset IO`

FAST VP SRDF coordination

If both arrays on an SRDF link are running Enginuity 5876 or HYPERMAX OS 5977, you can enable SRDF coordination to instruct FAST VP to factor the R1 device statistics into move decisions on the R2 device.

For information on FAST and FAST VP, see the .

CHAPTER 2

Basic SRDF Control Operations

This chapter covers the following:

Summary

Table 11 SRDF control operations summary

Control operation	symrdf argument	Description
SRDF modes of operation on page 65	set mode [sync|asynch|acp_disk|acp_wp|acp_off]	Set the replication mode for a device, device group, composite group, storage group, or list of devices in a device file.
Enable and disable SRDF consistency protection on page 210	enable disable	Enable or disable consistency protection for SRDF/A capable devices.
Establish an SRDF pair (full) on page 69	establish -full	Establish remote mirroring and initiate a full data copy from the source (R1) device to the target (R2) device. Use this for: • Initial synchronization of SRDF mirrors. • Replacement of a failed drive on the R2 side.
Establish an SRDF pair (incremental) on page 71	establish	Establish remote mirroring and initiate an incremental data copy from the source (R1) device to the target (R2) device. Use this to resynchronize after a split if you can discard the target data.
Failback to source on page 73	failback	Switches data processing from the target side (R2) back to the source (R1) side. Use this to return the source site from the target site after resolving the cause of a failure.
Failover to target on page 75	failover	Switch data processing from the source (R1) side to the target (R2) side. Use this when a failure occurs on the source side.
Invalidate R1 tracks on page 76	invalidate r1	Invalidate all tracks on the source (R1) side so that they can be copied over from the target (R2) side.

Table 11 SRDF control operations summary (continued)

Control operation	symrdf argument	Description
Invalidate R2 tracks on page 77	invalidate r2	Invalidate all tracks on the target (R2) side so that they can be copied over from the source (R1) side.
Make R1 ready on page 78	ready r1	Set the source (R1) device to be SRDF ready to its local host.
Make R2 ready on page 78	ready r2	Set the target (R2) device to be SRDF ready to its local host.
Make R1 not ready on page 78	not_ready r1	Set the source (R1) device to be SRDF not ready to its local host.
Make R2 not ready on page 79	not_ready r2	Set the target (R2) device to be SRDF not ready to its local host.
Merge track tables on page 79	merge	Merge the track tables between the source (R1) and the target (R2) side.
Move one-half of an SRDF pair on page 80	half_movepair	Move one-half of the SRDF device pair to a different SRDF group. **Note** If the RA ends up supporting more than 64K devices in the new SRDF group, this operation fails.
Move SRDF device pairs Move both sides of SRDF device pairs on page 80	movepair	Move the SRDF device pair to a different SRDF group. **Note** If the RA ends up supporting more than 64K devices in the new SRDF group, this operation fails.
Read/write disable target device on page 81	rw_disable r2	Read/write disables the target (R2) device to its local host.
Refresh R1 on page 81	refresh r1	Mark any changed tracks on the source (R1) side to be refreshed from the R2 side.

Table 11 SRDF control operations summary (continued)

Control operation	symrdf argument	Description
Refresh R2 on page 82	refresh r2	Mark any changed tracks on the target (R2) side to be refreshed from the R1 side.
Restore SRDF pairs (full) on page 82	restore -full	Resume remote mirroring and initiate a full data copy from the target (R2) device to the source (R1) device. Use this for: • Initial (reverse) synchronization of SRDF mirrors. • Replacement of a failed drive on the R1 side.
Restore SRDF pairs (incremental) on page 84	restore	Resume remote mirroring and initiate an incremental data copy from the target (R2) device to the source (R1) device. Use this for resynchronizing SRDF mirrors after a split if you can discard the source data.
Resume I/O on links on page 86	resume	Resume I/O traffic on the SRDF links for the remotely mirrored SRDF pairs in the group.
Split on page 87	split	Stop remote mirroring between the source (R1) device and the target (R2) device. The target device is made available for local host operations. Use this when both sides require independent access, such as for testing purposes.
Suspend I/O on links on page 89	suspend	Suspend I/O traffic on the SRDF links for the remotely mirrored SRDF pairs in the group.
Swap SRDF pairs on page 90	swap	Swap the SRDF personality of the designated dynamic SRDF pair. Source R1 devices become target R2 devices and target R2 devices become source R1 devices.

Table 11 SRDF control operations summary (continued)

Control operation	symrdf argument	Description
Swap one-half of an SRDF pair on page 90	half_swap	Swap the SRDF personality of one half of the designated dynamic SRDF pair. Source R1 devices become target R2 devices or target R2 devices become source R1 devices.
Update R1 mirror on page 91	update	Update the source (R1) side with the changes from the target (R2) side while the target (R2) side is still operational to its local hosts. Use this to synchronize the R1 side with the R2 side as much as possible before performing a failback, while the R2 side is still online to the host.
Write disable R1 on page 93	write_disable r1	Write disables the source (R1) device to its local host.
Write disable R2 on page 93	write_disable r2	Write disables the target (R2) device to its local host.
Write enable R1 on page 93	rw_enable r1	Write enables the source (R1) device to its local host.
Write enable R2 on page 94	rw_enable r2	Write enables the target (R2) device to its local host.

SRDF basic control operations

The remainder of this chapter describes the steps to perform typical SRDF operations.

Note

SRDF operations and applicable pair states on page 456 lists the applicable SRDF pair states for each of these basic operations.

SRDF modes of operation

SRDF modes of operation determine the following:

- How R1 devices are remotely mirrored to R2 devices across the SRDF links
- How I/Os are processed in an SRDF solution
- When the production host's write I/O command is acknowledged.
  This section describes the commands to set SRDF mode.

SRDF/Metro Active mode

All device pairs in an SRDF/Metro configuration always operate in Active SRDF mode. Changes to or from Active mode are not allowed.

Writes can be done to both sides of the device pair. Data must be stored in cache at both sides before an acknowledgment is sent to the host that wrote the data.

Set the default SRDF mode

The default mode of operation is adaptive copy disk. If you create device pairs without setting a mode, the devices are created in adaptive copy disk mode.

Use the SYMAPI_DEFAULT_RDF_MODE parameter in the options file to modify the default mode.

Note

The SYMAPI_DEFAULT_RDF_MODE parameter cannot be set to Active.

Set the SRDF mode

Syntax

You can use `createpair` to set the SRDF replication mode when you create SRDF device pairs.

symrdf createpair (-file option) syntax on page 109 shows the syntax of `createpair`.

Alternatively, use `symrdf set` to set or modify the SRDF replication mode for a device group, a composite group, or for devices listed in a device file.

To set the mode on a device group, composite group, storage group, and device file:

```
symrdf -g DgName set mode Mode
symrdf -cg CgName set mode Mode
symrdf -sg SgName set mode Mode -sid SID -rdfg GrpNum
symrdf -f[ile] FileName set mode Mode -sid SID -rdfg GrpNum
```

Options for *Mode*

sync

Sets the device pairs into synchronous mode.

semi

Sets the device pairs into semi-synchronous mode.

acp_disk

Sets the device pairs to adaptive copy disk mode.

acp_wp

Sets the device pairs to adaptive copy write pending mode.
Adaptive copy write pending mode is not supported when the R1 mirror of the RDF pair is on an array running HYPERMAX OS.

acp_off

Turns off the adaptive copy mode for the device pairs.

async

Sets the device pairs to asynchronous mode.

Set SRDF mode: synchronous

In synchronous mode, the array responds to the host that issued a write operation to the source (R1) device only after the array containing the target (R2) device acknowledges that it has received and checked the data.

Synchronous mode ensures that the source (R1) and target (R2) devices contain identical data.

Example

To set the replication mode in group `prod` to synchronous:

```
symrdf -g prod set mode sync
```

Set SRDF mode: adaptive copy

Adaptive copy mode is designed to transfer large amounts of data without loss of performance.

Adaptive copy mode allows the R1 and R2 devices to be more than one I/O out of synchronization. Unlike the asynchronous mode, adaptive copy mode does not guarantee a dependent-write consistent copy of data on R2 devices.

The amount of data (number of tracks) out of synchronization between the R1 and the R2 devices at any given time is determined by the maximum skew value. Set adaptive copy disk skew on page 68 shows how to set the maximum skew value.

Adaptive copy modes revert to the specified mode of operation (synchronous mode or semi-synchronous mode) when certain conditions are met.

The following sections describe the commands to set the two types of adaptive copy mode:

- Set SRDF mode: adaptive copy write pending on page 67
- Set SRDF mode: adaptive copy disk on page 68

Set SRDF mode: adaptive copy write pending

In adaptive copy write pending (acp_wp) mode, the array acknowledges all writes to the source (R1) device as if it is a local device.

The amount of data (number of tracks) out of synchronization between the R1 and the R2 devices at any given time is determined by the maximum skew value. You can set the maximum skew value using SRDF software.

New data accumulates in cache until it is successfully written to the source (R1) device and the remote director has transferred the write to the target (R2) device.

This SRDF mode is designed to have little or no impact on performance between the host and the array containing the source (R1) device.

HYPERMAX OS

Adaptive copy write pending mode is not available when the R1 side of the pair is on an array running HYPERMAX OS.

HYPERMAX OS/Enginuity 5876 backward compatibility

In SRDF configurations where R1 devices are on an array running HYPERMAX OS, connected to one or more arrays are running Enginuity 5876, the following restrictions apply:

- For swap and failover operations - If the R2 is on an array running HYPERMAX OS, and the mode of the R1 is adaptive copy write pending mode, SRDF sets the mode to adaptive copy disk.
- For migrate -replace R1 operations - If the R1 being replaced is on an array running HYPERMAX OS, and the mode of the R1 is adaptive copy write pending mode, SRDF sets the mode of the migrated pair to adaptive copy disk.

Examples

To set the replication mode in group **`prod`** to adaptive copy write pending:

```
symrdf -g prod set mode acp_wp
```

To disable adaptive copy write pending and set the replication mode in group **`prod`** to synchronous:

```
symrdf -g prod set mode acp_off
```

Set SRDF mode: adaptive copy disk

Adaptive copy disk (acp_disk) mode is designed to transfer large amounts of data without loss of performance.

Because the array cannot fully guard against data loss should a failure occur, Dell EMC recommends:

1. Use the adaptive copy disk mode to transfer the bulk of your data to target (R2) devices.
2. Then switch to synchronous mode to ensure full data protection.

When you set the SRDF mode to adaptive copy disk, the array acknowledges all writes to source (R1) devices as if they were local devices. New data accumulates on the source (R1) device and is marked by the source (R1) side as invalid tracks until it is subsequently transferred to the target (R2) device. The remote director transfers each write to the target (R2) device whenever link paths become available.

Examples

To set the replication mode in group `prod` to adaptive copy disk:

```
symrdf -g prod set mode acp_disk
```

To disable adaptive copy disk mode and set the replication mode in group `prod` to synchronous:

```
symrdf -g prod set mode acp_off
```

Set adaptive copy disk skew

Skew is an attribute that defines the maximum number of invalid tracks supported by adaptive copy disk mode.

If the number of invalid tracks defined by the skew attribute is exceeded, the remotely-mirrored device switches to synchronous mode.

As soon as the number of invalid tracks drops below the skew threshold, the remotely-mirrored pair reverts to adaptive copy mode.

Skew is configured at the device level and may be set to a value between 0 and 65,534 tracks. For devices with more than a 2 GB capacity drive, you can specify a value of 65,535 to indicate all tracks of any given drive.

Set SRDF mode: asynchronous

In asynchronous mode (SRDF/A), data is transferred from the source (R1) site in predefined timed cycles or *delta sets* to ensure that data at the remote (R2) site is *dependent write consistent*.

The array acknowledges all writes to the source (R1) devices as if they were local devices. Host writes accumulate on the source (R1) side until the cycle time is reached and are then transferred to the target (R2) device in one delta set. Write operations to the target device are confirmed when the current SRDF/A cycle commits the data to disk by successfully de-staging it to the R2 storage devices.

Because the writes are transferred in cycles, any duplicate tracks written to can be eliminated through *ordered write processing*, which transfers only the changed tracks within any single cycle.

The point-in-time copy of the data at the secondary site is slightly behind that on the primary site.

SRDF/A has little or no impact on performance at the primary site as long as the SRDF links contain sufficient bandwidth and the secondary array is capable of accepting the data as quickly as it is being sent across the SRDF links.

When you set the mode as asynchronous for an SRDF group, all devices in the group must operate in that mode.

Note

The system checks the status of all TimeFinder Snap and Clone device pairs in the group before allowing the `set mode async` action to proceed. Depending on the state of the device pair, asynchronous mode may not be allowed for devices employing either TimeFinder/Snap or TimeFinder/Clone operations. SRDF operations and TimeFinder sessions on page 479 explains the applicable device pair states for TimeFinder/Snap or TimeFinder/Clone operations.

SRDF/Asynchronous Operations on page 133 has details of all operations available for SRDF/Aysynchronous.

Example

To set the replication mode in group `prod` to asynchronous:

```
symrdf -g prod set mode async
```

Establish an SRDF pair (full)

A full establish initiates the following activities for each specified SRDF pair in a device group, consistency group, storage group, or list of devices in a device file:

1. The target (R2) device is write disabled to its local host I/O.
2. Traffic is suspended on the SRDF links.
3. All the tracks on the target (R2) device are marked invalid.
4. All tracks on the R2 side are refreshed by the R1 source side. The track tables are merged between the R1 and R2 side.
5. Traffic is resumed on the SRDF links.

In SRDF/S configurations, when the establish operation completes and the device pair is in the Synchronized state, the source (R1) device and the target (R2) device contain identical data.

In SRDF/A configurations, when the establish operation completes and the device pair is in the Consistent state, the target (R2) device contains dependent write consistent data.

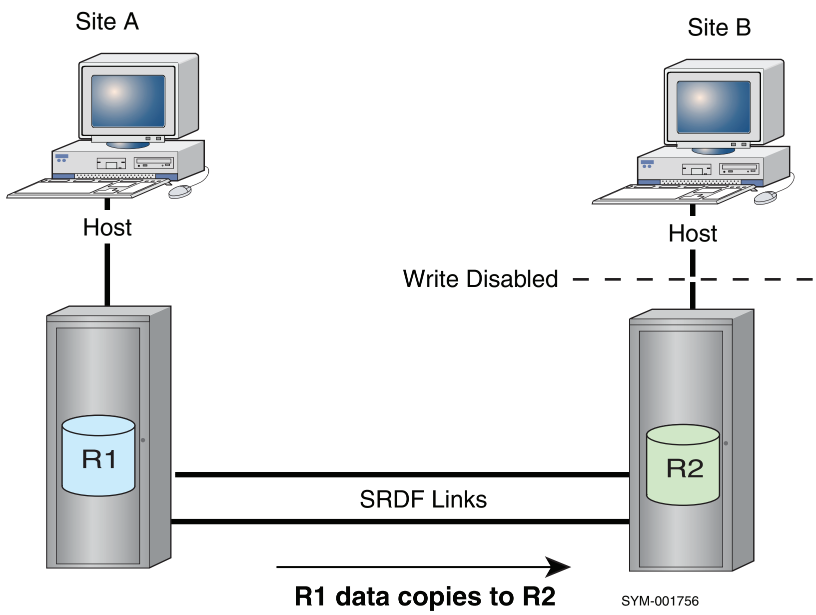
In SRDF/Metro configurations, once the source (R1) device and the target(R2) device contain identical data, the pair state changes to either ActiveActive or ActiveBias and the R2 side is made RW-accessible to the host(s).

A full establish on SRDF pairs is required only:

- At initial set-up of SRDF pairs.
- When an R2 member of an SRDF pair is either fully invalid, or has been replaced.

The following image shows establishing an SRDF pair.

Figure 4 SRDF establish (full)



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Note

The R2 may be set to read/write disabled (not ready) by setting the value of SYMAPI_RDF_RW_DISABLE_R2 to ENABLE in the options file. For more information, refer to the *Dell EMC Solutions Enabler CLI Reference Guide*.

Syntax

Use establish -full for a device group, composite group, storage group, or device file:

```
symrdf -g DgName establish -full
symrdf -cg CgName establish -full
symrdf -sg SgName establish -full
symrdf -f[ile] FileName establish -full
```

Use the `-use_bias` option in SRDF/Metro configurations to indicate that neither the Witness nor the vWitness methods of determining bias is used:

```
symrdf -g DgName establish -full -use_bias
symrdf -cg CgName establish -full -use_bias
symrdf -sg SgName establish -full -use_bias
symrdf -f[ile] FileName establish -full -use_bias
```

NOTICE

For SRDF/Metro configurations:

- The establish operation must include all devices in the group.
- If the Witness method is used to determine which side of the device pair remains accessible to the host, the Witness groups must be online or the vWitness must be accessible to both sides.

Create a device file on page 107 describes the steps to create a device file.

Use the `verify` command to confirm that the SRDF pairs are in the correct state:

SRDF Mode	State of the SRDF Pairs
Adaptive Copy	Synchronized
SRDF/Synchronous	Synchronized
SRDF/Asynchronous	Consistent
SRDF/Metro	ActiveActive or ActiveBias

Examples

To establish all the SRDF pairs in the device group `prod`:

`symrdf -g prod establish -full`

To establish all the pairs in an SRDF/Metro group using bias:

`symrdf -f /tmp/device_file -sid 085 -rdfg 86 establish -full -use_bias`

Establish an SRDF pair (incremental)

An incremental establish re-synchronizes data on the source (R1) and target (R2) device when:

- a split RDF pair is rejoined.
- device pairs are made Read-Write (RW) on the SRDF link after having been Not Ready (NR) on the link.

Only the data that was updated on the source (R1) device while the SRDF pair was split or suspended is copied, greatly reducing the amount of data that is to be transferred.

An incremental establish initiates the following activities for each specified SRDF pair in a device group:

- The target (R2) device is write disabled to its local host I/O.
- Traffic is suspended on the SRDF links.
- The invalid tracks on the target (R2) device are refreshed from the changed tracks of the source (R1) device.

- The track tables are merged between the source (R1) device and the target (R2) device.
- Traffic is resumed on the SRDF links.

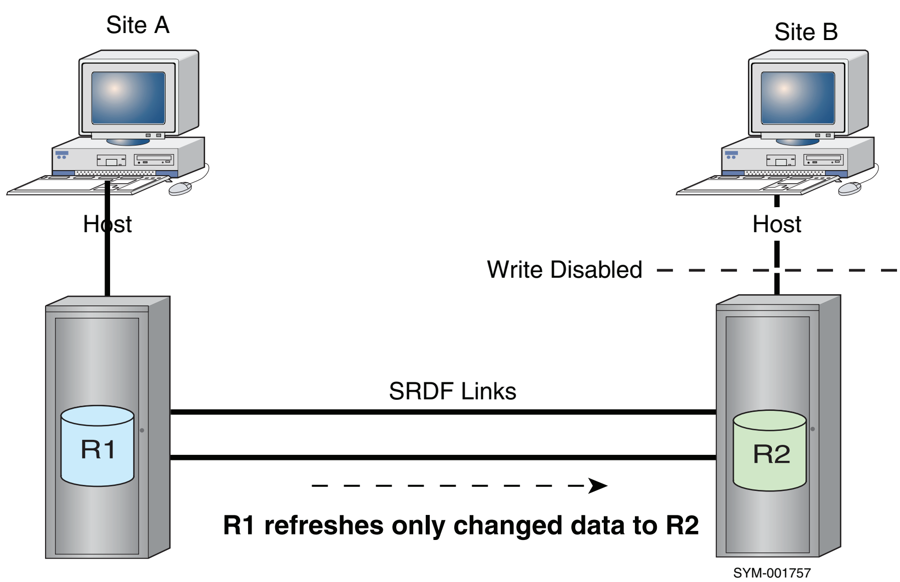
In SRDF/S configurations, when the establish operation completes and the device pair is in the Synchronized state, the source (R1) device and the target (R2) device contain identical data.

In SRDF/A configurations, when the establish operation completes and the device pair is in the Consistent state, the target (R2) device contains dependent write consistent data.

In SRDF/Metro configurations, once the source (R1) device and the target(R2) device contain identical data, the pair state is changed to either ActiveActive or ActiveBias and the R2 side is made RW-accessible to the host(s).

The following image shows an incremental establish of an SRDF pair.

Figure 5 SRDF establish (incremental)



Note

When you issue the **`symrdf`** command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use incremental `establish` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName establish
symrdf -cg CgName establish
symrdf -sg SgName establish
symrdf -f[ile] FileName establish
```

These commands do not include an option to definition the type of establish operation, because incremental is the default for this operation.

Include the `-use_bias` option in SRDF/Metro configurations to indicate that neither the Witness method nor vWitness methods of determining bias is used:

```
symrdf -g DgName establish -use_bias
symrdf -cg CgName establish -use_bias
symrdf -sg SgName establish -use_bias
symrdf -f[ile] FileName establish -use_bias
```

NOTICE

For SRDF/Metro configurations:

- The establish operation must include all devices in the SRDF/Metro group.
- If the Witness method is used to determine which side of the device pair remains accessible to the host, the Witness groups must be online or the vWitness must be accessible to both sides.

Note

R2 may be set to read/write disabled (not ready) by setting the value of SYMAPI_RDF_RW_DISABLE_R2 to ENABLE in the options file. For more information, refer to the *Dell EMC Solutions Enabler CLI Reference Guide*

Examples

To initiate an incremental establish on all SRDF pairs in the `prod` device group:

`symrdf -g prod establish`

To initiate an incremental establish for a list of SRDF pairs in SRDF/Metro group 86 where bias determines which side of the device pair remains accessible to the host:

`symrdf -f /tmp/device_file -sid 085 -rdfg 86 establish -use_bias`

Failback to source

After a failover (planned or unplanned), use the failback command to resume normal SRDF operations by initiating read/write operations on the source (R1) devices, and stop read/write operations on the target (R2) devices.

Failback initiates the following activities for each specified SRDF pair in a device group:

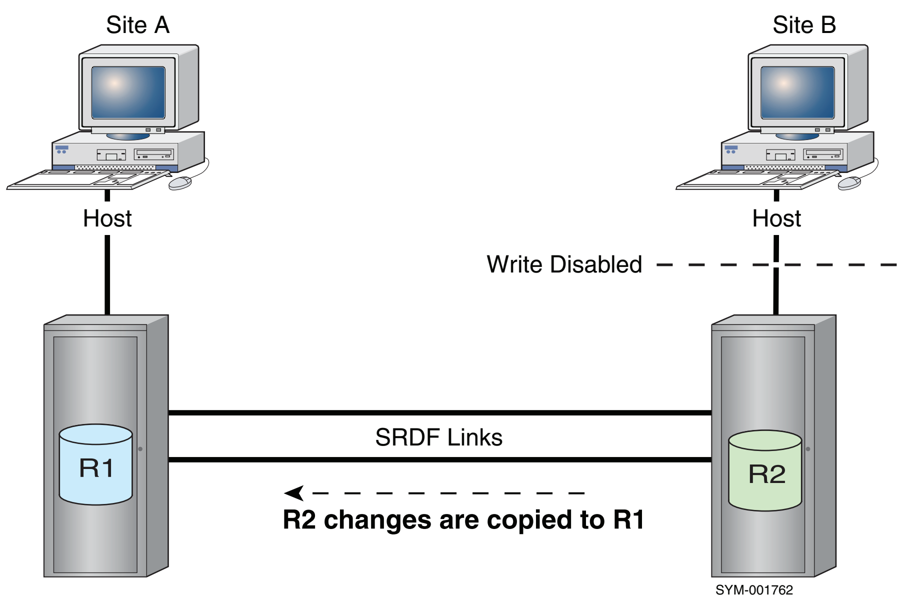
1. The target (R2) device is write disabled to its local hosts.
2. Traffic is suspended on the SRDF links.
3. If the target side is operational, and there are invalid remote (R2) tracks on the source side (and the force option is specified), the invalid R1 source tracks are marked to refresh from the target side.
4. The invalid tracks on the source (R1) side are refreshed from the target R2 side. The track tables are merged between the R1 and R2 sides.
5. Traffic is resumed on the SRDF links.
6. The source (R1) device is read/write enabled to its local hosts.
   The target (R2) devices become read-only to their local hosts.

Failback includes the following general steps:

1. Stop I/Os on the failover host at site B.
2. Make all R2 devices in the array at site B Not Ready or Read Only (Write Disabled) to the host.
3. If the array at site A was powered off, ensure that SRDF links between array A and array B are disabled before powering on the array at site A.
4. Power on the array at site A and make R1 devices Read/Write enabled to the production host.
5. Enable the SRDF links between the array at site A and the array at site B.
6. Bring the SRDF links online and restart the local host. The R1 devices automatically receive data from the R2 devices which accumulated invalid tracks on their R2 SRDF mirrors during production processing.
7. Once all SRDF pairs are synchronized, enable consistency groups on the SRDF links between the array at site A and the array at site B.
8. Restart the site A host and applications.

The following image shows the failback of an SRDF pair.

Figure 6 Failback of an SRDF device



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use `failback` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName failback
symrdf -cg CgName failback
symrdf -cg SgName failback
symrdf -f[ile] FileName failback
```

Note

The R2 may be set to read/write disabled (not ready) by setting the value of SYMAPI_RDF_RW_DISABLE_R2 to ENABLE in the options file. For more information, refer to the *Dell EMC Solutions Enabler CLI Reference Guide*

Examples

To initiate a failback on all the SRDF pairs in the `prod` device group:

```
symrdf -g prod failback
```

Failover to target

Failovers are used to move processing to the R2 devices during scheduled maintenance (planned failover) or when an outage makes the R1 devices unreachable (unplanned failover).

A failover transfers processing to the target (R2) devices and makes them read/write enabled to their local hosts.

Failover initiates the following activities for each specified SRDF pair in a device group:

- If the source (R1) device is operational, the SRDF links are suspended.
- If the source side is operational, the source (R1) device is write disabled to its local hosts.
- The target (R2) device is read/write enabled to its local hosts.

A planned failover is a controlled failover operation to test the robustness of the disaster restart solution, or to perform maintenance at the primary site. The secondary site temporarily becomes the primary/production site.

A planned failover includes the following general steps:

1. Shut down all applications on the production host.
2. Take all SRDF links between array A and array B offline to suspend remote mirroring.
3. When SRDF/CG is enabled, disable consistency groups between array A and array B.
4. Swap personalities between R1 and R2 devices.
   SRDF devices at array B are now R1 devices.

   SRDF devices at array A are now R2 devices.

   In SRDF/S configurations, devices are ready to resume production operations at array B.
5. When SRDF/CG is used, enable consistency between array B and array A.
6. Bring all SRDF links between array B and array A online to resume remote mirroring.
7. Start production applications from the host attached to array B.

An unplanned failover moves production applications from the primary site to the secondary site after an unanticipated outage at the primary site, and the primary site is not available.

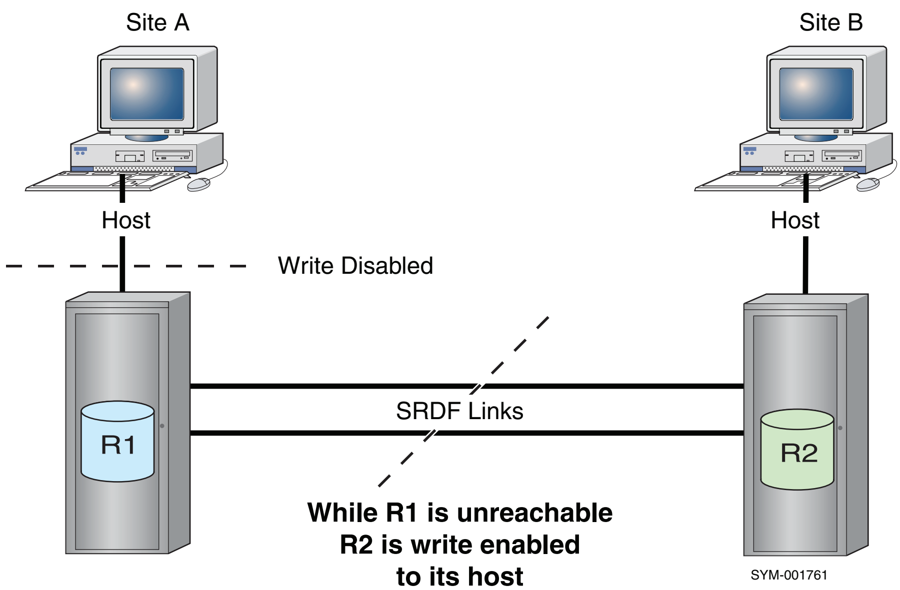
An unplanned failover includes the following general steps:

1. Take all SRDF links between array A and array B offline to suspend remote mirroring.

2. Change the R2 device states to Read/Write to the secondary host connected to array B.
3. Start applications on the secondary host and resume production to write-enabled R2 devices in array B.

The following image shows failover of an SRDF pair.

Figure 7 Failover of an SRDF device



Note

when you issue the **`symrdf`** command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use `failover` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName failover
symrdf -cg CgName failover
symrdf -sg SgName failover
symrdf -f[ile] FileName failover
```

Examples

To perform a failover on all the pairs in the `prod` device group:

`symrdf -g prod failover`

Invalidate R1 tracks

The `invalidate r1` operation invalidates all tracks on the source (R1) side, so they can be copied over from the target (R2) side.

Note

The SRDF pairs at the source must already be Suspended and write disabled (not ready).

Syntax

Use `invalidate r1` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName invalidate r1
symrdf -cg CgName invalidate r1
symrdf -sg SgName invalidate r1
symrdf -f[ile] FileName invalidate r1
```

Options

-nowd

Bypasses the validation check to ensure that the target of operation is write disabled to the host.

Examples

To invalidate the source (R1) devices in all the SRDF pairs in device group `prod`:

`symrdf -g prod invalidate r1`

Invalidate R2 tracks

The `invalidate r2` operation invalidates all tracks on the target (R2) side so that they can be copied over from the source (R1) side.

Note

The SRDF pairs at the source must already be Suspended and write disabled (not ready).

Syntax

Use `invalidate r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName invalidate r2
symrdf -cg CgName invalidate r2
symrdf -sg SgName invalidate r2
symrdf -f[ile] FileNameinvalidate r2
```

Options

-nowd

Bypasses the validation check to ensure that the target of operation is write disabled to the host.

Examples

To invalidate the target (R2) devices in all the SRDF pairs in device group `prod:`

`symrdf -g prod invalidate r2`

Make R1 ready

The Ready state means the specified mirror is ready to the host. The mirror is enabled for both reads and writes.

`ready r1` sets the source (R1) devices to ready for their local hosts.

This operation is particularly helpful when all SRDF links are lost and the devices are operating in domino mode.

Syntax

Use `ready r1` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName ready r1
symrdf -cg CgName ready r1
symrdf -sg SgName ready r1
symrdf -f[ile] FileName ready r1
```

Examples

To make the source (R1) device ready in all the SRDF pairs in device group `prod`:

`symrdf -g prod ready r1`

Make R1 not ready

The not ready state means the specified mirror is not ready to the host. Both reads and writes are disabled.

`not_ready r1` sets the source (R1) devices to not ready for their local hosts.

Syntax

Use `not_ready r1` on a device group, composite group, storage group, or device file:

```
symrdf -g DgName not_ready r1
symrdf -cg CgName not_ready r1
symrdf -sg SgName not_ready r1
symrdf -f[ile] FileName not_ready r1
```

Examples

To make the source (R1) devices not ready in all the SRDF pairs in device group `prod`:

`symrdf -g prod not_ready r1`

Make R2 ready

The Ready state means the specified mirror is ready to the host. The mirror is enabled for both reads and writes.

`ready r2` sets the target (R2) devices to ready for their local hosts.

Syntax

Use `ready r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName ready r2
symrdf -cg CgName ready r2
symrdf -sg SgName ready r2
symrdf -f[ile] FileName ready r2
```

Examples

To make the target (R2) devices ready in all the SRDF pairs in device group `prod`:

`symrdf -g prod ready r2`

Make R2 not ready

The Not Ready state means the specified mirror is not ready to the host. Both reads and writes are disabled.

`not_ready r2` sets the target (R2) devices to not ready for their local hosts.

Syntax

Use `not_ready r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName not_ready r2
symrdf -cg CgName not_ready r2
symrdf -sg SgName not_ready r2
symrdf -f[ile] FileName not_ready r2
```

Examples

To make the target (R2) devices not ready in all SRDF pairs in device group `prod`:

`symrdf -g prod not_ready r2`

Merge track tables

The `merge` operation merges the track tables between the source (R1) and the target (R2) devices.

Merge compares track tables on SRDF device pairs in a device group, composite group, storage group, or device file. Use the merge operation to compare the track tables between SRDF device pairs that have been split and re-established.

Syntax

Use `merge` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName merge
symrdf-cg CgName merge
symrdf-sg SgName merge
symrdf -f[ile] FileName merge
```

Examples

To merge the track tables of all the SRDF pairs in device group `prod`:

`symrdf -g prod merge`

Move one-half of an SRDF pair

The `half_movepair` operation moves only one side of a dynamic SRDF pair from one SRDF group to another.

The current invalid track counters on both R1 and R2 are preserved, so resynchronization is required.

This command moves the first device listed in each line of the device file to the new SRDF group.

After a successful `half_movepair` the pair state can go from partitioned to a different state or vice versa.

For example, when a `half_movepair` action results in a normal SRDF pair configuration, the resulting SRDF pair state will be Split, Suspended, FailedOver or Partitioned.

Example

To move one-half of the SRDF pairing of SRDF group 10 to a new SRDF group 15:

`symrdf half_movepair -sid 123 -file devicefile -rdfg 10 -new_rdfg 15`

Move both sides of SRDF device pairs

The `movepair` operation moves both the R1 and R2 sides of devices from one SRDF group to another. The current invalid track counters on both R1 and R2 are preserved, so resynchronization is required.

Note

All devices that are moved together must have the same SRDF personality: from R1 to R1 or from R2 to R2.

Syntax

Move SRDF pairs using a device group, storage group, or device file:

```
symrdf movepair -sid SID -g DgName -rdfg RDFgroup -new_rdfg
NewRDFgroup
symrdf movepair -sid SID -sg SgName -rdfg RDFgroup -new_rdfg
NewRDFgroup
symrdf movepair -sid SID -f FileName-rdfg RDFgroup -new_rdfg
NewRDFgroup
```

Move SRDF pairs on page 125 provides details on the `symrdf movepair` command for device files.

Options

-exempt

Allows devices to be moved into an active SRDF/A session without affecting the state of the session or requiring that other devices in the session be suspended.

Restrictions

The `movepair` operation has the following restrictions:

- The `-new_rdfg` *`NewRDFgroup`* argument and value are required.
- A device cannot move when it is enabled for SRDF consistency.

- A device cannot move if it is in asynchronous mode when an SRDF/A cleanup or restore process is running.
- When moving one mirror of a concurrent R1 or an R21 device to a new SRDF group, the destination SRDF group must not be the same as the one supporting the other SRDF mirror.
- When issuing a full `movepair` operation, the destination SRDF group must connect the same two arrays as the original SRDF group.
- If the destination SRDF group is in asynchronous mode, the SRDF group type of the source and destination group must match. In other words, in asynchronous mode, devices can only be moved from R1 to R1, or from R2 to R2.
- Always supply the `-exempt` option if the destination SRDF group supports an active SRDF/A session.
- The device pairs being moved must have been suspended using the `-exempt` option if the original SRDF group supports an active SRDF/A session.

Examples

To move pairs in a file from SRDF group 10 to SRDF group 15:

`symrdf movepair -sid 123 -file devicefile -rdfg 10 -new_rdfg 15`

The first device in each line of the device file moves to the new SRDF group. The second device in each line of the file moves to the remote SRDF group that is paired with the new SRDF group.

Read/write disable target device

The `rw_disable r2` operation blocks reads from and writes to the target (R2) devices from their local host.

Use `rw_disable r2` to set the specified device to the not ready state on the R2 side by making the device not ready on the RA.

Syntax

Use `rw_disable r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName rw_disable r2
symrdf -cg CgName rw_disable r2
symrdf -sg SgName rw_disable r2 -rdfg2
symrdf -f[ile] FileName rw_disable r2 -rdfg2
```

Examples

To read/write disable all the target (R2) mirrors in the SRDF pairs in a device group `prod`:

`symrdf -g prod rw_disable r2`

Refresh R1

The `refresh R1` mirror operation marks any changed tracks on the source (R1) side to refresh from the R2 side.

Use the `refresh R1` mirror action when the R2 device holds the valid copy and the R1 device's invalid tracks require refreshing using the R2 data.

Syntax

Use `refresh r1` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName refresh r1
symrdf -cg CgName refresh r1
symrdf -sg SgName refresh r1
symrdf -f[ile] FileName refresh r1
```

Examples

To refresh all the source (R1) devices in all the SRDF pairs in the device group `prod`:

`symrdf -g prod refresh r1`

Refresh R2

The `refresh R2` mirror operation marks any changed tracks on the target (R2) side to refresh from the R1 side.

Use the `refresh R2` mirror operation when the R1 device holds the valid copy and the R2 device's invalid tracks require refreshing using the R1 data.

Syntax

Use `refresh r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName refresh r2
symrdf -cg CgName refresh r2
symrdf -sg SgName refresh r2
symrdf -f[ile] FileName refresh r2
```

Examples

To refresh the target (R2) devices in all the SRDF pairs in device group `prod`:

`symrdf -g prod refresh r2`

Restore SRDF pairs (full)

Full restore copies the entire contents of the target (R2) device to the source (R1) device. After the restore operation completes, the pairs synchronize.

Note

Restore operations (incremental or full) are not allowed when the R2 device is larger than the R1 device.

When a restore is initiated for each specified SRDF pair in a device group, the following occurs:

1. The source (R1) device is write disabled to its local hosts.
2. The target (R2) device is write disabled to its local hosts.
3. Traffic is suspended on the SRDF links.
4. All tracks on the source (R1) device are marked as invalid.
5. All R1 tracks are refreshed from the R2 side. The track tables are merged between the R1 and R2 side.
6. Traffic is resumed on the SRDF links.

7. The source (R1) device is read/write enabled to its local hosts.

In SRDF/S configurations, when the restore control operation has successfully completed and the device pair is in the Synchronized state, the source (R1) device and the target (R2) device contain identical data.

In SRDF/A configurations, when the restore control operation has successfully completed and the device pair is in the Consistent state, the target (R2) device contains dependent write consistent data.

In SRDF/Metro configurations, once the source (R1) device and the target (R2) device contain identical data, the pair state is changed to either ActiveActive or ActiveBias and the R2 side is made RW-accessible to the host(s).

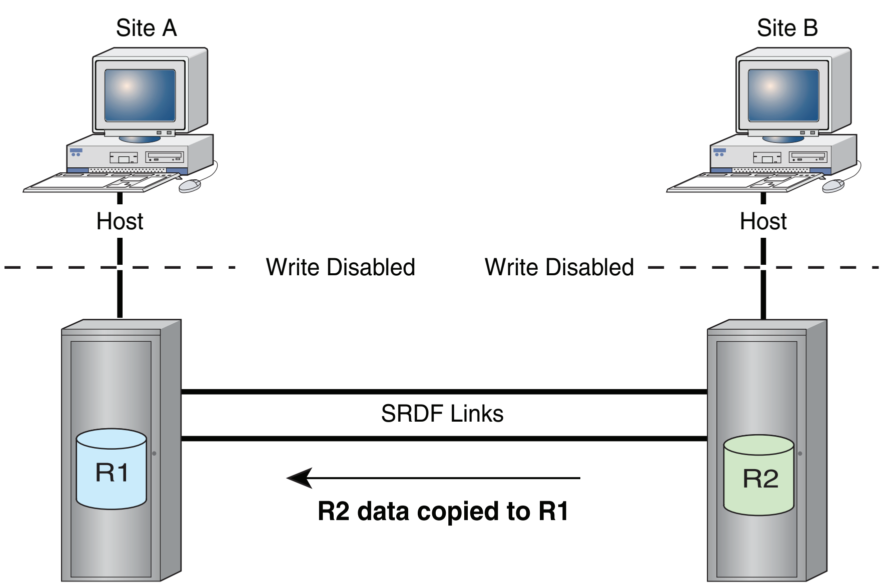
Note

R2 may be set to read/write disabled (not ready) by setting the value of SYMAPI_RDF_RW_DISABLE_R2 to ENABLE in the options file. For more information, refer to the Dell EMC Solutions Enabler CLI Reference Guide

---

The following image shows restoring an SRDF pair.

Figure 8 Restore (full) an SRDF device



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use `restore -full` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName restore -full
symrdf -cg CgName restore -full
```

```
symrdf -sg SgName restore -full
symrdf -f[ile] FileName restore -full
```

Include the `-use_bias` option in SRDF/Metro configurations to indicate that neither the Witness nor vWitness methods of determining bias are used:

```
symrdf -g DgName restore -full -use_bias
symrdf -cg CgName restore -full -use_bias
symrdf -sg SgName restore -full -use_bias
symrdf -f[ile] FileName restore -full -use_bias
```

For SRDF/A configurations, the restore operation must include all devices in the group unless the devices are `exempt`.

For SRDF/Metro configurations:

- The restore operation must include all devices in the group.
- If the Witness method is used to determine which side of the device pair remains accessible to the host, the Witness groups must be online.

Use the `verify` command to confirm that the SRDF pairs are in the correct state:

SRDF Mode	State of the SRDF Pairs
SRDF/Synchronous	Synchronized
SRDF/Asynchronous	Consistent
SRDF/Metro	ActiveActive or ActiveBias

Examples

To initiate a full restore on all SRDF pairs in the `prod` device group:

`symrdf -g prod restore -full`

To initiate a restore on a list devices in a SRDF/Metro group where bias determines which side of the device pair remains accessible to the host:

`symrdf -f /tmp/device_file -sid 085 -rdfg 86 restore -full -use_bias`

Restore SRDF pairs (incremental)

An incremental restore re-synchronizes data from the target (R2) to the source (R1) device when a split RDF pair is rejoined. Only those tracks on the target (R2) device that changed while the SRDF pair was split are copied, greatly reducing the amount of data that is copied.

Note

Restore operations (incremental or full) are not allowed when the R2 device is larger than the R1 device.

During an incremental restore SRDF carries out the following activities for each specified SRDF pair in a device group:

1. Set the source (R1) device to write disabled to its local hosts.
2. Set the target (R2) device to write disabled to its local hosts.
3. Suspend traffic on the SRDF links.

4. Refresh the invalid tracks on the source (R1) device from the changed tracks on the target (R2) side. The track tables are merged between the R1 and R2 side.
5. Resume traffic on the SRDF links.
6. Set the source (R1) device to read/write enabled to its local hosts.

In SRDF/S configurations, when the restore control operation has successfully completed and the device pair is in the Synchronized state, the source (R1) device and the target (R2) device contain identical data.

In SRDF/A configurations, when the restore control operation has successfully completed and the device pair is in the Consistent state, the target (R2) device contains dependent write consistent data.

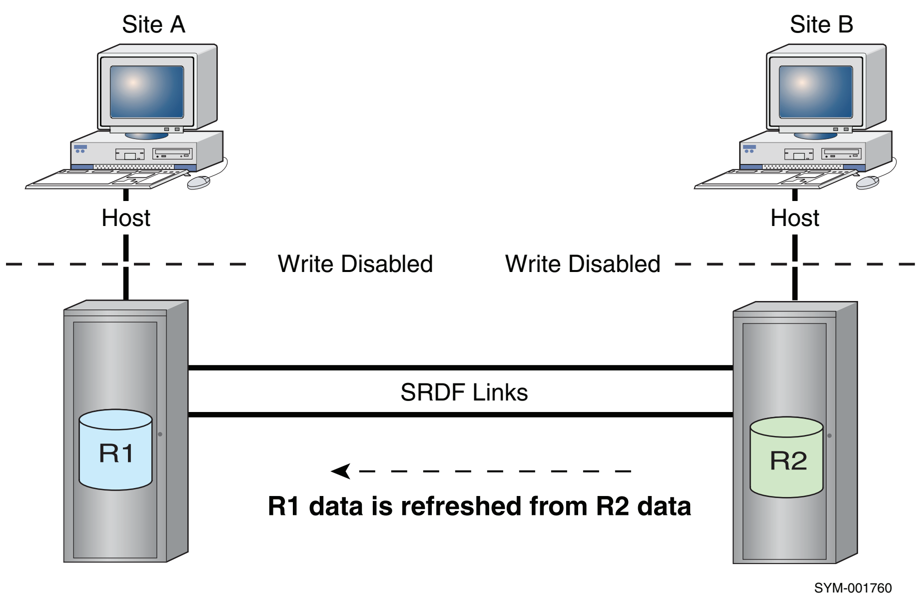
In SRDF/Metro configurations, once the source (R1) device and the target (R2) device contain identical data, the pair state is changed to either ActiveActive or ActiveBias and the R2 side is made RW-accessible to the host(s).

Note

R2 may be set to read/write disabled (not ready) set the value of SYMAPI_RDF_RW_DISABLE_R2 to ENABLE in the options file. For more information, refer to the *Dell EMC Solutions Enabler CLI Reference Guide*

The following image shows the incremental restore of an SRDF pair.

Figure 9 Incremental restore an SRDF device



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Note

Incremental is the default for the restore operation. No option is required.

Use incremental restore for a device group, composite group, storage group, or device file:

```
symrdf -g DgName restore
symrdf -cg CgName restore
symrdf -sg SgName restore
symrdf -f[ile] FileName restore
```

Include the `-use_bias` option in SRDF/Metro configurations to indicate that neither the Witness nor vWitness methods of determining bias are used:

```
symrdf -g DgName restore -use_bias
symrdf -cg CgName restore -use_bias
symrdf -sg SgName restore -use_bias
symrdf -f[ile] FileName restore -use_bias
```

For SRDF/A configurations, the restore operation must include all devices in the group unless the devices are `exempt`.

For SRDF/Metro configurations:

- The restore operation must include all devices in the group.
- If the Witness method is used to determine which side of the device pair remains accessible to the host, the Witness groups must be online.

Use the `verify` command to confirm that the SRDF pairs are in the correct state:

SRDF Mode	State of the SRDF Pairs
SRDF/Synchronous	Synchronized
SRDF/Asynchronous	Consistent
SRDF/Metro	ActiveActive or ActiveBias

Examples

To initiate an incremental restore on all SRDF pairs in the `prod` device group:

`symrdf -g prod restore`

To initiate an incremental restore on a list devices in a SRDF/Metro group where bias determines which side of the device pair remains accessible to the host:

`symrdf -f /tmp/device_file -sid 085 -rdfg 86 restore -use_bias`

Resume I/O on links

The `resume` operation resumes I/O traffic on the SRDF links.

For storage groups and device files, the operation applies to all SRDF pairs in the group or file.

For device groups and composite groups, the operation can be applied to all or only selected members of the group.

Syntax

Use `resume` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName resume
symrdf -cg CgName resume
symrdf -sg SgName resume
symrdf -f[ile] FileName resume
```

Note

The `resume` operation fails if you omit the `-force` option when the merge track table is required.

Examples

To resume the SRDF links between all the SRDF pairs in storage group `prod_sg`:

`symrdf -sg prod_sg resume`

Split

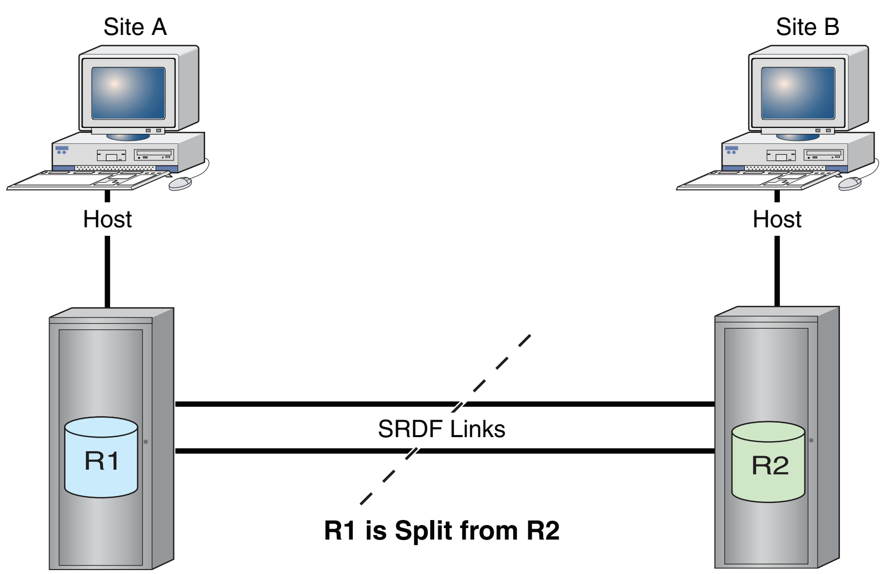
Split SRDF pairs when you require read and write access to the target (R2) side of one or more devices in a device group, composite group, storage group, or device file.

For a split operation, SRDF carries out the following activities for each specified SRDF pair:

1. Suspend traffic on the SRDF links.
2. Set the target (R2) device to read/write enabled to its local hosts.
   After the target (R2) device is split from the source (R1) device, the SRDF pair is in the Split state.

The following image shows splitting an SRDF pair.

Figure 10 Split an SRDF pair



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to establish. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use `split` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName split
symrdf -cg CgName split
symrdf -sg SgName split
symrdf -f[ile] FileName split
```

Note

Include the `-force` option when the device pairs are in domino mode or adaptive copy mode.

Examples

To perform a split on all the SRDF pairs in the `prod` device group:

`symrdf -g prod split`

Splits that impact databases

Note

See also: Consistency Group Operations on page 203

If a `split` operation impacts the access integrity of a database, additional operations such as freezing may be necessary. The freeze operation suspends writing database updates to disk.

Use the `freeze` operation in conjunction with the `split` operation.

Use the `symioctl` command to invoke I/O control operations to freeze access to a specified relational database or database objects.

Note

For access to the specified database, set the value of SYMCLI_RDB_CONNECT to your username and password.

Freeze access to a database

To freeze all I/O access to a specified relational database:

`symioctl freeze -type DbType Object Object`

SQL Server allows some or all databases to be specified. Oracle and Informix allow you to freeze or thaw an entire DB array.

If you have set the connection environment variables, the syntax is:

`symioctl freeze Object Object`

To freeze databases HR and Payroll:

`symioctl freeze HR Payroll`

Thaw access to a database

Once the freeze operation is complete, the split can proceed.

When the split operation is complete, use the `symioctl thaw` command to resume full I/O access to the database instance.

To resume I/O access:

`symioctl thaw`

Oracle databases: Hot backup control

For Oracle only, you can perform hot backup control on a list of tablespace objects. Hot backup control must be performed before and after a freeze/thaw command.

The steps required to split a group of SRDF pairs are:

1. Use the `symioctl begin backup` command.
2. Use the `symioctl freeze` command.
3. Split the SRDF pairs. This may involve several steps depending on your environment.
4. Use the `symioctl thaw` command.
5. Use the `symioctl end backup` command.

Suspend I/O on links

The `suspend` operation suspends I/O traffic on the SRDF links for the specified remotely mirrored SRDF pairs in the group or device file.

When the suspend is complete, the devices are suspended on the SRDF links and their link status is set to not ready (NR).

Note

The `suspend` operation fails if the specified device is in domino mode.

Suspend/resume timestamp

Suspend/resume causes SRDF link status to change from read/write to not ready and not ready to read/write. This status information is displayed in the output of the `symdev`, `sympd`, and `symdg show` commands.

Note

The timestamp in the displays is relative to the clock on the host where the command was issued and is reported for each SRDF mirror on both the R1 and R2 mirrors. This timestamp is not associated with the R2 data for SRDF/A.

Syntax

Use `suspend` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName suspend [-immediate | -exempt][-bias R1|R2]
symrdf -cg CgName suspend [-immediate | -exempt][-bias R1|R2]
symrdf -sg SgName suspend [-immediate | -exempt][-bias R1|R2]
symrdf -f[ile] FileName suspend [-immediate | -exempt][-bias R1|R2]
```

Options

-immediate

For SRDF/A configurations, causes the suspend command to drop the SRDF/A session immediately.

-exempt

Suspends devices without affecting the state of the SRDF/A session or requiring that other devices in the session be suspended.

-bias R1|R2

For SRDF/Metro configurations, specifies which side is the bias side.

Examples

To suspend the SRDF links between all the pairs in device group `prod`:

```
symrdf -g prod suspend
```

Swap one-half of an SRDF pair

The `half_swap` operation swaps the personality of one half of an SRDF relationship. It changes an R1 mirror to an R2 mirror or an R2 mirror to an R1 mirror.

You can swap one half of a designated SRDF pair as specified in a device file, device group, or composite group.

Restrictions

The `half_swap` operation has the following restrictions:

- The R2 device cannot be larger than the R1 device.
- A swap cannot occur during an active SRDF/A session or when cleanup or restore is running.
- Adaptive copy write pending is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS. If the R2 side is on an array running HYPERMAX OS and the mode of the R1 is adaptive copy write pending, SRDF sets the mode to adaptive copy disk.

Example

To swap the R1 designation of the associated BCV RDF1 pairs in device group `prod`, and refresh the data on the current R1 side:

```
symrdf -g Prod -bcv half_swap -refresh R1
```

Swap SRDF pairs

The `swap` operation swaps the personality of both halves in an SRDF relationship. The source (R1) device becomes the target (R2) device and the target (R2) device becomes the source (R1) device.

Note

The current states of the various devices involved in the SRDF swap must be considered before executing a swap action. Table 14 on page 127 lists which states are legal for this operation.

Restrictions

- A swap cannot occur if the R1 device (which becomes the R2) is currently a target for a TimeFinder/Snap or TimeFinder/Clone emulation. A device may not have two sources for data (in this case, the R1 and the emulation source). The swap cannot occur even if the emulation session has already completed copying the data.

- Adaptive copy write pending is not available when the R1 side of the RDF pair is on an array running HYPERMAX OS. If the R2 side is on an array running HYPERMAX OS, and the mode of the R1 is adaptive copy write pending, SRDF sets the mode to adaptive copy disk.

Example

To swap the R1 designation of the associated BCV RDF1 pairs in device group `prod`, and refresh the data on the current R1 side:

```
symrdf -g Prod -bcv swap -refresh R1
```

Update R1 mirror

The `update` operation starts an update of the source (R1) side after a failover while the target (R2) side may still be operational to its local hosts.

Use `update` to perform an incremental data copy of only the changed tracks from the target (R2) device to the source (R1) device while the target (R2) device is still Write Enabled to its local host.

SRDF updates each specified SRDF pair in a device group as follows:

1. Suspend the SRDF (R1 to R2) links when the SRDF links are up.
2. If there are invalid remote (R2) tracks on the source side and the force option was specified, mark tracks that were changed on the source devices for refresh from the target side.
3. Refresh the invalid tracks on the source (R1) side from the target R2 side. The track tables are merged between the R1 and R2 sides.
4. Resume traffic on the SRDF links.

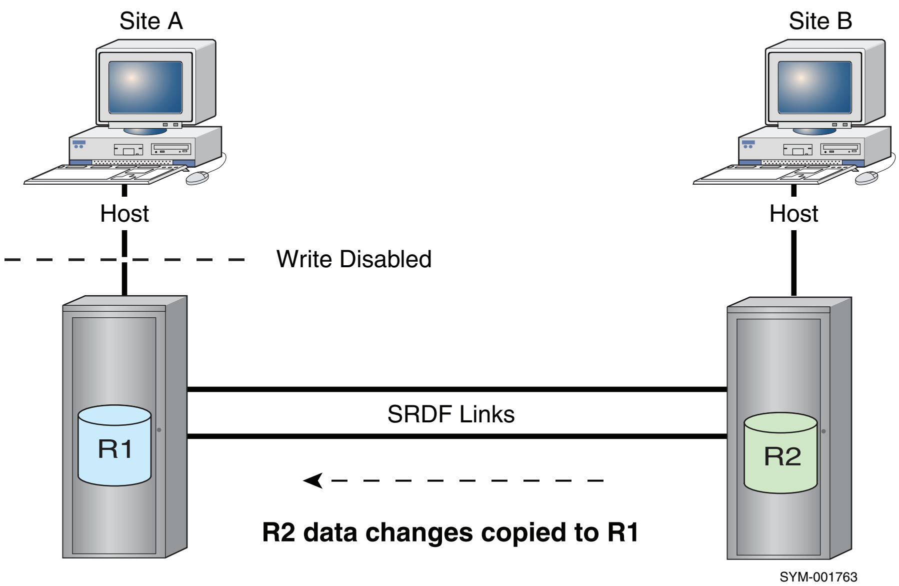
Note

If you update R1 while the SRDF pair is Suspended and not ready at the source, the SRDF pair types are in an Invalid state when the update completes. To resolve this condition, use the `rw_enable r1` operation to make the SRDF pairs become Synchronized.

When the update is complete, the pairs are in the R1 Updated state.

The following image shows an update of an SRDF pair.

Figure 11 Update SRDF device track tables



Note

When you issue the `symrdf` command, device external locks are set on all SRDF devices you are about to control. See Device external locks on page 56 and Table 5 on page 37.

Syntax

Use `update` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName update
symrdf -cg CgName update
symrdf -sg SgName update
symrdf -f[ile] FileName update
```

Use the `update -until #` command for scenarios where you want I/O to continue from the remote host and periodically update an inactive R1 device over an extended period of time.

Options

-until

Checks the number of invalid tracks that are allowed to build up from the active R2 local I/O before another update (R2 to R1 copy) is triggered. The update sequence loops until the invalid track count is less than the number specified by the `#` value

If the invalid track count is less than the number of tracks specified by the `–until #` value, the command exits. Otherwise, the following sequence of operations for update R1 mirror is retriggered until the threshold is reached.

1. Update the R1 mirror.
2. Build changed tracks on R2.
3. Check the invalid track count.

Examples
To update all the source (R1) devices in the SRDF pairs, for device group `prod`:

`symrdf -g prod update`

To update the R1 mirror of device group `prod` continuously until track the number of tracks to be copied is below 1000:

`symrdf -g prod update -until 1000`

Write disable R1

The `write_disable R1` operation sets the source (R1) devices as write disabled to their local hosts.

Syntax
Use `write_disable r1` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName write_disable r1
symrdf -cg CgName write_disable r1
symrdf -sg SgName write_disable r1
symrdf -f[ile] FileName write_disable r1
```

Examples
To write disable all the source (R1) mirrors in the SRDF pairs in device group `prod`:

`symrdf -g prod write_disable r1`

Write disable R2

The `write_disable R2` operation sets the target (R2) devices as write disabled to their local hosts.

Syntax
Use `write_disable r2` for a device group, composite group, storage group, or device file:

```
symrdf -g DgName write_disable r2
symrdf -cg CgName write_disable r2
symrdf -sg SgName write_disable r2
symrdf -f[ile] FileName write_disable r2
```

Examples
To write disable all the target (R2) mirrors in the SRDF pairs in device group `prod`:

`symrdf -g prod write_disable r2`

Write enable R1

The read/write enable R1 operation makes the source (R1) devices accessible to their local hosts.

Syntax

Use `rw_enable r1` for a device group, composite group, or device file:

```
symrdf -g DgName rw_enable r1
symrdf -cg CgName rw_enable r1
symrdf -f[ile] FileName rw_enable r1
```

Examples

To enable all the source (R1) mirrors in all the SRDF pairs in device group **`prod`**:

`symrdf -g prod rw_enable r1`

Write enable R2

The read/write enable R2 operation makes the target (R2) devices accessible to their local hosts.

Syntax

Use `rw_enable r2` for a device group, composite group, or device file:

```
symrdf -g DgName rw_enable r2
symrdf -cg CgName rw_enable r2
symrdf -f[ile] FileName rw_enable r2
```

Examples

To enable all the target (R2) mirrors in the SRDF pairs in device group `prod`:

`symrdf -g prod rw_enable r2`

CHAPTER 3

Dynamic Operations

This chapter covers the following:

Dynamic operations overview

An SRDF group consists of SRDF devices and SRDF directors on a storage array. The SRDF mirrors that belong to these SRDF devices point to the SRDF partner devices on another array and are configured to the partner SRDF group.

SRDF groups communicate with their partner SRDF groups in another array across the SRDF links. SRDF group configuration parameters include the partner array identification and the set of SRDF directors that belong to the partner SRDF group.

Create SRDF groups on both ends of the SRDF links.

SRDF groups can be created, modified, and deleted on demand while the array is in operation.

As soon as an empty SRDF group is created on one array, create a partner SRDF group on the second array. The SRDF directors assigned to each group share CPU processing power, SRDF ports, and serve all SRDF devices in the SRDF group associated with that director. SRDF directors on each side of the SRDF links cooperate to support regular SRDF I/O operations.

Maximum number of SRDF groups

The maximum number of SRDF groups and SRDF groups associated with a SRDF director varies by the version of Enginuity and HYPERMAX OS:

- Enginuity 5876:
  - 250 SRDF groups
  - 64 SRDF groups for each SRDF director
- HYPERMAX OS
  - 250 SRDF groups
  - 250 SRDF groups for each SRDF director

HYPERMAX OS and SRDF groups

All SRDF devices and SRDF groups on arrays running HYPERMAX OS are dynamic.

For configurations where one array is running HYPERMAX OS, and the second array is running Enginuity 5876, SRDF groups on the 5876 array must be dynamic. You cannot pair static SRDF groups or devices on one array with dynamic SRDF groups or devices on another.

HYPERMAX OS supports multiple ports per director.

When both arrays connected by an SRDF group are running HYPERMAX OS:

- Up to 250 SRDF groups can be defined across all of the ports of each SRDF director or
- Up to 250 SRDF groups can be defined on 1 port on a specific RDF director.

When one array is running HYPERMAX OS and the second array is running Enginuity 5876:

- The port on the array running HYPERMAX OS connected to a port on an array running Enginuity 5876 can support up to 64 SRDF groups.

Thus, the maximum number of SRDF groups supported on the HYPERMAX OS director is effectively 186 (250-64).

SRDF group attributes

All SRDF groups have configurable attributes that apply to the devices in the group, including:

- Link limbo on page 97
- Domino mode on page 97
- Autolink recovery on page 97
- Hardware compression on page 98
- Software compression on page 98

Note

SRDF/A device groups have additional configurable attributes. See Set SRDF/A group cycle time, priority, and transmit idle on page 140.

Link limbo

Link limbo is a feature for advanced users. It allows you to set a specific length of time for Enginuity to wait when a link goes down before updating the link status.

You can specify a link limbo value on the local side or both the local and remote sides of a dynamic SRDF group. If the link status is still not ready after the link limbo time expires, devices are marked not ready to the link.

The value of the link limbo timer can be 0 through 120 seconds. The default is 10 seconds.

To protect from session drops after the maximum link limbo time, enable the Transmit Idle feature (see Manage transmit idle on page 156).

NOTICE

Setting of the link limbo timer affects the application timeout period. So it is not recommended to set the timer while running in synchronous mode.Switching to SRDF/S mode with the link limbo parameter configured for more than 10 seconds may cause an application, database, or host to fail if SRDF is restarted in synchronous or semi-synchronous mode.

Domino mode

Under certain conditions, the SRDF devices can be forced into the Not Ready state to the host if, for example, the host I/Os cannot be delivered across the SRDF link.

Use the domino attribute to stop all subsequent write operations to both R1 and R2 devices to avoid data corruption.

While such a shutdown temporarily halts production processing, domino mode can protect data integrity in case of a rolling disaster.

Autolink recovery

If all SRDF links fail, the array stores the SRDF states of the affected SRDF devices. This enables the array to restore the devices to these states automatically when the SRDF links become operational.

Enable the Autolink recovery attribute (-autolink_recovery) to allow SRDF to automatically restore the SRDF links.

Valid values for -autolink_recovery are on (enabled) and off (disabled).

The default is off.

Hardware compression

SRDF hardware compression is available over Fibre Channel and GigE links. Compression minimizes the amount of data transmitted over an SRDF link.

Use the `-hwcomp` option to control hardware compression. Valid values for the option are on (compression is enabled) or off (compression is disabled). The default value is off.

Software compression

Software compression is available to SRDF traffic over Fibre Channel and GigE SRDF links. If software compression is enabled, Enginuity compresses data before sending it across the SRDF links.

The arrays at both sides of the SRDF links must support software compression and must have the software compression feature enabled in the configuration file.

Use the `-swcomp` option to control software compression. Valid values for the option are on (compression is enabled) or off (compression is disabled). The default is off.

Manage SRDF groups

This section contains procedures to create, manage, and delete SRDF groups:

- Create an SRDF group and add pairs on page 98
- Set SRDF group attributes on page 103
- Add/remove supporting directors for an SRDF group on page 105
- Removing dynamic SRDF groups on page 106

Create an SRDF group and add pairs

SRDF/Metro

HYPERMAX OS 5977.691.684 and Solutions Enabler 8.1 introduced SRDF/Metro which is a significant departure from traditional SRDF.

In SRDF/Metro configurations, R2 devices on VMAX3 arrays can be Read/Write accessible to hosts. SRDF/Metro R2 devices acquire the federated personality of the primary R1 device (such as geometry and device WWN). This federated personality of the R2 device causes the R1 and R2 devices to appear to host(s) as a single virtual device across both SRDF paired arrays.

By default, an SRDF/Metro configuration uses a Witness to determine which side of the SRDF device pair remains R/W accessible to the host or hosts in the event of link or other failures. The witness can be another array (an array Witness) or virtual Witness (vWitness).

SRDF/Metro Operations on page 165 provides more information on SRDF/Metro and how to manage it.

Multi-cores, multi-ports per director

In Enginuity 5876, all front-end emulations supported up to two ports. Multiple front-end emulations could exist on the same director board, providing additional host connectivity, but all such front-end directors were limited to one or two physical ports.

VMAX3 and VMAX All Flash arrays running HYPERMAX OS and Solutions Enabler 8.0.1 and later support a single front-end emulation of each type (sych as FA and EF) for each director, but each of these emulations supports a variable number of physical ports. Both the SRDF Gigabit Ethernet (RE) and SRDF Fibre Channel (RF) emulations can use any port on the director. The relationship between the SRDF emulation and resources on a director is configurable:

- 1 director for 1 or multiple CPU cores for 1 or multiple ports

Connectivity is not bound to a fixed number of CPU cores. You can change the amount of connectivity without changing CPU power.

The SRDF emulation supports up to 16 front-end ports per director (4 front-end modules per director), any or all of which can be used by SRDF. Both the SRDF Gigabit Ethernet and SRDF Fibre Channel emulations can use any port.

Note

If hardware compression is enabled, the maximum number of ports per director is 12.

When you create an SRDF group on VMAX3 arrays and VMAX All Flash arrays, select both the director AND the ports for the SRDF emulation to use on each side.

Syntax

Use the `symrdf addgrp` command to create a SRDF group.

```
symrdf addgrp -sid SID -label GrpLabel -rdfg GrpNum[-noprompt]
    [-i Interval] [-c Count]
        ..........
        -dir Dir:Port,Dir:Port,...
        -remote_rdfg GrpNum
        -remote_sid SID -remote_dir Dir:Port,Dir:Port,...
        -fibre | -gige | -farpoint
        -link_domino {on|off}
        -remote_link_domino
        -auto_link_recovery {on|off}
        -remote_auto_link_recovery
        -link_limbo Secs -rem_link_limbo Secs
        -witness
```

Required options

-sid ***SID***

The ID of the array where the group is added.

-label ***GrpLabel***

A label for a dynamic SRDF group.

-rdfg ***GrpNum***

An SRDF group number. Valid values are 1 - 250.

-dir ***Dir:Port, Dir:Port***

A comma-separated list one or more ports on a local director to be added to the group.

-remote_dir ***Dir:Port, Dir:Port***

A comma-separated list one or more ports on a remote director to be added to the group.

-remote_rdfg ***GrpNum***

The SRDF group number on the remote array.

-remote_sid ***SID***

The ID of the remote array.

Optional options

-fibre | -gige | -farpoint

The communication protocol for the group: Fibre Channel, Gigabit Ethernet, or FarPoint.

-link_domino {on|off}

Switches link domino mode on or off (see Domino mode on page 97).

-remote_link_domino {on|off}

Switches link domino mode on or off on the remote array.

-auto_link_recovery {on|off}

Switches autolink recovery on or off on the local array (see Autolink recovery on page 97).

-remote_auto_link_recovery

Switches autolink recovery on or off on the remote array.

-link_limbo ***0 - 120***

Sets the value of the link limbo timer for the local array (see Link limbo on page 97).

-rem_link_limbo ***0 - 120***

Sets the value of the link limbo timer for the remote array.

-witness

Identifies the SRDF group as a Witness group.

Requirements

The following are requirements for adding a dynamic SRDF group:

- The `dynamic_rdf` parameter must be enabled.
- The local or remote array must not be in the symavoid file.
- You can perform multiple operations (`addgrp`, `modifygrp`, `removegrp`), but each operation must complete before starting the next.
- Always specify a group label when adding a dynamic group.

Example - HYPERMAX OS

Arrays running HYPERMAX OS support multiple ports per director. You specify both the director ID and the port number when specifying the local and remote ports to add to the new SRDF group.

To specify 3 ports on each array:

```
symrdf addgrp -label new_group -rdfg 39 -remote_rdfg 49
```

```
-dir 2f:11,1f:12,2h:3-remote_dir 1h:2,2e:3,2f:12
-sid 000197100001 -remote_sid 000197100228 -nop
```

Example - Enginuity 5876

Arrays running Enginuity 5876 support a single port per director. Specify only the director ID when specifying the local and remote ports to add to the new SRDF group. For example:

```
symrdf addgrp -label new_group -rdfg 39 -remote_rdfg 49
-dir 2f -remote_dir 1h -sid 000195700001
-remote_sid 000195700228 -nop
```

Example - Mixed configurations

When one array in an SRDF configuration is running HYPERMAX OS, and one array is running Enginuity 5876, specify only the director ID on the array running 5876, and specify both the director ID and port number on the array running HYPERMAX OS. For example:

```
symrdf addgrp -label new_group -rdfg 39 -remote_rdfg 49
-dir 3h:12 -remote_dir 5f -sid 000197100001
-remote_sid 000195700228 -nop
```

Creating a dynamic SRDF group

Procedure

1. Use the `symcfg list` command to display the arrays visible to the host.
2. Use the `symsan list -sanrdf` command to display the SRDF topology from the local array, including available director pairs on the two arrays.

   For example, to determine which remote directors are visible from array 6180:

   `symsan -sanrdf -sid 6180 -dir all list`

   In this example, the output shows that director 13a on array 6240 is visible from director 12a on array 6180

   ```
   Symmetrix ID: 000194906180
       Flags                Remote
   --- ------- ---------------------------------
       Dir Lnk
   Dir CT  S   Symmetrix ID Dir WWN
   --- --- --- ------------ --- ----------------
   12A SO  C   000192606240 13A C465090872090050
   14A SO  C   000192602586 15A C465090872016879
   Legend:
     Director:
       (C)onfig : S = Fibre-Switched, H = Fibre-Hub
                  G = GIGE, - = N/A
       S(T)atus : O = Online, F = Offline, D = Dead, - = N/A
     Link:
       (S)tatus : C = Connected, P = ConnectInProg
                  D = Disconnected, I = Incomplete, - = N/A
   ```

3. Use the `symcfg list -ra all -switched` command to display all SRDF groups on the local array and its remotely connected arrays.

4. Use the `symrdf addgrp` command to create an empty dynamic SRDF group.

   In the following example, the `symrdf addgrp` command:

   - Creates a new dynamic SRDF group, specifying the local array (`-sid 6180`) and remote array (`-remote_sid 6240`).
   - Assigns an SRDF group number for the local array (`-rdfg 4`), and for the remote array (`-remote_rdfg 4`) to the new group.

     Note

     The two SRDF group numbers can be the same or different.

   - Assigns a group label (`-label dyngrp4`) to the new group.
     This label can be up to 10 characters long, and provides a user-friendly ID to modify or delete the new group.

     The group label is required to add/remove directors from the SRDF group.

   - Adds directors on the local array (`-dir 12a`) and the remote array (`-remote_dir 13a`) to the new group:
     symrdf addgrp -sid 6180 -rdfg 4 -label dyngrp4 -dir 12a -remote_rdfg 4 -remote_sid 6240 -remote_dir 13a

     NOTICE

     Network topology is important when choosing director endpoints. If using Fibre Channel protocol, the director endpoints chosen must be able to see each other through the Fibre Channel fabric in order to create the dynamic SRDF links. Ensure that the physical connections between the local RA and remote RA are valid and operational.

5. Use the `symcfg -sid` *`SID`* `list -rdfg` *`GrpNum`* command to confirm that the group was added to both arrays.
6. Use the `symrdf createpair` command to add SRDF pairs to the new group.

   Note

   When creating an RDF pair between HYPERMAX OS and Enginuity 5876, the maximum symdev number that can be used on the array running HYPERMAX OS is FFBF (65471).

   In the following example, the `symrdf createpair` command:

   - Adds the dynamic SRDF pairs listed in the device file (`-file dynpairsfile`) to the new dynamic SRDF group 4 (`-rdfg 4`)
   - Specifies the local array (`-sid 6180`) as the R1 side for the group (`-type R1`)
   - The `-invalidate` option (`-invalidate R2`) indicates that the R2 devices are the targets that will be refreshed from the R1 source devices.
   - Since no mode is specified in the `symrdf createpair` command, the default RDF mode (adaptive copy disk) will be used for the device pairs.

```
symrdf createpair -sid 6180 -rdfg 4 -file dynpairsfile -type R1 -invalidate R2
```

Modifying dynamic SRDF groups

Use the `symrdf set rdfg` command to set the attributes for an existing SRDF group, including:

- Link limbo
- Domino mode
- Autolink recovery
- Hardware compression
- Software compression

Use the `symrdf modifygrp` command to modify an existing SRDF group, including:

- Ports on a local director
- Ports on a remote director

Use the `-witness` option to modify Witness groups in SRDF/Metro configurations.

Set SRDF group attributes

Note

The remote side must be reachable in order to set the SRDF group attributes.

Syntax

Use the `symrdf set rdfg` command to set the attributes for an SRDF group.

```
symrdf -sid SID -rdfg GrpNum|-label GrpLabel [-v] [-symforce]
    [-noprompt] [-i Interval] [-c Count]
.............
    set rdfg
        [-limbo {0 - 120}]
        [-domino {on|off}]
        [-autolink_recovery {on|off}]
        [-hwcomp {on|off}]
        [-swcomp {on|off}]
        [-both_sides]
```

Options

-both_sides

Applies the group attribute to both the source and target sides of an SRDF session. If this option is not specified, attributes are only applied to the source side.

-limbo {0 - 120}

Sets the duration of the link limbo timer (seeLink limbo on page 97).

-domino {on|off}

Switches domino mode on or off (see Domino mode on page 97).

-autolink_recovery {on|off}

Switches autolink recovery on or off (see Autolink recovery on page 97).

-hwcomp {on|off}]

Switches hardware compression on or off (see Hardware compression on page 98).

-swcomp {on|off}

Switches software compression on or off (see Software compression on page 98).

Note

For arrays running Enginuity 5876, you can also use the `symconfigure` command to set SRDF group attributes. For more information, see the *Dell EMC Solutions Enabler Array Controls and Management CLI User Guide*.

Examples

To set the link limbo value to one minute (60 seconds) for both sides of SRDF group 4 on array 6180:

`symrdf -sid 6180 -rdfg 4 set rdfg -limbo 60 -both_sides`

To set the Link Domino mode on both sides of group 4 on array 6180:

`symrdf -sid 6180 -rdfg 4 set rdfg -domino on -both_sides`

To set the Autolink Recovery mode on both sides of group 4 on array 6180:

`symrdf -sid 6180 -rdfg 4 set rdfg -autolink_recovery on -both_sides`

To set limbo to thirty seconds and turn off Link Domino and Autolink Recovery modes for SRDF group 12:

```
symrdf -sid 134 -rdfg 12 set rdfg -limbo 30 -domino off -
autolink_recovery off
```

To turn on software compression and turn off hardware compression on both sides of the SRDF group 12:

`symrdf -sid 134 -rdfg 12 set rdfg -swcomp on -hwc off -both_sides`

Modify SRDF group attributes

Syntax

The `symrdf modifygrp` command modifies a dynamic SRDF group.

```
symrdf modifygrp {-add | -remove}
        -rdfg GrpNum|-label GrpLabel
        -sid SID

.........
        -dir Dir:Port,Dir:Port,...
        -remote_dir Dir:Port,Dir:Port,...
        -witness
```

Options

-dir ***Dir:Port, Dir:Port***

A comma-separated list of one or more local director:port combinations to be added to the group.

-remote_dir ***Dir:Port, Dir:Port***

A comma-separated list of one or more ports on a remote director to be added to the group.

-witness

Identifies the group as an SRDF/Metro Witness group.

Note

This option does NOT set the witness attribute on the group as a part of the `modifygrp` (that can only be done with the `addgrp` command). It just acknowledges that a witness group is being modified.

Add/remove supporting directors for an SRDF group

When adding a director to a dynamic group, that director for the local array must be online and a physical link to one online director in the remote array must exist.

NOTICE

Making physical cable changes within the SRDF environment may disable the ability to modify and delete dynamic group configurations.

Note

Reassigning directors for SRDF dynamic groups requires that you understand the network fabric topology when choosing director endpoints.

The group label or group number is required for modify operations.

Example - Modify a group using HYPERMAX OS

Arrays running HYPERMAX OS support multiple ports per director. You must specify both the director ID and the port number when modifying the local and remote ports. To add port 12 on local director 3h to SRDF group 38:

```
symrdf modifygrp -add -rdfg 38 -dir 3h:12 -sid 000197100001 -nop
```

Example - Modify a group using Enginuity 5876

Arrays running Enginuity 5876 support a single port per director. Specify only the director ID when specifying the ports to add/remove to/from the SRDF group. For example:

```
symrdf modifygrp -add -rdfg 38 -dir 3h -sid 000195700001 -nop
```

Example - Modify a group in a mixed configuration

When one array in an SRDF configuration is running HYPERMAX OS, and one array is running Enginuity 5876, specify only the director ID on the array running 5876, and specify both the director ID and port number on the array running HYPERMAX OS. For example:

```
symrdf modifygrp -add -rdfg 38 -dir 3h:12 -remote_dir 5f -sid
000197100001 -remote_sid 000195700228 -nop
```

Example - Remove a director

To remove director 13a from the group dyngrp4 on the local array 6180:

```
symrdf modifygrp -sid 6180 -label dyngrp4 -remove -dir 13a
```

Removing dynamic SRDF groups

To be able to remove an SRDF group:

- Both sides of the SRDF configuration must be defined and reachable
- The group must be empty.
- At least one physical connection between the local and remote array must exist.
- In SRDF/Metro configurations:
  - You cannot remove a Witness group if an SRDF/Metro group is currently using that Witness group for protection.
  - You can remove a Witness group if it is protecting an SRDF/Metro configuration(s) and there is another Witness (either physical (another array with witness groups to both sides of the SRDF/Metro configuration) or virtual (a vWitness that is enabled and visible to both sides of the SRDF/Metro configuration)) available to provide the protection. The Witness group can be removed and the new Witness array starts protecting the SRDF/Metro group(s).

Note

Deleting the group removes all local and remote director support.

Syntax

Use the `symrdf deletepair` command to remove all devices from the group.

Use the `symrdf removegrp` command to remove an SRDF group.

```
symrdf removegrp -sid SID
     -rdfg GrpNum | -label GrpLabel
     -noprompt
     -i Interval
     -c Count
     -star
     -symforce
     -witness
```

Options

-remote -rdfg*GrpNum* -label *GrpLabel*

The SRDF group number on the remote array.

-noprompt

Prompts are not displayed after the command is entered.

-i *Interval*

The interval, in seconds, between attempts to acquire an exclusive lock on the array host database or on the local and/or remote arrays.

-c *Count*

The number (count) of times to attempt to acquire an exclusive lock on the array host database, or on the local and/or remote arrays.

-star

The action is targeted at an RDF group in STAR mode.

-symforce

Requests the array force the operation to be executed when normally it would be rejected.

NOTICE

When used with `removegrp`, this option removes one side of a dynamic SRDF group if the other side is not defined or is not accessible. Do not use this option except in emergencies.

-witness

The SRDF group is a Witness group.

Example - Remove an SRDF group

In the following example:

- The `symrdf deletepair` command deletes SRDF dynamic pairs defined in a device file `dynpairsfile`. As all device pairs in the SRDF group are listed in the device file, the group will be emptied.
- The `symrdf removegrp` command removes the local and remote dynamic SRDF groups:

```
symrdf deletepair -sid 80 -rdfg 4 -file dynpairsfile
```

```
symrdf removegrp -sid 80 -label dyngrp4
```

Remove an SRDF group from one side of an SRDF configuration

Restrictions

To be able to remove one side of an SRDF group:

- The other side is not defined or reachable.
  If the other side of the SRDF configuration is reachable, you cannot issue this command.
- The group is empty.

Syntax

Use the `symrdf removegrp` command with the `-symforce` option to remove a dynamic SRDF group from one side of an SRDF configuration.

Example

The following example removes `dyngrp4` from array 180 on the local side:

```
symrdf removegrp -sid 180 -label dyngrp4 -symforce
```

Device pairing operations

You can create and delete SRDF pairs while the array is operating. You can specify the devices to be paired using a device file or storage group.

This section describes the steps to add and delete dynamic SRDF pairs.

Create a device file

1. Create a text file containing two columns.
2. Add a separate line in the file for each device pair.
   All devices for one side of the SRDF pair must be in the first column, and all devices for the other side of the SRDF pair must be in the second column.

It does not matter which side (R1 or R2) is in which column. The `-type` option of the `symrdf createpair` command defines the SRDF personality for column1.

NOTICE

All devices for an SRDF side must be in the same column. That is, all R1 devices must be in either the left or right column, and all R2 devices must be in the other column.

HYPERMAX OS

Solutions Enabler with HYPERMAX OS 5977 does not support meta-devices.

SRDF device pairs consisting of meta-devices on one side and non-meta-devices on the other side are valid if the meta-devices are on an array running Enginuity 5876.

Note

The maximum symdev number that can be used on the HYPERMAX OS array is FFBF (65471).

Example

In the following example, the vi text editor creates the RDFG148 device file consisting of 7 SRDF pairs for the local and remote arrays.

When the `symrdf createpair -file` *`FileName`* command processes the device file, the `-type` option determines whether the devices in the left column are R1 or R2.

```
vi RDFG148
0060 0092
0061 0093
0062 0094
0063 0095
0064 0096
0065 0097
0066 0098
```

Valid device types for SRDF pairs

The following table lists the valid device type combinations for creating an SRDF pair.

Table 12 Device type combinations for creating SRDF pairs

Device 1	Device 2
Standard	Standard
Thin	Thin
Standard	Diskless[a]
Thin[b]	Diskless[a,b]
Thin[c]	Standard[d]

a. 5876 diskless devices cannot be paired with devices on HYPERMAX OS.
b. FBA devices require Enginuity 5876 or higher. CKD devices are not supported.
c. FBA devices require Enginuity 5876 or higher. CKD devices require Enginuity 5876 Q42012 SR or higher.
d. Only on Enginuity versions 5876 and higher.

Block createpair when R2 is larger than R1

NOTICE

R2 devices larger than their corresponding R1 devices cannot restore or failover to the R1.

SYMAPI_RDF_CREATEPAIR_LARGER_R2 in the options file enables/disables creating SRDF pairs where R2 is larger than its corresponding R1. Valid values for the option are:

ENABLE - (default value) createpair for devices where R2 is larger than its R1 is allowed.

DISABLE - createpair for devices where R2 is larger than its R1 is blocked.

Creating SRDF device pairs

This section shows how to create dynamic SRDF device pairs in traditional SRDF configurations. Different rules and syntax apply for device pairs in an SRDF/Metro configuration. Create device pairs on page 180 shows how to create pairs in such a configuration.

symrdf createpair (-file option) syntax

Use the createpair command to create SRDF device pairs.

```
symrdf -file Filename -sid SID
      -rdfg GrpNum
      -bypass
      -noprompt
      -i Interval
      -c Count
         -v
      -noecho
      -force
      -symforce
      -star

createpair
      -type <R1|R2>
      -remote_sg SgName
      -invalidate R1|R2 | -establish | -restore [-rp] |format -establish]>
      -hop2_rdfg GrpNum]
      -rdf_mode sync | semi | acp_wp | acp_disk | async
      -remote
      -nowd
```

Note

Create device pairs on page 180 describes creating SRDF device pairs in SRDF/ Metro configurations.

Options

-file ***Filename***

The name of a device file for SRDF operations.

-rdfg ***GrpNum***

The identity of a specific SRDF group.
When used with `-sg createpair -hop2`, the option identifies the SRDF group associated with the SG.

-type [R1|R2]

Defines whether the devices listed in the left column of the device file are configured as the R1 side or the R2 side.

-remote_sg

When used with -hop2_rdfg *GrpNum*, the identity of the remote storage group for the second-hop.

-invalidate [R1|R2]

Marks the R1 devices or R2 devices in the list to be the invalidated target for a full device copy once the SRDF pairs are created.

-establish

Begins copying data to invalidated targets, synchronizing the dynamic SRDF pairs once the SRDF pairs are created.

-restore

Begins copying data to the source devices, synchronizing the dynamic SRDF pairs once the SRDF pairs are created.

-rp

Allows the operation even when one or more devices are tagged for RecoverPoint.
A non-concurrent R1 device can be tagged for RecoverPoint. A RecoverPoint tagged device can be used as an R1 device. A device tagged for RecoverPoint cannot be used as an R2 device (createpair) or swapped to become an R2 device (swap, half-swap).

-format

Clears all tracks on the R1 and R2 sides to ensure no data exists on either side, and makes the R1 read write to the host.
You can specify this option with `-establish`, `-type`, `-rdf_mode`, `-exempt`, and `-g`.

When used with `-establish`, the devices become read write on the SRDF link and are synchronized.

-rdf_mode

Sets the SRDF mode of the pairs to be one of the following:

- synchronous (sync),
- asynchronous (async),
- adaptive copy disk mode (acp_disk),
- adaptive copy write pending mode (acp_wp).

Note

Adaptive copy write pending mode is not supported when the R1 mirror of the RDF pair is on an array running HYPERMAX OS.

Adaptive Copy Disk is the default mode unless overridden by the setting of SYMAPI_DEFAULT_RDF_MODE in the options file. See Block createpair when R2 is larger than R1 on page 109.

-g *GrpName*

The name to give the device group created with the devices in the device file.

-remote

Requests a remote data copy. When the link is ready, data is copied to the SRDF mirror.

-hop2_rdfg

Specifies the SRDF group number for the second-hop. Applicable only for `createpair -hop2` for an SG.

-nowd

Bypasses the check explained in Verify host cannot write to target devices with -nowd option on page 119.

Example

In the following example:

- `-file` indicates devices are created using a device file `devices`.
- `-g ProdDB` names device group ProdDB.
- `-sid` indicates local source array is SID 810.
- `-invalidate -r2` indicates that the R2 devices are refreshed from the R1 source devices.
- `-type RDF1` indicates devices listed in the left column of the device file are configured as the R1 side.

```
symrdf createpair -g ProdDB -file devices -sid 810 -rdfg 2 -invalidate
r2 -nop -type RDF1
```

Create dynamic pairs with -file option

Create a device file on page 107 describes the steps to create a device file.

Example

In the following example, the `createpair` command:

- Creates device pairs using device pairs listed in a device file `devicefile`,
- Ignores the check to see if the host can write to its targets (`-nowd`),
- Sets the mode to the default (adaptive copy disk) by not specifying another mode:

```
symrdf createpair -sid 123 -file devicefile -type r1 -rdfg 10 -nowd
```

Create dynamic pairs with the -sg option

Starting from HYPERMAX OS 5977.596.583 you can manage SRDF operations using storage groups.

Storage groups (SGs) are a collection of devices on the array that are used by an application, a server, or a collection of servers. *Dell EMC Solutions Enabler Array Controls and Management CLI User Guide* provides more information about storage groups.

The following command options have been added or modified:).

- `- sg` *`SgName`* - Name of storage group on the local array. Required for all `-sg` operations.
- `-hop2_rdfg` *`GrpNum`* - SRDF group for the second hop. Used with `-sg createpair -hop2`.
- `-rdfg`*`GroupNum`* - SRDF group associated with the SG. Required for all -sg operations.
- `-remote_sg` *`SgName`*- Name of the storage group on the remote array. Used only for `createpair` operations.

This section contains:

- Pair devices using storage groups on page 114
- Pair mixed devices using storage groups on page 115
- Pair devices in cascaded storage groups on page 116
- Pair devices in storage groups (second hop) on page 116

symrdf createpair (-sg option) syntax

Use the `createpair` command with the `-sg` option to create SRDF device pairs using storage groups.

```
symrdf -sg SgName -sid SID -rdfg GrpNum
      -bypass
      -noprompt
      -i Interval
      -c Count
         -v | -noecho | -force | -symforce | -star
      -hop2

createpair
      -type <R1|R2>
      -remote_sg SgName
      -invalidate R1|R2 | -establish | -restore [-rp]
      -format | -establish
      -hop2_rdfg GrpNum]
      -rdf_mode sync | semi | acp_wp | acp_disk
      -remote
      -exempt
      -nowd
```

Options

-sg *SgName*

A storage group for SRDF operations.

-rdfg *GrpNum*

The name of the SRDF group that the command works on.
When used with `-sg createpair -hop2`, identifies the SRDF group associated with the storage group.

-type [R1|R2]

Whether the devices are configured as the R1 side or the R2 side.

-remote_sg *SgName*

When used with `-hop2_rdfg` *`GrpNum`*, the remote storage group for the second-hop.

-invalidate [R1|R2]

Marks the source (R1) devices or the target (R2) devices to invalidate for a full copy when an SRDF pair is created.

-establish

Begins copying data to invalidated targets, synchronizing the dynamic SRDF pairs once the SRDF pairs are created.

-restore

Begins copying data to the source devices, synchronizing the dynamic SRDF pairs once the SRDF pairs are created.

-rp

Allows the operation even when one or more devices are tagged for RecoverPoint.
A non-concurrent R1 device can be tagged for RecoverPoint. A RecoverPoint tagged device can be used as an R1 device. A device tagged for RecoverPoint cannot be used as an R2 device (createpair) or swapped to become an R2 device (swap, half-swap).

-format

Clears all tracks on the R1 and R2 sides to ensure no data exists on either side, and makes the R1 read write to the host.
You can specify this option with `-establish`, `-type`, `-rdf_mode`, `-exempt`, and `-g`.

When used with `-establish`, the devices become read write on the SRDF link and are synchronized.

-hop2_rdfg *GrpNum*

The SRDF group number for the second-hop. Applicable only for `createpair -hop2` for an SG.

-rdf_mode *Mode*

The SRDF mode of the pairs as one of the following:

- synchronous (sync),
- adaptive copy disk mode (acp_disk),
- adaptive copy write pending mode (acp_wp).

Note

Adaptive copy write pending mode is not supported when the R1 mirror of the SRDF pair is on an array running HYPERMAX OS.

Adaptive Copy Disk is the default mode unless overridden by the SYMAPI_DEFAULT_RDF_MODE options file setting. See Block createpair when R2 is larger than R1 on page 109.

-remote

Requests a remote data copy. When the link is ready, data is copied to the SRDF mirror.

-nowd

Bypasses the check explained in Verify host cannot write to target devices with -nowd option on page 119.

Pair devices using storage groups

The `createpair` operation uses the following logic to pair devices in storage groups:

- R1s are paired to R2s of like sizes. Geometry Compatible Mode (GCM) is taken into account.
  SRDF detects whether GCM is set or can be set/unset on local and remote devices. Geometry Compatible Mode" on page 28 provides more information about GCM.
- If the R2 is larger than R1, the device chosen to be the R2 is as close to the R1 size as possible.
- Device pairs must be the same emulation:
  - CKD 3380 to CKD 3380
  - CKD 3390 to CKD 3390
  - AS400 512 to AS400 512
  - AS400 520 to AS400 520
  - FBA to FBA
- FBA meta devices are paired as follows:
  - Concatenated metas are paired to concatenated metas and striped metas are paired to striped metas.
  - The number of members in the two metas must be the same.
  - The stripe size of the two metas must be the same.
  - Thin-to-thin pairs are created before thin-to-thick pairs.
  - Thick-to-thick pairs are created before thin-to-thick pairs.

NOTICE

If any of the devices in the two storage groups cannot be paired using these rules, the `createpair` operation fails.

Example

In the following example, storage group localSG includes 4 devices:

```
----------------------------------------------------------
Sym                                Device              Cap
Dev     Pdev Name                  Config     Sts     (MB)
----------------------------------------------------------
000A0   N/A                        TDEV       RW      3278
000A1   N/A                        TDEV       RW      1875
000B1   N/A                        TDEV       RW      4125
000C1   N/A                        TDEV       RW      3278
```

The remote storage group remoteSG also has 4 devices:

```
----------------------------------------------------------
Sym Device Cap
Dev Pdev Name Config Sts (MB)
----------------------------------------------------------
00030    N/A                        TDEV      RW      1877
00031    N/A                        TDEV      RW      4125
00050    N/A                        TDEV      RW      3278
00061    N/A                        TDEV      RW      4125
```

The `createpair -type r1` operation pairs the devices in the localSG group with devices in the remoteSG group:

symrdf createpair -sid 123 -rdfg 250 -sg localSG -type r1 -remote_sg remoteSG

After the operation, pairings are:

Table 13 Device pairs in storage groups

Local storage group		Remote storage group	
Device name	**Device size**	**Device name**	**Device size**
000A0	3278 MB	00050	3278 MB
000A1	1875 MB	00030	1875 MB
000B1	4125 MB	00031	4125 MB
000C1	3278 MB	00061	3278 MB

Pair mixed devices using storage groups

You can pair devices in a storage group that contains a mixture of RDF and non-RDF devices, or RDF devices with different RDF types, if the remote SG contains devices that can be paired with the R1s in the local SG.

Example

In the following example, local storage group localSG contains 4 devices of mixed types. Before the `createpair` operation, device A0 is an R1 device and B1 is an R2 device:

```
----------------------------------------------------------
Sym                                 Device          Cap
Dev      Pdev Name                  Config      Sts  (MB)
----------------------------------------------------------
000A0    N/A                        RDF1+TDEV   RW   3278
000A1    N/A                        TDEV        RW   1875
000B1    N/A                        RDF2+TDEV   RW   4125
000C1    N/A                        TDEV        RW   3278
```

The `createpair` operation pairs the devices in the localSG group with devices in the remoteSG group:

- `-sid 123 -sg localSG -type r1` - Create device pairs so that devices in the localSG group on array 123 are R1 devices.
- `-remote_sg remoteSG` - Pair the devices in the localSG group with devices in the remoteSG group:

symrdf createpair -sid 123 -rdfg 250 -sg localSG -type r1 -remote_sg remoteSG

After the operation, device A0 is an R11 device and device B1 is an R21 device:

```
--------------------------------------------------------
Sym                                Device          Cap
Dev     Pdev Name                  Config      Sts  (MB)
--------------------------------------------------------
000A0   N/A                        RDF11+TDEV   RW   3278
000A1   N/A                        TDEV         RW   1875
000B1   N/A                        RDF21+TDEV   RW   4125
000C1   N/A                        TDEV         RW   3278
```

Pair devices in cascaded storage groups

All combinations of cascaded and non-cascaded storage groups are available. You can pair all the devices in a parent storage group, or only the devices in a specified child storage group.

To pair all the devices in a local parent storage group, (including devices in any child storage groups) with devices in a remote parent storage group, (including devices in any child storage groups) specify the parent storage group names.

To pair devices in a local child storage group with devices in a specified remote child storage group, specify both child storage groups.

Examples

To pair devices in the local parent storage group SG-P1 (including devices in SG-P1's child storage groups) with devices in the remote parent storage group SG-P2 (including devices in SG-P2's child storage groups):

`symrdf createpair -sg SG-P1 -remote_sg SG-P2`

To pair devices in the local child storage group local-SG-Child-1 with devices in the remote child storage group remote-SG-Child-2:

`symrdf createpair –sg local-SG-Child-1 –remote_sg remote-SG-Child-2`

Pair devices in storage groups (second hop)

Use the following command to pair devices in the local storage group and RDF group with devices in the specified remote storage group and RDF group located at hop 2:

symrdf -sg *SgName* -sid *SID* -rdfg *GroupNum* -remote_sg *SgName* createpair -type {r1|r2} -hop2 -hop2_rdfg *GroupNum*

To create pairs using the `–hop2` option:

- Devices in the remote storage group must have 2 RDF mirrors and the operation is performed on the other mirror.
- Devices in the remote storage group cannot be R21, R22, or R11 devices before the `createpair` operation.
- The remote storage group must already exist.

Example

The following example creates an R1 -> R21 -> R2 configuration starting with an R1 -> R2 pair.

Before the operation, the storage group SG_ABC in RDF group 16 on local SID 085 contains 2 R1 devices:

```
--------------------------------------------------------
Sym                             Device                Cap
```

```
Dev       Pdev Name               Config       Sts       (MB)
---------------------------------------------------------
01AA0     N/A                     RDF1+TDEV    RW        3278
01AB1     N/A                     RDF1+TDEV    RW        4125
```

These are paired with 2 R2 devices in storage group SG_ABC on remote SID 086 (hop 1):

```
Logical        Sym     T     R1 Inv R2 Inv K Sym T...
Device         Dev     E     Tracks Tracks S Dev E...
--------------------------------- -- ---------...
N/A            01AA0  RW     0       0  NR 0007A WD...
N/A            01AB1  RW     0       0  NR 0007B WD...
```

On the remote SID 087 (hop 2), storage group SG_ABC_HOP2 in RDF group 6 contains two unpaired devices:

```
Sym                                 Device                Cap
Dev      Pdev Name                  Config     Sts        (MB)
---------------------------------------------------------
0009A    N/A                        TDEV       RW         3278
0009B    N/A                        TDEV       RW         4125
```

The following command creates an R1 -> R21 -> R2 configuration. The devices at hop 2 (SID 087) become R2 devices:

symrdf -sg SG_ABC -sid 085 -rdfg 16 -remote_sg remote_SG_ABC_HOP2 createpair -type R1 -est -hop2 -hop2_rdfg 6

```
---------------------------------------------------------
Sym                                  Device               Cap
Dev      Pdev Name                   Config     Sts       (MB)
---------------------------------------------------------
0009A    N/A                         RDF2+TDEV  RW        3278
0009B    N/A                         RDF2+TDEV  RW        4125
```

The devices at hop 1 that were R2 before the operation, are now R21 devices.

Create pairs with the -establish option

Note

In traditional SRDF configurations, the R2 may be set to read/write disabled (not ready) if SYMAPI_RDF_RW_DISABLE_R2=ENABLE is set in the options file. For more information, refer to the .

Example

In the following example, the `createpair -establish` command:

- Creates device pairs using device pairs listed in a device file `devicefile`.
- Begins copying data to its targets, synchronizing the device pairs listed in the device file.

symrdf createpair -file devicefile -sid 55 -rdfg 1 -type R1 -establish

Create pairs with the -format option

The format option (`-format`) clears all tracks on the R1 and R2 sides to ensure no data exists on either side, and makes the R1 read write to the host. When you use this option to create dynamic pairs, an application cannot write to these devices until the device-format operations completes.

Restrictions

The `symrdf createpair -format` option has the following restrictions:

- Not supported in concurrent SRDF configurations
- SRDF device pairs cannot be created in an SRDF Witness group
- The R1 and R2 cannot be mapped to a host

Example

In this example, the `createpair -format` command:

- Creates device pairs using device pairs listed in a device file `devicefile`.
- Ignores the check to see if the host can write to its targets (`-nowd`).
- Sets the mode for the device pairs to synchronous (`-rdf_mode sync`).
- Clears tracks on the R1 and R2 sides to ensure no data exists on either side, and makes the R1 read write to the host (`-format`).

```
symrdf createpair -sid 66 -format -file devicefile -type r1 -rdfg 117
-rdf_mode sync -nop
```

Create pairs with the -invalidate option

Syntax

Use the `symrdf createpair` command with the `-invalidate r1` or `-invalidate r2` option to create devices (R1 or R2) in a new or existing configuration.

When the command completes, the pairing information is added to the SYMAPI database file on the host.

When the command completes, you can:

- Use the `establish` command to start copying data to the invalidated target devices.
- Use the `restore` command to start copying to the invalidated source device.
- Use the `query` command to check the progress of the establish operation:

For example:

```
symrdf -sid 55 -file devicefile establish -rdfg 1
```

```
symrdf -sid 55 -file devicefile query -rdfg 1
```

Once synchronized, you can perform various SRDF operations on SRDF pairs listed in the device file.

Example

In the following example, the `symrdf createpair` command:

- Creates new SRDF pairs from the list of device pairs in the file `devicefile`.
- The `-type R1` option identifies the first-column devices in the device file in array 55 as R1 type devices.

- The `-invalidate r2` option indicates that the R2 devices are the targets to be refreshed from the R1 source devices.
- The `-nowd` option bypasses the validation check to ensure that the target of operation is write disabled to its host.
- The SRDF pairs become members of SRDF group 1.

```
symrdf createpair -sid 55 -file devicefile -rdfg 1
-type R1 -invalidate r2 -nowd
```

Create pairs with the -restore option

Use the `-restore` option to copy data back to the R1 source devices.

Once the SRDF device pairs are created, the restore operation begins copying data to the source devices, synchronizing the dynamic SRDF device pairs listed in the device file.

Restrictions

- The device cannot be the source or target of a TimeFinder/Snap operation.
- Devices cannot be in the backend not ready state.
- The emulation type must be same (such as, AS/400 has specific pairing rules).
- SRDF device pairs cannot be created in an SRDF/Metro Witness group
- You cannot create pairs using the `-restore` option in any of these circumstances:
  - an optimizer swap is in progress on a device.
  - there are local invalid tracks on either the local or remote device.
  - an SRDF/A session is active and `-exempt` is not specified.
  - the SRDF group is in asynchronous mode and the devices being added are not the same SRDF type R1 or R2.
  - the SRDF group is in asynchronous mode with the SRDF links suspended and the `-restore` option is selected.
  - the SRDF group is enabled for SRDF consistency protection.
  - the operation involves one or more of the following unsupported devices: VCM DB, SFS, RAD, DRV, RAID-S, WORM-enabled devices, 4-way mirror, Meta member.

Example

```
symrdf createpair -sid 55 -file devicefile -rdfg 1 -type R1 -restore
```

Verify host cannot write to target devices with -nowd option

When the SYMAPI_RDF_CHECK_R2_NOT_WRITABLE parameter in the options file is enabled, it verifies that the host cannot write to the R2 devices during `createpair` operations (other than `createpair -invalidate <R1|R2>`). This parameter is disabled by default.

Use the `-nowd` option of the `symrdf createpair` command to bypass this check. The `-nowd` option applies to:

- R2 devices for all `createpair` actions

- R1 devices for the `createpair -invalidate R1`

Create dynamic concurrent pairs

In concurrent SRDF, R1 devices are mirrored concurrently to two R2 devices that reside in two remote arrays.

Use the `symrdf createpair` command to dynamically create concurrent SRDF pairs. This feature allows a second remote mirror to be dynamically added by converting a dynamic R1 device to a concurrent SRDF device. This command can also be used to create a concurrent SRDF device resulting in one SRDF/Metro mirror and one SRDF/A or Adaptive Copy SRDF mirror.

Two remote mirrors are supported for any dynamic R1 device. With Enginuity 5876 or later, both mirrors of a concurrent R1 device can be operating in SRDF/A mode.

Concurrent Operations on page 235 provides more information.

To dynamically create a second remote mirror using the `symrdf createpair` command, you must create two separate device files:

- One file containing the first set of R1/R2 device pairs, and
- A second device file listing the same R1 device paired with a different remote R2 device.

Restrictions

The following restrictions apply to creating dynamic concurrent SRDF pairs:

- The SRDF BCVs designated as dynamic SRDF devices are not supported.
- The two SRDF mirrors of the concurrent device must be assigned to different SRDF groups.
- The concurrent dynamic SRDF, dynamic SRDF, and concurrent SRDF states must be enabled on the array.
- With the `-restore` option, the `-remote` option is also required if the link status for the first created remote mirror is read/write.
- The following operations are blocked:
  - Adding an SRDF/Metro mirror when the device is already part of an SRDF/Metro configuration.
  - Adding an SRDF/Metro mirror when the device is already an R2 device.
  - Adding an SRDF R2 mirror to a device that has an SRDF/Metro RDF mirror.
  - Adding an SRDF/Metro mirror when the non-Metro RDF mirror is in Synchronous mode.
  - Adding an SRDF mirror in Synchronous mode when the device is already part of an SRDF/Metro configuration

Examples

In a previous example, the `createpair` command created dynamic device pairs in RDF group 1 using a device file named `devicefile`. As a result, devices in the first column of the device file were configured as R1 devices on array 55:

```
symrdf createpair -file devicefile -sid 55 -rdfg 1 -type R1
```

This example creates SRDF pairs from the list of devices in a second device file, `devicefile2`

- `-type R1` tells SRDF that devices listed in the first column of **devicefile2** are R1 type devices on array 55.
  Devices listed in the second-column become the second remote mirror devices.

- `-rdfg 2` configures the new SRDF device pairs as members of SRDF group 2.
- `-invalidate R1` marks the R1 devices to invalidate for a full copy when the SRDF pair is created.

```
symrdf createpair -sid 55 -rdfg 2 -file devicefile2 -type R1 -invalidate R1
```

Use the `createpair` command with the `-restore -remote` options to copy the data on the R2 devices to the R1 devices.

In this example:

- `-restore` begins a full copy from the target to the source, synchronizing the dynamic SRDF pairs in the device file.
- `-remote` copies data to the concurrent SRDF mirror when the concurrent link is ready.

Note

These operations require the remote data copy option, or the concurrent link to be suspended.

```
symrdf createpair -file devicefile2 -sid 55 -rdfg 2 -type R1 -restore -remote
```

Note

The concurrent mirror device pairs must belong to a separate RA group than those defined in the first device file pairing.

Deleting dynamic SRDF device pairs

This section shows how to delete dynamic SRDF pairs.

Delete a dynamic SRDF pair

The `deletepair` operation:

- Cancels the dynamic SRDF pairs.
- Removes the pairing information from the array and the SYMAPI database,.
- If the device file option (`-file` *`Filename`*) is specified, changes the specified devices to non-SRDF devices (except for concurrent SRDF pairs).
- If the group option (`-g` *`GroupName`*) is specified, changes the device group to a regular device group (except when an SRDF concurrent pair exists).
  When deleting pairs using the group option:

  If additional devices were added to the device group before the `symrdf deletepair` command is issued, those added devices are also changed to non-SRDF devices, and the device group is changed to a regular device group, only if the added devices contained within it were dynamic devices. If the device group contained both SRDF and non-SRDF devices, the device group would be changed to an Invalid state.

Note

To prevent a device group or a composite group from becoming invalid, first remove the devices from the group before performing the `deletepair` action on a device file.

After execution of the `symrdf deletepair` command, the dynamic SRDF pairs are canceled.

NOTICE

Suspend the SRDF links using the `symrdf suspend` command before using the `symrdf deletepair` command.

Restrictions

The `deletepair` operation fails when any of the following conditions exist:

- The device is in one of the following BCV pair states: Synchronized, SyncInProg, Restored, RestoreInProg, and SplitInProg.
- There is a background BCV split operation in progress.
- Devices in the backend are not in the ready state.
- There is an optimizer swap in progress on a device.
- SRDF consistency protection is enabled and the devices were not suspended with the `-cons_exempt` option.
- The SRDF links are not suspended.

Examples

To delete pairs for a device group:

- `symrdf suspend` suspends the SRDF links for group NewGrp
- `symrdf deletepair` changes Newgrp to a non-SRDF group

```
symrdf suspend -sid 55 -g NewGrp
```

```
symrdf deletepair -sid 55 -g NewGrp
```

To delete pairs using a device file:

- `symrdf suspend` suspends the SRDF links for the devices listed in `devicefile`,
- `symrdf deletepair` deletes the specified SRDF pairs. The devices become non-SRDF devices.
- `-rdfg 2` specifies the SRDF group number:

```
symrdf suspend -sid 55 -file devicefile -rdfg 2
```

```
symrdf deletepair -sid 55 -file devicefile -rdfg 2
```

Clear local invalid tracks

Use `-symforce` with the `symrdf deletepair` command to:

- Remove the SRDF relationship between the R1 and R2 devices
- Clear any local invalid tracks on these devices.

Note

This functionality is not available for diskless devices and does not delete any device pairs containing R11, R21, or R22 devices.

Examples

- To suspend the SRDF relationship for device pairs listed in device file `devicefile`:

  `symrdf suspend -sid 55 -rdfg 112 -file devicefile`

- To delete the device pairs listed in device file `devicefile`:

  `symrdf deletepair -sid 55 -rdfg 112 -symforce -file devicefile`

Delete one-half of an SRDF pair

The `half_deletepair` command dynamically removes the SRDF pairing relationship between R1/R2 device pairs. One-half of the specified device pair is converted from an SRDF device to a regular device.

Note

In Concurrent SRDF configurations, the concurrent SRDF device is converted to a non-concurrent SRDF device.

The `half_deletepair` command can be specified using a device file or device group.

When specified using a device file, all devices listed in the first column of the file are converted to regular devices (non-SRDF). Devices in Concurrent SRDF configurations are converted to non-concurrent SRDF devices.

Concurrent SRDF operations and applicable pair states on page 468 lists the applicable SRDF pair states for `half_deletepair` operations.

Note

Suspend the SRDF links using the `symrdf suspend` command before using the `half_deletepair` command.

You can use the `symrdf list -half_pair` command to list all half pair devices for a specified SID or SRDF group. In addition to `half_deletepair` operations, half pairs can result from `symrdf failover` operations or configuration changes.

Restrictions

The `symrdf half_deletepair` command fails when any of the following situations exist:

- The device is in one of the following BCV pair states: Synchronized, SyncInProg, Restored, RestoreInProg, and SplitInProg.
- There is a background BCV split operation in progress.
- Devices in the backend are not in the ready state.
- There is an optimizer swap in progress on a device.
- SRDF consistency protection is enabled and the devices were not suspended with the `-exempt` option.
- The SRDF links are not suspended.

Examples

To remove the SRDF pairing from device group Prod and convert the devices assigned to Prod to regular (non-SRDF) devices, leaving their remote partners as SRDF devices:

symrdf suspend -g Prod

symrdf -g Prod half_deletepair

To remove the SRDF pairing of SRDF group 4 on array 1123 and convert one-half of those device pairs to regular (non-SRDF) devices:

symrdf suspend -sid 123 -rdfg 4 -file devicefile

symrdf half_deletepair -sid 123 -rdfg 4 -file devicefile

Group, move and swap dynamic devices

This section shows how to group, move and swap dynamic SRDF devices.

Creating a device group using a device file

Device groups are the primary method to manage SRDF devices.

An SRDF device file allows you to manage the devices specified in the file as a single entity.

Procedure

1. Create a list of device pairings in a device file.
2. Use the `createpair` command to create the dynamic SRDF pairs,
3. Use the `-g` *`GroupName`* option to add the devices in the device file to a device group with the specified name.

   For example, to create dynamic devices as specified in file `devicefile` and add them to a group named Newgrp:

   ```
   symrdf createpair -sid 55 -rdfg 2 -file devicefile -type rdf1
   -invalidate r2 -g NewGrp
   ```

   All SRDF commands for these dynamic pairs can now be executed within the context of the `NewGrp` device group.
4. Use the `-g` *`GroupName`* option to perform operations on all the dynamic SRDF pairs in the group.

   For example, establish the group:

   symrdf -g NewGrp establish

Move dynamic SRDF device pairs

This section shows how to move dynamic SRDF pairs.

Note

There is no need to fully resynchronize the devices when performing the move. The current invalid track counters on both R1 and R2 stay intact.

Move SRDF pairs

Use the `movepair -new_rdfg` *GrpNum* command to move SRDF pairs.

For SRDF/A sessions, use the consistency exempt (`-cons_exempt`) option to move into an active SRDF/A session without affecting the state of the session or requiring that other devices in the session be suspended.

To move devices out of an active SRDF/A session without affecting the state of the session, first suspend the devices using the `-exempt` option.

After a successful move, the pair state is unchanged.

Control operations for R1 - R2 pair states on page 456 lists the applicable SRDF pair states for `movepair` operations.

Syntax

SRDF pairs can be moved for a device file, storage group, or device group:

```
symrdf -file Filename -sid  SID -rdfg GrpNummovepair -new_rdfg
GrpNum

symrdf -sg SgName -sid SymmID -rdfg GrpNum movepair -new_rdfg GrpNum

symrdf -g GroupName movepair -new_rdfg GrpNum
```

Note

The `-new_rdfg` *GrpNum* option is required.

Restrictions

The `movepair` operation has the following restrictions:

- A device cannot move when it is enabled for SRDF consistency.
- A device cannot move if it is in asynchronous mode when an SRDF/A cleanup or restore process is running.
- When moving one mirror of a concurrent R1 or an R21 device to a new SRDF group, the destination SRDF group must not be the same as the one supporting the other SRDF mirror.
- When issuing a full `movepair` operation, the destination SRDF group must connect the same two arrays as the original SRDF group.
- If the destination SRDF group is in asynchronous mode, the SRDF group type of the source and destination groups must match. In other words, in asynchronous mode, devices can only be moved from R1 to R1, or from R2 to R2.
- If the destination SRDF group is supporting an active SRDF/A session, the `-exempt` option is required.
- If the original SRDF group is supporting an active SRDF/A session, the device pairs being moved must have been suspended using the `-exempt` option.

Move one-half of an SRDF pair

The `half_movepair` operation moves only one side of a dynamic SRDF pair from one SRDF group to another.

The current invalid track counters on both R1 and R2 are preserved, so resynchronization is required.

This command moves the first device listed in each line of the device file to the new SRDF group.

After a successful `half_movepair` the pair state can go from partitioned to a different state or vice versa.

For example, when a `half_movepair` action results in a normal SRDF pair configuration, the resulting SRDF pair state will be Split, Suspended, FailedOver or Partitioned.

Example
To move one-half of the SRDF pairing of SRDF group 10 to a new SRDF group 15:

```
symrdf half_movepair -sid 123 -file devicefile -rdfg 10 -new_rdfg 15
```

SRDF mode after a movepair

After a `movepair` or `half_movepair` action, the resulting SRDF mode for the moved device is as follows:

- When moving a device *to* an SRDF group that is currently in asynchronous mode, the resulting SRDF mode for the moved device is asynchronous.
- When moving a device *from* an SRDF group that is in asynchronous mode to an SRDF group that is not in asynchronous mode, the resulting SRDF mode for the moved device will be adaptive copy disk.

Swapping SRDF devices

With a dynamic swap, source R1 devices become target R2 devices and target R2 devices become source R1 devices.

The following general steps are required to perform an R1/R2 personality swap and resume SRDF operations:

1. Suspend the SRDF remote mirroring.
2. Perform a personality swap by converting the R1 to R2 and the R2 to R1 devices.
3. Determine the synchronization direction and synchronize the R1 and the R2 devices.
4. Resume remote mirroring.
   Host I/Os are accepted at the secondary site (now R1 device) and are remotely mirrored to the R2 device at the primary site.

Dynamic R1/R2 swaps switch the SRDF personality of the SRDF device group or composite group. Swaps can also be performed on devices in SRDF/A mode. Dynamic SRDF must be enabled to perform this operation.

Dynamic SRDF devices are configured as one of three types: RDF1 capable, RDF2 capable, or both. Devices must be configured as both in order to participate in a dynamic swap.

Required states before a swap operation

The current states of the various devices involved in the SRDF swap must be considered *before* executing a swap action.

The following table lists which states are legal for this operation.

Table 14 SRDF device states before swap operation

SRDF state	Source R2 invalids	Target R2 invalids	State after swap
Suspended with R1 Write Disabled	Refresh R1|R2	Refresh R1|R2	Suspended
R1 Updated	Refresh R1	NA	Suspended
Failed Over	Refresh R1	NA	Suspended

Display SRDF swap-capable devices

Syntax

Use the `symrdf list` command with the `-dynamic` option to display SRDF devices configured as dynamic SRDF-capable:

```
symrdf list -dynamic [-R1] [-R2] [-both]
```

Options

Use the command with no options to display all SRDF-capable devices.

-R1

Display all dynamic SRDF-capable devices that are configured as capable of becoming R1.

-R2

Display all dynamic SRDF-capable devices that are configured as capable of becoming R2.

-both

Display a list of dynamic SRDF-capable devices that are configured as capable of becoming R1 or R2.

From the displayed list, determine which dynamic devices you want to swap.

Device swap impact on I/O

After swapping source and target attributes, I/O is not allowed to the original R1 device, but I/O is allowed to the R2 device.

Incremental establish operation

Once devices are swapped, an `incremental establish` operation is initiated and the devices become immediately available on the link.

Refresh the data status

Swapping the R1/R2 designation of the SRDF devices can impact the state of your stored data.

The refresh action indicates which device does not hold a valid copy of the data before the swap operation begins. If you determine that the R1 holds the valid copy, the action of `-refresh R2` obtains a count of the tracks that are different on the R2 and marks those tracks to refresh from the R1 to the R2 device. The result is the opposite if you specify to `-refresh R1` as the option.

- `-refresh R1` — The R2 device holds the valid copy and the R1 device's invalid tracks are updated using the R2 data.
- `-refresh R2` — The R1 device holds the valid copy and the R2 device's invalid tracks are updated using the R1 data.

Syntax

You can issue the `swap` command for device groups, composite groups and device files:

```
symrdf [-g DgName |-cg CgName |-sg SgName |-f FileName] swap
   -refresh {r1 | r2}
   [-v | -noecho]
   [-force]
   [-symforce]
   [-bypass]
   [-noprompt]
   [-i Interval]
   [-c Count]
   [-hop2 | -bcv [-hop2] | -all | -rbcv | -brbcv]
   [-rdfg GrpNum]
   [-sid SID]
```

Note

`-sid`*`SID`* is required for `-sg` and `-f` operations.

Options

-bcv

Targets just the BCV devices associated with the SRDF device group for the **`swap`** action.

-all

Target both BCV and standard devices

-hop2

Targets the SRDF action at the group's second-hop devices in a cascaded SRDF relationship.
Use alone (without other options) to target standard devices. Use `-bcv -hop2` to target BCV devices.

Example

The following example:

- Swaps the R1 designation of the associated BCV RDF1 devices within device group ProdGrpB.
- Marks to refresh any modified data on the current R1 side of these BCVs from their R2 mirrors:

```
symrdf -g ProdGrpB -bcv swap -refresh R1
```

Dynamic swap restrictions

Dynamic swap operations have the following restrictions:

- Dynamic swap is not available on arrays if the R2 device is larger than the R1 device.

Note

Do not perform a dynamic swap on SRDF/A devices enabled for consistency protection or if the SRDF/A session is actively copying.

HYPERMAX OS

- Adaptive copy write pending is not supported when the R1 side of the SRDF pair is on an array running HYPERMAX OS. If the R2 side is on an array running HYPERMAX OS and the mode of the R1 is adaptive copy write pending, SRDF sets the mode to adaptive copy disk as a part of the swap.

Half-swap dynamic R1/R2 devices

Use a `half_swap` operation to swap one half of an SRDF relationship. This command changes an R1 mirror to an R2 mirror or an R2 mirror to an R1 mirror.

The `half_swap` operation has the following restrictions:

- The R2 device cannot be larger than the R1 device.
- A swap cannot be performed during an active SRDF/A session or when cleanup or restore is running.

Swap cascaded SRDF devices

Swapping of an R21 device in a cascaded SRDF relationship is allowed as long as the R21 device is converted into a concurrent R1 (R11) device.

You can convert a concurrent R1 device into an R21 device.

For example, in an R2->R11->R2 configuration, you can swap either side of the relationship:

- Swap R2-> to get R1-> R21->R2
- Swap R11-> R2 to get R2-> R21->R1

The following swap is allowed:

- Swap R1->R21 to get R2-> R11-> R2

The following swap is not allowed:

- Swap R21->R2 to get R1->R22-> R1

Dynamic failover operations

SRDF dynamic devices can be quickly failed over, swapped, and then re-established all within a single command-line operation.

Note

This functionality requires that dynamic devices be both RDF1 and RDF2 capable.

Dynamic failover establish

Use the `symrdf failover -establish` command as a composite operation on dynamic SRDF devices to quickly perform the following operations on SRDF devices in the specified group using a single command:

1. Failover the devices in the group.
   R2 devices in the group are made read/write enabled to their local hosts.

   Failover to target on page 75 provides a detailed explanation of a failover operation.
2. After the failover operation has completed, swap the SRDF pair personalities.
   R1 devices become R2 devices and the R2 devices become R1 devices.

   Dynamic swap restrictions on page 129 provides a detailed explanation with restrictions that apply when performing a dynamic swap operation.
3. Once the devices are dynamically swapped, perform an incremental establish operation.
   The devices become immediately available on the link.

   Establish an SRDF pair (incremental) on page 71 explains this operation.

Restrictions
The failover establish operation has the following restrictions:

- Both the R1 and the R2 devices in the failover must be dynamic SRDF devices.
- The R2 device cannot be larger than its R1 device.
- The swap cannot result in a cascaded R21<-->R21 device pair.
- This command cannot be executed on both mirrors of a concurrent R1 device (composite group operation). This swap would convert the concurrent R1 into a concurrent R2, with a restore on both mirrors of that concurrent R2.

NOTICE

The `symrdf failover -establish` operation does not support devices operating in asynchronous mode with a read/write link. This is because the R2 data is two or more HYPERMAX OS cycle switches behind the R1 data, and swapping these devices would result in data loss.

Dynamic failover restore

`symrdf failover -restore` swaps the R1 and R2 and restores the invalid tracks on the new R2 side (formerly R1) to the new R1 side (formerly R2).

You can execute this command for device groups, composite groups and device files. The devices in this failover can be using synchronous or asynchronous links.

Syntax

```
symrdf -g [-g DgName |-cg CgName |-sgSgName |-f FileName]
    [-bypass]
    [-noprompt]
    [-i Interval]
    [-c Count]
    [-hop2 | -bcv [-hop2] | -all | -rbcv | -brbcv]
    [-rdfg GrpNum]
    [-star]
```

```
    [-sid SID]

failover [- immediate | -establish | -restore [-remote]]
```

Note

`-sid SID` is required for `-sg` and `-f` operations.

Options

-immediate

Deactivates the SRDF/A session immediately, without waiting for the two cycle switches to complete before starting the **`failover -restore`** operation.

-establish

Begins copying data to invalidated targets, synchronizing the dynamic SRDF pairs once the SRDF pairs are created.

-restore

Causes the dynamic SRDF device pairs to swap personality and start an incremental restore.

-remote

Requests a remote data copy flag with failback, failover, restore, update, and resume. When the concurrent link is ready, data is copied to the concurrent SRDF mirror. These operations require the remote data copy option, or the concurrent link to be suspended.

Restrictions

- If an SRDF group being failed over is operating in asynchronous mode, then all devices in the group must be failed over in the same operation.
- The R1 and the R2 devices in the failover must be dynamic SRDF devices.
- The R2 device cannot be larger than its R1 device.
- The SRDF swap cannot result in a cascaded R21<-->R21 device pair.
- Not supported by any device group operations with more than one SRDF group.
- Cannot execute this command on both mirrors of a concurrent R2 device (composite group operation). This swap would convert the concurrent R2 into a concurrent R1, with a restore on both mirrors of that concurrent R1.

CHAPTER 4

SRDF/Asynchronous Operations

This chapter covers the following:

SRDF/Asynchronous operations overview

SRDF/Asynchronous (SRDF/A) is a long distance disaster restart solution with fast application response times.

SRDF/A maintains a dependent-write consistent copy between the R1 and R2 devices across any distance with no impact to the application.

SRDF/A restrictions

- All SRDF/A-capable devices running in asynchronous mode must be managed together in an SRDF/A session.
- For SRDF/A-capable devices enabled for consistency group protection, consistency must be disabled before attempting to change the mode from asynchronous.
- SRDF Automated Replication (SRDF/AR) control operations are currently not supported for SRDF/A-capable devices running in asynchronous mode.
- All SRDF/A sessions enabled within a consistency group operate in the same mode, multi-cycle or legacy (See SRDF/A cycle modes on page 135 for information on cycle modes.). For example, if:
  - SRDF group 1 connects Site A and Site B, both running HYPERMAX OS, and
  - SRDF group 2 Site A running HYMPERMAX OS and Site C running Enginuity 5876.
    - Group 1 can run in multi-cycle mode.
    - Group 2 must run in legacy mode.
      If both groups are in the same consistency group and are enabled together, then group 1 will transition from multi-cycle to legacy mode as a part of the enable.
- If there are tracks owed from the R2 to the R1, do not set mode to asynchronous.

Note

If tracks are owed to the R1 device, the `-force` option is required to make SRDF/A-capable devices in asynchronous mode Ready on the link.

TimeFinder snap and clone restrictions

- TF/Snap and TF/Clone operations affect whether SRDF devices are allowed to be set in asynchronous mode.
- TF/Snap and TF/Clone pair states impact setting SRDF devices to asynchronous mode.
- Some Snap and Clone operations are not be allowed SRDF/A-capable devices operating in asynchronous mode.
  Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide provides more information.

Move operations restrictions

After a `movepair` or `half_movepair` action, the resulting SRDF mode for the moved device is as follows:

- When moving a device to an SRDF group that is currently in asynchronous mode, the resulting SRDF mode for the device being moved is asynchronous.
- When moving a device from an SRDF group in asynchronous mode, the resulting SRDF mode for the device being moved is synchronous.

SRDF/A cycle modes

SRDF/A provides an R2 copy that is slightly behind its associated R1. Host writes are collected for a configurable interval (specified by the `-cycle_time` option) into delta sets. Delta sets are transferred to the remote array in predefined timed cycles.

Control of SRDF/A cycles varies depending on whether the array is running in legacy mode (Enginuity 5876) or multi-cycle mode (HYPERMAX OS):

Enginuity 5876
If either array in the solution is running Enginuity 5876, there are 2 cycles on the R1 side, and 2 cycles on the R2 side.

Each cycle switch moves the delta set to the next cycle in the process. This mode is referred to as "legacy mode".

A new capture cycle cannot start until the transmit cycle completes its commit of data from the R1 side to the R2 side, and the R2 apply cycle is empty.

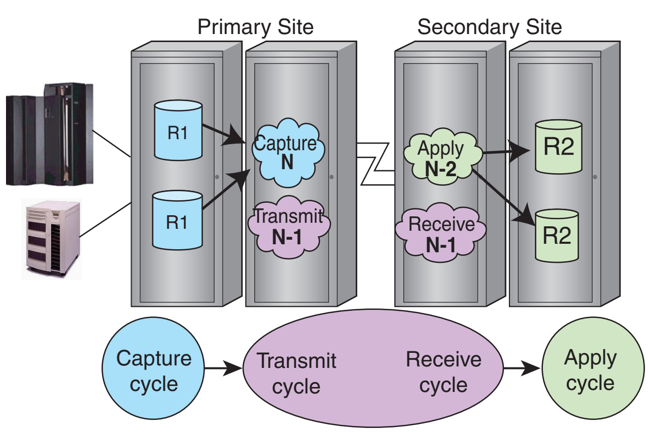
The basic steps in the life of a delta set in legacy mode include:

1. On the R1 side, host writes collect in the Capture cycle's delta set for a specified number of seconds.
   The length of the cycle is specified using the `-cycle_time` option.

   If a given track is overwritten multiple times, only the last write is preserved.
2. Once the cycle timer expires, and both the R1's Transmit cycle and the R2's Apply cycle are empty:
   - The delta set in the R2's Receive cycle is moved to the R2's Apply cycle, from which it is transferred to disk.
   - The delta set in the R1's Capture cycle is moved to the R1's Transmit cycle, from which it begins transferring to the R2's Receive cycle.
   - A new delta set is created as the R1 Capture cycle, to collect host writes. The delta set is received on the R2 side.

Subsequent host writes are collected into the next delta set.

Figure 12 SRDF/A legacy mode



Mixed configurations

When one array in an SRDF configuration is running HYPERMAX OS, and one or more other arrays are running Enginuity 5876:

- SRDF/A single sessions (SSC) have only two cycles on the R1 side (legacy mode)
- SRDF/A multi-session consistency sessions (MSC) operate in legacy mode.

When a delta set is applied to the R2 target device, the R1 and R2 are in the *consistent* pair state. The R2 side is consistently 2 cycles behind the R1 site.

In the event of a failure at the R1 site or of the SRDF links, a partial delta set of data can be discarded, preserving consistency on the R2. The maximum data loss of for such failures is two SRDF/A cycles or less.

Multiple devices or device groups that require consistency can be grouped into *consistency groups*. Members of consistency groups cycle at the same time, to ensure consistency among the members, and if one member is interrupted, all other members suspend.

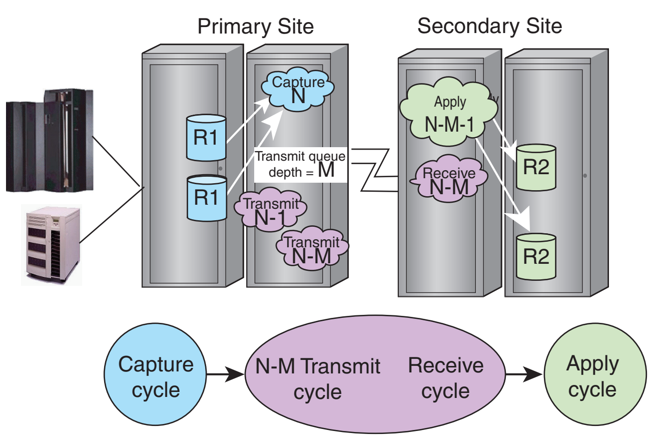
HYPERMAX OS

If both arrays in the solution are running HYPERMAX OS, both SSC and MSC operate in multi-cycle mode. There can be 2 or more cycles on the R1, but only 2 cycles on the R2 side. Cycle switches are decoupled from committing delta sets from the R1 to the R2.

When the preset Minimum Cycle Time is reached, the R1 data collected during the capture cycle is added to the transmit queue and a new R1 capture cycle is started. There is no wait for the commit on the R2 side before starting a new capture cycle.

The transmit queue holds cycles waiting to be transmitted to the R2 side. Data in the transmit queue is committed to the R2 receive cycle when the current transmit cycle and apply cycle are empty.

Figure 13 SRDF/A multi-cycle mode



Queuing allows smaller cycles of data to be buffered on the R1 side and smaller delta sets to be transferred to the R2 side.

The SRDF/A session can adjust to accommodate changes in the solution. If the SRDF link speed decreases or the apply rate on the R2 side decreases, more SRDF/A capture cycles can be added to the R1 side.

Data on the R2 side can be more than 2 cycles behind the R1.

In event of R1 failure or link failure, a partial delta set of data can be discarded, preserving consistency on the R2. The maximum data loss of for such failures can be more than two SRDF/A cycles.

The *EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS* and the *Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS* contain a detailed description of SRDF/A multi-cycle mode.

Protect the R2 side with TimeFinder BCVs

Dell EMC recommends that you use TimeFinder BCVs at the remote site to mirror R2 devices. This practice preserves a consistent image of data before resynchronization operations.

R2 device BCVs can be consistently split off of the R2 without dropping the SRDF links or disrupting 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.

Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide provides more information.

Drop SRDF/A session immediately

By default, the `failover`, `split`, and `suspend` operations cause SRDF to wait until the current cycle completes before dropping the session and making the devices Not Ready on the link. Completion time for these operations may be quite long.

Use the `-immediate` option in conjunction with `failover, split`, or `suspend` commands to immediately drop the SRDF/A session and make the devices Not Ready on the link.

The devices remain in asynchronous mode and pending tracks are converted to invalid tracks.

Use the `symrdf query -rdfa` command to display the number of tracks not committed to the R2 side and invalid tracks.

-immediate option restrictions

- The `-immediate` option applies only to devices participating in an active SRDF/A session.
- The `-immediate` option may result in remote invalid tracks on both the R1 and the R2 sides.
- The `-immediate` option does not compromise the consistency of data on the R2 side, but requires operator intervention to resolve any invalid tracks by using the correct `symrdf` command and pair state.
- If consistency is enabled on SRDF/A-capable devices, the `-force` option must used.

SRDF/Asynchronous operations

All SRDF/A operations (with the exception of consistency exempt, discussed later) must be performed on all devices in an SRDF group.

Thus, all devices in an SRDF group must be in the same SRDF device group. This is in contrast with SRDF/S, where operations can be performed on a subset of devices in an SRDF group.

The following table summarizes the operations described in this chapter.

Table 15 SRDF/A control operations

Control operation	Command	Description
Transition replication modes on page 139	symrdf set mode async	Change the mode of the an SRDF group, composite group or device list to asynchronous mode.
Set SRDF/A group cycle time, priority, and transmit idle on page 140	symrdf set rdfa	Set the cycle time, session priority, and transmit idle for and SRDF/A group.
Check for R1 invalid tracks on page 142	symrdf verify -noinvalids -consistent	Verify whether invalid tracks exist on both the R1 and R2 devices for a SRDF group, composite group or devices in a device list.
Consistency for SRDF/A devices on page 142	symrdf enable	Enable/disable consistency for a device group or devices in a device list.
Add/remove devices with the consistency exempt option on page 144	symrdf createpair symrdf suspend symrdf movepair symrdf resume symrdf verify	Dynamically add and remove device pairs from an active SRDF/A session.
Display checkpoint complete status on page 146	symrdf checkpoint	Display a checkpoint complete status when the data in the current cycle is committed to the R2 side.
Delta Set Extension management on page 147	symrdf set rdfa_dse symconfigure commit symcfg show	Set the SRDF/A DSE attributes for an SRDF group. Enginuity 5786 only: Add/remove/enable devices in DSE pools. Associate a DSE pool with and SRDF group. Monitor/display DSE pools.
Activate/deactivate SRDF/A DSE on page 155	rdfa_dse_autostart symrdf activate/deactivate	Activate/deactivate SRDF/A DSE.
Manage transmit idle on page 156	symrdf set rdfa -transmit_idle	Allow SRDF/A sessions to manage transient link outages without dropping.
Manage SRDF/A write pacing on page 156	symrdf set rdfa_pace symrdf -rdfa_pace activate symrdf -rdfa_pace deactivate symrdf -rdfa_wpace_exempt	Enable SRDF/A write pacing for groups or devices.
Display SRDF/A on page 163	symdg show	Display SRDF/A sessions.

Table 15 SRDF/A control operations (continued)

Control operation	Command	Description
	symrdf -g *DgName*query -rdfa	Display SRDF/A groups.
List SRDF/A- capable devices on page 163	symrdf list -rdfa	List SRDF/A capable devices.

Transition replication modes

To transition a device or group to asynchronous mode:

- Create a new device group specifying the mode as asynchronous, or
- Transition an existing SRDF device or group to asynchronous from another mode.

The time it takes for devices or groups to transition from one mode to asynchronous mode varies depending on the original mode:

- From synchronous mode:
  If the devices are in a Synchronized state, the R2 devices already have a consistent copy.

  Enabling SRDF/A provides consistent data on the R2 immediately.
- From adaptive copy disk mode:
  Invalid tracks owed to the R2 are synchronized.

  Enabling SRDF/A provides consistent data on the R2 in two cycles.
- From adaptive copy write pending mode:
  Write pending slots are merged into the SRDF/A cycles.

  Enabling SRDF/A provides consistent data on the R2 two cycles after there are no more write pending slots.

Transition to asynchronous mode

Syntax

Use the `set mode async` operation to set the mode to asynchronous for a device group, composite group, or devices in a device file:

```
symrdf -g DgName set mode async
symrdf -cg CgName set mode async
symrdf -file Filename set mode async
```

Examples

To set device group **`prod`** to asynchronous mode:

`symrdf -g prod set mode async`

To set composite group **`Comp`** to asynchronous mode:

`symrdf -cg Comp set mode async`

To set the devices listed in **`device.txt`** to asynchronous mode:

`symrdf -file device.txt set mode async`

Note

This operation may not be allowed on TimeFinder/Snap and TimeFinder/Clone device pairs. SRDF set operations for TimeFinder/Snap sessions on page 491 and SRDF set operations for TimeFinder/Clone sessions on page 505 provide more information.

Transition to synchronous mode

You can transition an SRDF/A device or device group to synchronous mode without losing consistency. Consistency on the R2 side is preserved.

The amount of time to complete the transition varies depending on whether the mode is legacy or multi-cycle:

- In legacy mode, the switch from asynchronous to synchronous requires two SRDF/A cycle switches to complete.
- In multi-cycle mode, the amount of time required includes the time to commit the current capture cycle and all cycles currently in the transmit queue to the R2 side.

Syntax

Use the `-consistent set mode sync` operation to set the mode to synchronous for a device group, storage group, or devices in a device file:

```
symrdf -g DgName -consistent set mode sync
symrdf -sg SgName -consistent set mode sync
symrdf -file Filename -consistent set mode sync
```

Examples

To switch modes from asynchronous to synchronous and maintain R2 data consistency in group `prod`:

`symrdf -g prod -consistent set mode sync`

To switch modes from asynchronous to synchronous and maintain R2 data consistency for devices listed in device file `devfile1`:

`symrdf -f devfile1 -consistent set mode sync`

Set SRDF/A group cycle time, priority, and transmit idle

SRDF/A configuration parameters include array-wide parameters, and group level settings.

Dell EMC Solutions Enabler Array Controls and Management CLI User Guide shows how to set the following SRDF/A array-wide parameters:

- SRDF/A cache usage - The percentage of write pending slots available to SRDF/A. Raising the value increases how much cache SRDF/A can use. Lowering the value reserves additional cache for non-SRDF/A cache usage.
- Maximum host throttle time - When the write pending limit is reached, delays writes from the host until a cache slot becomes free.

Syntax

To set the SRDF/A group-level attributes on an SRDF group:

```
symrdf -sid SymmID -rdfg GrpNum [-v] [-symforce]
```

```
      [-noprompt] [-i Interval] [-c Count]

.............

set rdfa
     [-cycle_time 1 - 60]
     [-priority 1 - 64]
     [-transmit_idle {on|off}]
     [-both_sides]
```

Options

-cycle_time (-cyc)

Sets the minimum time to wait before attempting an SRDF/A cycle switch.

Valid values are 1 through 60 seconds.

The default value for Enginuity 5876 and later is 15 seconds.

-priority (-pri)

Sets which SRDF/A sessions are dropped if the cache becomes full.

Valid values are 1 (highest priority, last to be dropped) through 64 (lowest priority).

The default value is 33.

-transmit_idle (-tra)

Allows the SRDF/A session to wait (not drop) when the link cannot transmit data.

Valid state values are on and off.

The default value is on.

-both_sides

Applies the SRDF/A attributes to both the source and target sides of an SRDF/A session.

If `-both_sides` is not specified, attributes are applied only to the source side.

Examples

To set the minimum cycle time for both sides of SRDF/A group 160:

`symrdf -sid 134 -rdfg 160 set rdfa -cycle_time 32 -both_sides`

To set the session priority for both sides of SRDF/A group 160:

`symrdf -sid 134 -rdfg 160 set rdfa -priority 55 -both_sides`

To set the cycle time and session priority for only the source side of SRDF/A group 12:

`symrdf -sid 134 -rdfg 12 set rdfa -cycle_time 32 -priority 20`

```


An RDF Set 'Attributes' operation execution is in progress for RDF group 12.
Please wait...
    SRDF/A Set Min Cycle Time(1134,012)..........................Started.
    SRDF/A Set Min Cycle Time (1134,012).........................Done.
    SRDF/A Set Priority (1134,012)...............................Started.
```

```
    SRDF/A Set Priority (1134,012)........................,,,,,Done.
The RDF Set 'Attributes' operation successfully executed for RDF group 12.
```

Check for R1 invalid tracks

Under normal operations, the `symrdf verify -consistent` command verifies that SRDF device pairs are in the R2 Consistent pair state. No invalid tracks are owed to the R2 side from its R1 side.

When an SRDF pair is in the Split state and the host writes to its R2 device, invalid tracks are owed to its R1 device.

Once the pair is restored, the pair is still in the Consistent state because no invalid tracks are owed to the R2 device. SRDF does not recognize invalid tracks owed from R2 to R1.

The `symrdf verify` command with `-noinvalids` and `-consistent` options performs an additional check to verify whether invalid tracks exist on both the R1 and R2 devices.

Syntax

Use the `symrdf verify` command with `-noinvalids` and `-consistent` options to verify invalid tracks on device groups, composite groups, storage groups, and device files.

```
symrdf verify -g Dgname -consistent -noinv
symrdf verify -cg Cgname -consistent -noinv
symrdf verify -sg SgName -consistent -noinv
symrdf verify -file Filename -consistent -noinv
```

Example

To monitor the clearing of invalid tracks every 60 seconds for the device group `dg1`:

`symrdf verify -g dg1 -consistent -noinv -i 60`

```
None of the devices in the group 'dg1' are in 'Consistent with no
invalid tracks' state.

Not all devices in the group 'dg1' are in 'Consistent with no
invalid tracks' state.

All devices in the group 'dg1' are in 'Consistent with no invalid
tracks' state.
```

Consistency for SRDF/A devices

The consistency feature ensures the dependent-write consistency of the data distributed across multiple R1 devices. The R1 and R2 devices can be distributed across multiple primary and secondary arrays.

Consistency groups are groups of SRDF devices enabled for database consistency. SRDF devices that belong to the same consistency group act in unison to preserve dependent-write consistency of a database distributed across multiple devices within the consistency group.

The consistency group ensures that remote mirroring is suspended for all SRDF devices in a consistency group as soon as one SRDF device in the group fails to send data across the SRDF links.

- Use the `enable` argument to enable consistency protection for devices in SRDF/Asynchronous mode by device group or device list.
  When consistency is enabled, and data cannot be copied from the R1 to the R2, all devices in the group will be made not ready on the links.
- Use the `disable` argument to disable consistency protection for devices in SRDF/Asynchronous mode by device group or device list.
  When consistency is disabled, and data cannot be copied from the R1 to the R2, only the devices in the group that are experiencing problems will be made not ready on the links. The device state for any remaining devices in the group will remain the same.

Enable consistency for SRDF/A devices

You can enable consistency for SRDF/A device pairs in a device group, storage group, or devices in a device file.

NOTICE

For concurrent SRDF configurations, you must enable consistency for each R2 mirror separately.

Syntax

```
symrdf -g DgName -sid SID-rdfg GrpNum enable
symrdf -sg SgName -sid SID -rdfg GrpNum enable
symrdf -file Filename -sid SID-rdfg GrpNum enable
```

To use the `-file` *`Filename`* option:

- All device pairs in that SRDF group must be in the device file.
- If the device file includes concurrent devices, only the R2 side specified by the `–sid` *`SID`*`-rdfg` options is enabled.
  The device group on the second R2 side is not enabled.

To use the `-g` *`DgName`* option:

- All device pairs in that SRDF group must be in the device group.
- If the device group includes concurrent devices, only the R2 side specified by the `-sid` *`SID`*`-rdfg` option is enabled.

Restrictions

Because you must enable consistency for each R2 mirror separately in a concurrent relationship, you cannot use the `-rdfg all` option.

Examples

To enable consistency protection for SRDF/A pairs in device group `prod`:

`symrdf -g prod enable`

To enable consistency protection for SRDF/A pairs listed in device file `devfile1`:

`symrdf -file devfile1 -sid 123 -rdfg 10 enable`

To enable consistency for devices in device file `FileOne`:

`symrdf -f FileOne -sid 123 -rdfg 55 enable`

To enable consistency for R2 devices in a concurrent configuration (SRDF group 56 and SRDF group 57) of `devgroup2` :

`symrdf -g devgroup2 -rdfg 56 enable`

`symrdf -g devgroup2 -rdfg 57 enable`

Disable consistency for SRDF devices

When consistency is disabled, and data cannot be copied from the R1 to the R2, only the devices in the group that are experiencing problems will be made not ready on the links. The device state for any remaining devices in the group will remain the same.

Syntax

```
symrdf -g DgName -sid SID -rdfg GrpNum disable
symrdf -file Filename -sid SID -rdfg GrpNum disable
```

Examples

To disable consistency protection for SRDF/A pairs in device group `prod`:

`symrdf -g prod disable`

To disable consistency protection for SRDF/A pairs listed in device file `devfile1`:

`symrdf -file devfile1 -sid -rdfg 10 disable`

Add/remove devices with the consistency exempt option

Note

The consistency exempt option (`-exempt`) is available with Enginuity 5876 and higher.

Use the consistency exempt option to dynamically add and remove device pairs from an active SRDF/A session without affecting:

- The state of the session, or
- Reporting of SRDF pair states for devices that are not the target of the operation

When enabled, the consistency exempt option places devices into a consistency exempt state. Exempt devices are excluded from the group's consistency check.

After the operation is complete, the consistency exempt state is automatically terminated. Specifically, consistency is terminated when:

- The target devices are resumed and fully synchronized and
- Two full cycle switches have occurred, or
  The devices are removed from the group.

The `-exempt` option can be used with the following commands:

- `createpair`
  The SRDF pairs become consistency exempt in the SRDF group in which they are created.
- `movepair`, `half_movepair`
  The SRDF pairs become consistency exempt in the target SRDF group into which they are moved.

- `suspend`
  Device pairs become consistency exempt in their current SRDF group. Device pairs moved from one group to another can be suspended with consistency exempt without effecting other devices in their group.

When devices are suspended and consistency exempt (within an active SRDF/A session) they can be controlled apart from other devices in the session. This is useful for `resume`, `establish`, `deletepair`, `half_deletepair`, `movepair`, and `half_movepair` operations.

Restrictions

- The consistency exempt option cannot be used for:
  - Devices that are part of an SRDF/Star configuration.
  - An SRDF/A session that is in the Transmit Idle state.
- If the device is an R2 device and the SRDF/A session is active, the `half_movepair` and `half_deletepair` commands are not available.
- If the session is deactivated before the consistency exempt state is cleared, when re-activated, the device remains in the consistency exempt state until the device has no invalid tracks that need to be synchronized.
- A `movepair` operation of an SRDF pair to another SRDF group with an active SRDF/A session is only allowed when the SRDF pair state is suspended and can be blocked if in the failed over or split pair state.
- The `createpair` and `movepair` operations are allowed without the –`cons_exempt` option if the new SRDF group is operating in the asynchronous mode but the SRDF/A session is not active.

Adding device pairs to an active SRDF/A session

The following procedure uses device file "Myfile" to add device pairs to an active SRDF/A session.

Procedure

1. Use the `createpair -establish` operation to create the new device pairs, add them to a temporary SRDF group (10), and synchronize:

   ```
   symrdf createpair -file Myfile -sid 1234 -rdfg 10 -type RDF1 -
   establish
   ```

2. Use the `verify -synchronized` operation to monitor synchronization:

   ```
   symrdf verify -file MyFile -sid 1234 -rdfg 10 -synchronized
   ```

   When the device pairs are synchronized:

3. Use the `suspend` operation to suspend the device pairs in the temporary group so they can be moved to the active SRDF/A group:

   ```
   symrdf suspend -file MyFile -sid 1234 -rdfg 10
   ```

   Note

   Since the temporary group is synchronous, you cannot use the consistency exempt option.

   ---

4. Use the `movepair` operation with the `-exempt` option to move the device pairs from the temporary SRDF group to the active SRDF/A group:

   ```
   symrdf movepair -file MyFile -sid 1234 -rdfg 10 -new_rdfg 20 -exempt
   ```

5. Use the `resume` operation to resume the device pairs:

   ```
   symrdf resume -file MyFile -sid 1234 -rdfg 20
   ```

6. Use the `verify -consistent -noinvalids` operation to display when the device pairs become consistent and there are no invalid tracks on the R1 and R2 sides:

   ```
   symrdf verify -file MyFile -sid 1234 -rdfg 20 -consistent -noinvalids
   ```

   NOTICE

   Do not enable host access to the R1 side until the pair state for the devices reaches Consistent.

Removing device pairs from an active SRDF/A session

The following example uses device file "Myfile" to remove device pairs from an active SRDF/A session.

Procedure

1. Use the `suspend` operation with the `-exempt` option to suspend the device pairs to be removed:

   ```
   symrdf suspend -file MyFile -sid 1234 -rdfg 20 -exempt
   ```

2. Use the `movepair` operation to move the device pairs from the current SRDF group to another SRDF group:

   ```
   symrdf movepair -file MyFile -sid 1234 -rdfg 20 -new_rdfg 30
   ```

3. Use the `resume` operation to resume the devices in their new group:

   ```
   symrdf resume -file MyFile -sid 1234 -rdfg 30
   ```

4. Use the `verify -synchronized` operation to monitor synchronization:

   ```
   symrdf verify -file MyFile -sid 1234 -rdfg 30 -synchronized
   ```

   NOTICE

   Do not enable host access to the R1 side until the pair state for the devices reaches Consistent.

Display checkpoint complete status

Use the `checkpoint` argument to display a checkpoint complete status when the data in the current cycle is committed to the R2 side.

The target devices must be in an active SRDF/A session.

Syntax

You can issue the `checkpoint` operation on a device group, composite group, storage group, or device file:

```
symrdf -g DgName [-i Interval] [-c Count] [-rdfg GrpNum]
        [-hop2 | -bcv [-hop2] | -all | -rbcv | -brbcv] checkpoint

symrdf -cg CgName [-i Interval] [-c Count][ -hop2 ]
     [-rdfg SID:GrpNum | name:GrpName] checkpoint

symrdf -sg SgName -sid SID -rdfg GrpNum
     [-i Interval] [-c Count] checkpoint

symrdf -file Filename -sid SID -rdfg GrpNum [-offline]
     [-i Interval] [-c Count] checkpoint
```

Options

-c *Count*

Number of times (Count) to repeat the operation before exiting.

-i *Interval*

Number of seconds to wait between successive iterations of the operation.
Default: 10 seconds.
Minimum interval: 5 seconds.

If -c *Count* is not specified and -i *Interval* is specified, the operation repeats continuously at the specified interval.

If -c *Count* is specified and -i *Interval* is not specified, the operation repeats the specified number of iterations using the default interval.

Restrictions

All specified devices must be in the same SRDF/A session.

Examples

To confirm R2 data copy for device group `prod`:

`symrdf -g prod checkpoint`

To confirm the R2 data copy for devices in device group `Test` in RA group 7 on the second hop of a cascaded SRDF configuration:

`symrdf -g Test -rdfg 7 -hop2 checkpoint`

Delta Set Extension management

Running many SRDF/A groups run on the same array creates complex I/O profiles with associated link availability and bandwidth issues. Together these complicate the task of calculating cache requirements.

SRDF/A Delta Set Extension (DSE) extends the cache space available for SRDF/A session cycles by off loading cycle data from cache to preconfigured pool storage. DSE helps SRDF/A to ride through larger and longer throughput imbalances than cache-based buffering alone.

DSE is enabled by default on arrays running HYPERMAX OS, and disabled by default on arrays running Enginuity 5876.

Note

DSE is not designed to solve permanent or persistent problems such as unbalanced or insufficient cache, host writes that consistently overrun cache, and long link outages.

When the SRDF/A session is activated, DSE is activated (on the R1 and R2 sides) if the autostart for DSE is set to enabled on both the R1 and the R2 sides. Autostart for DSE can be enabled/disabled, but the change does not take effect until the SRDF/A session is dropped and re-activated. By default, autostart for DSE is enabled regardless of whether the side is the R1 or R2 side.

DSE starts paging SRDF/A tracks to the DSE pool when the array write pending count crosses the DSE threshold (`-threshold` option). The default threshold is 50 percent of the System Write Pending Limit. After a cycle switch, Enginuity reads tracks from the DSE pool back into the array cache so that they can be transferred to the R2.

Enginuity 5876
Arrays running Enginuity 5876, can share SRDF/A DSE pools among multiple SRDF/A groups. A single SRDF/A group can have up to 4 DSE pools associated with it (one for each device emulation type).

HYPERMAX OS
Arrays running HYPERMAX OS come preconfigured with one or more Storage Resource Pools (SRPs) containing all the storage available to the array. SRDF/A DSE allocations are made against one SRP per array designated as the SRP for DSE.

The SRP designated for DSE supports the DSE allocations for all SRDF/A sessions on the array.

The default SRP for DSE is the default SRP for FBA devices.

You can change which SRP is associated with DSE, and you can change the capacity of the SRP associated with DSE.

Dell EMC Solutions Enabler Array Controls and Management CLI User Guide describes the steps to modify which SRP is associated with DSE.

DSE SRP capacity management (HYPERMAX OS)

This section describes the steps to modify the capacity of the DSE SRP for arrays running HYPERMAX OS.

The default SRP associated with DSE is configured prior to installation. You can create another SRP for use with DSE, but only one SRP per array can be associated with DSE. All SRDF/A sessions on the array use the one SRP designated for use with DSE.

- If you enable SRDF/A DSE (rdfa_dse attribute) on another SRP, that SRP becomes the SRP for all DSE allocations.
  The SRP that was previously designated to support DSE is automatically modified not to support DSE (its rdfa_dse attribute is set to disabled).
- If you disable the rdfa_dse attribute on the DSE SRP without designating another SRP to support DSE, the default SRP for FBA emulation automatically becomes the DSE SRP.

Restrictions

- CFGSYM access rights and Storage Admin authorization rights are required to run the symconfigure set command.
- If DSE requests for allocations exceed the maximum capacity of the DSE SRP, the SRDF/A session may drop.

- HYPERMAX OS does not support user defined DSE pools, and the following symrdf set commands are not supported:
  - symrdf set rdf_dse -fba_pool
  - symrdf set rdf_dse -ckd3390_pool
  - symrdf set rdf_dse -ckd3380_pool
  - symrdf set rdf_dse -as400_pool

Modify the DSE SRP capacity

Use the `symconfigure set symmetrix dse_max_cap` command to modify the capacity of the DSE SRP.

Syntax

```
symconfigure -sid SID commit -cmd "set symmetrix dse_max_cap =
MaxCap;"
```

Options

MaxCap

Specifies the maximum capacity in the array's DSE SRP. Valid values are:

- 1 - 100000 - Specifies the maximum number of GB in the specified SRP that can be used by DSE.
- NoLimit - Specifies that DSE can use the entire capacity of the specified SRP.

Examples

To set the maximum DSE capacity on SID 230 to a value of 100 GB:

```
symconfigure -sid 230 commit -cmd "set symmetrix dse_max_cap = 100;"

Execute a symconfigure operation for symmetrix '000197100230' (y/[n]) ? y

A Configuration Change operation is in progress. Please wait...

    Establishing a configuration change session...............Established.
    Processing symmetrix 000197100230
    {
          set symmetrix dse_max_cap=100;
    }

    Performing Access checks.................................Allowed.

     . . .
    Terminating the configuration change session..............Done.

The configuration change session has successfully completed.
```

To set the maximum DSE capacity on SID 230 to unlimited:

```
symconfigure -sid 230 commit -cmd "set symmetrix dse_max_cap = nolimit;"

Execute a symconfigure operation for symmetrix '000197100230' (y/[n]) ? y
.
.
```

```
.
The configuration change session has successfully completed.
```

DSE pool management - Enginuity 5876

This section describes DSE pool management on arrays running Enginuity 5876. These procedures do not apply to arrays that run HYPERMAX OS 5977 and higher.

Restrictions

- A DSE pool cannot have the same name as a Snap pool on the same array.
- Each DSE pool can only contain one type of device emulation: FBA, CKD3390, CKD3380, or AS400.
- Each SRDF group can have at most one pool of each emulation.

DSE pool best practices

- Configure DSE pools on both R1 and R2 arrays.
- Plan for peak workloads.
- Spread the DSE pool devices across as many disks as possible.
- Ensure that sufficient DA and RA CPU resources are available for the DSE task.
- To simplify management and make the most efficient use of resources, use as small a number of DSE pools as possible.
- Configure DSE pools and enable DSE on the primary and on the secondary array. When TimeFinder/Snap sessions are used to replicate either R1 or R2 devices, create two separate preconfigured storage pools: DSE and Snap pools.
- Configure a separate DSE pool for each device emulation type (FBA, IBMi, CKD3380 or CKD3390). You can create multiple DSE pools for different SRDF/A groups.

Best Practices for Dell EMC® SRDF®/A Delta Set Extension Technical Note provides more information.

Set SRDF/A DSE attributes for an SRDF group

Use the `set rdfa_dse` operation to set the SRDF/A DSE attributes for an SRDF group.

Note

The remote array must be reachable to complete this task.

For arrays running Enginuity 5876, the `symconfigure` command can also be used to set these SRDF/A DSE attributes. See the *Dell EMC Solutions Enabler Array Controls and Management CLI User Guide.*

Syntax

```
symrdf -sid SymmID -rdfg GrpNum [-v] [-symforce]
     [-noprompt] [-i Interval] [-c Count]
.............
set rdfa_dse
    [-autostart {on | off}]
    [-threshold 20 - 100]
```

```
    [-fba_pool PoolName]
    [-ckd3390_pool PoolName]
    [-ckd3380_pool PoolName]
    [-as400_pool PoolName>]
    [-both_sides]
```

Options

-autostart (-aut)

Whether SRDF/A DSE is automatically enabled or disabled when an SRDF/A session is activated for an SRDF group.
Valid values are on or off.

Default is off.

-threshold (-thr)

Percentage of the array's write pending limit. If cache usage of all active SRDF/A groups in the array exceeds this limit, data tracks for this SRDF group start to spill over to disks.
Valid values 20 - 100.

Default is 50.

-fba_pool (-fba) *PoolName*

Associates the pool *PoolName* containing SAVE devices with FBA emulation with the specified SRDF group.
If the argument *PoolName*is not specified, the currently associated FBA pool is removed from the group.

-ckd3380_pool (-ckd3380) *PoolName*

Associates the pool *PoolName* containing SAVE devices with CKD 3380 emulation with the specified SRDF group.
If the argument *PoolName*is not specified, the currently associated CKD 3380 pool is removed from the group.

-ckd3390_pool (-ckd3390) *PoolName*

Associates the pool *PoolName* containing SAVE devices with CKD 3390 emulation with the specified SRDF group.
If the argument *PoolName*is not specified, the currently associated CKD 3390 pool is removed from the group.

-as400_pool (-as400) *PoolName*

Associates the pool *PoolName* containing SAVE devices with an AS400 emulation with the specified SRDF group.
If the argument *PoolName*is not specified, the currently associated AS400 pool is removed from the SRDF group.

-both_sides

Sets the SRDF/A DSE attributes on both the source and target sides of an SRDF/A session.
If `-both_sides` is not specified, attributes are only applied to the source side.

Clear existing DSE pool names

Syntax

Use the `-_pool` commands with no *PoolName* argument to remove the association between the specified SRDF group and DSE pools.

Example

To clear the DSE pool names for all 4 emulation types:

`symrdf -sid 432 -rdfg 75 set rdfa_dse -fba_pool -ckd3390_pool -ckd3380_pool -as400_pool`

```
An RDF Set 'Attributes' operation execution is in progress for
RDF group 75. Please wait...
    SRDF/A Set FBA Pool (0432,075)....................................Started.
    SRDF/A Set FBA Pool (0432,075)....................................Done.
    SRDF/A Set CKD3380 Pool (0432,075)................................Started.
    SRDF/A Set CKD3380 Pool (0432,075)................................Done.
    SRDF/A Set CKD3390 Pool (0432,075)................................Started.
    SRDF/A Set CKD3390 Pool (0432,075)................................Done.
    SRDF/A Set AS400 Pool (0432,075)..................................Started.
    SRDF/A Set AS400 Pool (0432,075)..................................Done.

The RDF "Attributes'' operation successfully executed for RDF group 75.
```

Add devices to an SRDF/A DSE pool

Devices can be added to a DSE pool if they are:

- Disabled
- Inactive
- Do not belong to another pool

Syntax

To add and enable SAVE devices to a DSE pool:

```
add dev SymDevName[:SymDevName] to pool PoolName
type = <snap | rdfa_dse>
[, member_state = <ENABLE | DISAB ];
```

Example

```
add dev 018B:018C to pool finance,
type = rdfa_dse,
member_state=ENABLE;
```

Remove devices from an SRDF/A DSE pool

Remove SAVE devices from an SRDF/A DSE pool only if the devices are disabled and drained.

When a device is removed from a pool, it becomes available for use by other SAVE device pools.

Syntax

```
remove dev SymDevName[:SymDevName]
from pool PoolName,
type = <snap | rdfa_dse>;
```

Restrictions

The last device cannot be removed from an SRDF/A DSE pool if the pool is associated with an SRDF group.

Example

`remove dev 018B from pool finance, type = rdfa_dse;`

Enable/disable devices in an SRDF/A DSE pool

Devices in a DSE pool do not all have to be in the same state (enabled or disabled):

- If all the devices in a pool are disabled, the pool is disabled.
- If at least one device in a pool is enabled, the pool is enabled.

To enable or disable a range of devices, all the devices must be in the same pool.

All the devices in an SRDF/A DSE pool cannot be disabled if the pool is currently associated with an SRDF group and SRDF/A DSE is active for the group.

Syntax

```
enable dev SymDevName[:SymDevName] in pool PoolName,
type = <snap | rdfa_dse>;
```

Example

```
enable dev 018C in pool finance,
type = rdfa_dse;
```

Associating an SRDF group with a DSE pool

Create and manage SRDF/A DSE pools with command files and execute them using the **`symconfigure`** command.

To set the SRDF/A DSE threshold, associate an SRDF group with a pool, and activate DSE:

Procedure

1. Use the `symcfg list -sid SID-pools -rdfa_dse` command to list the configured DSE pools.
2. Create a text file containing the commands to set attributes for an SRDF group.

   The first command in the file must be to set the threshold.

   The following commands carry out the following for SRDF group 7.:

   - Set the threshold,
   - Associate with DSE pool `r1pool`,
   - Specify FBA emulation, and

- Enable autostart

```
set rdf group 7 rdfa_dse_threshold=20;
set rdf group 7 rdfa_dse_pool=r1pool, emulation=fba;
set rdf group 7 rdfa_dse_autostart=enable;
```

3. Use the `symconfigure commit` command to perform the operation:

```
symconfigure commit -sid 12 -file setup_dse.cmd
```

provides more information about the `symconfigure` command.

Display/monitor SRDF/A DSE pool usage

Use the `symcfg` show command to display the pool utilization for a specified SRDF/A DSE pool.

Syntax

```
symcfg show [-sid SmID] -pool PoolName -rdfa_dse
```

Example

To display the utilization for DSE pool BC_DSE:

symcfg show -sid 03 -pool BC_DSE -rdfa_dse

```
Symmetrix ID: 000194901103

Symmetrix ID                       : 000194901103
Pool Name                          : BC_DSE
Pool Type                          : Rdfa DSE
Disk Location                      : Internal
Technology                         : FC
Dev Emulation                      : FBA
Dev Configuration                  : 2-Way Mir
Pool State                         : Enabled
# of Devices in Pool               :    4
# of Enabled Devices in Pool       :    4
# of Related RDF Groups            :    1

Enabled Devices(4):
  {
   -----------------------------------------------------
   Sym         Usable       Free        Used Full Device
   Dev         Tracks      Tracks      Tracks  (%) State
   -----------------------------------------------------
   0228         17250        8682        8568   49 Enabled
   0229         17250       17062         188    1 Enabled
   022A         17250        8413        8837   51 Enabled
   022B         17250        8579        8671   50 Enabled
           ---------- ---------- ---------- ----
   Tracks       69000       42736       26264   38
```

Activate/deactivate SRDF/A DSE

There are several methods to activate SRDF/A DSE:

- Set the SRDF/A group parameter `rdfa_dse_autostart` to ENABLE.
  SRDF/A DSE becomes active when the SRDF/A session is activated.
- Modify the SRDF/A DSE status for a device group, composite group, or file when the SRDF link status is Read Write,
  This activates or deactivates SRDF/A DSE for groups on both the R1 and R2 sides.

  Note

  The SRDF links must be in asynchronous mode and SRDF/A must be active for activate or deactivate actions to succeed.

  Use the following commands to modify the device group, composite group, or file:

  `symrdf [-g DgName | -cg CgName | -f FileName]`

  `activate | deactivate -rdfa_dse`
- Modify the SRDF/A DSE status using RA group operations when the SRDF link status is Read Write.
  Use the following commands to modify the group:

```
symrdf -sid SID -rdfg GrpNum
      [-v][-noprompt]
      [-i Interval]
      [-c Count]

activate   -rdfa_dse  [-both_sides]
deactivate  -rdfa_dse [-both_sides]
```

  The `-both_sides` option activates/deactivates SRDF/A DSE for groups on both the source and target sides. Otherwise, the activate/deactivate is only performed on the source side.
- Set the group mode to `sync` or `acp` when SRDF/A DSE is active for an SRDF group.
  This method does not require deactivating SRDF/A DSE.

  Deactivating SRDF/A in a group automatically deactivates SRDF/A DSE for that group.

Restrictions

Restrictions on activating SRDF/A DSE with dynamic cache partitioning include:

- All devices in the SRDF/A session must be in the same DCP.
- The `rdfa_dse_threshold` must be set, and must be lower than the `rdfa_cache_percentage` setting.
- The SRDF group must have at least one associated DSE pool with SAVE devices enabled.

Use the following syntax to activate SRDF/A DSE when dynamic cache partitioning is enabled:

```
symrdf type activate -rdfa_dse
```

Valid values for *type* are `-dg`, `-cg`, `-file`, or `-rdfg`.

Note

After activation, R1 and R2 cache usage is reported as a percent of DCP Write Pending Limit.

Manage transmit idle

Transmit idle allows an SRDF/A session to manage transient link outages without terminating. If transmit idle is not enabled, the SRDF/A session terminates when the link cannot transmit data.

If transmit idle is enabled, a link failure starts the link limbo timer. If the link status is still Not Ready after the link limbo time expires, devices remain Ready to the link with a pair state of TransIdle.

Restrictions

When the SRDF pair is in the Transmit Idle state, only the following operations are allowed from the R1 side:

- `rw_enable -r1`
- `write_disable -r1`
- `ready -r1`
- `not_ready -r1`
- `suspend -immediate`

When the SRDF pair is in the Transmit Idle state, only the following operations are allowed from the R2 side:

- `suspend -immediate`
- `failover -immediate`

If at the beginning of a control action, all SRDF/A groups are not in the Transmit Idle state, the action fails if one of the groups enters the Transmit Idle state during processing.

Syntax

```
symrdf -sid SID -rdfg GrpNum [-v] [-symforce]
[-noprompt] [-i Interval] [-c Count]
.............

    set rdfa
        [-transmit_idle {on | off}]
        [-both_sides]
```

Example

To enable transmit idle on both sides for SRDF/A group 12:

`symrdf -sid 134 -rdfg 12 set rdfa -transmit_idle on -both_sides`

Manage SRDF/A write pacing

SRDF/A write pacing extends the availability of SRDF/A by preventing conditions that result in cache overflow on both the R1 and R2 sides. Write pacing balances cache utilization by extending the host write I/O response time to prevent SRDF/A operational interruptions.

There are two types of write pacing:

- group-level pacing
- device-level pacing

Group-level pacing

Group-level pacing is dynamically enabled for the entire SRDF/A group when slowdowns in host I/O rates, transmit cycle rates, or apply cycle rates occur. SRDF/A group-level write pacing monitors and responds to:

- Spikes in the host write I/O rates
- Slowdowns in data transmittal between R1 and R2
- R2 restore rates.

Group-level pacing controls the amount of cache used by SRDF/A. This prevents cache overflow on both the R1 and R2 sides, and helps the SRDF/A session to continue running.

Group-level pacing requires Enginuity 5876 or greater.

HYPERMAX OS introduced enhanced group-level pacing. Enhanced group-level pacing paces host I/Os to the DSE transfer rate for an SRDF/A session. When DSE is activated for an SRDF/A session, host-issued write I/Os are throttled so their rate does not exceed the rate at which DSE can offload the SRDF/A session's cycle data.

Enhanced group-level pacing requires HYPERMAX OS on the R1 side. The R2 side can be running either HYPERMAX OS or Enginuity 5876.

Enhanced group-level pacing responds only to the spillover rate on the R1 side. It is not affected by spillover on the R2 side.

Device-level pacing

Device-level pacing is for SRDF/A solutions in which the SRDF/A R2 devices participate in TimeFinder copy sessions.

Note

Device-level pacing is not supported in HYPERMAX OS.

SRDF/A device-level write pacing addresses conditions that lead to cache overflow specifically due to TimeFinder/Snap and TimeFinder/Clone sessions on an R2 device running in asynchronous mode.

Device-level write pacing requires Enginuity version 5876 or higher on both arrays.

Either or both write pacing options can be enabled or disabled. Both write pacing options are compatible with each other and with other SRDF/A features including tunable cache utilization, Reserve Capacity, and MSC.

Enginuity version 5876.82.57 or higher includes a global write pacing statistics report.

Group-level and device-level write pacing can be activated and controlled individually or simultaneously at the group, device group, composite group, or file level on the R1 side.

Both methods have an autostart capability that automatically activates write pacing whenever an SRDF/A session becomes active. If an SRDF group has both group-level and device-level pacing configured to autostart, both are activated when the SRDF/A session becomes active.

SRDF/A write pacing requirements

- The `activate` argument requires that the SRDF/A session be active and contain at least one participating device.
  This requirements does not apply to the autostart capability.

Write pacing operations

Write-pacing behavior varies by the type of pacing, the SRDF topology (2-site, cascaded, concurrent), and OS version.

Group-level pacing considerations

- Only the group-level pacing values configured for the SRDF group on the R1 side of the SRDF/A session are used.
- In a cascaded SRDF environment:
  - With Enginuity 5876 Q4 2012 SR and later, group-level write pacing is supported on both the R1->R21 and R21->R2 hops of the relationship.
- In a concurrent SRDF/A environment, group-level pacing is supported on both mirrors of the concurrent R1. In this case, write pacing calculations are performed independently for the two SRDF/A sessions, and the host write I/Os sessions are subject to the greater of the two calculated delays.

Device-level pacing considerations

- Only the device-level pacing values configured for the SRDF group on the R1 side of the SRDF/A session are used.
- In a cascaded SRDF environment:
  - With Enginuity 5876 Q4 2012 SR and later, device-level write pacing is supported on both the R1->R21 and R21->R2 hops of the relationship.
- There is no exemption from device-level pacing as there is for group-level pacing, and the R1 group-level exempt state does not affect device-level pacing.
- In a concurrent SRDF/A environment, device-level pacing is available on both mirrors of the concurrent R1. In this case, write pacing calculations are performed independently for the two SRDF/A sessions, and the host write I/Os sessions are subject to the greater of the two calculated delays.
- If both group-level pacing and device-level pacing are active for an SRDF/A session, the group-level and device-level delays are calculated independently, and the greater calculated value is used for pacing. Note that as many as four different calculation results may be taken into account for a concurrent R1 device with both mirrors operating in asynchronous mode (group-level pacing for each mirror, device-level pacing for each mirror), using the greatest calculated delay in the calculation.

Operations
SRDF/A write pacing bases some of its actions on the following:

- R1 side cache usage
- Transfer rate of data from transmit delta set to receive delta set
- Restore rate on the R2 side

SRDF/A group-level write pacing can respond to the following conditions:

- The write-pending level on an R2 device in an active SRDF/A session reaches the device's write-pending limit.

- The restore (apply) cycle time on the R2 side is longer than the capture cycle time.

The enhanced group-level write pacing feature can effectively pace host write I/Os in the following operational scenarios:

- Slower restore (apply) cycle times on specific R2 devices that are managed by slower-speed physical drives.
- FAST operations that lead to an imbalance in SRDF/A operations between the R1 and R2 sites.
- Sparing operations that lead to R2-side DAs becoming slower in overall restore operations.
- Production I/Os to the R2 side that lead to DAs and/or RAs becoming slower in restore operations.
- Restore delays during the pre-copy phase of TimeFinder/Clone sessions before activation.

The configuration and management of group-level write pacing are unaffected by this enhancement.

Devices that cannot be paced in a cascaded SRDF configuration

A source device might not be paced because it has been set exempt from group-level write pacing or because it is not currently pace-capable.

- Exempt source devices (R1 or R21) have been excluded from group-level write pacing using the `-rdfa_wpace_exempt` option of the `symrdf` command. Exempt devices can be paced by device-level write pacing.
- R21 devices (in an R21>R2 pair) are not pace-capable if the corresponding R1>R21 SRDF pair is read/write (RW) on the SRDF link and operating in an adaptive copy mode. A device that is not pace-capable cannot be paced by device-level write pacing or group-level write pacing. The `-force` option is required for actions that will cause a device to become not pace-capable.

Identifying devices that cannot be paced

Procedure

1. Use the `symcfg list` command with the `-rdfa` option to determine if the SRDF/A session includes devices that cannot be paced. This command provides the following information related to write pacing:

   - The state of write pacing (group-level and device-level) for the SRDF group
   - Whether write pacing is currently activated and supported
   - Whether write pacing is configured for autostart
   - Whether there are devices in the SRDF/A session that might not be paced either because they have been set exempt from group-level write pacing or because they are not pace-capable.

   To view write pacing information for SRDF group 153:

   `symcfg list -sid 1134 -rdfg 153 -rdfa`

```
Symmetrix ID : 000195701134
```

```
                  S Y M M E T R I X   R D F A   G R O U P S
-------- ---------- -------- ----- --- --- --------- ------------------------
                                                           Write Pacing

 RA-Grp  Group      Flags    Cycle Pri Thr Transmit   Delay  Thr GRP DEV FLGS
         Name       CSRM TDA time          Idle Time (usecs) (%) SAU SAU P
-------- ---------- -------- ----- --- --- --------- ------- --- --- --- ----
153 (98) lc153142   .IS- XI.    15  33  50 000:00:00   50000  60 I.- I.- X
.
.
    (FLGS) Flags for Group-Level and Device-Level Pacing:
      Devs (P)aceable : X = All devices, . = Not all devices, - = N/A
```

An X in the FLGS P column indicates that all of the devices in the SRDF group can be paced. A period in the FLGS P column indicates that some of the devices in the SRDF group cannot be paced either because they have been set exempt from group-level write pacing or because they are not pace-capable.

2. Use the `symrdf list` command to determine which devices cannot be paced.

   a. Use the `symrdf list` command with the `-rdfa_wpace_exempt` option to identify devices that are exempt from group-level write pacing.

   b. Use the `symrdf list` command with the `-rdfa_not_pace_capable` option to identify devices participating in the SRDF/A session that are not pace-capable.

3. Use the `symdev show` command to obtain additional information about the devices identified in the previous step. This command provides the following information related to write pacing:

   - Whether the device is exempt from group-level write pacing
   - Whether write pacing is currently activated and supported
   - Whether the device is pace-capable

   To view write pacing information for device 00d1:

   symdev show -sid 230 00d1

```
.
.
.
Write Pacing Information
            {
            Pacing Capable                     : Yes
            Configured Group-level Exempt State: Disabled
            Effective Group-level Exempt State : Enabled
            Group-level Pacing State           : Enabled
            Device-level Pacing State          : Disabled
.
.
.
```

Set SRDF/A group-level write pacing attributes

To set these group attributes, the remote side must be reachable.

Syntax

Use the `symrdf set rdfa_pace` command to set the SRDF/A write pacing attributes for an SRDF group.

```
symrdf -sid SID -rdfg GrpNum [-v] [-symforce]
     [-noprompt] [-i Interval] [-cCount]

.............

    set rdfa_pace
          [-dp_autostart {on | off}]
          [-wp_autostart {on | off}]
          [-delay 1 - 1000000]
          [-threshold 1 - 99]>
          [-both_sides]
```

Options

-dp_autostart (-dp_aut)

Whether SRDF/A device-level pacing is automatically enabled or disabled when an SRDF/A session is activated or deactivated for an SRDF group.
Valid state values are on or off.

Default is off.

-wp_autostart (-wp_aut)

Whether the SRDF/A group-level pacing feature is automatically enabled or disabled when an SRDF/A session is activated for an SRDF group.
Valid state values are on or off.

Default is off.

-delay (-del)

Sets the maximum host I/O delay, in microseconds, that the SRDF/A write pacing can cause.
Valid values are 1 through 1000000 microseconds.

Default is 50000 microseconds.

-threshold (-thr)

Sets the minimum percentage of the array write-pending cache at which the array begins pacing host write I/Os for an SRDF group.
Valid values are between 1 and 99.

Default is 60.

-both_sides

Sets the SRDF/A write pacing attributes on both the source and target sides of an SRDF/A session. Otherwise, these attributes are only set on the source side.

Note

If you plan on swapping the personalities of the R1 and R2 devices, configure the same SRDF/A write pacing values on both sides.

Examples

In the following example, SRDF/A group-level write pacing is enabled for SRDF group 12 with:

- A maximum of a 1000 microsecond delay
- A write pending cache threshold of 55 percent
  If the calculated delay is less than the specified delay (1000), the calculated delay is used.

```
symrdf -sid 134 -rdfg 12 set rdfa_pace -delay 1000 -threshold 55 -wp_autostart on
```

To display two entries for each attribute being applied; one for the source side and one for the target side, use the `-both_sides`, option:

```
symrdf -sid 432 -rdfg 75 set rdfa_pace -delay 500 -threshold 10 -wp_autostart on -
dp_autostart on -both_sides
```

Activate write pacing

Syntax

To activate and deactivate SRDF/A write pacing at the device-group level:

```
symrdf -g DgName [-v | -noecho] [-force] [-symforce]

        activate [-rdfa_dse | -rdfa_pace | -rdfa_wpace | -
rdfa_devpace] |

        deactivate [-rdfa_dse | -rdfa_pace | -rdfa_wpace | -
rdfa_devpace]|
```

Examples

To activate group-level write pacing for SRDF group 76:

```
symrdf -sid 123 -rdfg 76 activate -rdfa_wpace
```

Simultaneous group-level and device-level write pacing

When write pacing is active at both group-level and device-level, Enginuity monitors both the SRDF link performance of the SRDF/A session and the performance of the devices on the R2 side.

Restrictions

- The `symrdf activate/deactivate -rdfa_pace` commands act on all devices in the SRDF group.
- The R1 array is accessible.
- The SRDF/A session under control is active and contains at least one participating device.
- The `symrdf deactivate -rdfa_pace` command requires the following:
  - The R2 array is accessible to verify that there are no TimeFinder/Snap or TimeFinder/Clone sessions using the R2 devices before deactivating device-level pacing.

- If the SRDF/A session is in the transmit idle state, issue `symrdf deactivate -rdfa_pace -symforce` from the R1 side.

Examples

To activate group-level and device-level write pacing simultaneously for the ConsisGrp Consistency Group:

```
symrdf -cg ConsisGrp activate -rdfa_pace
```

To deactivate both group-level and device-level write pacing on the devices in `DeviceFile2`:

```
symrdf -file DeviceFile2 -sid 55 -rdfg 2 deactivate -rdfa_pace
```

Display SRDF/A

This section shows how to display information about: and.

1. SRDF/A groups using the `query` operation
2. Devices capable of participating in a SRDF/A session using the `list` operation

Note that the output of `list` and `query` operations varies depending on whether SRDF/A is in multi-cycle mode (HYPERMAX OS) or legacy mode (Enginuity 5876).

Show SRDF/A group information

Syntax

Use the `show` operation to display SRDF/A session status information:

```
symrdf show Dgname
```

Use the `query` operation to display SRDF/A group information:

```
symrdf -g DgName query -rdfa
```

Description

SRDF/A-capable devices in an SRDF group are considered part of the SRDF/A session. The session status is active or inactive, as follows:

- Active indicates the SRDF/A mode is active and that SRDF/A session data is being transmitted in operational cycles to the R2.
- Inactive indicates the SRDF/A devices are either Ready or Not Ready on the link and working in their basic mode (synchronous, semi-synchronous, or adaptive copy).

Note

If the links are suspended or a split operation is in process, SRDF/A is disabled and the session status shows as Inactive.

List SRDF/A- capable devices

Syntax

Use the `list` operation to list SRDF/A-capable devices (R1, R2 and R21 devices) that are configured in SRDF groups:

```
symrdf list -rdfa
```

Description

Note

SRDF/A-capable does not mean the device is actually operating in asynchronous mode, only that it is capable of doing so. There is no command that lists devices that are actually operating in asynchronous mode.

The device type shows as R1 for SRDF/A-capable devices on the R1 and as R2 for SRDF/A-capable devices on the R2.

The R21 device type represents a cascaded SRDF device configuration.

CHAPTER 5

SRDF/Metro Operations

This chapter covers the following:

SRDF/Metro Overview

The following sections contain an overview of SRDF/Metro and define its concepts.

What is SRDF/Metro?
SRDF/Metro is a high availability facility, rather than a disaster recovery facility as provided by other SRDF implementations.

In its basic form, SRDF/Metro consists of pairs of R1 and R2 devices, which are connected by an SRDF link, just like any other SRDF configuration. However, in SRDF/Metro both sets of devices are write accessible to host systems simultaneously. Indeed a pair of devices appears as a single, virtual device to the host systems. SRDF/Metro synchronously copies data written to either device in a pair to its partner. This ensures that both devices have identical content.

In SRDF/Metro the R1 and R2 devices are collectively known as a *Metro region*.

For connectivity requirements on HYPERMAX OS 5977 and Enginuity 5876 versionsSRDF/Metro, refer to the *SRDF Interfamily Connectivity Information*.

Bias
Equipment or communication failures can make either device unavailable or break the SRDF link. In such an event, SRDF/Metro uses a facility named *Bias* to determine which side remains accessible to the host system. There are three methods for deciding which side remains available:

- Device Bias
- Array Witness
- Virtual Witness

Device Bias uses a configuration setting of the device pair to specify which side remains available. Array Witness and Virtual Witness use a third party to decide, depending on the type of failure, which side remains available.

There is more information on the bias methods in Bias on page 168.

Disaster recovery
In its simplest form SRDF/Metro has no disaster recovery protection. However, the HYPERMAX OS 5977 Q3 2016 SR release adds disaster recovery capabilities.

Either of the participating arrays can be connected to an array at a remote location. Alternatively, for added robustness, each array can be connected to a remote array. The connections between the Metro region and the DR arrays use SRDF/A or Adaptive Copy Disk (ADP) to replicate data.

There is more information on disaster recovery for SRDF/Metro in Disaster recovery facilities on page 172.

Highlights of SRDF/Metro

In SRDF/Metro configurations:

- The R2 device is Read/Write accessible to the host.
- Host(s) can write to both R1 and R2 devices.
- The R2 device assumes the personality of the primary R1 device (such as geometry and device WWN).
  This shared identity causes the R1 and R2 devices to appear to hosts(s) as a single virtual device across the two arrays.

- There are two additional RDF pair states:
  - ActiveActive for configurations using the Array Witness or Virtual Witness resiliency methods
  - ActiveBias for configurations using the Device Bias resiliency method

  Bias on page 168 explains the concepts of Device Bias, Array Witness, and Virtual Witness.

  When an SRDF/Metro pair is RW on the SRDF link and has reached the ActiveActive or ActiveBias pair state, both sides of the SRDF device pair share the ID that the R1 device advertised at the time the devices were made RW on the link. Restore the native device personality on page 188 explains how to restore native device personality.

In addition:

- For SRDF/Metro configurations that are part of a Composite Group (CG), CG control and set operations are allowed on only one group at a time.
- All device pairs in an SRDF/Metro group are managed together for all supported operations, except for `createpair` and `deletepair` operations.

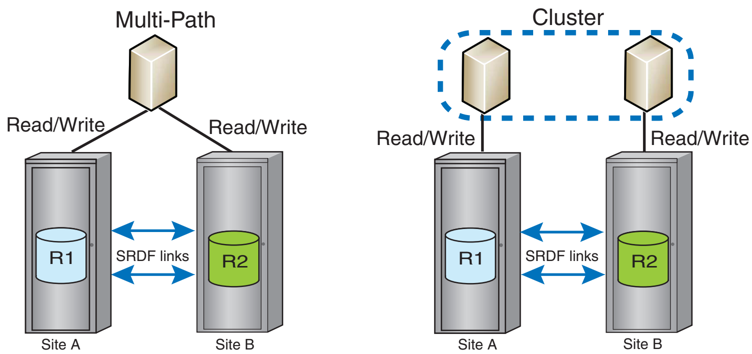
Note

Having multiple devices in a mixed parent storage group, that is one child SG has only R1 devices, another has only R2 devices, requires SRDF/Metro to be managed at the child SG level.

Deployment options

SRDF/Metro can be deployed in either a single host or a clustered configuration.

Figure 14 SRDF/Metro



In a single-host configuration, a single host computer generates I/O requests. Multi-pathing software (such as PowerPath) distributes the requests between both storage arrays.

In a 2-node cluster each node has dedicated access to an individual array.

Note

R1 and R2 devices should not be presented to a cluster until they reach either the ActiveActive or ActiveBias state and they present the same WWN.

In both configurations, writes to the R1 or R2 devices are synchronously copied to the paired device. The SRDF/Metro software resolves write conflicts to maintain consistent images on the SRDF devices pairs.

SRDF/Metro requires an appropriate license on both arrays.

VMAX3 and VMAX All Flash arrays can simultaneously support SRDF groups configured for SRDF/Metro operations and SRDF groups configured for traditional SRDF operations.

Bias

Bias determines which side of the SRDF device pair remains R/W accessible to the host if the SRDF link fails, or some other failure occurs (such as one of the storage arrays becoming unavailable). The *bias device* refers to the device that remains accessible to the host. That device appears as the R1 in Solutions Enabler (SE) displays and commands. The non-bias device appears as the R2 in SE displays and commands. Furthermore, the device side that contains the bias device is known as the *bias side*.

SRDF/Metro has three methods for deciding which side remains accessible following a failure:

- Device Bias
- Array Witness
- Virtual Witness

Device Bias

Device Bias is the simplest of the bias methods. When making device pairs available on the SRDF link, you use the `-use_bias` option to indicate that the bias method should be used for the device pairs. The bias side is the R1 side. However, if there is a failure on the array that contains the bias device, the host loses device access.

Note

The Device Bias method provides no way to make the R2 device available to the host.

To change the bias side of a device group, composite group, storage group, or devices from one side to the other, use the `set bias R1 | R2` option.

Note

On arrays running PowerMaxOS 5978, the set bias operation is only allowed if the SRDF/Metro session is not protected by a witness.

When operating with Device Bias the state of the device pair is ActiveBias.

Array Witness

When using the Array Witness method, SRDF/Metro uses a third "witness" array to determine the bias side. The witness array runs one of the following operating environments:

- PowerMaxOS 5978.xxx.xxx
- HYPERMAX OS 5977.945.890 or later
- HYPERMAX OS 5977.810.784 with ePack containing fixes to support SRDF N-x connectivity
- Enginuity 5876 with ePack containing fixes to support SRDF N-x connectivity

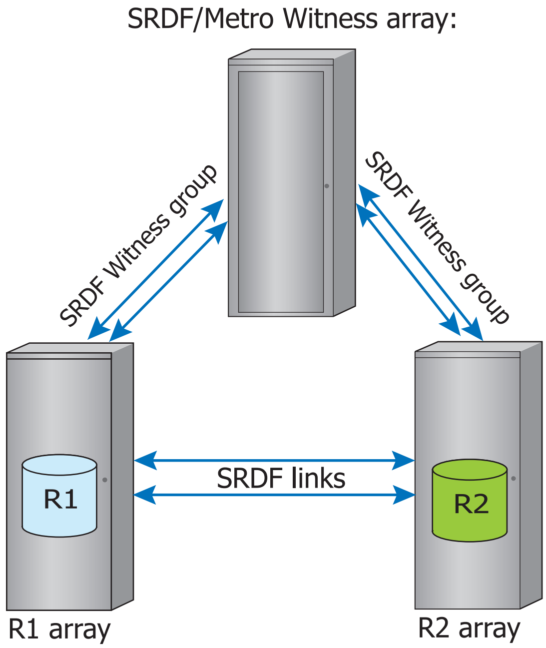
In the event of a failure, the witness decides which side of the Metro group remains accessible to hosts, giving preference to the bias side. The Array Witness method allows for choosing which side operations continue when the Device Bias method may not result in continued host availability to a surviving non-biased array.

The Array Witness must have SRDF connectivity to both the R1-side array and R2-side array. SRDF remote adapters (RA's) are required on the witness array with applicable network connectivity to both the R1 and R2 arrays.

For complete redundancy, there can be multiple witness arrays but only one witness array is used by an individual Metro group; the two sides of the Metro group agree on the witness array to use when the Metro group is activated. If the auto configuration process fails and no other applicable witness arrays are available, SRDF/Metro uses the Device Bias method.

The Array Witness method requires 2 SRDF groups; one between the R1 array and the witness array, and a second between the R2 array and the witness array. Neither group contains any devices.

Figure 15 SRDF/Metro Array Witness and groups



Solutions Enabler checks that the Witness groups exist and are online when carrying out establish or restore operations. SRDF/Metro determines which witness array an SRDF/Metro group is using, so there is no need to specify the Witness. Indeed, there is no means of specifying the Witness.

When the witness array is connected to both the SRDF/Metro paired arrays, the configuration enters Witness Protected state.

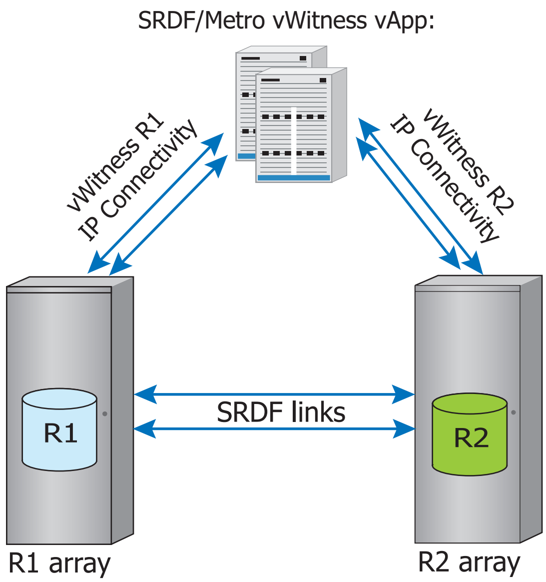
When the Array Witness method is in operation, the state of the device pairs is ActiveActive.

If the witness array becomes inaccessible from both the R1 and R2 arrays, HYPERMAX OSPowerMaxOS sets the R1 side as the bias side, the R2 side as the non-bias side, and the state of the device pairs becomes ActiveBias.

Virtual Witness (vWitness)

Virtual Witness (vWitness) is an additional resiliency option introduced in HYPERMAX OS 5977.945.890 and Solutions Enabler or Unisphere V8.3. vWitness has similar capabilities to the Array Witness method, except that it is packaged to run in a virtual appliance (vApp) on a VMware ESX server, not on an array. There can be up to 32 vApps, each providing a *vWitness instance*.

Figure 16 SRDF/Metro vWitness vApp and connections



The R1 and R2 arrays each contain a user-defined list of *vWitness definitions* that identify the vWitness instances that the array can use. A vWitness definition consists of a user-specified name and the location of the instance (either the IP address or the fully-qualified DNS name). The lists of vWitness definitions on each array do not have to be identical. However, they must have at least one definition in common. Initially, the R1 and R2 arrays negotiate which vWitness instance to use from the list of vWitness definitions that each array holds.

Should the SRDF links between the R1 and R2 arrays fail, or one of the arrays has a serious problem, the vWitness instance decides which array remains available to the host or hosts.

Unisphere for VMAX and SYMCLI provide facilities to manage a vWitness configuration. The user can add, modify, remove, enable, disable, and view vWitness definitions on the arrays. In addition, the user can add and remove vWitness instances. To remove an instance, however, it must not be actively monitoring SRDF/Metro activities.

Coexistence of witness bias methods

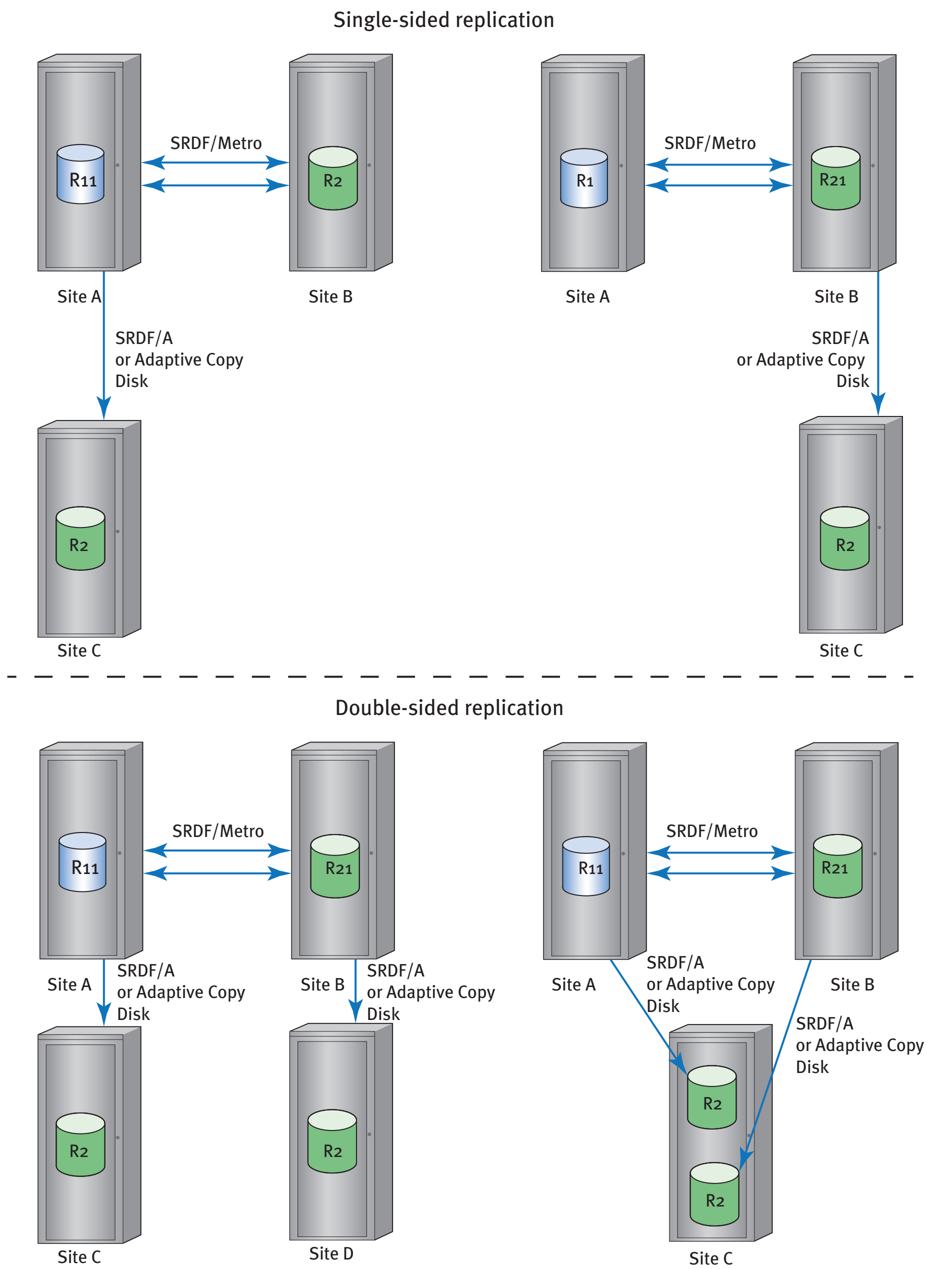
HYPERMAX OS treats the vWitness and Array Witness options similarly. You can deploy them independently or simultaneously. When deployed simultaneously, SRDF/Metro favors the Array Witness option over the vWitness option, as the Array Witness option has better availability. If all the witness methods become unavailable for any reason, SRDF/Metro falls back to the Device Bias method.

Disaster recovery facilities

HYPERMAX OS 5977 Q3 2016 SR adds disaster recovery facilities to SRDF/Metro. Devices in SRDF/Metro groups can simultaneously be part of device groups that replicate data to a third, disaster-recovery site.

Either or both sides of the Metro region can be replicated. You can choose which ever configuration that suits your business needs. The following diagram shows the possible configurations:

Figure 17 Disaster recovery for SRDF/Metro



Note the naming conventions for the various devices differ from a standard SRDF/ Metro configuration. For instance, when the R1 side of the SRDF/Metro configuration is replicated, it becomes known as a R11 device. That is because it is the R1 device both in the SRDF/Metro configuration and in the disaster-recovery replication.

Similarly, when the R2 side of the SRDF/Metro configuration is replicated, it becomes known as a R21 device. This is because it is the R2 device in the SRDF/Metro configuration and the R1 device in the disaster-recovery replication.

Replication modes

As the diagram shows, the links to the disaster-recovery site use either SRDF/Asynchronous (SRDF/A) or Adaptive Copy Disk. In a double-sided configuration, each of the SRDF/Metro arrays can use either replication mode. That is:

- Both sides can use the same replication mode.
- R11 can use SRDF/A while the R21 side uses Adaptive Copy Disk.
- R11 can use Adaptive Copy Disk while the R21 side uses SRDF/A.

Operating environment

The two SRDF/Metro arrays must run HYPERMAX OS 5977 Q3 2016 SR or later for 3rd site disaster-recovery. The disaster-recovery arrays can run Enginuity 5876 and later or HYPERMAX OS 5977.691.684 and later.

The two SRDF/Metro arrays must run PowerMaxOS 5978.xxx.xxx or later for 3rd site disaster recovery. The disaster recovery arrays can run PowerMaxOS 5978.xxx.xxx, HYPERMAX OS 5977.952.892 and later, or Enginuity 5876.288.195 and later.

SRDF/Metro changes to SYMCLI operations commands

SRDF/Metro introduces a number of enhancements to, and restrictions on, SYMCLI commands. This section summarizes those changes.

addgrp, removegrp, and modifygrp commands

An additional option, `-witness`, for the `addgrp`, `removegrp`, and `modifygrp` commands enables the management of Witness SRDF groups. Witness SRDF groups on page 189 shows how to manage Witness groups.

createpair command

`-metro` enables the creation of device pairs in an SRDF/Metro configuration. The `createpair -metro` command provides the following operations:

- `-establish [-use_bias]`
- `-restore [-use_bias]`
- `-invalidate r1`
- `-invalidate r2`
- `-exempt`
- `-format`

Create device pairs on page 180 shows how to create device pairs in an SRDF/Metro configuration.

Commands to restore device personality

A device removed from an SRDF/Metro configuration retains its federated personality. The additional option `set -no_identity` is available with the following commands to restore devices to their original, native personality:

- `symdev`
- `symsg`
- `symdg`
- `symcg`

Note

Restoring device personality should only be done after Storage Area Network (SAN) and hosts are reconfigured to make sure there are no disruptions in the applications resulting from changed device identities.

Operations blocked when adding devices into an existing SRDF/Metro configuration with the -format option

The following actions are blocked when adding new devices into an existing SRDF/Metro configuration with the `-format` option:

- `use_bias`
- `establish`
- `invalidate R1`
- `invalidate R2`
- `type R1`
- `type R2`

Additional SRDF/Metro restrictions

The following restrictions apply to devices in SRDF/Metro configurations:

- The R2 device cannot be larger that the R1 device.
- The `-remote`, and `-rdf_mode` options of the `createpair` operation are not available in SRDF/Metro.
- Devices that are part of an SRDF/Metro configuration cannot:
  - Have User Not Ready set
  - Have User Geometry set
  - Be monitored by SRDF Automated Recovery
  - Be migrated
  - Be part of an SRDF/Star configuration

Display SRDF/Metro

The output of `show` and `list` commands displays devices in SRDF/Metro configurations. In the example listings, text specific to SRDF/Metro configurations appears in bold.

Mobility ID

Devices in VMAX arrays running HYPERMAX OS 5977 or PowerMAXOS 5978 can have either a Compatibility ID or a Mobility ID. The `symdev show` and `symdev list` commands can be used to report the device ID type for arrays running PowerMaxOS 5978.

The example output of the `symdev show` command below shows a device carrying Mobility ID on array 084.

```
symdev show 0325C -sid 084

    Device Physical Name     : Not Visible
```

```
    Device Symmetrix Name    : 0325C
    Device Serial ID         : N/A
    Symmetrix ID             : 000197100084

      . . .
    Vendor ID                : EMC
    Product ID               : SYMMETRIX
    Product Revision         : 5977
    Device WWN               : 600009700BBF82341FA1006E00000017
    Device ID Type           : Mobility
Device Emulation Type    : FBA
      . . .

    Device External Identity
        {
        Device WWN           : 600009700BBF82341FA1006E00000017

        Front Director Paths (0): N/A

        Geometry             : Native
            {
            Sectors/Track        :          256
            Tracks/Cylinder      :           15
            Cylinders            :        10925
            512-byte Blocks      :     41952000
            MegaBytes            :        20484
            KiloBytes            :     20976000
            }
        }
      . . .
```

To filter devices based on ID type, use the `symdev list` command with the following syntax:

```
symdev -sid <SymmID> list -device_id <compatibility | mobility>
```

Converting Device ID

To covert device ID types between Compatibility ID and Mobility ID on a FBA devices, use the following syntax:

```
symdev -sid <SymmID> -devs <<SymDevStart>:<SymDevEnd> |
<SymDevName> set -device_id <compatibility | mobility>
```

symdev show

Output of the `symdev show` command displays the ActiveActive or ActiveBias pair state. Results relating to SRDF/Metro include:

- Additional RDF pair states (`RDF Pair State ( R1 <===> R2 )` of ActiveActive or ActiveBias
- Additional RDF mode of Active for an SRDF device

The following output is for an R1 device when it is in an SRDF/Metro configuration and the pair state is ActiveActive. The R1 designation indicates that this is the bias side:

```
symdev show 3F –sid 085

    Device Physical Name     : /dev/sdam
```

```
    Device Symmetrix Name    : 0003F
    Device Serial ID         : 850003F000
    Symmetrix ID             : 000197100085
      . . .
    Device Service State     : Normal

    Device Status            : Ready            (RW)
    Device SA Status         : Ready            (RW)
    Device User Pinned       : False
    Host Access Mode         : Active
    Device Tag(s)            : None
      . . .
    RDF Information
        {
        Device Symmetrix Name                 : 0003F
        RDF Type                              : R1
        RDF (RA) Group Number                 : 86 (55)

        Remote Device Symmetrix Name          : 0008E
        Remote Symmetrix ID                   : 000197100086
          . . .
        RDF Mode                              : Active
        RDF Adaptive Copy                     : Disabled
        RDF Adaptive Copy Write Pending State : N/A
        RDF Adaptive Copy Skew (Tracks)       : 65535
          . . .
        Device Suspend State                  : N/A
        Device Consistency State              : Enabled
        Device Consistency Exempt State       : Disabled
        RDF R2 Not Ready If Invalid           : Disabled
          . . .
        Device RDF State                      : Ready           (RW)
        Remote Device RDF State               : Ready           (RW)
        RDF Pair State (  R1 <===> R2 )       : ActiveActive
          . . .
```

The following output is for an R2 device when it is in an SRDF/Metro configuration and the pair state is ActiveActive. The R2 designation indicates that this is the non-bias side:

```
symdev show 8E -sid 086

    Device Physical Name     : /dev/sdac

    Device Symmetrix Name    : 0008E
    Device Serial ID         : 85000C8000
    Symmetrix ID             : 000197100086
      . . .
    Device Service State     : Normal

    Device Status            : Ready            (RW)
    Device SA Status         : Ready            (RW)
    Device User Pinned       : False
    Host Access Mode         : Active
    Device Tag(s)            : None
      . . .
    RDF Information
        {
        Device Symmetrix Name                 : 0008E
        RDF Type                              : R2
        RDF (RA) Group Number                 : 85 (54)

        Remote Device Symmetrix Name          : 0003F
        Remote Symmetrix ID                   : 000197100085
```

```
   . . .
RDF Mode                               : Active
RDF Adaptive Copy                      : Disabled
RDF Adaptive Copy Write Pending State  : N/A
RDF Adaptive Copy Skew (Tracks)        : 65535
   . . .
Device Suspend State                   : N/A
Device Consistency State               : Enabled
Device Consistency Exempt State        : Disabled
RDF R2 Not Ready If Invalid            : Disabled
   . . .
Device RDF State                       : Ready           (RW)
Remote Device RDF State                : Ready           (RW)
RDF Pair State (  R1 <===> R2 )        : ActiveActive
   . . .
```

symcfg list -rdfg

Output of the `symcfg list -rdfg` command includes:

- Indication of whether the SRDF group is online (Group (S)tatus = O).
- Indication of whether an SRDF group is a Witness SRDF group (Group (T)ype = W).
- Indication of whether the device pairs in the SRDF group are configured for SRDF/Metro (Group Flag M = X).

```
symcfg list -rdfg all -sid 084


Symmetrix ID : 000197100084

                S Y M M E T R I X   R D F   G R O U P S

    Local             Remote                  Group                RDFA Info
------------ --------------------- --------------------------- ---------------
        LL                                       Flags   Dir Flags Cycle
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CSRM  time  Pri
------------ --------------------- --------------------------- ----- ----- ---
115 (72)  10 116 (73) 000197100086 OD sdp_dg3    XX.. ..XX F-S -IS-     15  33
120 (77)  10 117 (74) 000197100086 OW sdp_dg4    XX.. ..X. F-S -IS-     15  33
121 (78)  10 118 (75) 000197100086 FD sdp_dg5    XX.. ..X. F-S -IS-     15  33

Legend:
  Group (S)tatus    :  O = Online, F = Offline
  Group (T)ype      :  S = Static, D = Dynamic, W = Witness
  Director (C)onfig :  F-S = Fibre-Switched, F-H = Fibre-Hub
                       G = GIGE, E = ESCON, T = T3, - = N/A
  Group Flags       :
      Prevent Auto (L)ink Recovery      : X = Enabled, . = Disabled
      Prevent RAs Online Upon (P)ower On: X = Enabled, . = Disabled
      Link (D)omino                     : X = Enabled, . = Disabled
      (S)TAR/SQAR mode                  : N = Normal, R = Recovery, . = OFF
                                          S = SQAR Normal, Q = SQAR Recovery
      RDF Software (C)ompression        : X = Enabled, . = Disabled, - = N/A
      RDF (H)ardware Compression        : X = Enabled, . = Disabled, - = N/A
      RDF Single Round (T)rip           : X = Enabled, . = Disabled, - = N/A
      RDF (M)etro                       : X = Configured, . = Not Configured
  RDFA Flags        :
      (C)onsistency : X = Enabled, . = Disabled, - = N/A
      (S)tatus      : A = Active, I = Inactive, - = N/A
      (R)DFA Mode   : S = Single-session, M = MSC, - = N/A
      (M)sc Cleanup : C = MSC Cleanup required, - = N/A
```

symcfg list -rdfg -metro

The `-metro` option shows information specific to SRDF/Metro as well as other information not related to SRDF/Metro. This includes:

- RDFA Info displayed in the default output (above) is replaced with information specific to SRDF/Metro.
- Indication of whether the SRDF group was enabled for Witness or bias protection during the establish/restore.
- Indication of whether Witness or bias protection is currently in effect.
- SRDF groups that have Witness protection in effect, and the group is in the ActiveActive state, identify the witness array or virtual witness that they use.

In the following example,

- Group 115 on array 000197100084:
  - Contains SRDF device pars that are configured for SRDF/Metro;
  - Is configured to use Witness protection;
  - Is currently Witness-protected; and
  - The Witness array is 000197100087.
- Group 116 on array 000197100084
  - Contains SRDF device pairs that are configured for SRDF/Metro;
  - Is configured to use Witness protection; but
  - Is currently using bias.
- Group 117 on Symmetrix 000197100084:
  - Contains SRDF device pairs that are configured for SRDF/Metro;
  - Is configured to use bias; and
  - Is currently using bias.
- Group 125 on Symmetrix 000197100084:
  - Contains devices that are configured for SRDF/Metro;
  - Is configured to use Array Witness protection; but
  - Its Witness protection is degraded (only one side can see the witness array);

- The witness array is 000197100087

```
symcfg list -rdfg all -sid 084 -metro


Symmetrix ID : 000197100084

                S Y M M E T R I X   R D F   G R O U P S

    Local             Remote                   Group                RDF Metro
------------ --------------------- --------------------------- -----------------
        LL                                           Flags   Dir    Witness
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CE S Identifier
------------ --------------------- --------------------------- -- --------------
115 (72)  10 116 (73) 000197100086 OD sdp_dg3    XX.. ..XX F-S WW N 000197100087
125 (7C)  10 126 (7D) 000197100086 OD sdp_dg13   XX.. ..XX F-S WW D 000197100087
120 (77)  10 117 (74) 000197100087 OW sdp_dg4    XX.. ..X. F-S -- - -
121 (78)  10 118 (75) 000197100086 FD sdp_dg5    XX.. ..X. F-S -- - -
116 (73)  10 119 (76) 000197100086 OD sdp_dg7    XX.. ..XX F-S WB F -
117 (74)  10 120 (77) 000197100086 OD sdp_dg9    XX.. ..XX F-S BB - -

Legend:
  Group (S)tatus    :  O = Online, F = Offline
  Group (T)ype      :  S = Static, D = Dynamic, Q = Witness
  Director (C)onfig :  F-S = Fibre-Switched, F-H = Fibre-Hub
                       G = GIGE, E = ESCON, T = T3, - = N/A
  Group Flags       :
      Prevent Auto (L)ink Recovery      : X = Enabled, . = Disabled
      Prevent RAs Online Upon (P)ower On: X = Enabled, . = Disabled
      Link (D)omino                     : X = Enabled, . = Disabled
      (S)TAR/SQAR mode                  : N = Normal, R = Recovery, . = OFF,
                                          S = SQAR Normal, Q = SQAR Recovery
      RDF Software (C)ompression        : X = Enabled, . = Disabled, - = N/A
      RDF (H)ardware Compression        : X = Enabled, . = Disabled, - = N/A
      RDF Single Round (T)rip           : X = Enabled, . = Disabled, - = N/A
      RDF (M)etro                       : X = Configured, . = Not Configured
  RDF Metro Flags   :
      (C)onfigured Type                 : W = Witness, B = Bias, - = N/A
      (E)ffective Type                  : W = Witness, B = Bias, - = N/A
      Witness (S)tatus                  : N = Normal, D = Degraded,
                                          F = Failed, - = N/A
```

Device pairs in SRDF/Metro configurations

An SRDF/Metro configuration is:

1. Created when a `createpair -metro` command is issued against an existing, but empty, RDF group.
2. Terminated when a `deletepair` operation removes the last device pair from the RDF group used for the SRDF/Metro configuration; the now-empty RDF group remains and can be removed manually or can be used for other purposes.

Device pairs can be added to an existing SRDF/Metro configuration:

1. `createpair -metro -format` can be used to add device pairs that do not already contain data.
2. `createpair -metro -exempt` or `movepair -exempt` can be used to add device pairs that contain data (PowerMaxOS 5978).

Device pairs can be removed from an existing SRDF configuration:

1. `deletepair` removes a device pair from an SRDF configuration and deletes the RDF relationship between the two sides of the device pair.

2. `movepair` moves a device pair from an SRDF/Metro configuration to another RDF group, retaining the RDF relationship between the two sides of the device pair (PowerMaxOS 5978).

Once a device pair has been removed from an SRDF/Metro configuration, one side of the device pair remains host-accessible while the other side is made inaccessible to the host.

SRDF/Metro device restrictions

The following restrictions apply when adding devices to SRDF/Metro:

- An SRDF/Metro group cannot contain a mixture of R1 and R2 devices.
- The R2 cannot be larger than the R1.
- The R2 device cannot have device inactive set if it is mapped to a host.
- The R1 device cannot be device inactive.
- The devices cannot have User Not Ready set. (Please note that `createpair -format` requires this when the devices are mapped to a host. It is also allowed if GCM is set on what will become the R1 and the `createpair` is done with `-restore` or `-invalidate R1`.)
- Devices cannot have User Geometry set.
- RCopy is not supported.
- Devices cannot be BCVs.
- Devices cannot be CKD.
- Devices cannot be RP.
- Devices cannot be used as the target of a TimeFinder data copy when the RDF devices are RW on the RDF link with either a SyncInProg, ActiveBias or ActiveActive RDF pair state.
- `createpair` operations are only allowed for devices with Mobility IDs in SRDF/Metro configurations when both sides of the RDF pair are running PowerMaxOS 5978. `createpair` is blocked if the device ID types of each individual RDF device pair are not the same on both sides, that is, both Compatibility or both Mobility.

Create device pairs

To create SRDF devices in an SRDF/Metro configuration, use the `-metro` option with the `createpair` command.

The `symrdf createpair` command allows creating a concurrent RDF device resulting in one SRDF/Metro mirror and one Asynchronous or Adaptive Copy RDF mirror.

The `createpair -format -metro` command allows creating devices into an non-empty SRDF/Metro group when the existing devices are RW on the link. If the SRDF group in which the device pairs are being created is not empty, all device pairs already in the SRDF group must be Not Ready (NR) on the SRDF link. The devices that are being added will be formatted as a part of the createpair.

The `createpair -metro -invalidate R1 [or R2]` command allows adding devices to a non-empty SRDF/Metro group when the group is suspended (all devices already in the group are NR on the link). Data on the devices being added is preserved (`-invalidate R2` preserves the R1 data; `-invalidate R1` preserves the R2 data).

The `symrdf createpair -metro -exempt` command allows creating device pairs that get special handling allowing devices to be added without affecting the state of the SRDF/Metro session or requiring that other devices in the session be suspended.

Even if the device pairs are being created in an existing SRDF/Metro group, the `-metro` option is still necessary.

Use the `-use_bias` option to indicate that the SRDF/Metro configuration uses Device Bias rather than either form of witness protection. This is only valid with the `-establish` or `-restore` options.

When using the `createpair` operation with the `-establish` or `-restore` options the following rules apply when a witness bias method is in use:

- In an Array Witness configuration, the required Witness SRDF groups must exist and be online.
- In a vWitness configuration, both arrays must be connected to the same vWitness instance and that instance must be active.

Options

Table 16 createpair -metro options

Option	Preserves Data	SRDF/Metro Group				Polarity can differ from SRDF/ Metro
		Not Empty	Empty	RW on Link	NR on Link	
-invalidate R1/R2	Y		Y			
	Y	Y			Y	
-format		Y		Y	Y	
-establish	Y		Y			
-restore	Y		Y			
-exempt	Y	Y		Y	Y	Y

Restrictions

The following operations are not allowed when using the `symrdf createpair` command to create concurrent RDF devices:

- Adding a SRDF/Metro mirror when the device is already part of an SRDF/Metro configuration.
- Adding a SRDF/Metro mirror when the device is already an R2 device.
- Adding a non-SRDF/Metro R2 mirror to a device that has an Metro RDF mirror.
- Adding a SRDF/Metro mirror when the non-SRDF/Metro mirror is in Synchronous mode.
- Adding a non-SRDF/Metro mirror in Synchronous mode when the device is already part of an SRDF/Metro configuration.
- An SRDF/Metro group cannot contain a mixture of R1 and R2 devices.

Examples

In the following example:

- `-metro` indicates the devices are created in a SRDF/Metro configuration.
- `-sid 174 -type R1` indicates array 174 is the R1 side.

- `-sg` specifies the name of the storage group.
- `-remote_sg` specifies the remote storage group name.
- `-establish` starts the synchronization process from R1 to R2 devices.

Note

Since `-use_bias` is not specified, the `-establish` operation requires either a witness array or a vWitness, otherwise the `createpair` action is blocked.

```
symrdf createpair -metro -sid 174 -type R1 -rdfg 2 -sg RDF1_SG -remote_sg RDF2_SG -
establish

Execute an RDF 'Create Pair' operation for storage group 'RDF1_SG' (y/[n]) ? y

An RDF 'Create Pair' operation execution is
in progress for storage group 'RDF1_SG'. Please wait...

    Create RDF Pair in (0174,002)....................................Started.
    Create RDF Pair in (0174,002)....................................Done.
    Mark target device(s) in (0174,002) for full copy from source....Started.
    Devices: 006B-0074 in (0174,002).................................Marked.
    Mark target device(s) in (0174,002) for full copy from source....Done.
```

In the following example, the `createpair` command:

- Creates device pairs using device pairs listed in a device file `/tmp/device_file`.
- Specifies the pairs are in a SRDF/Metro configuration (`-metro`) .
- As with the previous example, this `createpair` operation omits the `-use_bias` option; hence a witness array or vWitness is required.

```
symrdf createpair -est -f /tmp/device_file -metro -sid 085 -type R1
-rdfg 86
```

Create pairs with the -establish option

- All devices in the group must be specified for the operation. That is, the group must be empty prior to the `createpair -metro -establish` operation.
- The `-metro` option must be specified.
- If the Device Bias method of determining which side of the device pair remains accessible to the host is used, include the `-use_bias` option.
- For configurations that use the Array Witness bias method, the Witness SRDF groups must be online.
- For configurations that use the vWitness bias method, both arrays must be connected to the same vWitness instance and that instance must be active.
- The operation creates the device pairs and makes them RW on the link. When the `createpair` operation completes, the device pair's mode is Active and pair state is SyncInProg.
- The pair state is SyncInProg until there are no invalids and the R2 side has acquired the R1 device information. Then the pair state transitions to ActiveActive or ActiveBias.

Restrictions

- SRDF device pairs cannot be created in an SRDF Witness group

- Both the R1-side and R2-side arrays must be running HYPERMAX OS 5977.691.684 or later.
- The `createpair -establish -metro` requires that the specified RDF group be empty.

Example - Create SRDF/Metro pairs (Array Witness and vWitness)
To create SRDF/Metro device pairs using device file `device_file`:

```
symrdf -f /tmp/device_file -sid 085 -type r1 -rdfg 86 createpair -establish  -metro
```

Example - Create SRDF/Metro pairs (Device Bias)
To create SRDF/Metro device pairs using device file `device_file` and specify the bias method:

```
symrdf -f /tmp/device_file -sid 085 -type r1 -rdfg 86 createpair -establish -metro -
use_bias
```

Create pairs with the -format option

Use the `-format` option to add unmapped or NR device pairs to an SRDF/Metro group that is RW on the SRDF link. SRDF/Metro clears all the tracks on the new devices as it adds them to the group. Once added, the devices are RW on the SRDF link but are inaccessible to the host until they are fully protected by SRDF/Metro and are in the ActiveActive or ActiveBias state.

You can also use the `-format` option to add device pairs to a group that is NR on the SRDF link. In this case, the newly added devices are also NR on the SRDF link. In addition, the R1 devices are accessible to the host while the R2 devices are inaccessible to the host.

Restrictions

- Both arrays in the SRDF/Metro configuration must run HYPERMAX OS 5977 Q3 2016 SR or later.
- The `-format` option cannot be used to add devices into an empty RDF group.
- The new devices must be unmapped or NR.
- The RDF type cannot be specified as a part of the `createpair` operation. The new RDF pair matches the polarity of the existing devices in the SRDF/Metro configuration.
- The bias cannot be changed until all the devices in the SRDF/Metro configuration are RW on the link and have reached an ActiveActive or ActiveBias RDF pair state.
- The newly added R1 devices are accessible to the host immediately, even if the active SRDF/Metro session drops before the newly added devices are synchronized.
- When using the `-format` option to add devices to a SRDF/Metro configuration, you cannot use the following `createpair` options:

  ```
  -use_bias
  -establish
  -invalidate
  -type
  -restore
  ```

Example

```
symrdf createpair -sid 55 -file devicefile -rdfg 1 -format -metro
```

Create pairs with the -invalidate option

Syntax

Use the `symrdf createpair` command with the `-invalidate r1` or `-invalidate r2` option to create devices (R1 or R2) in a new or existing configuration.

The `createpair -metro -invalidate R1/R2` operation can be used to add device pairs to an empty SRDF/Metro configuration, or to an existing one, provided that all device pairs already in the group are Not Ready (NR) on the SRDF link.

When the command completes, you can:

- Use the `establish` command to start copying data to the invalidated target devices.
- Use the `restore` command to start copying to the invalidated source devices.

Example

```
symrdf createpair -sid 55 -file devicefile -rdfg 1 -type R1 -invalidate r2 -metro
```

Create pairs with the -restore option

Use the `-restore` option to copy data back to the R1 source devices.

- All devices in the group must be specified for the operation. The group must be empty prior to the `createpair -metro -restore` operation.
- Include `-metro` option to create devices.
- If the Device Bias method determines which side remains accessible to the host in the event of a link or other failure, include the `-use_bias` option.
- The operation creates the device pairs and makes them RW on the link. When the `createpair` operation completes, the device pair's mode is Active and their pair state is SyncInProg.
- The pair state is SyncInProg until there are no invalids and the R2 side has acquired the R1 device information. Then the pair state transitions to ActiveActive or ActiveBias.

Once the SRDF device pairs are created, the restore operation begins copying data to the source devices, synchronizing the dynamic SRDF device pairs listed in the device file.

Restrictions

- Both the R1-side and R2-side arrays must be running HYPERMAX OS 5977.691.684 or later.
- The devices cannot have GCM set.

Example - Create SRDF/Metro pairs (Array Witness)
To create SRDF/Metro device pairs using device file `device_file`:

```
symrdf -f /tmp/device_file -sid 085 -type r1 -rdfg 86 createpair
      -restore -metro
```

Example - Create SRDF/Metro pairs (Device Bias)
To create SRDF/Metro device pairs using device file `device_file` and specify the bias method:

```
symrdf -f /tmp/device_file -sid 085 -rdfg 86 createpair -restore -metro -use_bias
```

Add devices with the -exempt option

On arrays running PowerMaxOS 5978, devices that already contain data can be added to an SRDF/Metro session when either:

- The devices already in the session are RW on the RDF link, or
- The devices already in the session are either RW or NR on the link and the polarity of the new RDF device pairs is reversed from that of the device pairs already in the session; that is, the R1 side (the side that contains the data to be preserved) of the new RDF device pairs is aligned with the R2 side of the device pairs already in the session.

Addition of devices to an SRDF/Metro session under either of the above conditions is accomplished by using the `-exempt` option with either the `createpair` or the `movepair` command.

When using the `-exempt` option, device pairs get special handling allowing devices to be added without affecting the state of the SRDF/Metro session or requiring that other devices in the session be suspended.

Note

The `-exempt` option can only be used if the SRDF/Metro session contains at least one non-exempt device.

Options

Table 17 movepair (into SRDF/Metro) options

Option	Preserves Data	SRDF/Metro Group				Polarity can differ from SRDF/Metro
		Not Empty	Empty	RW on Link	NR on Link	
-exempt	Y	Y		Y	Y	Y

Example
In the following example, (building on the `createpair` examples above that left the devices in the group RW on the link), the `createpair` command:

- Creates device pairs using device pairs listed in a device file `/tmp/device_file` placing them in the SRDF/Metro session.
- `-exempt` option indicates that data on the R1 side of the new RDF device pairs should be preserved and host accessibility should remain on the R1 side.

- After creating the new device pairs in RDF group 86, Solutions Enabler performs an establish on them, setting them RW on the RDF link with SyncInProg RDF pair state. Then they will transition to the ActiveActive RDF pair state if the devices already in the group are using witness protection; ActiveBias if they are using bias protection. If the devices already in the group are suspended, then the newly-added devices will also be suspended.

```
symrdf -sid 085 -rdfg 86 -f /tmp/device_file createpair -type R1 -metro -exempt.
```

In the following example (building on the `createpair` examples above), the `movepair` command:

- Moves existing RDF pairs using device pairs listed in a device file `/tmp/device_file` from RDF group 10 on array 456 to the SRDF/Metro session.
- The `-exempt` option is required because the device pairs already in the session are RW on the RDF link. The `-exempt` option would also be required if the R1 side of RDF group 10 was on array 456, since then the device pairs being added to the SRDF/Metro session would have reversed polarity relative to the device pairs already in the session, whose R1 side is on array 085.

```
symrdf -sid 456 -rdfg 10 -f /tmp/device_file movepair -new_rdfg 8 -exempt.
```

Delete SRDF/Metro pairs

Delete both sides of an SRDF/Metro pair

The `deletepair` operation:

- Deletes the SRDF/Metro device pairing
- Removes the pairing information from the array and the SYMAPI database

Both halves of the specified device pair are converted from an SRDF device to a regular device, but only R1 or R2 can become a regular device.

Deleting dynamic SRDF device pairs on page 121 provides more information about deleting pairs.

NOTICE

Deleting the last device pair from an SRDF group in an SRDF/Metro configuration terminates the SRDF/Metro configuration. After that, you can re-use the group either for another SRDF/Metro configuration or for a traditional SRDF configuration.

Delete one side of an SRDF/Metro pair

The `half_deletepair` operation removes the SRDF pairing relationship between R1/R2 device pairs.

One-half of the specified device pair is converted from an SRDF device to a regular device, but not if the device is concurrent, that is, R21 devices can become R1 or R2, but only R1 or R2 can become a regular device.

The `half_deletepair` command can be specified using a device file (`-f` *`FileName`*), device group (`-g` *`GrpName`*), consistency group (`-cg` *`CGrpName`*), or storage group (`-sg` *`SGrpName`*) .

NOTICE

If a `half_deletepair` operation removes all devices from one side of an SRDF group that is in an SRDF/Metro configuration, that side of the group is no longer part of the SRDF/Metro configuration.

Removing device pairs from SRDF/Metro using -keep

Using the `-keep` option with either the `deletepair` or `movepair` operation on arrays running HYPERMAX OS 5978, device pairs can be removed when:

- the devices in the session are RW on the RDF link, or
- the current R2 side should remain host-accessible and the current R1 side should be host-inaccessible after removal from the session.

Only one side of the RDF device pairs that are removed from the SRDF/Metro session will remain host-accessible when the operation completes. To specify the side that should remain host-accessible, use the `-keep R1` or `-keep R2` option.

Note

In all cases, only the side specified with `-keep` remains host-accessible. It retains the device ID that was being used when it was part of the SRDF/Metro session (this would be the ID of the original R1 side). If the devices are configured with Compatibility ID, the losing side will have the ID of the original R2 side when the device pair was first put into the SRDF/Metro session. If the devices are configured with Mobility ID, the losing side will be assigned a new Mobility ID.

Restrictions

The following restrictions apply when removing devices from SRDF/Metro:

- The RDF device pairs in the SRDF/Metro session must have an RDF pair state of Suspended, SyncInProg, ActiveActive, or ActiveBias, otherwise the operation is blocked.
- If devices that are being removed from the session have the SyncInProg RDF pair state, the `-symforce` option is required.
- The `-keep R2` option is not allowed if the RDF pair state is SyncInProg or Suspended.

Examples

In the following example, the `deletepair` command:

- removes the RDF device pairs described in file `/tmp/device_file` and then deletes the RDF pairings.
- uses the `-keep` option because the devices are RW on the RDF link. The `-keep R1` indicates that the current R1-side devices should remain host-accessible after the `deletepair` operation.

```
symrdf deletepair -sid 123 -rdfg 3 -f /tmp/device_file keep R1
```

In the following example, the `movepair` command:

- moves the RDF device pairs described in file `/tmp/device_file` out of the SRDF/Metro session into RDF group 10 on array 123.

- uses the `-keep` option because the devices are RW on the RDF link.The `-keep R2` indicates that the current R2-side devices should remain host-accessible after the `movepair` operation.

```
symrdf movepair  -sid 123  -rdfg 3  -f /tmp/device_file movepair -
new_rdfg 10 -keep R2
```

After completing the `movepair` operation, the devices that were previously identified as R2 will remain host-accessible and will be identified as R1 and the devices that were previously identified as R1 will be host-inaccessible and will be identified as R2.

Note

Once the `deletepair` or `movepair` is issued, it is required to clear the device inactive indication on the inaccessible side with the command `symdev ready -symforce` to make the devices accessible to host again.

Restore the native device personality

When an SRDF/Metro pair is RW on the SRDF link and has reached the ActiveActive or ActiveBias pair state, both sides of the SRDF device pair share the ID that the R1 device advertised at the time the devices were made RW on the link. This device ID is "owned" by the bias side of the device pair, originally the R1 side.

A `set bias R2` or `suspend -bias r2` operation transfers ownership of the device pair's ID to the R2 side, which now becomes the R1 side as a result of acquiring the bias. (See Setting SRDF/Metro bias on page 193 and Setting bias when suspending the group on page 194for more on setting bias.)

After a `deletepair` operation, the device side that last owned the ID (the bias side, referred to as the R1 in displays and exported data) uses that ID. The other device side (non-bias side) uses the original R2's device ID.

Once a device has been removed from a Metro configuration using `deletepair` or `half_deletepair`, its original ID can be restored, if necessary.

The following rules and restrictions apply to restoring the native personality of a device which has a federated personality as a result of a previous SRDF/Metro configuration:

- Devices must be unmapped and unmasked.
- Devices should not be SRDF devices.
- Devices must have a federated WWN.
- Devices cannot be Data Domain devices.

The following SYMCLI commands have the `set -no_identity` option that restores the personality of devices removed from SRDF/Metro configurations:

- Devices: `symdev set -no_identity`
- Device groups: `symdg set -no_identity`
- Composite groups: `symcg set -no_identity`
- Storage groups: `symsg set -no_identity`

The steps to restore device personality vary depending on whether the bias was changed before the devices are deleted from the SRDF/Metro group configuration.

If bias was changed before the `deletepair` operation:

- The R1 (the original R2) has the original R1's ID
- The R2 (the original R1) has the original R2's ID.

Both sides of the device pair need to be replaced. Not doing so could expose the two different devices to a host using the same ID. Use the `symdev show` command to display which IDs need to be reset.

Procedure

1. Use the `half_deletepair` or `deletepair` operation to remove all devices from the SRDF/Metro group configuration.
2. Use the applicable `set -no_identity` command to restore the native identity of the specified device, or all the devices in the specified group.

   To restore the personality of R2 (now non-SRDF) devices in storage group RDF_2SG:

   ```
   symsg -sid 248 -sg RDF2_SG set -no_identity
   ```

Manage bias

This section contains information on managing the available bias methods:

- Witness SRDF groups on page 189
- vWitness definitions on page 190
- Setting SRDF/Metro bias on page 193

Witness SRDF groups

The Array Witness bias method requires two Witness SRDF groups:

- One between the R1 array and the witness array
- One between the R2 array and the witness array

Some characteristics of Witness SRDF groups are:

- There can be only one Witness SRDF group between any two arrays.
- Witness SRDF groups must be empty. SRDF/Metro prevents the creation of SRDF device pairs in Witness SRDF groups.
- When choosing to use a witness to protect the SRDF/Metro configuration, the witness selects the winner side in the event of a failure.

This section shows how to create, modify, and remove Witness SRDF groups.

Witness SRDF group attributes

Some attributes of Witness SRDF groups are different from those of a standard SRDF group. Differences include:

- Link limbo - The default value for an Witness SRDF group is 1 second. Dell EMC recommends that this value not be increased, as this decreases Witness protection.

Add a Witness group

To create a SRDF/Metro Witness group, include the `-witness` option in the `addgrp` operation.

For example, to create a Witness group Witness1 between group 10 on array 0085 and group 110 on array 086:

```
symrdf addgrp -sid 0085 -rdfg 10 -remote_sid 086 -remote_rdfg 110 -dir 1g:28
      -remote_dir 1g:28 -nop -label Witness1 -witness
```

Remove a Witness group

To remove a Witness group, include the `-witness` option in the `removegrp` operation.

You cannot remove a Witness group if it is protecting an SRDF/Metro session.

For example, to remove SRDF/Metro Witness group 10:

```
symrdf removegrp -sid 0085 -rdfg 10 -nop -witness
```

Modify a Witness group

To modify a SRDF/Metro Witness group, include the `-witness` option in the `modifygrp` operation.

For example, to add director 1g:29 to SRDF/Metro Witness group 10:

```
symrdf modifygrp -add -sid 0085 -rdfg 10 -dir 1g:29 -witness
```

vWitness definitions

In an SRDF/Metro configuration that uses the vWitness bias method, you maintain a list of vWitness definitions on each of the participating arrays. You can use SYMCLI commands to add, enable, modify, remove, suspend, and view vWitness definitions. as the following sections show.

The *Dell EMC SRDF/Metro vWitness Configuration Guide* contains more information on how to set up and manage a vWitness configuration. That includes information on how to manage vWitness instances.

Value of command options
The commands use a number of options and these sections use the following conventions to denote their values in syntax definitions:

SymmID

The local storage system.

WitnessName

A name for a vWitness definition.

- The name has up to 12 characters and starts with an alphabetic character.
- The remainder of the name can contain alphanumeric characters, underscores, and hyphens.
- The name is not case sensitive, but the system preserves the case.

IPorDNS

The IP address or the fully qualified DNS name of a vWitness instance. The address or name has a maximum of 128 characters.

Array access rights and user authorization
All the commands, except for list and show, require array access rights of SYMCFG and user authorization of Storage Admin.

Add a vWitness definition

To add a new vWitness definition to a storage array, use the syntax below. This also enables the definition automatically, but you can disable it using `symcfg disable` as described in Suspend using a vWitness definition on page 191:

```
symcfg -sid SymmID add -witness WitnessName -location IPorDNS
```

Note

Create only one definition for each vWitness instance, specifying either the IP address or the fully-qualified DNS name of the instance.

Example
To add and enable a vWitness definition named metrovw1 that refers to a vWitness instance at IP address 198.51.100.24 on the storage array 1234:

```
symcfg -sid 1234 add -witness metrovw1 -location 198.51.100.24
```

Suspend using a vWitness definition

To suspend the use of a vWitness definition:

```
symcfg -sid SymmID disable -witness WitnessName [-force|-symforce]
```

Use the `-force` option when the definition is in use (protecting a Metro configuration), and there is another Witness (either an Array or a Virtual Witness) available to take over from this one.

Use the `-symforce` when the definition is in use and there is no other Witness available to take over from this one.

Example
To disable (suspend) the availability of the vWitness definition named metrovw1 on storage array 1234 when there is no other Witness available:

```
symcfg -sid 1234 disable -witness metrovw1 -symforce
```

Enable a vWitness definition

To enable a vWitness definition after it has been suspended:

```
symcfg -sid SymmID enable -witness WitnessName
```

Example
To enable the vWitness definition named metrovw1:

```
symcfg -sid 1234 enable -witness metrovw1
```

Modify a vWitness definition

To modify a vWitness definition:

1. Disable (Suspend using a vWitness definition on page 191) and remove the existing definition (Remove a vWitness definition on page 192).
2. Add a new definition with the modified values (Add a vWitness definition on page 191).

Example

To change the IP address of a vWitness definition named metrovw1 on storage system 1234 to 198.51.100.32:

```
symcfg -sid 1234 disable -witness metrovw1 -force
```

```
symcfg -sid 1234 remove -witness metrovw1
```

```
symcfg -sid 1234 add -witness metrovw1 -loction 198.51.100.32
```

Remove a vWitness definition

First, disable the vWitness definition (Suspend using a vWitness definition on page 191) and then remove it:

```
symcfg -sid SymmID remove -witness WitnessName
```

Example

To remove the vWitness definition named metrovw1 from storage system 1234:

```
symcfg -sid 1234 disable -witness metrovw1 -force
symcfg -sid 1234 remove -witness metrovw1
```

View vWitness definitions

View information on all vWitness definitions

To view summary information on all vWitness definitions:

```
symcfg -sid SymmID list -witness [-v] [-out xml] [-offline]
```

The `-v` option produces detailed information, similar to that produced by the `show` argument, but for all vWitness definitions.

Output is available in text or XML format. Use `-out xml` to generate XML.

Use the `-offline` option to display information from the data cached in the Solutions Enabler database file.

View detailed information on a single vWitness definition

To view detailed information on a specific vWitness definition:

```
symcfg -sid SymmID show -witness WitnessName [-out xml] [-offline]
```

Examples

Display information on all vWitness instances on the storage system 1234:

```
symcfg -sid 1234 list -witness
```

Display information on vWitness definition named metrovw1 on storage system 1234:

```
symcfg -sid 1234 show -witness metrovw1
```

Setting SRDF/Metro bias

By default, the `createpair -metro` operation places an SRDF device pair into an SRDF/Metro configuration and pre-configures the bias to the R1 side of the pair.

You can change the bias once all SRDF device pairs in the SRDF group are in the ActiveActive or ActiveBias SRDF pair state. The bias side is represented as R1 and the non-bias side is represented as R2. Changing the bias changes the SRDF personalities of the two sides of the SRDF device pair.

The `symrdf` command includes the `set bias R1 | R2` option that changes the bias side of a device group, composite group, storage group, or devices in listed a device file.

Note

The `set bias` operation is only allowed if the SRDF/Metro session is not protected by a witness.

In the event of a link failure (or suspend), the witness decides which side remains host-accessible, giving preference to the bias side, but not guaranteeing that is the side that remains accessible. Changing the bias makes it appear that a`symrdf swap` has been performed. It might be necessary to do this prior to suspending the group, in order to change the side that will remain host-accessible.

Procedure

1. Use the `symrdf query` command to display the devices before changing their bias.
2. Use the `symrdf set bias` command to change the bias of the devices.

   For example, to change the bias of devices in storage group RDF1_SG to the R2 side:

   symrdf -sid 174 -sg RDF1_SG -rdfg 2 set bias R2

   ```
   Execute an RDF Set 'Bias R2' operation for storage
   group 'RDF1_SG' (y/[n]) ? y

   An RDF Set 'Bias R2' operation execution is in
   progress for storage group 'RDF1_SG'. Please wait...

   The RDF Set 'Bias R2' operation successfully executed
   for storage group 'RDF1_SG'.
   ```

3. Use the `symrdf query` command to confirm the change.

Setting bias when suspending the group

The bias may also be changed when suspending the group.

Procedure

1. Use the `symrdf suspend` command with the `-keep R2` option to suspend the SRDF group while changing the bias to the R2 side:

   The `-force` option is required to complete this operation because the devices are enabled.

   ```
   symrdf -sid 174 -sg RDF1_SG -rdfg 2 suspend -keep R2 -force

   Execute an RDF 'Suspend' operation for storage
   group 'rdf1_sg' (y/[n]) ? y

   An RDF 'Suspend' operation execution is
   in progress for storage group 'rdf1_sg'. Please wait...

       Suspend RDF link(s) for device(s) in
   (0174,002)..................Done.

   The RDF 'Suspend' operation successfully executed for
   storage group 'rdf1_sg'.
   ```

   The bias-side devices remain host-accessible. Following a `symrdf suspend -keep R2`, these are the devices that had been the R2 side until the suspend was issued.

2. Use the `symrdf establish` command with the `-use_bias` option to resume the link. The bias remains set on the R1 side:

```
symrdf -sid 174 -sg RDF1_SG -rdfg 2 establish -use_bias -force

Execute an RDF 'Incremental Establish' operation for storage
group 'rdf1_sg' (y/[n]) ? y

An RDF 'Incremental Establish' operation execution is
in progress for storage group 'rdf1_sg'. Please wait...

    Suspend RDF link(s) for device(s) in (0174,002)..................Done.
    Resume RDF link(s) for device(s) in (0174,002)...................Started.
    Read/Write Enable device(s) in (0174,002) on SA at target (R2)...Done.

The RDF 'Incremental Establish' operation successfully initiated for
storage group 'rdf1_sg'.
```

Suspend an SRDF/Metro group

In general, you manage groups in SRDF/Metro in much the same way as in other SRDF implementations. However, the `suspend` action has some characteristics that are specific to SRDF/Metro, as this section shows.

The `suspend` action suspends I/O traffic on the SRDF links for the specified remotely mirrored SRDF pairs in the group or device file and makes them Not Ready (NR) on the SRDF link. In SRDF/Metro, the suspend (or a link failure) also suspends I/O traffic to/from the hosts (that is host writes and reads). Once one side has been rendered inaccessible to hosts, host I/O to/from the other (typically bias) side resumes.

In SRDF/Metro configurations, where Device Bias determines the side of the device pair that remains accessible to the host, you can use the `-keep R1|R2` option to set the winner side of the SRDF/Metro group in conjunction with the suspend operation.

The following restrictions apply to `suspend` in SRDF/Metro configurations:

- The suspend operation must include all devices in the group.

For example, to suspend the SRDF links for devices in the specified device file in group 86 and set bias to the R2 side:

```
symrdf -f /tmp/device_file -sid 085 -rdfg 86 suspend -force -keep
R2
```

Deactivate SRDF/Metro (deletepair)

Use the `deletepair` or the `movepair` operation to remove individual device pairs from an SRDF/Metro group. Removing the last device pair from an SRDF/Metro group terminates the SRDF/Metro configuration at both sides of the SRDF group.

Note

Only a `deletepair` operation can remove the last device pair from an SRDF/Metro group and, thereby, deactivate SRDF/Metro.

Refer to Delete SRDF/Metro pairs on page 186 for additional detail.

Planned outage

For a planned outage, use the `suspend` operation to move the device pairs from the ActiveActive or ActiveBias SRDF pair state to the Suspended SRDF pair state.

Once in the Suspended SRDF pair state, a half_swap to the R1 (bias) side will change the SRDF personality of those devices to R2 and make them host-inaccessible; the pair state will change to Partitioned as a result of the half-swap.

A half-swap can then be applied to the devices on the side that was the R2 prior to the suspend (the non-bias side); that will change the SRDF personality of those devices to R1 (bias) and make them host-accessible; the SRDF pair state will change back to Suspended as a result of this second half-swap.

When the outage is complete, either:

- Use the `establish` command to keep the data that is on the R1 side.
- Use the `restore` command to keep the data that is on the R2 side.

Unplanned outage

During an unplanned outage, when the SRDF device pairs are in partitioned SRDF pair state or not suspended, use the `half_deletepair` operation to terminate the SRDF/Metro configuration at one side of the SRDF group. `half_deletepair` can operate on all devices or on a subset of devices on one side of the SRDF group. After a `half_deletepair` operation:

- The devices affected are no longer SRDF devices unless this side of the SRDF/Metro configuration is connected to an SRDF/Asynchronous or Adaptive Copy Disk disaster recovery array.
- The devices at the other side of the SRDF group continue to be configured for SRDF/Metro.

Recovery from Unplanned Not Ready (NR) on the SRDF link

When an SRDF link failure occurs between the two sides, the device pairs will change from the ActiveActive or ActiveBias SRDF pair state into a Partitioned SRDF pair state.

If the application continues to run on the R1 side, once the SRDF link failure is addressed the SRDF pair state will change from Partitioned to Suspended and you can follow the steps outlined above.

If the application can no longer run on the R1 side, you may want to bring up the application on the R2 (non-bias) side. If you have access to the R1 (bias), issuing a `half_swap` to change the personality to an R2 before bringing up the application on the R2 will ensure that original R1 will not be host accessible.

To bring up the application on the R2 (non-bias) side you need to change the personality (and bias) of the R2 by issuing a `half_swap` action. You can then start the application on the newly swapped R1 (bias) side.

Note

- A `half_swap` action changes the R2 (non-bias) personality to an R1 (bias).
- The new R1 (bias) will become accessible to the host.

Once the R2 is swapped to an R1 and the SRDF link failure is addressed the SRDF pair state will continue to be Partitioned if the original R1 side was not `half_swapped`. The SRDF device pair will be R1 – R1, which is referred to as a duplicate pair.

At this point you can choose either to continue to run the application on the new R1 or to stop the application in order to restart it on the original R1.

Completing the switch to the new R1 and new R2

Once the SRDF link failure is addressed you may then issue a `half_swap` on the original R1.

Note

- A `half_swap` action changes the original R1 (bias) personality to an R2 (non-bias).
- The new R2 (non-bias) will become inaccessible to the host.

Reverting back to the original R1 and original R2

Once the SRDF link failure is addressed you may then issue a `half_swap` on the new R1 to revert it back to an R2.

Note

- The application should be stopped on the new R1.
- A `half_swap` action changes the new R1 (bias) personality to the R2 (non-bias).

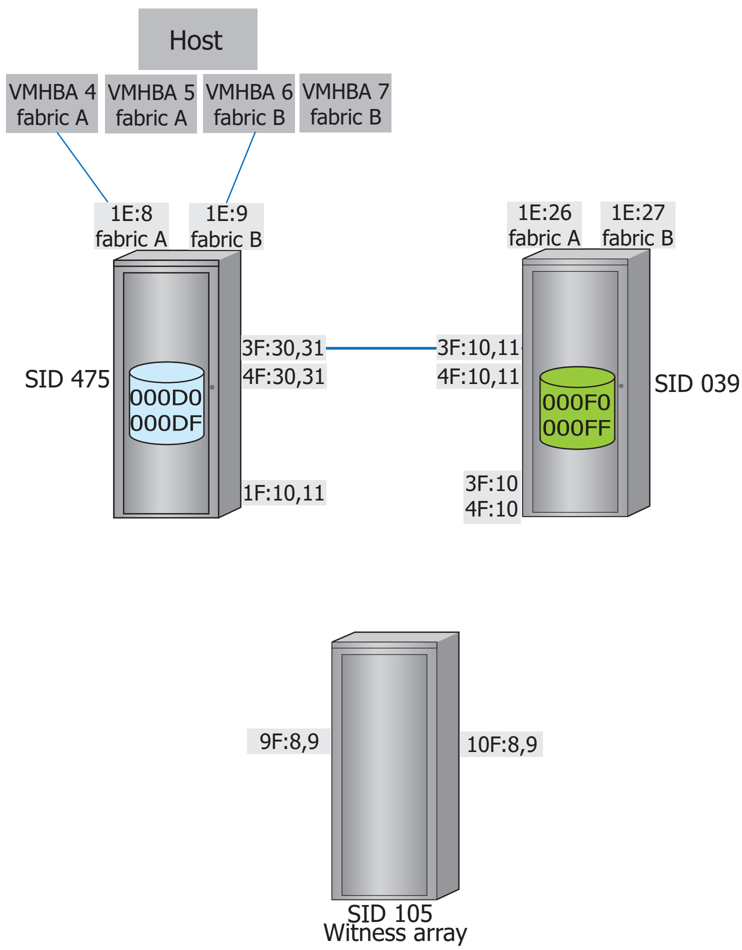
The R2 (non-bias, which was the original R2) will become inaccessible to the host.

Example: Setting up SRDF/Metro (Array Witness bias method)

This example shows the steps to set up SRDF/Metro using a witness array. The following image shows the initial configuration:

- The array that will become the R1 side is mapped/masked to the host.
- The array that will become the R2 side is NOT mapped/masked to the host.

Figure 18 Setting up SRDF/Metro with Witness array; Before



Procedure

1. On the host, use the `symcli` command to verify the version of Solutions Enabler is 8.1 or later.
2. If a single host is being used for the presentation of both R1 and R2 devices, use the `verify` command to confirm that multi-pathing software such as PowerPath or similar native functionality is in use.

3. Use the `symrdf addgrp` command to create Witness SRDF groups between SIDs 475/105 and 039/105:

```
 symrdf addgrp -witness -label SG_120 -sid 000196700475 -rdfg 120 -dir 1F:10,1F:11 -
remote_sid 000197200105 -remote_rdfg 120 -remote_dir 9F:8,9F:9

Successfully Added Dynamic RDF Group 'SG_120' for Symm: 000196700475

 symrdf addgrp -witness -label SG_121 -sid 000197200039 -rdfg 121 -dir 3F:10,4F:10 -
remote_sid 000197200105 -remote_rdfg 121 -remote_dir 10F:8,10F:9

Successfully Added Dynamic RDF Group 'SG_121' for Symm: 000197200039
```

4. Use the `symrdf addgrp` command to create the SRDF group for the SRDF pairs between SIDs 475 and 039:

```
symrdf addgrp -label SG_20 -sid 000196700475 -rdfg 20 -dir 3F:30,3F:31,4F:30,4F:31 -
remote_sid 000197200039 -remote_rdfg 20 -remote_dir 3F:10,3F:11,4F:10,4F:11

Successfully Added Dynamic RDF Group 'SG_20' for Symm: 000196700475
```

5. Use the `createpair` command with the `-metro` option to create SRDF/Metro device pairs. The file `rdfg20` defines the device pairs.

   To create SRDF/Metro device pairs in local group 20 and remote group 20:

```
symrdf -sid 000196700475 -rdfg 20 -f rdfg20 createpair -type r1 -metro -establish

An RDF 'Create Pair' operation execution is in progress for device
file 'rdfg20'. Please wait...

    Create RDF Pair in (0475,020)....................................Started.
    Create RDF Pair in (0475,020)....................................Done.
    Mark target device(s) in (0475,020) for full copy from source....Started.
    Devices: 00D0-00D7 in (0475,020).................................Marked.
    Mark target device(s) in (0475,020) for full copy from source....Done.
    Merge track tables between source and target in (0475,020).......Started.
    Devices: 00D0-00D7 in (0475,020).................................Merged.
    Merge track tables between source and target in (0475,020).......Done.
    Resume RDF link(s) for device(s) in (0475,020)...................Started.
    Resume RDF link(s) for device(s) in (0475,020)...................Done.

The RDF 'Create Pair' operation successfully executed for device
```

6. Wait for the device pairs to reach the ActiveActive state:

```
symrdf -sid 000196700475 -rdfg 20 -f rdfg20 verify -activeactive -i 15

None of the device(s) in the list are in 'ActiveActive' state.

All device(s) in the list are in 'ActiveActive' state.
```

7. Use `symcfg list` commands with the `-metro` option to display the SRDF groups.

To display group 20 on SID 475:

```
symcfg -sid 475 -rdfg 20 -metro list

Symmetrix ID : 000196700475
                S Y M M E T R I X   R D F   G R O U P S
    Local             Remote                   Group                RDF Metro
------------ --------------------- --------------------------- -----------------
          LL                                   Flags   Dir    Witness
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CE S Identifier
------------ --------------------- --------------------------- -- --------------
 20 (13)  10  20 (13) 000197200039 OD SG_20      XX.. ..XX F-S WW N 000197200105

Legend:
  Group (S)tatus    :  O = Online, F = Offline
  Group (T)ype      :  S = Static, D = Dynamic, W = Witness
  Director (C)onfig :  F-S = Fibre-Switched, F-H = Fibre-Hub
                       G = GIGE, E = ESCON, T = T3, - = N/A
  Group Flags       :
      Prevent Auto (L)ink Recovery      : X = Enabled, . = Disabled
      Prevent RAs Online Upon (P)ower On: X = Enabled, . = Disabled
      Link (D)omino                     : X = Enabled, . = Disabled
      (S)TAR/SQAR mode                  : N = Normal, R = Recovery, . = OFF
                                          S = SQAR Normal, Q = SQAR Recovery
      RDF Software (C)ompression        : X = Enabled, . = Disabled, - = N/A
      RDF (H)ardware Compression        : X = Enabled, . = Disabled, - = N/A
      RDF Single Round (T)rip           : X = Enabled, . = Disabled, - = N/A
      RDF (M)etro                       : X = Configured, . = Not Configured
  RDF Metro Flags   :
      (C)onfigured Type                 : W = Witness, B = Bias, - = N/A
      (E)ffective Type                  : W = Witness, B = Bias, - = N/A
      Witness (S)tatus                  : N = Normal, D = Degraded,
                                          F = Failed, - = N/A
```

To display all SRDF Metro groups on SID 039:

```
symcfg list –rdfg all -sid 039 –metro

Symmetrix ID : 000197200039

                S Y M M E T R I X   R D F   G R O U P S

    Local             Remote                   Group                RDF Metro
------------ --------------------- --------------------------- -----------------
          LL                                   Flags   Dir    Witness
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CE S Identifier
------------ --------------------- --------------------------- -- --------------
 20 (13)  10  20 (13) 000196700475 OD SG_20      XX.. ..XX F-S WW N 000197200105
116 (73)  10 119 (76) 000197100086 OD sdp_dg7    XX.. ..XX F-S WW N Wit084086
117 (74)  10 120 (77) 000197100086 OD sdp_dg9    XX.. ..XX F-S BB - -
121 (78)  10 121 (78) 000197200039 OW SG_121     XX.. ..X. F-S WW N 000197200105
```

To display group 20 on SID 039:

```
symcfg -sid 039 -rdfg 20 -metro list

Symmetrix ID : 000197200039

                S Y M M E T R I X   R D F   G R O U P S

    Local             Remote                   Group                RDF Metro
------------ --------------------- --------------------------- -----------------
```

```
         LL                                       Flags   Dir    Witness
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CE S Identifier
------------ --------------------- --------------------------- -- ---------------
 20 (13)  10  20 (13) 000196700475 OD SG_20      XX.. ..XX F-S WW N 000197200105
```

To display all groups on SID 105:

```
symcfg -sid 105 -rdfg all list

Symmetrix ID : 000197200105

S Y M M E T R I X   R D F   G R O U P S

    Local            Remote                  Group               RDFA Info
------------ --------------------- --------------------------- ---------------
         LL                                       Flags   Dir Flags Cycle
 RA-Grp  sec  RA-Grp  SymmID       ST    Name    LPDS CHTM Cfg CSRM  time  Pri
------------ --------------------- --------------------------- ----- ----- ---
120 (77)   1 120 (77) 000196700475 OW SG_120     XX.. ..X. F-S -IS-     15  33
121 (78)   1 121 (78) 000197200039 OW SG_121     XX.. ..X. F-S -IS-     15  33
```

8. Query the device pairs:

```
symrdf -sid 000196700475 -rdfg 20 -f rdfg20 query

Symmetrix ID                 : 000196700475    (Microcode Version: 5977)
Remote Symmetrix ID          : 000197200039    (Microcode Version: 5977)
RDF (RA) Group Number        :  20 (13)
        Source (R1) View                 Target (R2) View     MODE
---------------------------------    ------------------------ ---- ------------
                ST                  LI       ST
Standard         A                   N        A
Logical  Sym     T R1 Inv  R2 Inv    K Sym    T R1 Inv  R2 Inv       RDF Pair
Device   Dev     E Tracks  Tracks    S Dev    E Tracks  Tracks  MACE STATE
--------------------------------- -- ------------------------ ---- ------------
N/A      000D0 RW       0       0 RW 000F0 RW       0       0 T.X. ActiveActive
N/A      000D1 RW       0       0 RW 000F1 RW       0       0 T.X. ActiveActive
N/A      000D2 RW       0       0 RW 000F2 RW       0       0 T.X. ActiveActive
N/A      000D3 RW       0       0 RW 000F3 RW       0       0 T.X. ActiveActive
N/A      000D4 RW       0       0 RW 000F4 RW       0       0 T.X. ActiveActive
N/A      000D5 RW       0       0 RW 000F5 RW       0       0 T.X. ActiveActive
N/A      000D6 RW       0       0 RW 000F6 RW       0       0 T.X. ActiveActive
N/A      000D7 RW       0       0 RW 000F7 RW       0       0 T.X. ActiveActive

Total                ------- -------              ------- -------
  Track(s)                 0       0                    0       0
  MB(s)                  0.0     0.0                  0.0     0.0
```

9. After the pairs have reached ActiveActive state, display the WWNs to verify the R1 WWNs and the non-native device WWNs on the R2 are the same:

```
symdev list -sid 475 -wwn -devs d0:d3

Symmetrix ID: 000196700475
        Device Name                                  Device
---------------------------- --------------------------------------------------
Sym   Physical               Config       Attr WWN
---------------------------- --------------------------------------------------
000D0 Not Visible            RDF1+TDEV         60000970000196700475533030304430
```

```
000D1 Not Visible            RDF1+TDEV        60000970000196700475533030304431
000D2 Not Visible            RDF1+TDEV        60000970000196700475533030304432
000D3 Not Visible            RDF1+TDEV        60000970000196700475533030304433


symdev list -sid 039 -wwn_non_native -devs f0:f3

Symmetrix ID: 000197200039
        Device Name                                     Device
---------------------------- ---------------------------------------------------
Sym   Physical               Config       Attr Non-Native WWN
---------------------------- ---------------------------------------------------
000F0 Not Visible            RDF2+TDEV        60000970000196700475533030304430
000F1 Not Visible            RDF2+TDEV        60000970000196700475533030304431
000F2 Not Visible            RDF2+TDEV        60000970000196700475533030304432
000F3 Not Visible            RDF2+TDEV        60000970000196700475533030304433
```

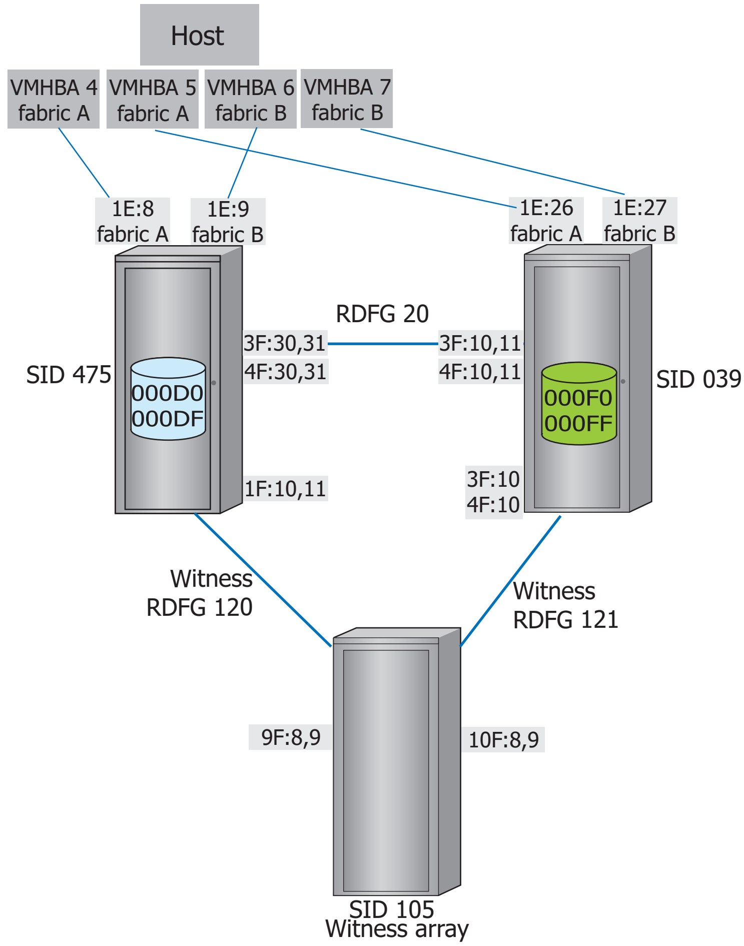
Note

- For an R1 device, the `symdev list -wwn_non_native` command does not show anything. (In case a set bias R2 was done, the new R1 has the identity of the original R1 (and the new R2/original R1) has no –`wwn_non_native`.)
- The `symdev show` command for the R2 device shows its native WWN (Device WWN field) and its external WWN (Device External Identity/Device WWN field).
- The second WWN (Device External Identity) should match the native WWN of its R1 partner, and should also be the value displayed by the `symdev list -non_native_wwn` command.

10. Map and mask the R2 devices to the host and access additional paths to the devices.

    The following image shows the final SRDF/Metro configuration.

Figure 19 Setting up SRDF/Metro with Witness array; After



CHAPTER 6

Consistency Group Operations

This chapter describes the following topics:

Consistency group operations overview

SRDF consistency preserves the dependent-write consistency of devices within a group by monitoring data propagation from source devices to their corresponding target devices. If a source R1 device in the consistency group cannot propagate data to its corresponding R2 device, SRDF consistency suspends data propagation from *all* the R1 devices in the group.

SRDF consistency allows rapid recovery from certain types of failures or physical disasters by retaining a consistent, DBMS-restartable copy of your database.

SRDF consistency group protection is available for SRDF/S and SRDF/A.

An SRDF *consistency group* is a composite group comprised of SRDF devices with consistency enabled.

The devices in the *consistency group* are configured to act in unison to maintain the integrity of a database when distributed across multiple arrays or across multiple devices within an array.

Domino mode also ensures consistency of a remote database.

Consistency protection using the SRDF daemon

The SRDF daemon (storrdfd) provides consistency protection for:

- SRDF/A Multi-Session Consistency (MSC) consistency groups in multi-array environments
- SRDF/S RDF-Enginuity Consistency Assist (ECA) consistency groups in multi-array environments
- Multiple SRDF groups within the same array
- For MSC consistency groups, the SRDF daemon performs cycle switching and cache recovery for all SRDF/A sessions within a consistency group, and manages the R1 -> R2 commits for SRDF/A sessions in multi-cycle mode.
  If a data flow interruption (such as a trip event) occurs, storrdfd:
  - Halts R1->R2 data propagation
  - Analyzes the status of all SRDF/A sessions.
  - Either commits the last cycle of data to the R2 targets or discards it.
- For RDF-ECA consistency groups, storrdfd continuously polls SRDF/S sessions for data flow interruptions.
  If any R1 device is unable to propagate data to its R2 target, storrdfd:
  - Halts all R1->R2 data flow within an RDF-ECA consistency group.

storrdfd ensures that you always have a consistent R2 copy of a database at the point in time in which a data interruption occurs.

Before you begin consistency group operations

Before storrdfd can monitor and manage a consistency group, you must:

- Create a composite group with SRDF consistency enabled (`-rdf_consistency` option)
- Enable the composite group (`symcg enable` command).

Enable the SRDF daemon

The storrdfd daemon is required for SRDF consistency group operations.

By default, the storrdfd daemon is disabled and must be enabled for all applications using the SYMAPI configuration database file and SRDF consistency protection.

Each host running the SRDF daemon must also be running the base daemon (storapid).

Dell EMC Solutions Enabler CLI Reference Guide explains common daemon tasks, including how to start and stop daemons.

Syntax
Use the following SYMAPI options file setting to enable storrdfd:

```
SYMAPI_USE_RDFD=ENABLE
```

Enable the Group Naming Services daemon

The storrdfd daemon runs on each host for which SRDF consistency is required.

If the Group Naming Services (GNS) daemon is enabled, storrdfd relies on GNS to propagate updated CG definitions to all hosts locally attached to the same set of arrays.

If GNS is not enabled, manually recreate the updated CG definition on each one of these hosts.

NOTICE

When using GNS, enabling the gns_remote_mirror option in the daemon_options file will not mirror the CG if it includes any devices listed in "Mirroring exceptions" in the

Syntax
Enable GNS on each host using the following SYMAPI options file setting:

```
SYMAPI_USE_GNS=ENABLE
```

Redundant consistency protection

Two instances of the SRDF daemon can run simultaneously on separate control hosts to create redundant consistency protection for composite groups.

Simultaneous SRDF daemons perform independent monitoring and switching operations. If one fails, the other SRDF daemon takes it place, and completes all pending tasks (commit the last cycle to the target site).

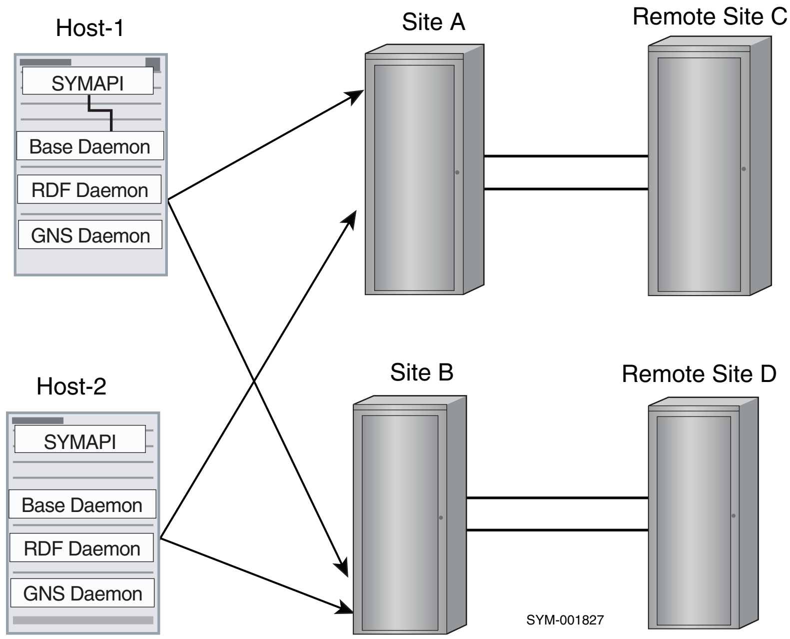
Redundant SRDF daemons allow you to avoid service interruptions caused by:

- Performance bottlenecks on one of the control hosts
- Link failures of the redundant SRDF daemons
- Failure of one control hosts

Each control host must have a common view of the composite group being monitored. To give each control host a common view, do one of the following:

- Run the GNS daemon on each control hosts, as shown in the following image, or
- Manually define the composite group on all control hosts.

Figure 20 Running redundant hosts to ensure consistency protection



In the image above, Host-1 and Host-2 run all three daemons: base daemon, SRDF daemon, and GNS daemon to ensure data consistency protection

NOTICE

Dell EMC strongly recommends running redundant SRDF daemons on at least two control hosts at each site. This ensures at least one SRDF daemon is available to perform time-critical, consistency monitoring operations.

Dell EMC recommends that you do not run the SRDF daemon on the same control host running the database applications. Use this control host to issue other control commands (such as SRDF, TimeFinder, and Clone operations).

If the control host is powerful enough to efficiently handle all CPU operations, and is configured with sufficient gatekeeper devices for all your management applications, you can run ECC and Unisphere for VMAX with the Solutions Enabler daemons.

SRDF consistency group operations

SRDF composite groups are initially created using the `symcg create` command. Once they are created, they are populated with devices and device groups.

In order to be enabled as an SRDF consistency group, the composite group must be:

- Defined as a type RDF1, RDF2, or RDF21
- Have consistency enabled using the option-rdf_consistency option.

`symrdf` control operations can change a composite group. For example, a device personality swap operation can change an RDF1 CG to an RDF2 CG. SRDF control operations (`failover -establish` and `swap` operations) cannot change the type of an ANY composite group but can affect the devices in that CG.

Consistency group operations and applicable pair states on page 477 provides a list of control actions and the required SRDF pair states for consistency group operations.

Creating a consistency group

The following steps illustrate how to build a consistency group when devices in the group are either all synchronous or all asynchronous.

Note

All devices containing application and array data must be included in the consistency group for each DBMS or across the DBMS controlling the multi-database transactions.

Procedure

1. Use the symcfg list command to list all SRDF (RA) groups on the source arrays connected to the local hosts to determine which devices to include in the CG:

   ```
   symcfg list -rdfg all
   ```

2. Use the symcg create command to create a consistency group (`ConsisGrp)` on one of the local hosts.

   Specify the SRDF type of the group and the -rdf_consistency option:

   ```
   symcg create ConsisGrp -type rdf1 -rdf_consistency
   ```

3. Use the symcg addall command to add the devices from an SRDF (RA) group, such as `RDG 64` , into the consistency group (`ConsisGrp)` :

   ```
   symcg -cg ConsisGrp -sid 3264 addall dev -rdfg 64
   ```

4. In a database configuration with multiple local hosts, you must build the same consistency group on all local hosts in the configuration.

   You can use the `symcg export` command to manually transfer the consistency group definition, or if enabled, use GNS to automatically transfer it.

   The following commands create the consisgrp.txt text file containing the new ConsisGrp composite group definition and then transfer it to `Host-1`:

   ```
   symcg export ConsisGrp -f consisgrp.txt
   rcp consisgrp.txt Host-1:/.
   ```

   In the following command, the `-rdf_consistency` option adds the imported ConsisGrp definition to the SRDF consistency database on `Host-1`:

   ```
   symcg import ConsisGrp -f consisgrp.txt -rdf_consistency
   ```

5. Verify that all devices in the group are either all synchronous or all asynchronous.

   ```
   symrdf -cg ConsisGrp verify -async
   ```

6. If the devices are currently operating with synchronous replication and you want them to be operating asynchronously, set the composite group for asynchronous replication:

   ```
   symrdf -cg ConsisGrp set mode async
   ```

7. If the SRDF pairs are not in the Consistent or Synchronized state at this time (the Split or Suspended state), you can use the symrdf establish command to initiate SRDF copying of R1 data to the R2 side.

   ```
   symrdf -cg ConsisGrp establish
   ```

The device state is SyncInProg until the Consistent or Synchronized state is reached.

With asynchronous replication, it may take two cycle switches for all devices to reach the Consistent state.

In multi-cycle mode, if either the link is or destaging the R2Apply cycle is slow, it may take more than 2 cycle switches for all devices to reach Consistent state.

8. From one of the local hosts, use the `symcg enable` command to enable the composite group for consistency protection:

   `symcg -cg ConsisGrp enable`

   The `ConsistGrp` CG becomes an SRDF consistency group managed by the SRDF daemon.

   The SRDF daemon watches for any problems with R1->R2 data within the `ConsistGrp` CG.

Create composite groups from various sources

Souces from which to create a composite group include:

- Device group - Translate the devices of an existing device group
- RDMS database - Translate the devices of an existing RDBMS database or tablespace
- Volume group - Translate the devices of an existing logical volume group

---

Note

The E-Lab[TM] Interoperability Navigator at http://elabnavigator.EMC.com provides detailed interoperability information.

Create a composite group from an existing device group

Use the `symdg` command with the `-rdf_consistency` option to translate the devices of an existing device group to a new or existing composite group.

Example
In the following example, the `symdg` command:

- Translates devices to SRDF
- Adds all devices from a device group Symm64DevGrp to a composite group `ConsistGrp`.
- Adds the composite group to the SRDF consistency database on the host
- Enables the group for SRDF consistency protection:

```
symdg dg2cg Symm64DevGrp ConsistGrp -rdf_consistency
```

Create a composite group from an RDBMS database

Use the `export` command to translate the devices of an existing RDBMS database or tablespace to a new or existing composite group.

Note

For SYMCLI to access a specified database, you must set the `SYMCLI_RDB_CONNECT` environment variable to the username and password of the array administrator's account.

Note

The Bourne and Korn shells use the `export` command to set environment variables. The C shell uses the `setenv` command.

Connecting by network

When connecting by the network, add a database-specific variable to the RDB_CONNECT definition.

When connecting through the network in an Oracle environment, Oracle has a network listener process running.

An Oracle connection string such as the Transparent Network Substrate (TNS) is required.

Examples

In the following example, a local connect is used. The `export` command sets the variable to a username of "array" and a password of "manager".

```
export SYMCLI_RDB_CONNECT=array/manager
```

In the following example, the export command adds the TNS alias name "api217":

```
export SYMCLI_RDB_CONNECT=array/manager@api217
```

When connecting through the network in an SQL Server 2000 environment, add a string to indicate the ODBC data source administrator.

To add string "HR":

```
set SYMCLI_RDB_CONNECT=array/manager@HR
```

Optionally, set the `SYMCLI_RDB_TYPE` environmental variable to a specific type of database (oracle, informix, sqlserver, or ibmudb) so that you do not have to include the `-type` option on the symrdb rdb2cg command line.

To set the environmental variable to `oracle` :

```
export SYMCLI_RDB_TYPE=oracle
```

Translate devices in a composite group

You can translate the devices in a database to a composite group.

You can translate the devices in an Oracle type tablespace to a composite group.

With most RDBMS database arrays, you must set up environment variables specific to that array.

Oracle arrays use `ORACLE_HOME` and `ORACLE_SID`.

Sybase arrays use `SYBASE` and `DSQUERY`.

Examples

In the following example, the `symrdb rdb2cg` command:

- Translates the devices of an Oracle-type database named oradb to an RDF1 type composite group named `ConsisGrpDb` .
- The `-rdf_consistency` option adds the composite group to the SRDF consistency database on the host:

```
symrdb -type oracle -db oradb rdb2cg ConsisGrpDb -cgtype rdf1 -
rdf_consistency
```

In the following example, the `symrdb tbs2cg` command translates the devices of an oracle type tablespace orats to an RDF1 type composite group named `ConsisGrpTs`:

```
symrdb -type oracle -tbs orats tbs2cg ConsisGrpTs -cgtype rdf1 -
rdf_consistency
```

Create a composite group from a logical volume group

use the `symvg` command to translate the devices of an existing logical volume group to a new or existing composite group. This command does not require environment variables.

Example

In the following example, the `symvg` command:

- Translates the devices of a logical volume group named LVM4vg to an RDF1 type composite group named `ConsisGrp`.
- The `-rdf_consistency` option adds the composite group to the SRDF consistency database on the host:

```
symvg vg2cg LVM4vg ConsisGrp -cgtype rdf1 -rdf_consistency
```

Enable and disable SRDF consistency protection

You can enable or disable consistency protection for all the devices in a composite group. When you enable the composite group for consistency, the group is referred to as an SRDF consistency group.

Restrictions

- You can have either consistency protection or the domino effect mode enabled for a device, but not both.
- When a composite group is enabled for consistency protection:
  - Its name cannot be changed without first disabling the consistency protection. After the name change, re-enable the composite group using the new name.

- If the composite group is enabled for SRDF/A consistency protection, the SRDF daemon immediately begins cycle switches on the SRDF groups within the composite group (or named subset).
  The cycle switches for all SRDF groups will be performed at the same time. The interval between these cycle switches is determined by the smallest minimum cycle time defined on the R1 SRDF groups in the composite group (or named subset).

  The smallest minimum cycle time supported by the SRDF daemon is 3 seconds. This value is used if the smallest minimum cycle time across all component groups is less than 3 seconds.

- If you change the minimum cycle time for any of the R1 SRDF groups while the composite group (or named subset) is enabled for SRDF/A consistency protection, the new minimum cycle time will not take effect until you disable consistency protection and then re-enable it.
- You can change contents of a composite group by doing one of the following:
  - Disable consistency protection on a composite group while you add or remove devices, and then re-enable consistency protection after editing the composite group.
    Devices in the composite group are unprotected during the time required to edit and then re-enable the composite group.
  - For RDF1 composite groups, you can dynamically modify the composite group while maintaining consistency protection during the editing process.
    Modify consistency groups on page 220 provides more information.

Enable consistency: composite group vs. SRDF group name

Consistency protection can be enabled and disabled at the composite group level or at the SRDF group name level:

- When consistency is enabled at the composite group level, all devices within the consistency group operate as a single unit.
- When consistency protection is enabled at the SRDF group name level, only the devices in the specified SRDF group operate as a unit.

Enable/disable consistency for a composite group

If one R1 device in a CG is unable to propagate data to its R2 target, the SRDF links of all the devices within that CG are suspended.

To enable consistency protection at the composite group level, all device mirrors must be operating in the same SRDF mode: all device mirrors must be operating either synchronously or asynchronously.

Use the `symcg enable` and `symcg disable` commands to enable/disable consistency protection at the composite group level. All device pairs in the specified group are enabled/disabled.

Examples

To enable consistency protection for all device pairs in composite group `prod` CG:

```
symcg -cg prod enable
```

To disable consistency protection for all device pairs in `prod` CG:

```
symcg -cg prod disable
```

Enable consistency for an SRDF group

If an R1 device in a CG cannot send data to its R2 target, the SRDF links for only those devices in the specified SRDF group of the CG are suspended.

SRDF group protection is useful for concurrent devices with one mirror operating in synchronous mode and the other mirror operating in asynchronous mode.

To enable consistency protection at the SRDF group name level, you must first define one or more named subsets of devices within the composite group.

A subset can consist of one or more of the SRDF groups within the composite group.

Restrictions

When a subset of a CG is enabled for consistency protection at the SRDF group name level:

- You must disable consistency protection on the subset before you can:
  - Change the name of the subset.
  - Add or remove SRDF groups to the subset.

  Note

  For an RDF1 composite group, you can dynamically modify the contents of a subset while consistency protection is enabled. Modify consistency groups on page 220 provides more information.

- You cannot enable a composite group at the CG level and a member SRDF group at the same time.
  - If a composite group is enabled at the CG level, no part of it can be simultaneously enabled at the SRDF group name level.
  - If a subset of the group is enabled at the SRDF group name level, the group cannot be enabled at the CG level.

Examples

In the following example, composite group SALES consists of a set of concurrent SRDF devices distributed across two arrays, 076 and 077.

- On array 076:
  - SRDF group 100 operates in asynchronous mode, and
  - SRDF group 120 operates in synchronous mode.
- On array 077:
  - SRDF group 101 operates in asynchronous mode, and
  - SRDF group 121 operates in synchronous mode.

To create two named subsets of the composite group:

One containing the asynchronous SRDF groups:

```
symcg -cg SALES set -name sales1 -rdfg 76:100
symcg -cg SALES set -name sales1 -rdfg 77:101
```

One containing the synchronous SRDF groups:

```
symcg -cg SALES set -name sales2 -rdfg 76:120
symcg -cg SALES set -name sales2 -rdfg 77:121
```

To enable independent consistency protection for the two subsets:

```
symcg -cg SALES enable -rdfg name:sales1
symcg -cg SALES enable -rdfg name:sales2
```

Note

To remove an RDF group from a set, simply set the set name to null:

```
symcg -cg [groupname] set -name -rdfg
XX:YY
```

As a result, the specified group will no longer be associated with the name.

Enable/disable consistency protection for SRDF/S devices

The `enable` action enables consistency protection either:

- Across all synchronous-mode devices in a consistency group, or
- Across all synchronous-mode devices in a named subset of a composite group.

If any R1 devices in an SRDF/S consistency group cannot propagate data to their corresponding R2 targets, the SRDF daemon suspends data propagation from all R1 devices in the consistency group, halting all data flow to the R2 targets.

Examples

To enable consistency protection for SRDF/S pairs in the `prod` CG:

```
symcg -cg prod enable
```

To disable consistency protection for SRDF/S pairs in the `prod` CG:

```
symcg -cg prod disable
```

Enable/disable consistency protection for SRDF/A devices

The `enable` action enables consistency protection either:

- Across all asynchronous-mode devices in a consistency group, or
- Across all asynchronous-mode devices in a named subset of a composite group.

If an SRDF/A session that was enabled for consistency protection cannot propagate data from the R1 devices to their corresponding R2 target, Enginuity deactivates that session, suspending data propagation for all devices in the SRDF/A session and preserving R2 consistency.

If the consistency group or named subset of a composite group is comprised of multiple SRDF/A sessions, the SRDF daemon suspends data propagation for the other

SRDF/A sessions, halting all data flow to the R2 targets in order to preserve R2 consistency.

Examples
To enable consistency protection for SRDF/A pairs in the `prod2` CG:

```
symcg -cg prod2 enable
```

To disable consistency protection for SRDF/A pairs in the `prod2` CG:

```
symcg -cg prod2 disable
```

Enabling SRDF consistency protection for concurrent SRDF devices

You can enable and disable consistency protection for concurrent devices at the composite group level or at the SRDF group name level:

- When consistency is enabled for concurrent devices at the composite group level, all device mirrors must be operating in the same SRDF mode; that is all device mirrors must be operating either synchronously or asynchronously.
- When consistency is enabled for concurrent devices at the SRDF group name level, the SRDF daemon monitors the SRDF groups separately.

Enable/disable consistency for concurrent devices in a composite group

If the two groups are operating in asynchronous mode, they cycle-switch together.

In either asynchronous or synchronous mode, the SRDF daemon suspends the SRDF links for both groups if a concurrent R1 device is unable to propagate its data to either of its remote R2 partners. This preserves the consistency of R2 data.

Syntax
Use the `symcg enable` and `symcg disable` commands to enable/disable consistency protection at the composite group level. All device pairs in the specified group are enabled/disabled.

If the concurrent mirrors are in asynchronous mode, the `enable` command enables consistency with MSC consistency protection.

If the concurrent mirrors are in synchronous mode, the `enable` command enables consistency with RDF-ECA consistency protection.

Examples
In the following example, composite group `prod` contains a concurrent R1 with two asynchronous target mirrors.

To enable consistency protection with MSC consistency protection for the two target mirrors:

```
symcg -cg prod enable
```

To disable consistency protection for all device pairs in `prod` CG:

```
symcg -cg prod disable
```

Enable consistency for concurrent devices in a SRDF group

When consistency is enabled at the SRDF group name level, the SRDF daemon monitors the SRDF groups separately.

If a concurrent R1 device is unable to propagate its data to one of its remote R2 partners, the daemon suspends the SRDF links for only the group representing that R2 mirror.

Restrictions

- If the two mirrors of the concurrent R1 devices in the composite group are operating in different modes (one mirror in synchronous mode and the other mirror in asynchronous mode), SRDF consistency protection cannot be enabled at the composite group level.
  You must individually enable each group representing the device mirrors by its group name.
- The following table lists the combinations of consistency protection modes allowed for the mirrors of a concurrent relationship.

Table 18 Consistency modes for concurrent mirrors

R1->R2 (first mirror)	R1->R2 (second mirror)
MSC	None
MSC	RDF-ECA
MSC	MSC
RDF-ECA	None
RDF-ECA	RDF-ECA
RDF-ECA	MSC
None	None
None	MSC
None	RDF-ECA

Enabling consistency for concurrent pairs

Procedure

1. Use the `symcg` command to define the group name to associate with the SRDF group number.

   In the following example, the name `cGrpA` is associated with SRDF group 55 on array 123:

   ```
   symcg -cg prod set -name cGrpA -rdfg 123:55
   ```

2. Use the `symcg` command to enable consistency protection for the SRDF group.

In the following example, the name `cGrpA` is associated with SRDF group 55 on array 123:

```
symcg -cg prod enable -rdfg name:cGrpA
```

- If the mirrors in SRDF group 55 are operating in asynchronous mode, the SRDF group is enabled with MSC consistency protection.
- If the mirrors in SRDF group 55 are operating in synchronous mode, the SRDF group is enabled with RDF-ECA protection.

3. Repeat the steps above to enable consistency protection for the second concurrent SRDF group

   Use a unique name for the second group.

Check if device pairs are enabled for consistency protection

Syntax

Use the `symrdf verify -enabled` command to validate whether device pairs are enabled for consistency protection.

Use the `symrdf verify -enabled -synchronized -consistent` command to verify whether the device pairs are enabled for consistency protection and are in the synchronized OR consistent pair state.

Examples

To verify whether the device pairs in the STAGING group are enabled for consistency protection:

```
symrdf -g STAGING verify -enabled
```

If none of the device pairs in the STAGING group are enabled for consistency protection, the following message displays:

```
None of the devices in the group 'STAGING' are 'Enabled'.
```

If all devices in the STAGING group were enabled for consistency protection, the following message displays:

```
All devices in the group 'STAGING' are 'Enabled'.
```

To verify whether the device pairs in the STAGING group are enabled for consistency protection and are in the synchronized or consistent pair state:

```
symrdf -g STAGING verify -enabled -synchronized -consistent
```

If all devices are enabled and in the synchronized OR consistent pair state, the following message displays:

```
"All devices in the group 'STAGING' are 'Enabled' and in
'Synchronized, Consistent' states."
'Synchronized, Consistent' states."Blocking symcg enable on R2 side
```

Block symcg enable on R2 side

You can execute the `symcg enable` command from the R1 or R2 side of an SRDF relationship.

The `SYMAPI_ALLOW_CG_ENABLE_FROM_R2` in the options file allows you to prevent the `symcg enable` operation from being executed on the R2 side.

The default for `SYMAPI_ALLOW_CG_ENABLE_FROM_R2` is enabled. When enabled, this option allows the SDRF daemon running on the R2 side to close the RDF-ECA window due to a link failure, even though the failure prevents the R2 side from communicating with the R1 side.

This option can be set as:

- `ENABLE` - (Default) Allows the composite group to be enabled on the R2 side.
- `DISABLE` - Blocks the composite group from being enabled on the R2 side.

Delete an SRDF consistency group

When you delete an SRDF consistency group from a CG, the SRDF daemon stops monitoring the CG.

NOTICE

After deletion, SRDF consistency protection on the R2 data cannot be guaranteed even though the devices formerly in the CG may remain enabled.

Best practice is to disable consistency protection before deleting a group. Enable and disable SRDF consistency protection on page 210 provides more information.

Syntax

`symcg delete` *`GroupName`*

Options

-force

Required if the group is disabled and there are members in the group.

-symforce

Required if the group is enabled. The composite group remains enabled but is removed from the SYMAPI database.

Example

To delete a disabled SRDF consistency group `mycg1` (with members):

```
symcg delete mycg1 -force
```

Suspend SRDF consistency protection

When the same consistency group is defined on multiple hosts, you can initiate a suspend operation from any host provided the consistency group is enabled.

Consistency protection is automatically restored upon resumption of the link.

Consistency protection is not disabled unless you specify `symcg -cg disable`.

Syntax

Use the `suspend`, `split` or `failover` commands to suspend consistency protection for all devices in an SRDF consistency group where all devices are either synchronous or asynchronous.

For asynchronous replication, use the `symrdf -cg verify` command with the `–cg_consistent` option to ensure that the SRDF consistency group is SRDF-consistency enabled and in a consistent state.

A consistent state means that at least two cycle switches have occurred and all devices in each SRDF (RA) group have reached a consistent state.

The state of the R2 devices at the end of the deactivation varies depending on whether the `suspend` or `split` command is used:

Note

If you execute the `failover` command on both mirrors of a concurrent R1 device, the concurrent R1 is converted into a concurrent R2 with a restore on both mirrors of the concurrent R2.

Options

The state of the R2 devices at the end of the deactivation varies depending on whether the `suspend` or `split` command is used:

symrdf -cg suspend

The R2 devices are in the write disabled state and cannot be accessed by the target-side hosts. R2 database copy is consistent with the production copy on the R1 side.

symrdf -cg split

The R2 devices are enabled for both reads and writes by the target-side hosts.

Note

The `–force` option is required.

Examples

To deactivate consistency in a consistency group named `ConsisGrp`:

```
symrdf -cg ConsisGrp suspend -force
```

To resume the SRDF links between the SRDF pairs in the SRDF consistency group and I/O traffic between the R1 devices and their paired R2 devices:

```
symrdf -cg ConsisGrp resume
```

Verify SRDF consistency

Examples
To verify that the SRDF consistency group ConsisGroup is SRDF-consistency enabled and in a consistent state:

```
symrdf -cg ConsisGrp verify -cg_consistent
```

(For synchronous operations) To verify if the device pairs in ConsisGroup are in Synchronized state:

```
symrdf -cg ConsisGrp verify -synchronized
```

Composite group cleanup (msc_cleanup)

When an SRDF/A single mode session is dropped, the OS automatically starts a cleanup process:

- The primary array marks new incoming writes as being owed to the secondary array.
- The capture and transmit delta sets are discarded, but the data is marked as being owed to the secondary array. All of these owed tracks are sent to the secondary array once SRDF is resumed, as long as the copy direction remains primary to secondary.
- The secondary array marks and discards the receive delta set only. Data is marked as tracks owed to the primary array.
- The secondary array makes sure the apply (N-2) delta set is safely applied to disk; this is the dependent-write consistent image.

When a SRDF/A multiple mode session with Multi-Session Consistency (MSC) is dropped, MSC cleanup operations either:

- Discards any incomplete SRDF/A data, or
- Commits completed data to the R2 to maintain dependent write consistency.

When a SRDF/A multiple mode session with MSC is dropped, additional cleanup is required in fault scenarios where all delta sets of a transition have not been fully applied or discarded.

If a link failure causes protection to be triggered, the daemon may not be able to process all cleanup operations for the R2 devices where the receive and apply delta sets reside. Run the `symrdf msc_cleanup` command manually from the R2 site. If no consistency group definition is available at the R2 site, direct the cleanup operation to an SRDF (RA) group that was included as part of the consistency group.

Output of the `symcfg list` command includes flag information for SRDF groups operating in SRDF/A mode. An X in the RDFA Flags "M" column denotes that an MSC cleanup operation is required.

Syntax

Use the `msc_cleanup` command to cleanup after a session is dropped for devices operating in SRDF/A mode with consistency enabled MSC. The command can be executed by composite group from the R1 or R2 site or by SRDF group from the R2 site.

Use the `symcfg list` command to check whether a MSC cleanup operation is required.

Use the `symcfg list` command with the `-rdfg all` option to display whether a MSC cleanup operation is required for only SRDF (RA) groups on the specified array.

Examples

To cleanup a composite group (mycg):

```
symrdf -cg mycg msc_cleanup
```

To cleanup from the remote host at the R2 site for array 123 and direct the command to SRDF group 4:

```
symrdf -sid 123 -rdfg 4 msc_cleanup
```

Modify consistency groups

You can dynamically add or remove the following device types for an RDF1 consistency group without first disabling consistency protection:

- Simple R1
- Concurrent R11

Use the `symcg modify` command with the `add` and `remove` options to modify SRDF consistency groups.

Before you begin consistency group modification

Before you begin, you must understand how the SRDF daemon maintains consistency protection during dynamic modification:

- On the local host, the SRDF daemon continuously monitors the consistency group being changed.
  The SRDF daemon must be running locally on the host where the `symcg modify` command is issued.
- On other hosts, the SRDF daemons do the following:
  - On hosts running GNS - SRDF daemons monitor the consistency group as it is being modified as long as these hosts are locally attached to the same set of arrays as the control host.
    Depending on the timing of the GNS updates, there may be a brief period during which the SRDF daemon stops monitoring the consistency group while waiting for the updated consistency group definition to propagate to the local GNS daemon.
  - On hosts *not* running GNS - If the SRDF daemons are running Solutions Enabler versions lower than 7.3.1, the daemons stop monitoring the CG during

dynamic modification. These older daemons see the old CG definition until the symstar buildcg -update command is issued.

NOTICE

Dell EMC strongly recommends running GNS on your hosts to ensure consistency protection while dynamically modifying CGs.

Consistency group modification restrictions

The following apply to dynamic `add` and `remove` options of the `symcg modify` command:

- Devices that are in an SRDF/Metro configuration cannot be added to SRDF CGs
- A CG that contains devices that are in an SRDF/Metro configuration cannot be enabled for SRDF consistency.
- All arrays are reachable.
- The SRDF daemon must be running locally on the host where the `symcg modify` command is issued.
- The `symcg modify` command only applies to RDF1 composite groups.
  It is not allowed for RDF2, RDF21, or type=ANY composite groups.
- The `symcg modify` command is not allowed for:
  - CGs consisting of device groups.
  - CGs containing concurrent SRDF devices.
  - Any devices in SRDF/Star mode.
    Use the `symstar modifycg` command to modify devices in the CG are in STAR mode.
- The SRDF groups affected by the `symcg modify` command cannot contain any devices enabled for consistency protection by another CG.
- Devices within SRDF groups of the CG to be modified must be in one of the following SRDF pair states:
  - Synchronized
  - SyncInProg with invalid tracks owed to the R2
  - Consistent with no invalid tracks
  - Within an affected SRDF group, device pairs can be a mixture of Synchronized and SyncInProg or a mixture of Consistent and SyncInProg.

Note

If the `symcg modify` command fails, you can rerun the command or issue `symcg modify -recover`. No control operations are allowed on a CG until after a recover completes on that CG.

Prepare staging area for consistency group modification

Before you can dynamically modify SRDF consistency groups, you must create a staging area that mirrors the configuration of the CG. The staging area consists of:

- SRDF groups containing the device pairs to be added to a consistency group (`symcg modify -add` operations),

- SRDF groups for receiving the device pairs removed from a consistency group (`symcg modify -remove` operations).
- The SRDF groups in the staging area must be established between the same arrays as the SRDF groups in the consistency group.
  For concurrent CGs, the SRDF groups in the staging area must be established among three arrays.

Restrictions: SRDF groups and devices in the staging area

- SRDF groups cannot be part of an SRDF/Star configuration.
- Staging area cannot be an SRDF/Metro configuration.
- Devices cannot be enabled for consistency protection.
- Devices cannot be defined with SRDF/Star SDDF (Symmetrix Differential Data Facility) sessions.
- BCVs are not allowed.
- All devices must be SRDF dynamic and of the same type:
  - Simple R1 devices
  - Concurrent R11 devices
- All device pairs must set in the same mode:
  - Adaptive copy disk
  - Adaptive copy write pending for diskless R21->R2 device pairs

  ---

  Note

  Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS, and diskless R21 devices are not supported on arrays running HYPERMAX OS.

Restrictions: SRDF groups and devices for dynamic add operations

The dynamic modify add operation moves device pairs from the staging area into the SRDF groups of a consistency group.

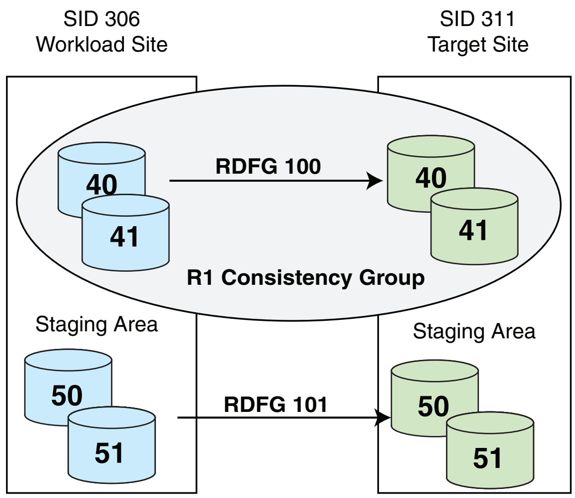
All devices in the staging area must be in one of the following SRDF pair states for each SRDF group:

- Synchronized
- SyncInProg with invalid tracks owed to the R2
- Suspended
- Suspended with invalid tracks owed to the R2

If any device pair is Suspended (with or without invalid tracks on any of its SRDF groups), then the device pairs in the same SRDF group must all be Suspended.

The following image shows a staging area for an R1-R2 configuration:

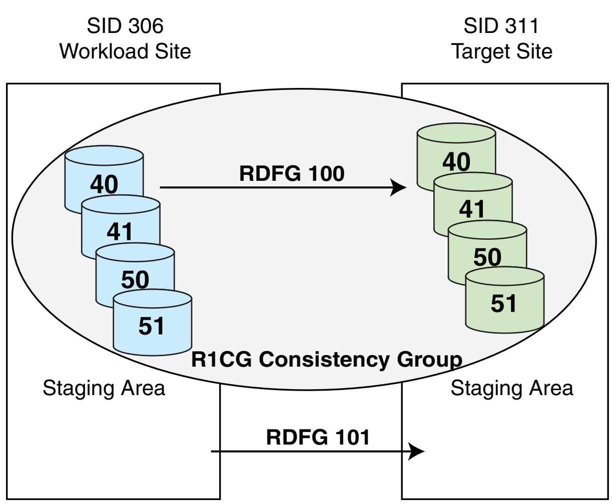
Figure 21 Staging area for adding devices to the R1CG consistency group



RDFG 101 is established between the same array as the RDFG 100 in the R1CG consistency group.

The following image shows the R1CG consistency group after the dynamic add operation:

Figure 22 R1CG consistency group after a dynamic modify add operation



Devices 50 and 51 were moved to R1CG.

The staging area contains the empty RDFG 101.

Prepare the staging area to remove devices

The dynamic modify remove operation moves the device pairs from the consistency group into the SRDF groups in the staging areas.

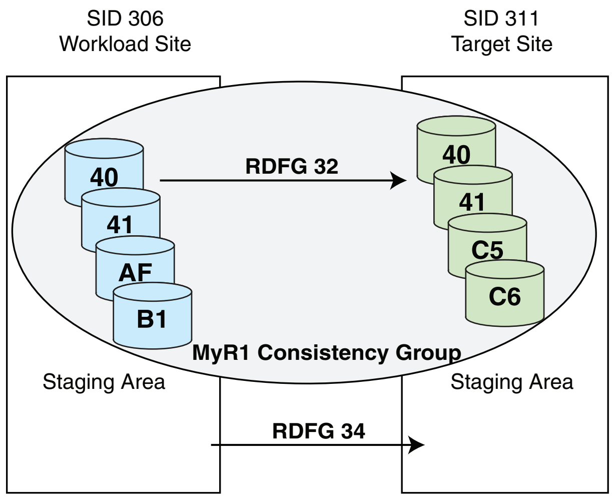
To prepare the staging area for this operation, create the SRDF groups for receiving the device pairs removed from a consistency group.

Note

The dynamic modify remove operation must never leave an SRDF group empty.

The following image shows empty group RDFG 34 configured to receive devices removed from RDFG 32:

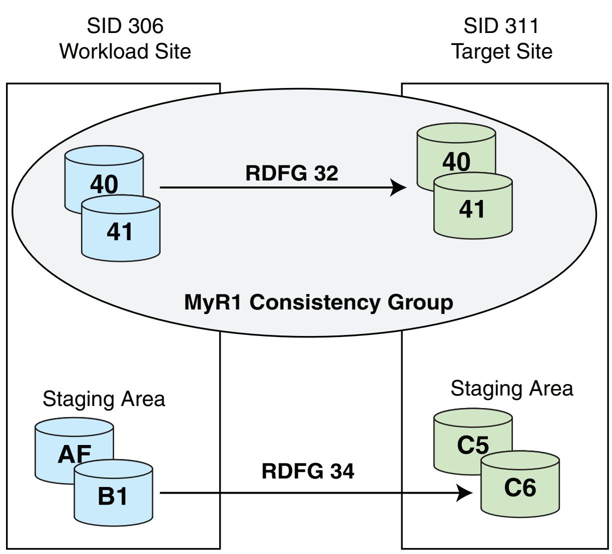
Figure 23 Preparing the staging area for removing devices from the MyR1 CG



The staging area consists of RDFG 34, an R1->R2 configuration established between the same array as RDFG 32 in the MyR1 consistency group.

The following image shows the MyR1 consistency group and its staging area after the dynamic modify remove operation has completed.

Figure 24 MyR1 CG after a dynamic modify remove operation



Restrictions: Add devices to SRDF consistency group

The following are restrictions for dynamically adding devices to an SRDF consistency group using the `symcg modify -add` command:

- The `symcg modify -add` command:
  - Cannot add new SRDF groups to the CG.

  - Cannot add a concurrent R11 device to a CG enabled at the composite group level.
  - Prohibits adding both mirrors of a concurrent R11 device to the same SRDF group name.
  - Cannot add a triangle of devices to a CG. In other words, a concurrent R11 device cannot have one R1 mirror paired with an R21 device, which is then paired with an R22 device that is paired with the other R1 mirror of the concurrent R1 device.
  - Prohibits adding a cascaded R1 device to a concurrent CG.
  - Prohibits adding a concurrent R1 device to a cascaded CG.
- If the target is a cascaded CG, the operation must be enabled by CG hop 1 or by the SRDF group name hop 1.
- If the target is a cascaded CG and the devices to be added are simple R1 devices, the CG cannot be enabled by CG hop 2 or by SRDF group name hop 2.
- If the target is a cascaded CG and the devices to be added are cascaded R1 devices paired with diskless R21 devices, then all R21 devices in the affected SRDF group must also be diskless.
- If the target is a cascaded CG and the devices to be added are cascaded R1 devices paired with non-diskless R21 devices, then all R21 devices in the affected SRDF group must be non-diskless.

Restrictions: Remove devices from SRDF consistency group

The following are restrictions for dynamically removing devices from an SRDF consistency group using the `symcg modify -remove` command:

- The dynamic modify remove operation must never leave an SRDF group empty.
- The `symcg modify -remove` command cannot remove SRDF groups from a consistency group.
- The `symcg modify -remove` command prohibits a cascaded R1 device from being removed from a consistency group enabled at the composite group level.
- The `symcg modify -remove` command cannot remove both legs of a concurrent R11 device if they are enabled for consistency protection by the same SRDF group name.

Restrictions: Device types allowed for add operations to an RDF1 consistency group

The following table lists the allowable device types for a dynamic modify add operation on a composite group enabled for consistency protection at the composite group level and the SRDF group name level. This RDF1 CG is not concurrent or cascaded.

Table 19 Allowable device types for adding devices to an RDF1 CG

Device type in staging area	Enabled at CG level	Enabled at SRDF group name level
Simple R1 (R1->R2)	Allowed	Allowed
Concurrent R11	Not allowed	Only allowed if both affected SRDF groups in the CG

Table 19 Allowable device types for adding devices to an RDF1 CG (continued)

Device type in staging area	Enabled at CG level	Enabled at SRDF group name level
		already exist and are assigned to different SRDF group names.
Cascaded R1	Not allowed	Not allowed

Examples

To move devices 50 and 51 from SRDF group 101 in the staging area to SRDF group 100 in `R1CG` on array 306:

```
symcg -cg R1CG modify -add -sid 306 -stg_rdfg 101 -devs 50:51 -
cg_rdfg 100
```

To check if the devices were added to **R1CG**:

```
symrdf -cg R1CG query -detail
```

Restrictions: Device types and consistency modes allowed for add operations to a concurrent RDF1 consistency group

Before you perform this procedure, review Enabling SRDF consistency protection for concurrent SRDF devices on page 214.

The following table lists the allowable device types for a dynamic modify add operation on a concurrent RDF1 composite group enabled for consistency protection at the composite group level and the SRDF group name level.

Table 20 Allowable device types for adding devices to a concurrent RDF1 CG

Device type in staging area	Enabled at CG level	Enabled at SRDF group name level
Simple R1 (R1->R2)	Allowed	Allowed
Concurrent R11	Not allowed	Only allowed if each mirror is assigned to a different SRDF group
Cascaded R1	Not allowed	Not allowed

The following table lists the allowable consistency modes for the SRDF groups of a concurrent CG.

Table 21 Supported consistency modes for concurrent SRDF groups

SRDF group 1 (first mirror)	SRDF group 2 (second mirror)
RDF-ECA	RDF-ECA

Table 21 Supported consistency modes for concurrent SRDF groups (continued)

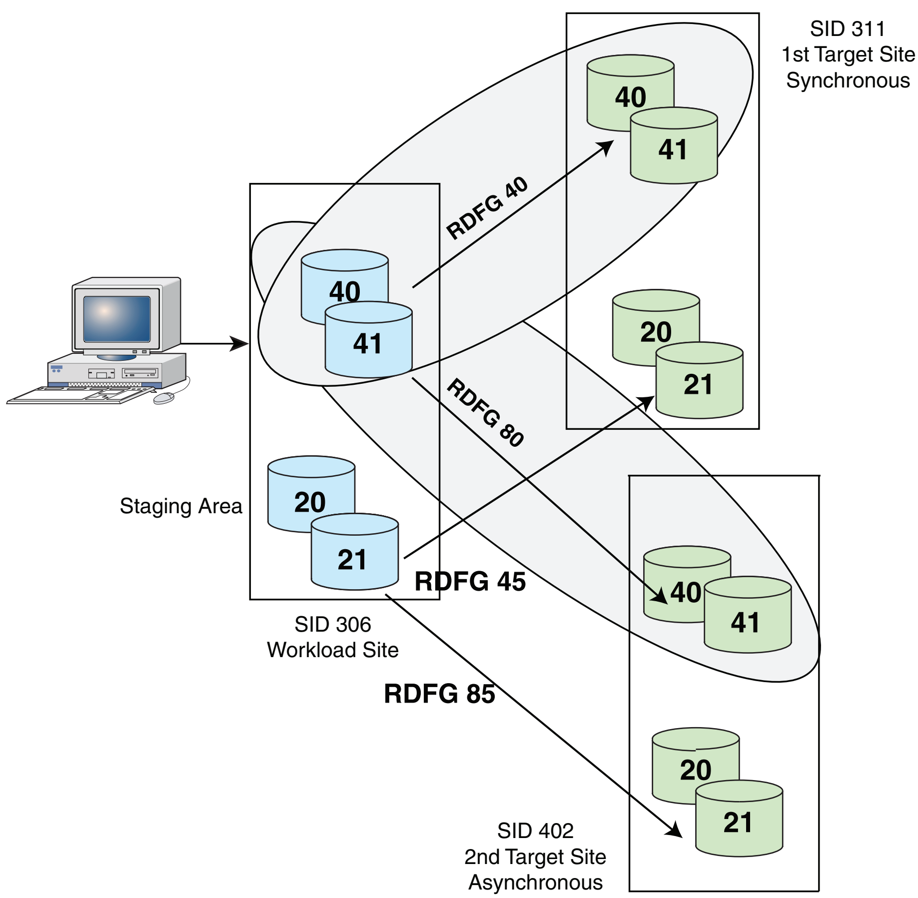
SRDF group 1 (first mirror)	SRDF group 2 (second mirror)
RDF-ECA	MSC
RDF-ECA	Not enabled
Not enabled	RDF-ECA
MSC	RDF-ECA
MSC	MSC
MSC	Not enabled
Not enabled	MSC

Examples

In this example, device 20 is added to two independently-enabled SRDF groups of a CG.

The following image shows the staging area shared by array 306, 311, and 402 in a concurrent SRDF configuration:

Figure 25 Adding a device to independently-enabled SRDF groups of a concurrent CG



The staging area contains devices 20 and 21.

SRDF groups 70 and 71 of `ConCG` operate in different SRDF modes. They were enabled independently for consistency protection using the following SRDF group names:

Boston: device pairs operate in SRDF/S mode and are set for RDF-ECA consistency protection.

New York: device pairs operate in SRDF/A mode and are enabled for MSC consistency protection.
To add only device 20 from the staging area into SRDF groups 70 and 71 of `ConCG`:

```
symcg -cg ConCG modify -add -sid 306 -stg_rdfg 80,81 -devs 20 -cg_rdfg 70,71
```

To check if the devices were added to `ConCG`:

```
symrdf -cg ConCG query -detail
```

Restrictions: Devices types allowed to add to a cascaded RDF1 consistency group

Before you perform this procedure, review Check if device pairs are enabled for consistency protection on page 216.

The following table lists the allowable device types for a dynamic modify add operation on a cascaded R1 composite group enabled for consistency protection at the composite group level and the SRDF group name level.

Table 22 Allowable device types for adding devices to a cascaded RDF1 CG

	Enabled at CG level			Enabled at SRDF group name level		
Device type in staging area	**Hop 1 enabled Hop 2 not enabled**	**Hop 1 enabled Hop 2 enabled**	**Hop 1 not enabled Hop 2 enabled**	**Hop 1 enabled Hop 2 not enabled**	**Hop 1 enabled Hop 2 enabled**	**Hop 1 not enabled Hop 2 enabled**
Simple R1 (R1->R2)	Allowed	Not allowed	Not allowed	Allowed	Not allowed	Not allowed
Concurrent R11	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed
Cascaded R1	Allowed	Allowed	Not allowed	Allowed	Allowed	Not allowed

The following table lists the allowable consistency modes for the hops of a cascaded CG.

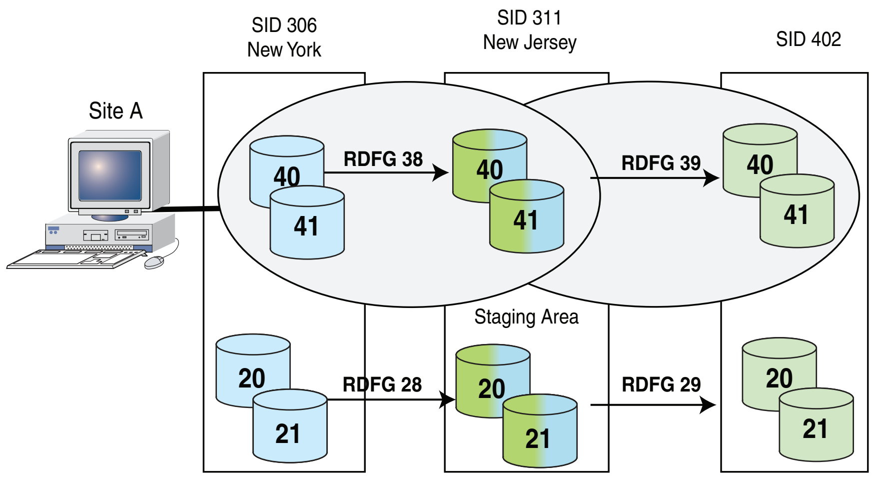
Table 23 Supported consistency modes for cascaded hops

R1->R21 (hop 1)	R21->R2 (hop 2)
RDF-ECA	MSC
RDF-ECA	Not enabled
MSC	Not enabled

Examples

The following image shows a cascaded SRDF configuration sharing the staging area among array 306, 311, and 402:

Figure 26 Adding devices to independently-enabled SRDF groups of a cascaded CG



The staging area contains devices 20 and 21 to be added to `CasCG`.

The hops were independently enabled for consistency protection using the following SRDF group names:

- New York: device pairs operate in SRDF/S mode and are set for RDF-ECA consistency protection.
- New Jersey: device pairs operate in SRDF/A mode and are enabled for MSC consistency protection.

To add devices 20 and 21 from the staging area into SRDF groups 38 and 39 of `CasCG`:

```
symcg -cg CasCG modify -add -sid 306 -stg_rdfg 28 -devs 20:21 -stg_r21_rdfg 29
      -cg_rdfg 38 -cg_r21_rdfg 39
```

To check if the devices were added to `CasCG`:

```
symrdf -cg CasCG query -detail -hop2
```

Restrictions: Device types allowed for remove operations from an RDF1 consistency group

The following table lists the allowable device types for a dynamic modify remove operation on a composite group enabled for consistency protection at the composite group level and the SRDF group name level. This RDF1 CG is not concurrent or cascaded.

Table 24 Allowable device types for removing devices from an RDF1 CG

Device type in CG	Enabled at CG level	Enabled at SRDF group name level
Simple R1 (R1->R2)	Allowed	Allowed

Table 24 Allowable device types for removing devices from an RDF1 CG (continued)

Device type in CG	Enabled at CG level	Enabled at SRDF group name level
Concurrent R11	Not applicable	Not applicable
Cascaded R1	Not applicable	Not applicable

Example

To remove devices `50` and `51` from `RDFG 100` of `R1CG` on array 306 to `RDFG 101` in the staging area:

```
symcg -cg R1CG modify -remove -sid 306 -stg_rdfg 101 -devs 50:51 -cg_rdfg 100
```

Restrictions: Device types allowed for remove operations from a concurrent RDF1 consistency group

The following table lists the allowable device types for a dynamic modify remove operation on a concurrent R1 composite group enabled for consistency protection at the composite group level and the SRDF group name level.

Table 25 Allowable device types for removing devices from a concurrent RDF1 CG

Device type in CG	Enabled at CG level	Enabled at SRDF group name level
Simple R1 (R1->R2)	Allowed	Allowed
Concurrent R11	Not allowed	Only allowed if both mirrors are not enabled by the same SRDF group name.
Cascaded R1	Now allowed	Not allowed

Example

To remove devices `20` through `30` from SRDF groups `70` and `80` of `ConCG` on array 306 into SRDF groups `71` and `81` in the staging area:

```
symcg -cg ConCG modify -remove -sid 306 -stg_rdfg 71,81 -devs 20:30 -cg_rdfg 70,80
```

Restrictions: Device types allowed for remove operations from a cascaded RDF1 consistency group

The following table lists the allowable device types for performing a dynamic modify remove operation on a cascaded R1 composite group enabled for consistency protection at the CG level and the SRDF group name level.

Table 26 Allowable device types for removing devices from a cascaded RDF1 CG

Device type in CG	Enabled at CG level			Enabled at SRDF group name level		
	Hop 1 enabled Hop 2 not enabled	**Hop 1 enabled Hop 2 enabled**	**Hop 1 not enabled Hop 2 enabled**	**Hop 1 enabled Hop 2 not enabled**	**Hop 1 enabled Hop 2 enabled**	**Hop 1 not enabled Hop 2 enabled**
Simple R1 (R1->R2)	Allowed	Not applicable	Not applicable	Allowed	Not applicable	Not applicable
Concurrent R11	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed
Cascaded R1	Allowed	Allowed	Not allowed	Allowed	Allowed	Not allowed

Example

To remove device 20 of SRDF groups 38 (R1->R21) and 39 (R21->R2) of CasCG on array 306 into SRDF groups 28 and 29 in the staging area:

```
symcg -cg CasCG modify -remove -sid 306 -cg_rdfg 38 -devs 20 -cg_r21_rdfg 39 -stg_rdfg 28 -
stg_r21_rdfg 29
```

Recovering from a failed dynamic modify operation

Details about dynamic modify operations (target CG, SRDF groups, staging area, and operation type) are stored in the Symmetrix File System (SFS).

If a dynamic modify operation fails and all sites are reachable:

1. Re-run the command with the exact parameters.
2. If the command fails again, execute the `symcg modify -recover` command:
   `symcg modify -cg CasCG -recover`

This command uses the dynamic modify command information in SFS.

The recover operation either:

- Completes the unfinished steps of the dynamic modify operation, or
- Rolls back any tasks performed on the CG before failure, placing the CG into its original state

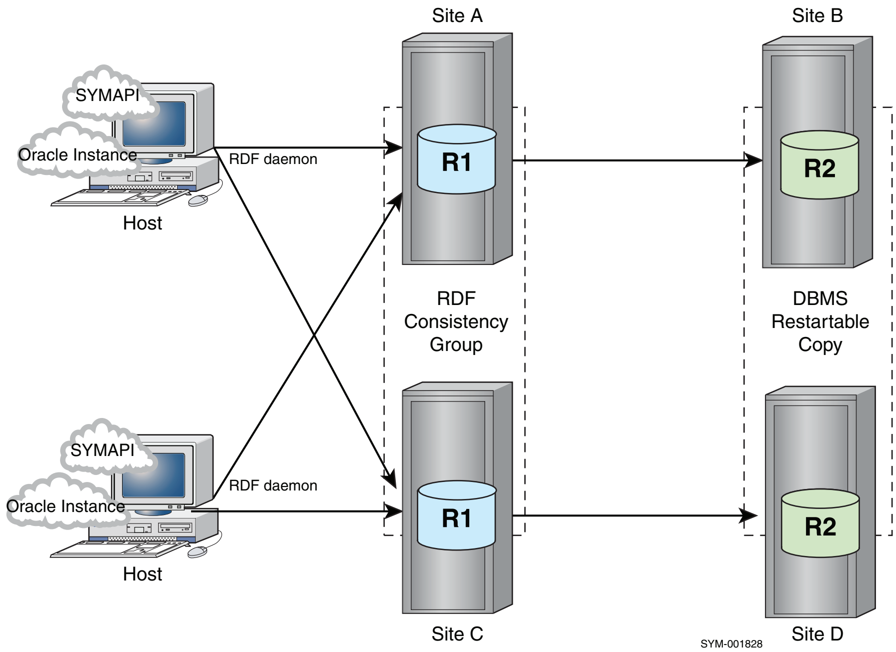
For example, if a concurrent R11 loses a link to one of its mirrors during a dynamic modify add operation, the recover operation may remove all devices added to the CG by this operation. This ensures that the CG device pairs are consistent at all three sites.

Consistency groups with a parallel database

The following images shows an SRDF consistency group with a parallel database such as Oracle Parallel Server (OPS).

- The production database array spans two hosts and two arrays, A and C.
- A SRDF consistency group includes R1 devices from arrays A and C.

Figure 27 Using an SRDF consistency group with a parallel database configuration



The same consistency group definition must exist on both hosts. If enabled, Group Name Services (GNS) automatically propagates a composite group definition to the arrays and to all locally-attached hosts running the GNS daemon.

Although each production host can provide I/O to both R1 devices in the configuration, the DBMS has a distributed lock manager that ensures two hosts cannot write data to the same R1 device at the same time.

The SRDF links to two remote arrays (B and D) enable the R2 devices on those arrays to mirror the database activity on their respective R1 devices.

A typical remote configuration includes a target-side host or hosts (not shown in the illustration) to restart and access the database copy at the target site.

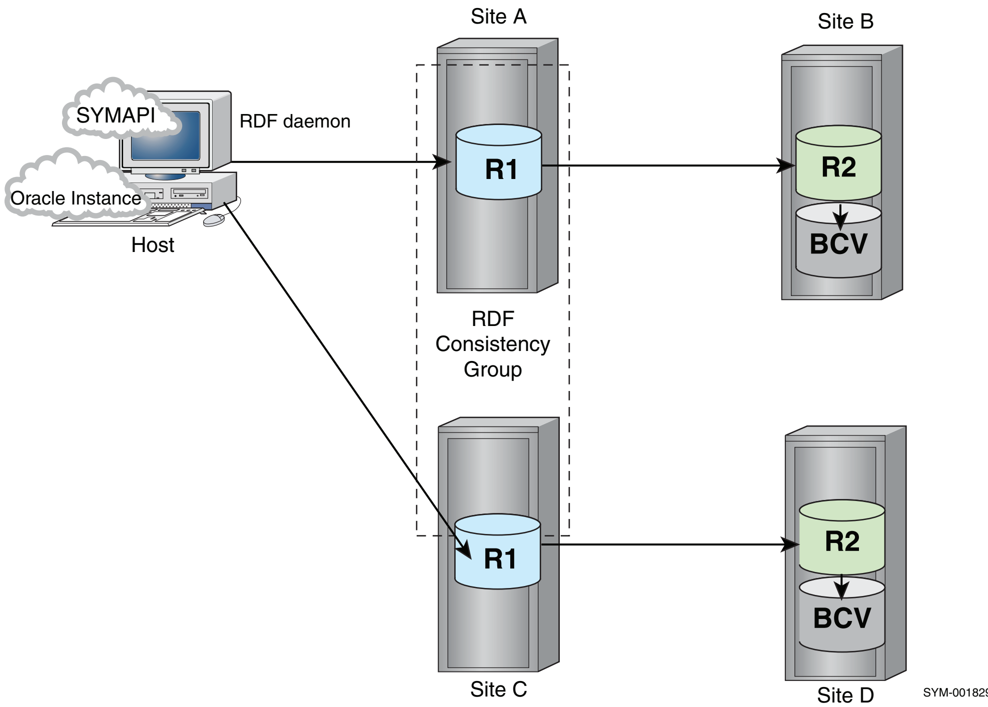
Figure 27 on page 232 shows the SRDF daemons located on the production hosts. Dell EMC recommends that you do not run the SRDF daemon on the same control host running database applications.

Consistency groups with BCV access at the target site

When an SRDF consistency group includes devices on one or more source arrays propagating production data to one or more target arrays, TF BCVs at the target site can be indirectly involved in the consistency process.

The following image shows a configuration with target-side BCVs that mirror the R2 devices:

Figure 28 Using an SRDF consistency group with BCVs at the target site



You must split the BCV pairs at the target sites to access data on the BCVs from the target-side hosts.

The recovery sequence in a configuration that includes BCVs at the target site is the same as described in Recovering from a failed dynamic modify operation on page 231 with the following exception:

At the end of the sequence, the DBMS-restartable copy of the database exists on the target R2 devices and on the BCVs if the BCVs were synchronized with the target site's R2 devices at the time the interruption occurred.

When data propagation is interrupted, the R2 devices of the suspended SRDF pairs are in a Write Disabled state. The target-side hosts cannot write to the R2 devices, thus protecting the consistent DBMS-restartable copy on the R2 devices.

You can perform disaster testing and business continuance tasks by splitting off the BCV version of the restartable copy, while maintaining an unchanged R2 copy of the database. The R2 copy can remain consistent with the R1 production database until normal SRDF mirroring between the R1 and R2 sides resumes.

This configuration allows you to split off and access the DBMS-restartable database copy on the BCVs without risking the data protection that exists on the R2 devices when propagation of data is interrupted.

To manage the BCVs from the R2 side, associate the BCVs with a single SRDF consistency group defined on the target-site host that is connected to arrays B and D.

Figure 28 on page 233 shows the SRDF daemons located on the production hosts.

Note

Dell EMC recommends: Do not run the SRDF daemon on the same control host running database applications.

CHAPTER 7

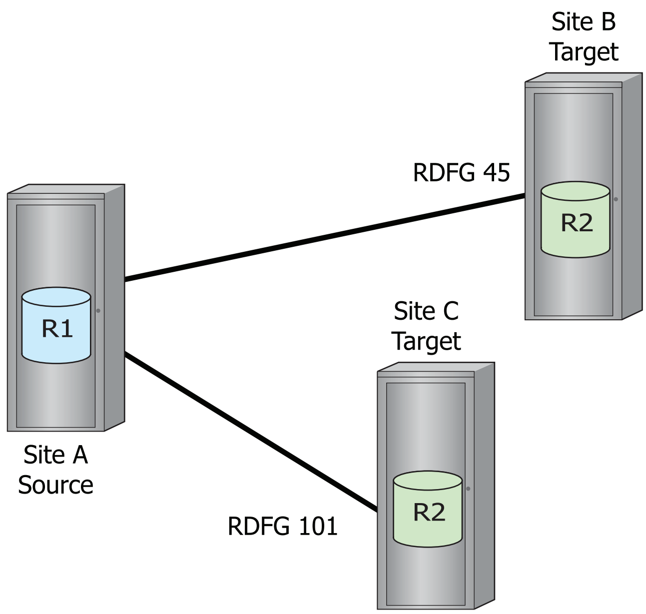
Concurrent Operations

This chapter describes the following topics:

Concurrent operations overview

In a concurrent SRDF configuration, the source R1 device is mirrored to two R2 devices on two different remote arrays.

Figure 29 Concurrent SRDF



The two R2 devices operate independently but concurrently using any combination of SRDF modes.

Note

For Enginuity 5876 or higher, both legs of the concurrent SRDF configuration can be in asynchronous mode

---

If both R2 mirrors are synchronous:

- A write I/O from the host at the R1 device side is returned as completed when both remote array' signal that the I/O is in cache at the remote side.

If one R2 is synchronous and the other R2 is adaptive copy:

- I/O from the R2 operating in synchronous mode must present ending status to the sending array before a second host I/O can be accepted.
  The host does not wait for the R2 operating in adaptive copy mode.

Concurrent operations restrictions

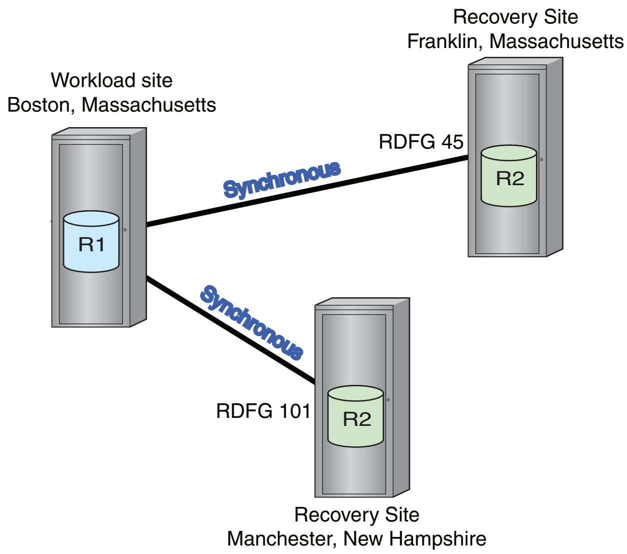
- The R2 devices at each remote array must belong to a different SRDF group.
- Simultaneous restore from both R2 devices to the R1 device cannot be performed.
- Both mirrors of an SRDF device cannot be swapped at the same time.

Restrictions: both R2 devices in synchronous mode

If both R2 devices are in synchronous mode, both target sites have exact replicas of the source data. For this configuration, all three sites must be within synchronous distances.

The following image shows three sites that are within synchronous distance:

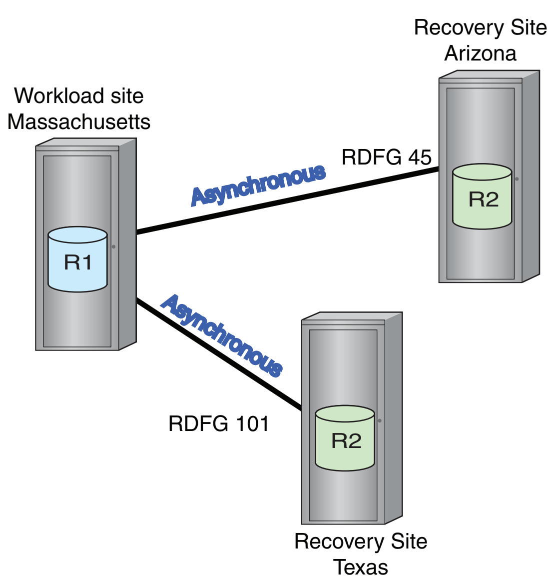
Figure 30 Concurrent SRDF/S to both R2 devices



Restrictions: both R2 devices in asynchronous mode

You can configure concurrent SRDF/A to asynchronously mirror to recovery sites located at extended distances from the workload site.

Figure 31 Concurrent SRDF/A to both R2 devices



With concurrent SRDF, you can build a device group or a composite group containing devices that only belong to the two SRDF groups representing the concurrent remote mirrors.

The device group can also include BCV devices and SRDF devices that are not concurrent SRDF devices but that belong to either one of the concurrent SRDF groups.

Each mirror in a concurrent relationship must belong to a different SRDF group. When controlling or setting concurrent SRDF devices:

- `-rdfg n` performs the operation on the specified SRDF group number (remote mirror)
- `-rdfg ALL` performs the operation on the both SRDF groups.

Additional documentation for concurrent operations

Applicable pair states for concurrent SRDF operations
You can perform a control operation on one of these legs only if the other leg is in an acceptable pair state.

Concurrent SRDF operations and applicable pair states on page 468 provides more information.

Consistency protection
You can enable consistency protection for devices in a concurrent configuration.

Enable consistency for concurrent devices in a SRDF group on page 215 provides more information.

Configuring a concurrent SRDF relationship

To configure a concurrent SRDF relationship:

Procedure

1. Create the initial R1 -> R2 pair between the first array and second array.
2. Create the R11 -> R2 pair between first array and the third array.

Creating and establishing concurrent SRDFdevices

To create a device group for the concurrent SRDF devices and initially synchronize (establish) the devices across the concurrent SRDF links:

Procedure

1. Use the `symdg` command to create an R1 device group.

```
symdg [-i Interval] [-c Count] [-v]
.....
create DgName -type RDF1
```

   `symdg create ConcGrp -type RDF1`

2. Use the `symdg add` command to add all concurrent SRDF devices to the device group:

```
symdg -g DgName[-i Interval] [-c Count] [-v]
....
add dev SymDevName
```

   `symdg add dev 0001 -g ConcGrp -sid 0001`

   `symdg add dev 0021 -g ConcGrp`

symdg add dev 002A -g ConcGrp

3. Use the `symrdf establish` command to establish concurrent SRDF pairs that belong to the device group for the first R2 devices:

```
symrdf -g DgName [-v | -noecho]
......
-rdfg GrpNum establish
```

symrdf -g ConcGrp establish -rdfg 1

4. Repeat Step 3 to establish concurrent SRDF pairs that belong to the device group for the second R2 devices:

```
symrdf -g ConcGrp establish -rdfg 2
```

Alternatively, use the `-rdfg ALL` option to simultaneously establish both mirrors of each SRDF pair in one command:

```
symrdf -g concGrp -full establish -rdfg ALL
```

Note

Business Continuance Volume (BCV) devices cannot contain concurrent SRDF mirrors.

Split concurrent SRDF devices

Syntax

Use the `symrdf split` command to split concurrent SRDF pairs, either one at a time or at the same time.

Note

Concurrent R1 devices can have two mirrors participating in different consistency groups with MSC consistency protection enabled.

To split the concurrent pairs one at a time:

```
symrdf -g DgName split -rdfg GrpNum of first mirror
symrdf -g DgName split -rdfg GrpNum of second mirror
```

To split the concurrent pairs simultaneously:

```
symrdf -g DgName split -rdfg All
```

Examples

To split the concurrent pairs for device group concGrp one at a time:

```
symrdf -g concGrp split -rdfg 1
symrdf -g concGrp split -rdfg 2
```

To split the concurrent pairs for device group concGrp at the same time:

```
symrdf -g concGrp split -rdfg ALL
```

Restore concurrent devices

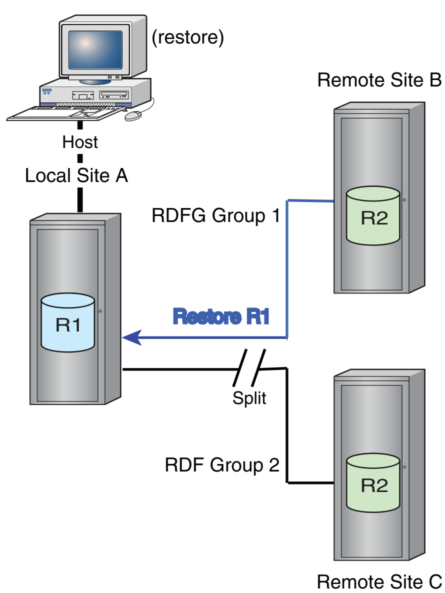
In concurrent configuration, there are two RDFG groups of R2 devices.

- You can restore the R1 device from either of the R2 devices.
  To restore the R1 device from either of the R2 devices, you must specify which R2 device to use.
- You can restore both the R1 and one R2 device from the second R2 device.

Restore R1 from a concurrent R2

Use the `restore` command to restore only the R1 device from the specified R2:

Figure 32 Restoring the R1 a concurrent configuration



When the `restore` command is executed:

- Both remote mirrors are split.
- The R1 device is restored from and synchronized with the R2 device in the specified RDFG group specified in the command.
- The R2 device belonging to SRDF group not used in the restore operation remains in the split state.

Syntax

Use the symrdf restore command to restore from the specified RDFG group:

```
symrdf -g DgName restore -rdfg GroupNum of selected R2 mirror
```

Examples

To restore devices in group concGrp from RDFG group 1:

```
symrdf -g concGrp restore -rdfg 1
```

To re-establish the R2 devices not used in the restore operation:

```
symrdf -g DgName restore -rdfg GroupNum of group not used to restore
```

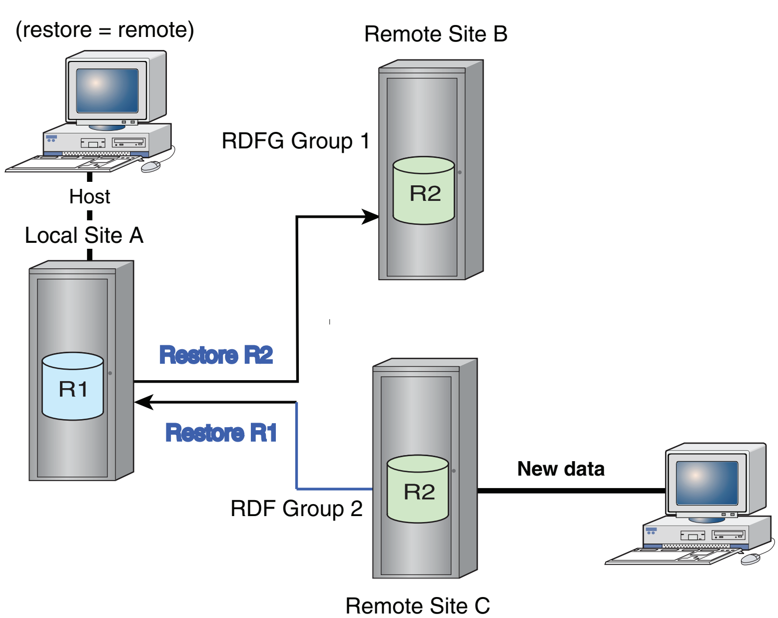
To re-establish second mirror (RDFG 2) for group concGrp:

```
symrdf -g concGrp establish -rdfg 2
```

Restore both R1 and R2 from the second concurrent R2

Use the `restore` command with the `remote` option to restore both the R1 devices and the R2 devices on one leg from the R2 devices on the second leg:

Figure 33 Restoring the source device and mirror in a concurrent SRDF configuration



When the `restore` command with the `remote` option is executed:

- Data from the specified R2 SRDF group 2 propagates data to the R1.
- The R1 SRDF group uses this data to restore the other R2 mirror, synchronizing all concurrent SRDF mirrors.

Note

You cannot simultaneously restore from both remote mirrors to the R1 device.

Syntax

Use the `symrdf restore` command with the `remote` option to restore both the R1 devices and R2 devices on the second leg from the specified RDFG group:

```
symrdf -g DgName restore -rdfg GroupNum -remote
```

Examples

To restore the both the R1 and the R2 devices in RDF group 1 using the data in RDF group 2:

```
symrdf -g ConcGrp restore -rdfg 2 -remote
```

View concurrent SRDF devices

Use the `symrdf list` command with the `-concurrent` option to display concurrent SRDF devices on the local array.

Each device of a concurrent pair belongs to a different RDF group, as shown in the RDF Typ:G column.

symrdf list -concurrent -sid 321

```
Symmetrix ID: 000192600321
                              Local Device View
----------------------------------------------------------------------------
                      STATUS     MODES                    RDF  S T A T E S
Sym   Sym    RDF      ---------  -----   R1 Inv    R2 Inv ----------------------
Dev   RDev   Typ:G    SA RA LNK  MDATE   Tracks    Tracks Dev RDev Pair
---- ---- --------    ---------  ----- ---------  --------- --- ---- -------------
00060 00060   R1:128  RW RW RW   S..1.        0         0 RW  WD   Synchronized
      00060   R1:228  RW RW RW   S..1.        0         0 RW  WD   Synchronized
00061 00061   R1:128  RW RW RW   S..1.        0         0 RW  WD   Synchronized
.
.
.
```

Use the `query -rdfg all` command to display the state of concurrent SRDF pairs.

In the following example, concurrent SRDF pairs are in the process of synchronizing (SyncInProg):

symrdf -g conrdf query -rdfg all

```
Device Group (DG) Name                : conrdf
DG's Type                             : RDF1
.
.
.
Source (R1) View                      Target (R2) View         MODES
```

```
--------------------------------   ------------------------ ----- ------------
               ST                   LI      ST
Standard       A                    N       A
Logical        T  R1 Inv   R2 Inv   K       T  R1 Inv   R2 Inv       RDF Pair
Device  Dev    E  Tracks   Tracks   S Dev   E  Tracks   Tracks MDAE  STATE

-------------------------------- -- ------------------------ ----- ------------
DEV001  00060 RW       0    69030 RW 0060 WD       0        0 S...  SyncInProg
              RW       0    69030 RW 0060 WD       0        0 S...  SyncInProg
DEV002  00061 RW       0    69030 RW 0061 WD       0        0 S...  SyncInProg
              RW       0    69030 RW 0061 WD       0        0 S...  SyncInProg
DEV003  00062 RW       0    69030 RW 0062 WD       0        0 S...  SyncInProg
```

During synchronization, use the `symrdf verify -summary` command to displays a summary message every 30 seconds until both concurrent mirrors of each SRDF pair are synchronized:

symrdf -g conrdf verify -summary -rdfg all -i 30 -synchronized

```
.
.
None of the devices in the group 'conrdf' are in 'Synchronized' state.
.
.
Not All devices in the group 'conrdf' are in 'Synchronized' state.
.
.
All devices in the group 'conrdf' are in 'Synchronized' state.
```

CHAPTER 8

Cascaded Operations

This chapter describes the following topics:

Cascaded operations overview

Cascaded SRDF is a three-way data mirroring and recovery solution that consists of:

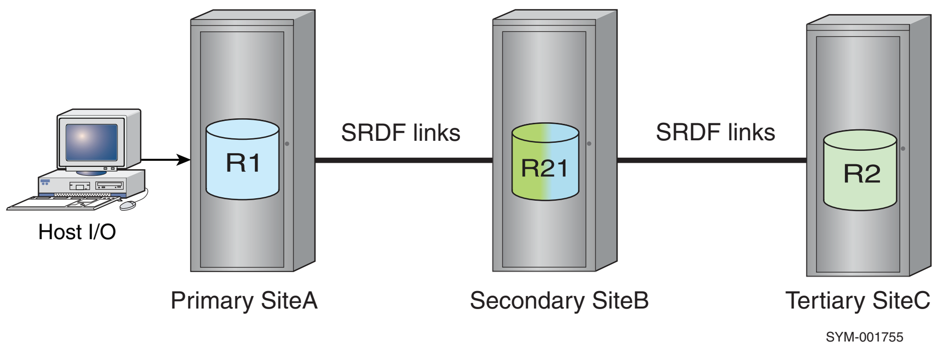
- A R1 device replicating data to
- An R21 device at a secondary site, which replicates the same data to a
- R2 device located at a tertiary site

Cascaded SRDF reduces recovery time at the tertiary site because replication continues to the tertiary site if the primary site fails.

This enables a faster recovery at the tertiary site, if that is where the data operation is restarted. You can achieve zero data loss up to the point of the primary site failure.

The following image shows a basic cascaded SRDF configuration.

Figure 34 Cascaded SRDF configuration



Cascaded SRDF uses a new type of SDRF device: the R21 device. An R21 device is both an R1 mirror and an R2 mirror, and is used only in cascaded SRDF configurations.

An R21 device is both:

- An R2 in relation to the R1 source device at the primary site, and
- An R2 in relation to the R2 target device at the tertiary site.

There are two sets of pair states in a cascaded configuration:

- Pair states between the primary and secondary site (R1 -> R21)
- Pair states between the secondary and tertiary sites (R21 -> R2)

These two pair states are separate from each other.

When performing a control operation on one pair, the state of the other device pair must be known and considered.

The following tables list the applicable pair states for cascaded operations:

- Cascaded SRDF control operations and applicable pair states on page 460
- Cascaded SRDF set operations and applicable pair states on page 466

Note

To perform cascaded SRDF operations with Access Control enabled, you need SRDF BASECTRL, BASE, and BCV access types. *Dell EMC Solutions Enabler Array Controls and Management CLI User Guide* provides more information.

SRDF modes in cascaded configurations

The SRDF modes supported on each hop in a cascaded configuration vary depending on whether the R21 device is diskless (EDP is configured).

SRDF modes in cascaded configurations with EDP on page 248 lists the SRDF modes supported from R1 -> R21, and R21 -> R2 when EDP is configured and the R21 device is diskless.

The following table lists the SRDF modes supported from R1 -> R21, and R21 -> R2 when the R21 device is NOT diskless.

Table 27 SRDF modes for cascaded configurations (no EDP)

R1 -> R21	R21 -> R2
Adaptive copy disk	Asynchronous Adaptive copy disk
Adaptive copy write pending*	Asynchronous Adaptive copy disk
Asynchronous (no EDP)	Asynchronous Adaptive copy disk
Synchronous	Asynchronous Adaptive copy disk

* Adaptive Copy Write Pending mode is not supported when the R1 mirror of the RDF pair is on an array running HYPERMAX OS.

Note

Asynchronous mode can be run on either the R1-> R21 hop, or the R21 -> R2 hop, but not both.

SRDF modes in cascaded configurations with EDP

SRDF/Extended Distance Protection (EDP) enables you to designate an R21 device as a diskless device.

A diskless R21 device directly cascades data to the remote R2 disk device, streamlining the linkage and cost of storage at the middle site.

Table 28 SRDF modes for cascaded configurations with EDP

R1 -> Diskless R21	Diskless R21 -> R2
Synchronous Adaptive copy disk Adaptive copy write pending*	Asynchronous
Synchronous Adaptive copy disk Adaptive copy write pending*	Adaptive copy write pending*

*Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS, and diskless R21 devices are not supported on arrays running HYPERMAX OS.

Restrictions: Cascaded operations

- An R21 device cannot be paired with another R21 device
  R1 -> R21 -> R21 -> R2 is not supported.
- R21 devices cannot be BCV devices or PPRC devices.
- R21 devices are supported only on GigE and Fibre RAs.
- If the first device added to an SRDF group is in asynchronous mode (`-rdf_mode async`), all subsequent devices added to the SRDF group must also be added in asynchronous mode.
- If you do not specify a mode, the option file setting SYMAPI_DEFAULT_RDF_MODE is used. The default is adaptive copy.
- If the device to be the R21 device is currently an R1 device, and is in synchronous or adaptive copy write pending mode, creation of the R1 -> R21 relationship is blocked.
  For diskless devices, creation of an R1 device operating in adaptive copy disk is blocked.

  Diskless devices are not supported on arrays running HYPERMAX OS.
- If both SRDF groups for the R21 device are not on a Fibre or GigE director, creation of an R21 device is blocked.
- The same SRDF group cannot be configured for both R21 device mirrors.

Setting up cascaded SRDF

Setting up a relationship for cascaded SRDF

Setting up a cascaded SRDF relationship is a two-step process:

Procedure

1. Create the initial R1 -> R21 pair between array A and array B for the first hop. SRDF/S, SRDF/A, adaptive copy disk mode, or adaptive copy write-pending mode is allowed over the first hop.

   Note

   Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS.

   Note

   Only one hop (R1 -> R21 or R21 -> R2) can be asynchronous at a time. If R1 -> R21 is in asynchronous mode, R21 -> R2 must be in adaptive copy disk mode.

2. Create the R21 -> R2 pair between array B and array C for the second hop. SRDF/S, SRDF/A or adaptive copy disk mode is allowed over the second hop.

   The most common implementation is SRDF/S mode for the first hop and SRDF/A mode for the second hop.

   Note

   For cascaded SRDF without Extended Distance Protection (EDP), the R21 device paired with an R2 device must be in either asynchronous or adaptive copy disk mode.

Create cascaded SRDF pairs and set mode

Syntax (-file option)

Use the `symrdf createpair` command with the `-rdf_mode` option to create the SRDF pairs for both the first and second hops, and set the SRDF mode.

Note

Use the command twice, once for each hop.

```
symrdf -file Filename -sid SID -rdfg GrpNum
      [-bypass] [-noprompt] [-i Interval] [-c Count]
      [-v|-noecho] [-force] [-symforce] [-star]

    createpair -type <R1|R2>
      <-invalidate <R1|R2> | -establish | -restore>
      [-rdf_mode <sync|acp_wp|acp_disk|async>]
      [-g NewDg] [-remote]
```

Note

Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS.

Example

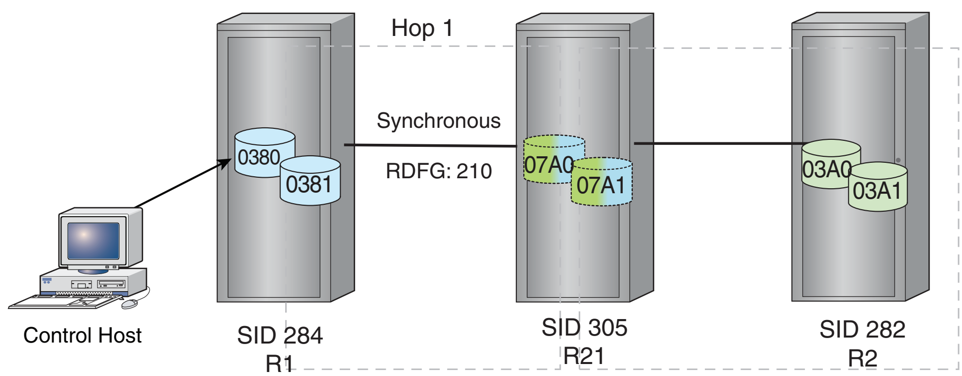
In the following example, TestFile1 specifies two device pairs on SIDs 284 and 305:

```
0380    07A0
0381    07A1
```

1. Use the `symrdf createpair` command to configure the device pairs, SRDF group, and SRDF mode for the first (R1 -> R2) hop:

```
symrdf createpair -file TestFile1 -sid 305 -rdfg 210 -type R2 -establish -rdf_mode sync
```

Figure 35 Configuring the first hop



The SRDF R1 -> R2 device pairs are created and established in SRDF synchronous mode.

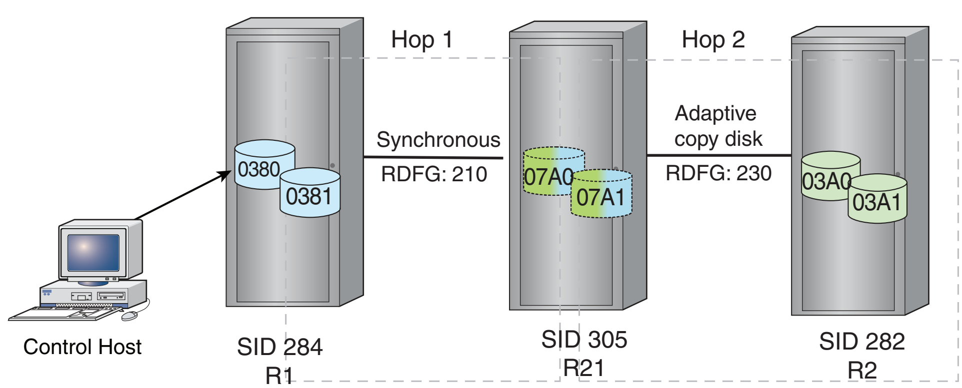
TestFile2 specifies two device pairs on SIDs 305 and 282:

- 07A0 03A0
- 07A1 03A1

2. Use a second `symrdf createpair` command to configure the device pairs, SRDF group, and SRDF mode for the second hop(R21 -> R2):

```
symrdf createpair -file TestFile2 -sid 305 -rdfg 230 -type R1 -establish -rdf_mode
acp_disk
```

Figure 36 Configuring the second hop



Devices 0390 and 0391 are R21 devices in the cascaded configuration. They are:

- R2 devices in the R1 ->R21 relationship
- R1 devices in the R21-> R2 relationship

Applicable pair states for cascaded SRDF operations

In a cascaded relationship, control operations are only allowed for the pair R1->R21 when the R21->R2 pair is in a specific pair state.

The following tables list the applicable pair states for cascaded operations:

- Cascaded SRDF control operations and applicable pair states on page 460
- Cascaded SRDF set operations and applicable pair states on page 466

RDF21 SRDF groups

You can create device groups and composite groups to contain R21 devices as standards. These groups are identified with an SRDF group type: RDF21.

Use the `symdg create` and `symcg create` commands to create device and composite groups with type RDF21.

To create a device group with SRDF group type RDF21:

```
symdg -type RDF21 create test_group_dg
```

To create a composite group with SRDF group type RDF21:

```
symcg -type RDF21 create test_group_cg
```

To create an RDF1 composite group, add devices and set an SRDF group name:

1. To create an empty RDF1 composite group testcg:

   ```
   symcg -type rdf1 create testcg
   ```

2. To add all devices visible to the local host at SID 284 to composite group testcg:

   ```
   symcg -cg testcg addall dev -sid 284 -rdfg 210
   ```

3. To add all devices visible to the local host at SID 256 to composite group testcg:

   ```
   symcg -cg testcg addall dev -sid 256 -rdfg  60
   ```

4. To set the SRDF group name to name1:

   ```
   symcg -cg testcg set -name name1 -rdfg 284:210,256:60
   ```

R21 device management

In a cascaded SRDF relationship, the term first hop refers to the R1-> R21 device pair, the term second hop refers to the R21->R2 device pair.

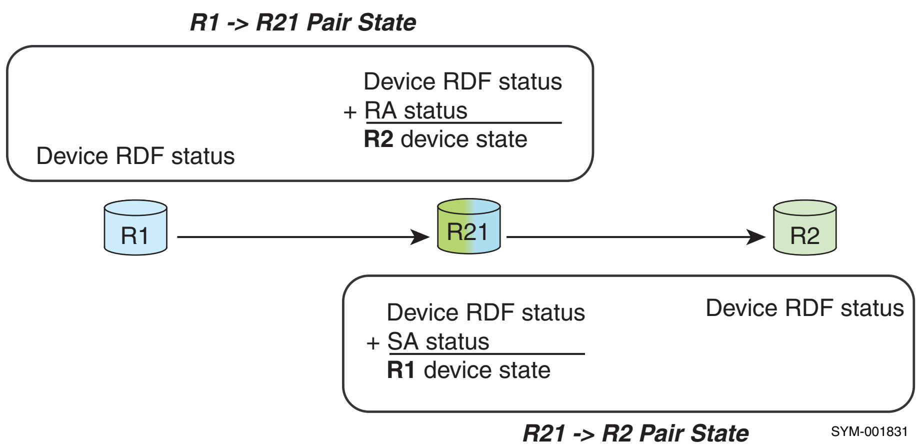
When controlling an R2 device in a cascaded SRDF relationship, the first hop represents the R2->R21 relationship and the second hop represents the R21-> R1 relationship.

Operations against one pair relationship depend on the state of the other pair relationship. The SRDF state of the R21 device in a cascaded relationship is determined as follows:

- The SRDF pair state of the R1 -> R21 device is determined by the RA status.
- The SRDF pair state of the R21 -> R2 mirror is determined by the SA status.

The following image shows how the R21 SRDF device state is determined and how each SRDF mirrored pair state is determined.

Figure 37 Determining SRDF pair state in cascaded configurations



Device actions modify only the SA status of the R21 device.

For example, if `rw_enable r1` is performed against the R1 -> R21 pair, and the R21 has a device SA status of WD, the overall device SRDF state is WD.

You must perform both `rw_enable r1` against the R21 -> R2 pair and a `rw_enable r2` against the R1 -> R21 pair to make the R21 device `rw_enable` to the host.

Note

If either the R1 or the R2 mirror of an R21 SRDF device is made NR or WD, the R21 device will be NR or WD to the host.

Cascaded SRDF control operations and applicable pair states on page 460 provides more information.

Hop 2 controls in cascaded SRDF

You can perform control operations from hosts connected any of the three arrays in a cascaded configuration.

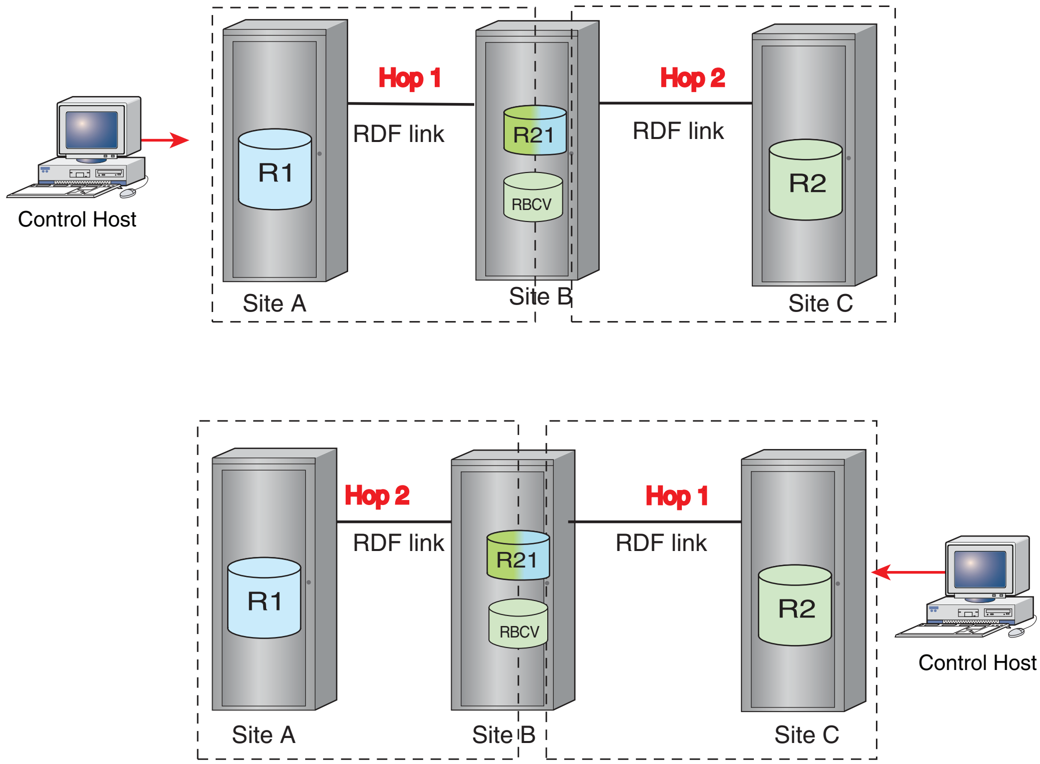
Use the -hop2 option to control an SRDF device that is two hops away. The `-hop2` option can be used with device groups, composite groups, STDs, and local BCVs.

Use the -hop2 option to control the:

- R21->R2 relationship for an RDF1 device group or composite group
- R1->R21 relationship for an RDF2 device group or composite group

The location of hop-2 devices depends on the location of the controlling host.

Figure 38 Location of hop-2 devices



In the image above:

- When the controlling host is at Site A, a control operation with the `-hop2` option acts on the device pair in the array from Site B to Site C.
- When the controlling host is at Site C, a control operation with the `-hop2` option acts on the device pair in the array from Site B to Site A.

Examples

Use the `-hop2` option with `-rdfg name:` to operate on the second hop SRDF relationship for the specified `-rdfg name:`.

In the following example a composite group has 4 devices spread across two arrays:

```
CG: testcg     cg type: RDF1   with  R1->R21->R2

Sym: 000192600284  / rdf group  210   /  rdfg name:  name1
R1 device  0380
R1 device  0381

Sym: 000192600256  / rdf group   60   /  rdfg name:  name1
R1 device  0940
R1 device  0941
```

The following command only operates on the R21->R2 SRDF relationships associated with all the R1 devices using SRDF groups named `name1`:

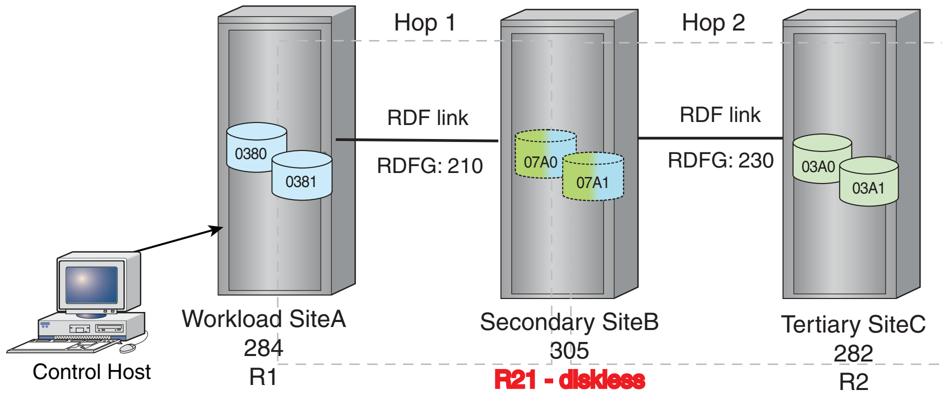
```
symrdf -cg testcg -rdfg name:name1 -hop2 establish
```

Cascaded SRDF with EDP

SRDF/Extended Distance Protection (EDP) streamlines cascaded SRDF linkage to the R2 with a diskless R21 device.

With EDP, replication between the R1 and R2 does not require disks at R21 site.

Figure 39 Cascaded SRDF with EDP



Without EDP, the R21 disk device has its own local mirrors so there are three full copies of data, one at each of the three sites.

With EDP, the R21 diskless device has no local mirrors.

Thus, there are only two full copies of data, one on the R1 disk device and one on the R2 disk device.

When using a diskless R21 device, changed tracks received from the R1 mirror are saved in cache until these tracks are sent to the R2 disk device. Once the data is sent to the R2 device and the receipt is acknowledged, the cache slot is freed and the data no longer exists on the R21.

SRDF/EDP restrictions

The following rules apply when creating diskless SRDF devices:

- A diskless device cannot be mapped to the host. Therefore, no host is able to directly access a diskless device for I/O data (read or write).
- The diskless SRDF devices are only supported on GigE and Fibre RAs.
- Other replication technologies (TimeFinder/Snap, TimeFinder/Clone, Open Replicator, and Federated Live Migration) do not work with diskless devices as the source or the target of the operation.
- The `symreplicate` command returns an error if a diskless device is found in the configuration.
- Diskless devices are not supported with thin CKD devices.
- The R1 and R2 volumes must be *both* thin or *both* standard. For example:
  - Thin R1-> diskless R21->thin R2, *or*
  - Standard, fully provisioned R1 -> diskless R21 -> standard, fully provisioned R2.

Setting up cascaded SRDF with EDP

Setting up a SRDF/EDP relationship is a two-step process:

1. Create the DLR1 --> R2 pair between array B and array C.
2. Create the R1 --> DLR2 pair between array A and array B.

After these two steps, the configuration is R1 --> DLR21 --> R2.

The following table lists the SRDF modes allowed for SRDF/EDP.

Table 29 SRDF modes allowed for SRDF/EDP

R1 - DLR21	DLR21 - R2
Synchronous	Asynchronous
Adaptive copy disk[a]	Asynchronous

a. Adaptive copy mode on the first leg does not provide full time consistency of the R21 or R2 devices.

Create cascaded SRDF/EDP pairs and set mode

Use the `symrdf createpair` command with the `-rdf_mode` option to create the SRDF pairs for both the first and second hops, and set the SRDF mode.

Use the command twice, once for each hop.

Syntax

```
symrdf -file Filename -sid SID -rdfg GrpNum
      [-bypass] [-noprompt] [-i Interval] [-c Count]
      [-v|-noecho] [-force] [-symforce] [-star]

    createpair -type <R1|R2>
      <-invalidate <R1|R2> | -establish | -restore>
      [-rdf_mode <sync|acp_wp|acp_disk|async>]
      [-g NewDg] [-remote]
```

Note

Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS.

In an SRDF/EDP configuration, you cannot bring devices Read Write on the link until the diskless devices are designated as being R21s.

Use the -invalidate R2 option instead of the -establish option.

Note

Since the R21 devices are diskless and cannot be mapped, you do not need to make the device Not Ready or Write Disabled before using the -invalidate R2 option.

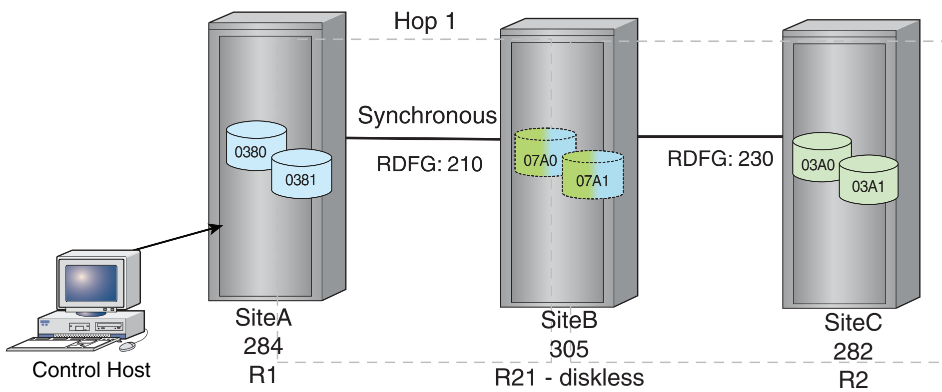
In the following example procedure, TestFile1 specifies two device pairs on SIDs 284 and 305:

- 0380 07A0
- 0381 07A1

1. Use the `symrdf createpair` command to configure the device pairs, SRDF group, and SRDF mode for the first (R1 -> R2) hop:

```
symrdf createpair -file TestFile1 -sid 305 -rdfg 210 -type R2 -invalidate R2 -rdf_mode
sync
```

Figure 40 Set up first hop in cascaded SRDF with EDP



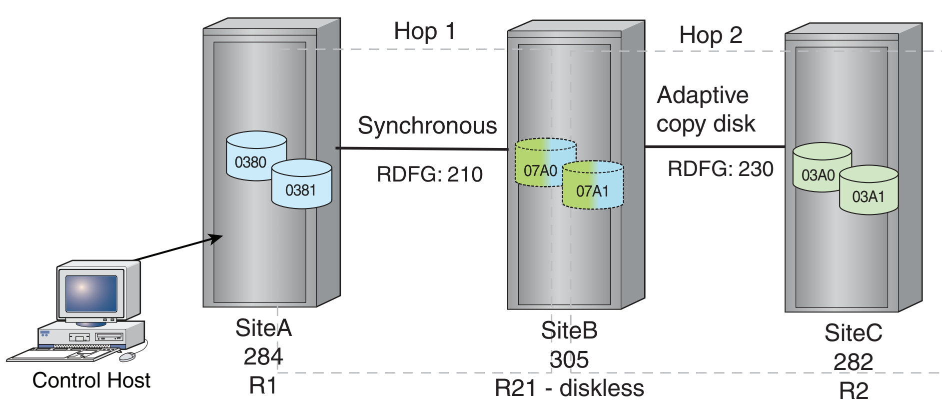
The SRDF device pairs are created and placed in synchronous mode.

- TestFile2 specifies two device pairs:
  - 07A0 03A0
  - 07A1 03A1

2. Use a second `symrdf createpair` command to configure the device pairs, SRDF group, and SRDF mode for the second (R21 -> R2) hop:

```
symrdf createpair -file TestFile3 -sid 305 -rdfg 230 -type R1 -establish -rdf_mode
acp_disk
```

Figure 41 Set up second hop in cascaded SRDF with EDP



3. Use the `symrdf establish` command to make the R1 device pairs Read Write in the first (R1->R21) hop on the link.

```
symrdf establish -file TestFile1 -sid 305 -rdfg 210
```

Restrictions for diskless devices in cascaded SRDF

Note

Diskless devices should only be used as R21 devices in a cascaded environment. Diskless R1, R2, or R22 devices should only be used as an intermediate step to create a diskless R21 device.

General restrictions for diskless devices in cascaded SRDF

- The following control operations are blocked for diskless devices in a R1->R2 relationship that is not part of a cascaded configuration (R1->R2, R2<-->R2, or R1->R22<-R1), or is not going to become part of a cascaded relationship
  - Establish, resume, restore, failback, R1_update, merge
  - Failover if the R2 is a diskless device
  - Createpair -restore or -establish
  - Refresh R1 or swap -refresh R1
  - Refresh R2 or swap -refresh R2
  - Ready/not_ready R1 of a diskless R1 device
  - Ready/not_ready R2 of a diskless R2 device
- A diskless SRDF device may not be paired with another diskless SRDF device.
- For SRDF groups in asynchronous mode, all the devices in the SRDF group must be either diskless or non-diskless.
- You cannot set the skew limit when the R21->R2 hop is in adaptive copy write pending mode. SRDF behaves as if the skew is infinite.
- You must make the link between R21->R2 Ready (RW) before making the R1->R21 link ready (RW). Otherwise, Enginuity makes the diskless R1->R21 devices NR on the link when the R21->R2 state is NR on the link.

Control and set restrictions for diskless devices in cascaded SRDF

You can perform SRDF control and set operations for diskless environments on composite groups, device groups, and files that contain both diskless and non-diskless devices.

Note

You can control SRDF pairs with diskless devices and without diskless devices in a single control operation if some of the R21 devices in the group are diskless and others are not.

- The following configurations are supported when the R21 is a diskless SRDF device:
  - R1->R21->R2
  - R11->R21->R2
  - R11->R21->R22
- You cannot set the mode for an SRDF group containing diskless and non-diskless devices to asynchronous.

SRDF modes in cascaded configurations on page 247 lists the modes allowed for cascaded SRDF configurations.

SRDF modes in cascaded configurations with EDP on page 248 lists the modes allowed for cascaded SRDF configurations where the R21 is diskless.

All other combinations are blocked. If synchronous mode is not allowed, specify a valid SRDF mode when creating these device pairs

NOTICE

The adaptive copy write pending -> asynchronous combination in SRDF modes in cascaded configurations with EDP on page 248 cannot reach the Consistent state. The R21->R2 hop hangs in the SyncInProg state with 0 invalid tracks. To have the R2 reach the Consistent state in an R1->R21->R2 setup, configure synchronous -> asynchronous.

Dynamic control restrictions for diskless devices in cascaded SRDF

Use dynamic SRDF controls (`createpair`, `deletepair`, `swap_personality`, `movepair`, and `failover -establish` actions) to create and manage diskless device relationships.

The following rules apply for these operations:

- A diskless SRDF device can only be configured on a Fibre or GigE SRDF director.
- A `createpair` action is blocked when both sides are diskless devices.
- The `createpair` and `movepair` actions are blocked if the action results in a mixture of diskless and non-diskless devices in an SRDF group containing devices in asynchronous mode.
- The `createpair`, `movepair`, `swap_personality`, and `failover -establish` actions will be blocked if the action will result in a violation of the allowable SRDF modes as outlined in Control and set restrictions for diskless devices in cascaded SRDF on page 257.
- The `createpair` action is blocked if the action results in an R1->R21->R2 relationship where the R1 and the R2 are the diskless devices.

SRDF query restrictions for diskless devices in cascaded SRDF

- A diskless device has no local mirrors. Thus, no local invalid tracks are reported for the device.
- Queries to a diskless R1 device do not show any R1 invalid tracks.
- Queries to a diskless R2 device do not show any R2 invalid tracks.
- Queries to a diskless R21 device do not show any R1 invalid tracks.
- Queries to diskless R21 device do not show any R1 invalid tracks when queried from the R21->R2 relationship point of view.
- Queries to diskless R21 device do not show any R2 invalid tracks when queried from the R1->R21 relationship point of view.

Create diskless devices

Use the `symconfigure` command to perform control operations (creation, configuration, convert, and delete) for diskless devices, using the following device type designations:

- DLDEV
- RDF1+DLDEV
- RDF2+DLDEV
- RDF21+DLDEV

Create a diskless device using the existing `create/configure dev` command with one of the these device types.

You cannot create an RDF21+DLDEV device directly. Use the `add rdf mirror` command with `symconfigure` to create R21 diskless devices. Add a diskless SRDF mirror on page 259 provides more information.

Use the `set dev` command with `symconfigure` to set attributes on diskless devices.

Note

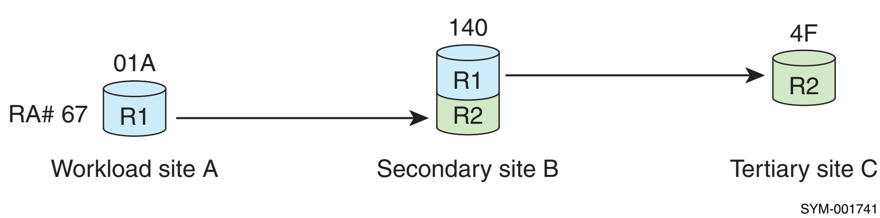
For more information about the `symconfigure` command, see the .

Add a diskless SRDF mirror

The procedure to set up a diskless R21 device is the same as any other type of R21 device.

In order to add the diskless device, it must already be an RDF1+DLDEV or an RDF2+DLDEV device:

Figure 42 Adding a diskless SRDF mirror



Use the `symconfigure` command to add the R21 mirrors.

Perform the `add rdf mirror` command twice; once for each site.

Syntax

Use the `symconfigure add rdf mirror` command to add both static and dynamic SRDF mirrors to diskless devices.

Restrictions

- Either the local or the remote device can be diskless, however, both the local and the remote SRDF device cannot be diskless.
- Diskless devices can only be configured on a fibre or GigE SRDF directors.
- Cannot add a mix of diskless and non-diskless SRDF devices to an SRDF group with devices in Async mode.
- The create pair action is blocked if it results in an R1->R21->R2 relationship where the R1 and the R2 are diskless devices.
- When configuring a diskless device the modes should be set as per rules discussed in Control and set restrictions for diskless devices in cascaded SRDF on page 257.

Examples

To add the specified device from site A:

```
add rdf mirror to dev 01A
  ra_group=67, mirror_type=RDF1
  remote_dev=140
...
```

To add the specified device from site C:

```
add rdf mirror to dev 04F
  ra_group=67, mirror_type=RDF2
  remote_dev=140
```

Restart a diskless configuration

- When restarting a diskless SRDF configuration:
  The R21->R2 hop is recovered before the R1->R21 hop.

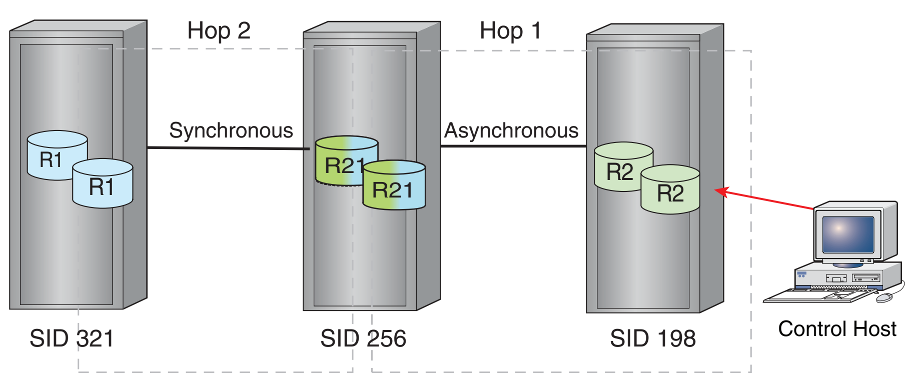
  The R1->R21 relationship cannot be RW on the link when the R21->R2 relationship is NR on the link.
- When recovering with a diskless R21 device:
  The `restart_sync_type` is in adaptive copy write pending mode for the R21->R2 relationship.

  Adaptive copy write pending mode (acp_wp) is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS, and diskless R21 devices are not supported on arrays running HYPERMAX OS.

Sample session: planned failover

This section is an example of a planned failover of the cascaded SRDF configuration depicted in title 36:

Figure 43 Cascaded configuration before planned failover



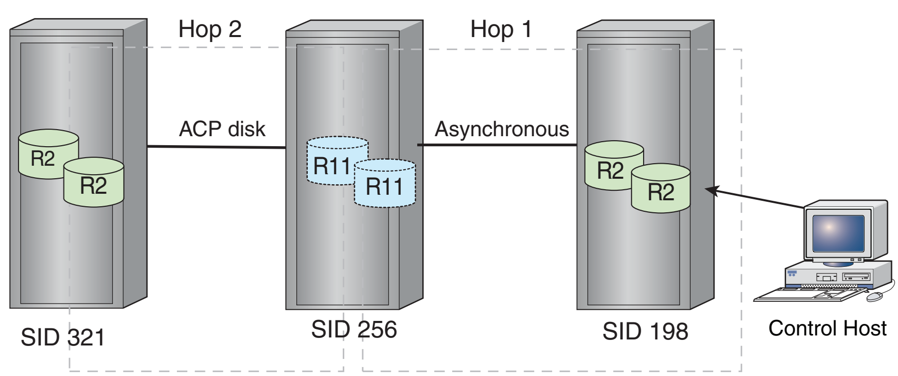
For the example session:

- Commands are issued from a control host connected to SID 198.
- Commands are issued to an SRDF device group.

1. Use the `symcfg list` command to verify that both array 321 and 256 are visible to the control host.

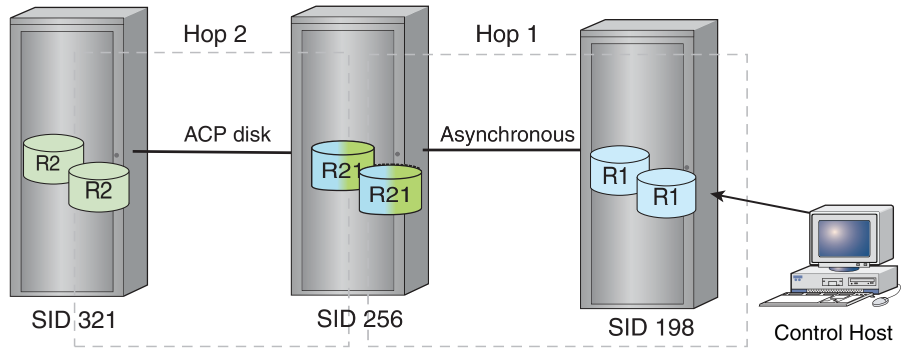
2. Use the `symrdf -g`*`GroupName`*` query -hop2` command to verify that the RDF Pair State for devices in the SID 321 -> SID 256 hop are Synchronized.
   The SID 321 -> SID 258 hop is synchronous. Healthy device pairs are "Synchronized".
3. Use the `symrdf -g `*`GroupName`*`query -rdfa` command to verify that the RDF Pair State for devices in the SID 256 -> SID 198 hop are Consistent.
   The SID 256 -> SID 198 hop is asynchronous. Healthy device pairs are "Consistent".
4. Use the `symrdf -g `*`GroupName`*` suspend -hop2` command to suspend the device pairs of the SID 321 -> SID 256 hop.
5. Use the `symrdf -g `*`GroupName`*` query -hop2` command to verify that the RDF Pair State for devices in the SID 321 -> SID 256 hop is Suspended.
6. Use the `symrdf -g `*`GroupName`*` suspend -force` command to suspend the device pairs of the SID 256 -> SID 198 hop.
7. Use the `symrdf -g `*`GroupName`*` query` command to verify that the RDF Pair State for devices in the SID 256 -> SID 198 hop is Suspended.
8. Use the `symrdf -g `*`GroupName`*` failover -hop2` command to failover from SID 321 to SID 256.
9. Use the `symrdf -g `*`GroupName`*` failover -force` command to failover from SID 256 to the SID 198.
10. Use the `symrdf -g `*`GroupName`*` query -hop2` command to verify that the RDF Pair State for devices in the SID 321 -> SID 256 hop are Failed Over.
11. Use the `symrdf -g `*`GroupName`*` query` command to verify that the RDF Pair State for devices in the SID 256 -> SID 198 hop are Failed Over.
12. Use the `symrdf -g `*`GroupName`*` set mode acp_disk -hop2` command to change the SRDF mode between SID 321 and SID 256 to adaptive copy disk mode.
13. Use the `symrdf -g `*`GroupName`*` swap -hop2` command to swap personalities between SID 321 and SID 256.
    The configuration is now:

    Figure 44 Planned failover - after first swap

14. Use the `symrdf -g `*`GroupName`*` swap` command to swap personalities between SID 256 and SID 198.
    The configuration is now:

Figure 45 Planned failover - after second swap



15. Use the `symrdf -g` *`GroupName`* `resume -hop2` command to resume the device pairs of the SID 256 -> SID 321 hop.
16. Use the `symrdf -g` *`GroupName`* `resume -force` command to resume the device pairs of the SID 198 -> SID 256 hop.

Note

Do not change the SRDF mode from SID 256 -> SID 321. The R1 -> R21 hop is now Asynchronous. Only adaptive copy disk mode is supported for the R21 -> R2 hop.

Display cascaded SRDF

You can display the following information about a cascaded SRDF configuration:

- List cascaded SRDF devices
- List diskless devices
- Query hop 2 information

List cascaded SRDF devices

Use the `symrdf list` command with the following options to display information about cascaded SRDF devices:

-R21

Displays all R21 devices. This option cannot be specified in the same command with the `-R1` or `-R2` option.

-cascade

Lists all R21 devices and the R1 and R2 devices with which they are paired. This option also lists R1 and R2 devices participating in cascaded SRDF relationships. Use the `-cascade` option in conjunction with the `-R1` , `-R2` , or `-R21` options to display only R1, R2, or R21 devices participating in cascaded SRDF relationships.

-concurrent

R21 devices and the devices with which they are paired are considered concurrent devices. Use the `-concurrent` option to display these devices.

List R21 devices

Syntax

Output of the `symrdf list` command includes the SRDF Mirror Type associated with the SRDF group.

Example

In the following example, Mirror Type is in bold text.

`symrdf list -sid 305 -cascaded`

```
Symmetrix ID: 000192600305
                              Local Device View
---------------------------------------------------------------------------
                      STATUS     MODES                    RDF  S T A T E S
Sym    Sym   RDF      ---------  -----  R1 Inv    R2 Inv ----------------------
Dev    RDev  Typ:G    SA RA LNK  MDATE  Tracks    Tracks Dev RDev Pair
----   ---- --------  ---------  ----- --------  -------- --- ---- -------------
00390 00380  R21:210  RW WD RW   S..2.        0         0 WD  RW   Synchronized
      003A0  R21:230  RW RW RW   C.D1.        0         0 RW  WD   Synchronized
00391 00381  R21:210  RW WD RW   S..2.        0         0 WD  RW   Synchronized
      003A1  R21:230  RW RW RW   C.D1.        0         0 RW  WD   Synchronized
.
.
.
Legend for MODES:
 M(ode of Operation)    : A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
 D(omino)               : X = Enabled, . = Disabled
 A(daptive Copy)        : D = Disk Mode, W = WP Mode, . = ACp off
 (Mirror) T(ype)        : 1 = R1, 2 = R2
 (Consistency) E(xempt): X = Enabled, . = Disabled, M = Mixed, - = N/A
```

Diskless devices

NOTICE

`symcg`,`symdg`, or `symdev` commands used with the `relabel` option fail when the scope includes any diskless device.

List SRDF diskless devices

Syntax

Use the `symrdf list` command with the `-diskless_rdf` option to view only SRDF diskless devices.

Use the `-R1`, `-R2`, `-R21`, or `-dynamic` options to display only the selected device types.

The specified diskless SRDF or SRDF capable devices are displayed.

Example

To display SRDF diskless devices:

```
symrdf list -diskless_rdf
```

List all diskless devices

Syntax

Use the `symdev list` command with the `-dldev` option to display all configured diskless devices.

Use the `-R1`, `-R2`, `-R21`, or `-dynamic` options to display only the selected device types.

Example

To display all diskless devices for Symm 305:

`symdev list -sid 305 -dldev`

```
Symmetrix ID: 000192600305
        Device Name           Directors                  Device
---------------------------  ------------- -------------------------------------
                                                                           Cap
Attribute    Sts   (MB)
---------------------------  ------------- -------------------------------------
007A0 Not Visible            ???:? ???:?   RDF21+DLDEV    Grp'd      RW    1031
007A1 Not Visible            ???:? ???:?   RDF21+DLDEV    Grp'd      RW    1031
```

Show specified diskless device

Syntax

In the following example, output of the `symdev show` command displays the following information about the specified diskless device:

- Device Configuration - shows the device as being an R21 diskless device.
- Device SA Status - always N/A. Diskless devices cannot be mapped to a host.
- Paired with Diskless Device - indicates if the device is in an SRDF relationship with a diskless SRDF device, and the device type for the SRDF partner of this device.

Example

`symdev show 07A0 -sid 05`

```
.
    Device Configuration     : RDF21+DLDEV      (Non-Exclusive Access)
.
.
Device Status            : Ready            (RW)
    Device SA Status         : N/A              (N/A)
    Mirror Set Type          : [R2 Remote,R1 Remote,N/A,N/A]
    Mirror Set DA Status     : [RW,RW,N/A,N/A]
    Mirror Set Inv. Tracks   : [0,0,0,0]
    Back End Disk Director Information
        {
        Hyper Type                            : R2 Remote
        Hyper Status                          : Ready           (RW)
        Disk [Director, Interface, TID]       : [N/A,N/A,N/A]
        Disk Director Volume Number           : N/A
        Hyper Number                          : N/A
        Mirror Number                         : 1

        Hyper Type                            : R1 Remote
        Hyper Status                          : Ready           (RW)
        Disk [Director, Interface, TID]       : [N/A,N/A,N/A]
```

```
        Disk Director Volume Number            : N/A
        Hyper Number                           : N/A
        Mirror Number                          : 2
...
}
    RDF Information
        {
        Device Symmetrix Name                  : 007A0
        RDF Type                               : R2
        RDF (RA) Group Num                     : 210             (D1)

        Remote Device Symmetrix Name           : 00380
        Remote Symmetrix ID                    : 000192600284

        R2 Device Is Larger Than The R1 Device : False
        Paired with Diskless Device            : False
        Concurrent RDF Relationship            : False
        Cascaded RDF Relationship              : True
...
    RDF Information
        {
        Device Symmetrix Name                  : 007A0
        RDF Type                               : R1
        RDF (RA) Group Num                     : 230             (E5)

        Remote Device Symmetrix Name           : 003A0
        Remote Symmetrix ID                    : 000192600282

        R2 Device Is Larger Than The R1 Device : False
        Paired with Diskless Device            : False
              Paired with a Concurrent RDF Device    : False
           Paired with a Cascaded RDF Device      : False
...
```

Query hop 2 information

Syntax

Use the `symrdf -cg` *`CGName`* `-rdfg name:` *`name`* `-hop2 query` command to display information about the second hop SRDF pair of a cascaded SRDF relationship, for the specified subset of the composite group.

Example

To display second hop information for composite group `testcg`:

`symrdf -cg testcg -rdfg name:name1 -hop2 query`

```

Composite Group Name      :  testcg
Composite Group Type      :  RDF1
Number of Symmetrix Units :  2
Number of RDF (RA) Groups :  2
RDF Consistency Mode      :  NONE

Symmetrix ID                       : 000192600284    (Microcode Version: 5876)
Hop-2 Symmetrix ID                 : 000192600305    (Microcode Version: 5876)
Hop-2 Remote Symmetrix ID          : 000192600282    (Microcode Version: 5876)
RDF (RA) Group Number              : 210 (D1)
Hop-2 RDF (RA) Group Number        : 230 (E5)
        Source (R1) View             Target (R2) View       MODES STATES
--------------------------------  ------------------------- ----- ------ ------------
              ST                 LI       ST                       C  S
  Standard    A                  N        A                        o  u
Logical   Sym  T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv        n  s   RDF Pair
Device    Dev  E  Tracks Tracks   S  Dev   E  Tracks  Tracks MDAE   s  p   STATE
```

```
-------------------------------- -- ----------------------- -----  ------ ------------
DEV001   00390 RW       0       0 RW 003A0 WD       0       0 C.D.  .  -   Synchronized
DEV002   00391 RW       0       0 RW 003A1 WD       0       0 C.D.  .  -   Synchronized

Symmetrix ID                        : 000192600256    (Microcode Version: 5876)
Hop-2 Symmetrix ID                  : 000192600321    (Microcode Version: 5876)
Hop-2 Remote Symmetrix ID           : 000192600198    (Microcode Version: 5876)
RDF (RA) Group Number               :  60 (3B)
Hop-2 RDF (RA) Group Number         :  70 (45)
        Source (R1) View             Target (R2) View       MODES STATES
-------------------------------- ------------------------- ----- ------ ------------
              ST                  LI      ST                      C  S
  Standard     A                   N       A                      o  u
Logical  Sym   T   R1 Inv  R2 Inv   K       T  R1 Inv  R2 Inv      n  s   RDF Pair
Device   Dev   E   Tracks  Tracks   S Dev   E  Tracks  Tracks MDAE s  p   STATE
-------------------------------- -- ----------------------- ----- ------ ------------
DEV003   00944 RW       0       0 RW 00942 WD       0       0 C.D.  .  -   Synchronized
DEV004   00945 RW       0       0 RW 00943 WD       0       0 C.D.  .  -   Synchronized
Total                 ------- -------            ------- -------
  Track(s)                 0       0                  0       0
  MBs                    0.0     0.0                0.0     0.0

Legend for MODES:

 M(ode of Operation)   : A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
 D(omino)              : X = Enabled, . = Disabled
 A(daptive Copy)       : D = Disk Mode, W = WP Mode, . = ACp off
 (Consistency) E(xempt): X = Enabled, . = Disabled, M = Mixed, - = N/A

Legend for STATES:

 Cons(istency State)   : X = Enabled, . = Disabled, M = Mixed, - = N/A
 Susp(end State)       : X = Online, . = Offline, P = Offline Pending, - = N/A
```

Query output summary

- Number of SRDF (RA) Groups — Represents the number of R1 -> R21 SRDF groups in the composite group.
- Symmetrix ID — Represents the Symmetrix ID of the R1 device.
- Hop-2 Symmetrix ID — Represents the Symmetrix ID of the R21 device.
- Hop-2 Remote Symmetrix ID — Represents the Symmetrix ID of the R2 device.
- SRDF (RA) Group Number — Represents the SRDF group of the R1 device.
- Hop-2 SRDF (RA) Group Number — Represents the SRDF group of the R21 device.
- Total — Sums the invalid tracks (and MB) across all displayed R21 -> R2 SRDF groups (that is, it sums all hop-2 invalid tracks).

Note

With an R1->R21-> R2 configuration, issuing a `query -hop2` from an RDF1 composite group indicates that the query should show the relationship of the R21-> R2 device pairs. Thus the query displays the R21 device from the R1 mirror point of view (and vice versa for RDF2 CG).

To see both hops of the RDF1 or RDF2 CG that contains devices in a cascaded SRDF relationship, use the `symrdf -cg query` command with the `-hop2` and the `–detail` options.

Query output detailed information

Syntax

To display detailed information about the second hop SRDF pair of a cascaded SRDF relationship, use the `-detail` option with the `symrdf query` command.

Detailed output displays the association of the cascaded pair with the appropriate local pair.

Note

The `-detail` option is not supported for a device group.

Example

To display detailed information about the second hop SRDF pair of a cascaded SRDF relationship for composite group `testcg`:

`symrdf query -cg testcg -rdfg name:name1 -hop2 -detail`

```
Composite Group Name       :  testcg
Composite Group Type       :  RDF1
Number of Symmetrix Units :  2
Number of RDF (RA) Groups :  2
RDF Consistency Mode       :  NONE

RDFG Names:
    {
    RDFG Name                             : name1
    RDF Consistency Mode                  : NONE
    }

Symmetrix ID                      : 000192600284    (Microcode Version: 5876)
Remote Symmetrix ID               : 000192600305    (Microcode Version: 5876)
RDF (RA) Group Number             : 210 (D1) - name1

        Source (R1) View            Target (R2) View       MODES
--------------------------------  ------------------------- ----- ------------
              ST                  LI       ST
  Standard     A                   N        A
Logical   Sym   T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv       RDF Pair
Device    Dev   E  Tracks Tracks   S Dev    E  Tracks  Tracks MDACE STATE
-------------------------------- -- ------------------------- ----- ------------
DEV001   00380 RW       0       0 RW 00390 WD       0       0 S.... Synchronized
DEV002   00381 RW       0       0 RW 00391 WD       0       0 S.... Synchronized

Hop-2
    {
    Symmetrix ID                      : 000192600305    (Microcode Version: 5876)
    Remote Symmetrix ID               : 000192600282    (Microcode Version: 5876)
    RDF (RA) Group Number             : 230 (E5)

            Source (R1) View            Target (R2) View       MODES
    --------------------------------  ------------------------- ----- ------------
                  ST                  LI      ST
      Standard     A                   N       A
    Logical   Sym   T  R1 Inv  R2 Inv  K       T  R1 Inv  R2 Inv       RDF Pair
    Device    Dev   E  Tracks  Tracks  S Dev   E  Tracks  Tracks MDACE STATE
    -------------------------------- -- ------------------------- ----- ------------
    DEV001   00390 RW       0       0 RW 003A0 WD       0       0 C.D.. Synchronized
    DEV002   00391 RW       0       0 RW 003A1 WD       0       0 C.D.. Synchronized
    }
```

```
Symmetrix ID                      : 000192600256    (Microcode Version: 5876)
Remote Symmetrix ID               : 000192600321    (Microcode Version: 5876)
RDF (RA) Group Number             :  60 (3B) - name1

        Source (R1) View             Target (R2) View       MODES
--------------------------------  ------------------------- ----- ------------
               ST                 LI       ST
  Standard      A                  N        A
Logical   Sym   T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv       RDF Pair
Device    Dev   E  Tracks Tracks   S Dev    E  Tracks  Tracks MDACE STATE
--------------------------------- -- ------------------------ ----- ------------
DEV003   00940 RW       0       0 RW 00944 WD       0       0 S.... Synchronized
DEV004   00941 RW       0       0 RW 00945 WD       0       0 S.... Synchronized

Hop-2
{
    Symmetrix ID                      : 000192600321    (Microcode Version: 5876)
    Remote Symmetrix ID               : 000192600198    (Microcode Version: 5876)
    RDF (RA) Group Number             :  70 (45)

            Source (R1) View             Target (R2) View       MODES
    --------------------------------  ------------------------- ----- ------------
                   ST                 LI       ST
      Standard      A                  N        A
    Logical   Sym   T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv       RDF Pair
    Device    Dev   E  Tracks Tracks   S Dev    E  Tracks  Tracks MDACE STATE
    --------------------------------- -- ------------------------ ----- ------------
    DEV003   00944 RW       0       0 RW 00942 WD       0       0 C.D.. Synchronized
    DEV004   00945 RW       0       0 RW 00943 WD       0       0 C.D.. Synchronized
    }

Total                ------- -------            ------- -------
  Track(s)                 0       0                  0       0
  MBs                    0.0     0.0                0.0     0.0

  Hop-2 Track(s)           0       0                  0       0
  Hop-2 MBs              0.0     0.0                0.0     0.0

Legend for MODES:

 M(ode of Operation)    : A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
 D(omino)               : X = Enabled, . = Disabled
 A(daptive Copy)        : D = Disk Mode, W = WP Mode, . = ACp off
 C(onsistency State)    : X = Enabled, . = Disabled, M = Mixed, - = N/A
 (Consistency) E(xempt): X = Enabled, . = Disabled, M = Mixed, - = N/A
```

Query output information

- Symmetrix ID — Represents the Symmetrix ID of the R1 device if outside a Hop-2 {. . .} group, or the Symmetrix ID of the R21 device if inside a Hop-2 {. . .} group.
- Remote Symmetrix ID — Represents the Symmetrix ID of the R21 device if outside a Hop-2 {. . .} group, or the Symmetrix ID of the R2 device if inside a Hop-2 {. . .} group; had this been an RDF2 CG, then Remote Symmetrix ID inside a Hop-2 {. . .} group would represent the Symmetrix ID of the R1 device.
- SRDF (RA) Group Number — Represents the SRDF group from the R1->R21 devices if outside a Hop-2 {. . .} group, or the SRDF group from the R21->R2 devices if inside a Hop-2 {. . .} group; had this been an RDF2 CG, then SRDF (RA) Group Number inside a Hop-2 {. . .} group would represent the SRDF group from the R21->R1 devices.

Note

Each R21->R2 SRDF group is reported separately.

CHAPTER 9

SRDF/Star Operations

This chapter describes the following topics.

SRDF/Star operations overview

SRDF/Star deployments include three geographically dispersed data centers in a triangular topology. SRDF/Star protects against a primary site failure or a regional disaster by mirroring production data synchronously to a nearby site and asynchronously to a distant site. This architecture can be expanded to include multiple triangles.

If a failure occurs at the workload site, one target site resumes data replication for the workload site while the other resumes as a protected secondary target site.

SRDF/Star uses dynamic SRDF devices that can function as either an R1 or an R2 device. During failure recovery, the R2 devices at either the synchronous target site or the asynchronous target site are dynamically converted to R1 devices to become production devices at the new workload site.

The basic component of the SRDF/Star configuration is the composite group (CG). Multi-Session Consistency (MSC) or Enginuity Consistency Assist (ECA) technology ensures data consistency, and that all members in the CG are either replicating or not replicating.

Note

When running SRDF/Star and MSC, MSC needs to be disabled to remove all Star flags and sessions from a device.

The CG definition can span cascaded and concurrent SRDF configurations (SRDF/A and SRDF/S) across multiple arrays.

Note

SRDF/Star requires a Star control host at the workload site, SRDF/A recovery links, and a Star control host at one of the target sites. A Star control host is a host which is locally attached to only one of the sites in the SRDF/Star triangle and is where the symstar commands are issued.

SRDF/Star topologies include:

- Cascaded SRDF/Star
- Cascaded SRDF/Star with R22 devices
- Concurrent SRDF/Star
- Concurrent SRDF/Star with R22 devices

The following prerequisites exist for the SRDF/STAR topologies:

- SRDF/STAR topologies without R22 devices cannot have any RDF device pairs in the recovery SRDF group.
- The SRDF/STAR topologies with R22 devices must have RDF device pairs configured between all the devices in the recovery SRDF group.

Cascaded SRDF/Star

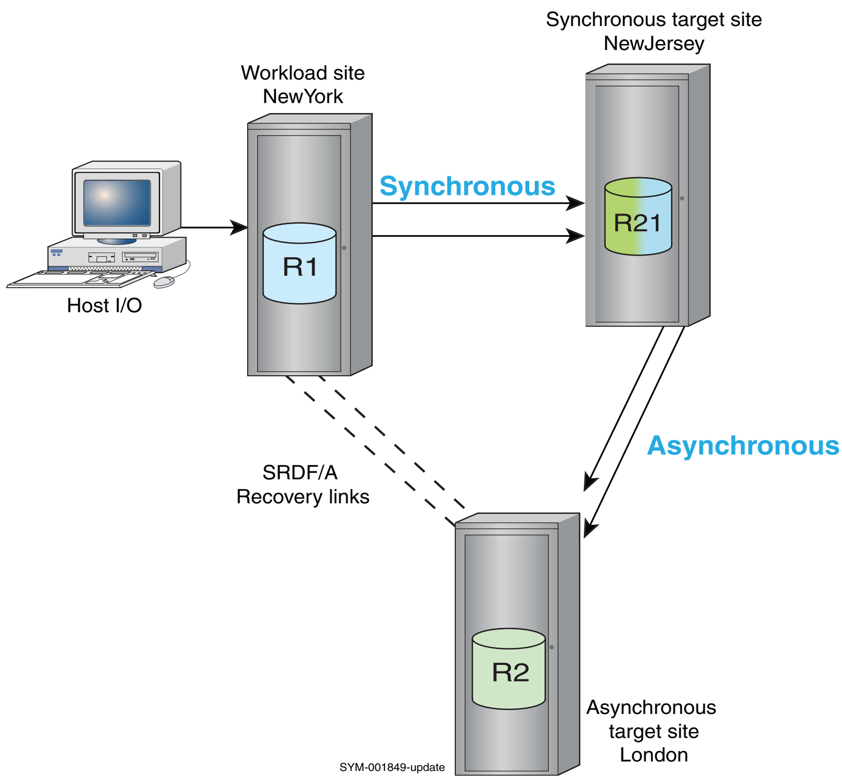
Note

Cascaded and Concurrent SRDF/Star environments dramatically reduce the time to reestablish replication operations in the event of a failure.

In a cascaded configuration, data at the workload site is replicated to a synchronous target site within synchronous distances.

The data is then replicated from the synchronous target site to a more remote asynchronous target site.

Figure 46 Cascaded SRDF/Star configuration



In cascaded SRDF/Star, the synchronous target site is always more current than the asynchronous target site, but it is possible to determine which site's data to use for recovery.

Note

During normal operations, the recovery links between the workload and the asynchronous target site are inactive.

Concurrent SRDF/Star

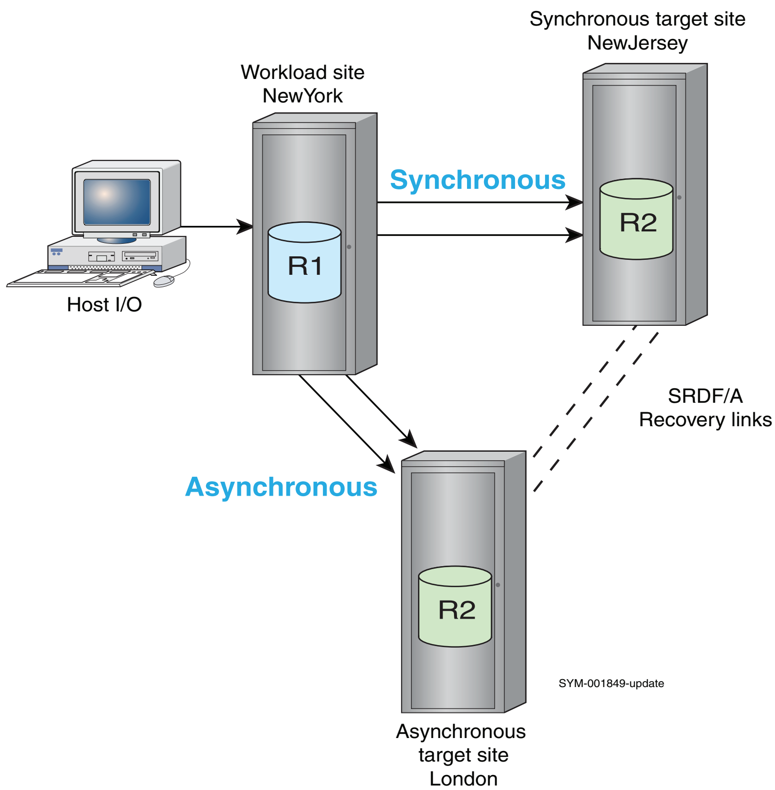
Note

Cascaded and Concurrent SRDF/Star environments dramatically reduce the time to reestablish replication operations in the event of a failure.

In a concurrent configuration, data at the workload site is replicated directly to two remote target sites:

- The synchronous target site is within synchronous distances and is linked to the workload site by SRDF/S replication.
- The asynchronous target site can be hundreds of miles from the workload site and is linked to the workload site by SRDF/A replication.

Figure 47 Concurrent SRDF/Star configuration



Data transfer from the workload site is:

- Synchronous to the nearby target site (NewYork) and,
- Asynchronous to the distant target site (London).

During normal operations, the recovery links between synchronous target site and the asynchronous target site are inactive.

In the event of an outage at the workload site, an SRDF/A session can be quickly established between the two target sites.

In the event of a rolling disaster at the workload site, it is possible to determine which target site contains the most current data.

Concurrent SRDF/Star with R22 devices

R22 devices (concurrent R2 devices) are specifically designed for SRDF/Star configurations to simplify failover and improve the resiliency of SRDF/Star applications. R22 devices significantly reduce the number of steps needed for `reconfigure`, `switch`, and `connect` commands.

Figure 48 Typical concurrent SRDF/Star with R22 devices

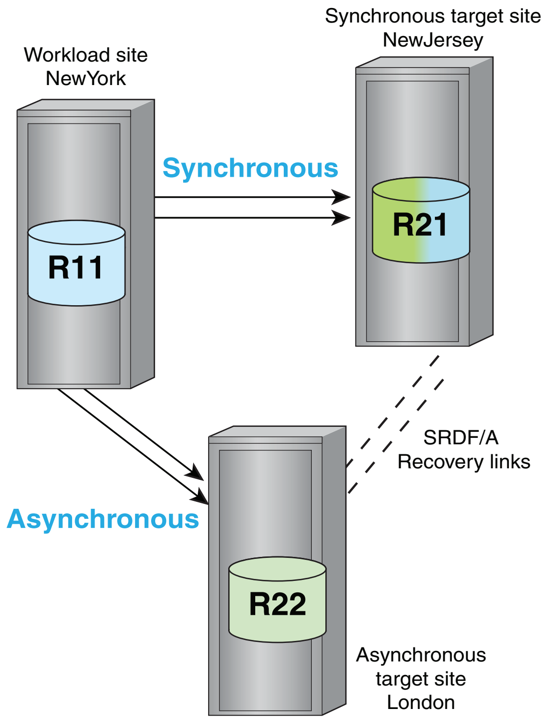
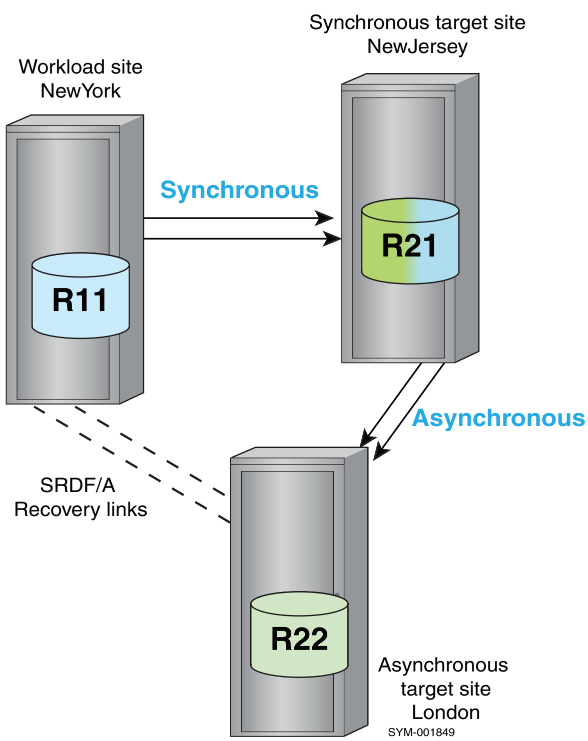


Figure 49 Typical cascaded SRDF/Star with R22 devices



R11 and R22 devices have two mirrors, each paired with a different mirror.

Only one of the R22 mirrors can be active (read/write) on the link at a time.

SRDF/Star features

- Differential synchronization greatly reduces the time to establish remote mirroring and consistency.
- In the event of a workload site failure occurring, SRDF/Star reduces the time to failover and resume asynchronous data transfer between the remaining target sites.
- In the event of a rolling disaster at the workload site, it is possible to determine which of the target sites holds the more current data and switch workload operations to that site.
- Devices can be added to an SRDF consistency group or removed from an SRDF consistency group to maintain data consistency without interrupting the workload.

SRDF/Star restrictions

- GNS Remote Mirroring is NOT supported with STAR configurations .
- Devices that are part of an RP configuration, cannot at the same time, be part of an SRDF/Star configuration.
- The RDF groups that are part of a STAR CG cannot contain any devices that are not part of the Star CG.
- Devices that are part of a STAR CG should not be controlled outside of `symstar` commands.
- Devices that are part of an SRDF/Metro configuration cannot at the same time be part of an SRDF/Star configuration.
- If any array in a SRDF/Star configuration is running HYPERMAX OS, Solutions Enabler 8.1 or higher is required in order to manage that configuration.
- If any array in a SRDF/Star configuration is running PowerMaxOS, Solutions Enabler 9.0 or later is required in order to manage that configuration.
- Each SRDF/Star control host must be connected to only one site in the SRDF/Star triangle. A Star control host is where the symstar commands are issued.
- A minimum of one SRDF daemon must be running on at least one host attached locally to each site. This host must be connected to only one site in the SRDF/Star triangle. The host could be the same as the Star control host but is not required unless using `symstar modifycg`.
  Dell EMC strongly recommends running redundant SRDF daemons on multiple hosts to ensure that at least one SRDF daemon is available to perform time-critical, consistency monitoring operations. Redundant SRDF daemons avoid service interruptions caused by performance bottlenecks local to a host.
- SRDF/A recovery links are required.
- SRDF groups cannot be shared between separate SRDF/Star configurations.
- R22 devices are required in SRDF/Star environments that include VMAX 10K or VMAXe arrays.
- CKD striped metadevices are not supported.
- R2 devices cannot be larger than their R1 devices.
- Composite groups consisting of device groups are not supported.

- Devices enabled as part of consistency groups cannot at the same time be part of an SRDF/Star configuration.
- Devices cannot be BCV devices.
- Every device must be dynamic SRDF (R1 and R2 capable).
- BCV device management must be configured separately.

Note

Dell EMC strongly recommends that you have BCV device management available at both the synchronous and asynchronous target sites.

- With Enginuity 5876.159.102 and higher, a mixture of thin and (non-diskless) thick devices is supported.

Note

If the thick device is on a DMX array running Enginuity 5876 and higher, thick-to-thin migration is supported if the array is running Enginuity 5876.163.105 and higher.

SRDF/Star states and operations

The state of the SRDF/Star environment determines possible operations and includes the following:

- The SRDF/Star state of the configuration,
- The state of the target sites,
- The location of the workload site and target sites.

SRDF/Star state

SRDF/Star state refers to the workload site and both target sites as a complete entity.

Table 30 SRDF/Star states

State	Description
Star Protected	There is data flow and consistency protection at each target site. SDDF sessions are tracking the differences between the sites. If the workload site failed, a differential synchronization between the two target sites would be possible.
Star Tripped	There is no data flow between the workload site and at least one of the target sites.

Table 30 SRDF/Star states (continued)

State	Description
Star Unprotected	A differential synchronization between the target sites would not be possible.

NOTICE

The configuration must be in the Star Protected state in order to have SRDF/Star consistent data protection and incremental recovery capabilities.

Target site states

SRDF/Star target site state refers to the relationship between the target sites and the workload site.

Table 31 SRDF/Star target site states

State	Description
Disconnected	May indicate that there is no data flow between the workload site and the target sites. **Note** If SRDF/Star cannot determine the site state, it will report the state as Disconnected even though there may still be data flow between the sites.
Connected	There is data flow between the sites. The target site is not necessarily synchronized with the workload site.
Protected	There is data flow between the sites. Dependent write consistency of the data at the target site is assured.
Halted	There is no data flow between the sites. There is no data protection at the target site relative to the workload site. The data at each site is the same.

Table 31 SRDF/Star target site states (continued)

State	Description
Isolated	There is no data flow between the sites. The devices at the target site are read/write enabled to their local host.
PathFail	There is no data flow between the sites. **Note** Occurs only if the specified target was in a Protected state. The PathFail;CleanReq state indicates that the `cleanup` operation is required to perform MSC cleanup on the asynchronous target before it will be consistent.

SRDF/Star site configuration transitions

In the following discussion, the initial configuration is as follows:

- Site A is the workload site.
- Site B is the nearby synchronous target site.
- Site C is the distant asynchronous target site.

After a switch or reconfiguration, the workload site can shift to Sites B or C.

The new location of the synchronous target and the asynchronous target varies based on the new configuration.

In cascaded configurations, there are two possible configurations when the workload is at Site C:

- Site A is the first hop toward Site B.
- Site B is the first hop toward Site A.

NOTICE

When the workload is at Site C:

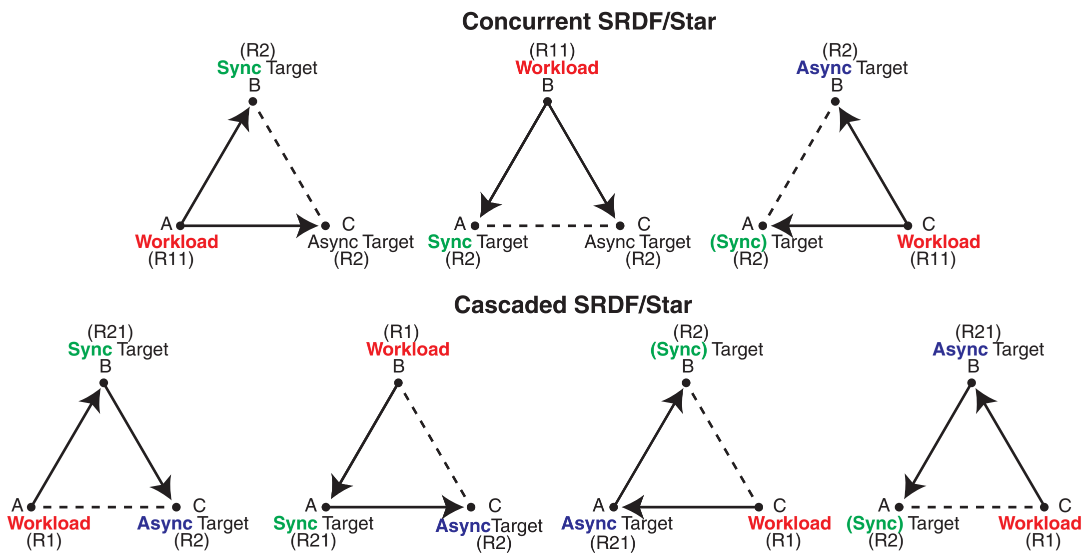
- Both of the target sites are long-distance links, so neither site can be synchronously mirrored.
- Only one target site can be in a protected state and the Star CG an never become fully STAR protected.

Note

In the following diagrams, one of the targets is labeled as the (Sync) target in order to differentiate between the two target sites.

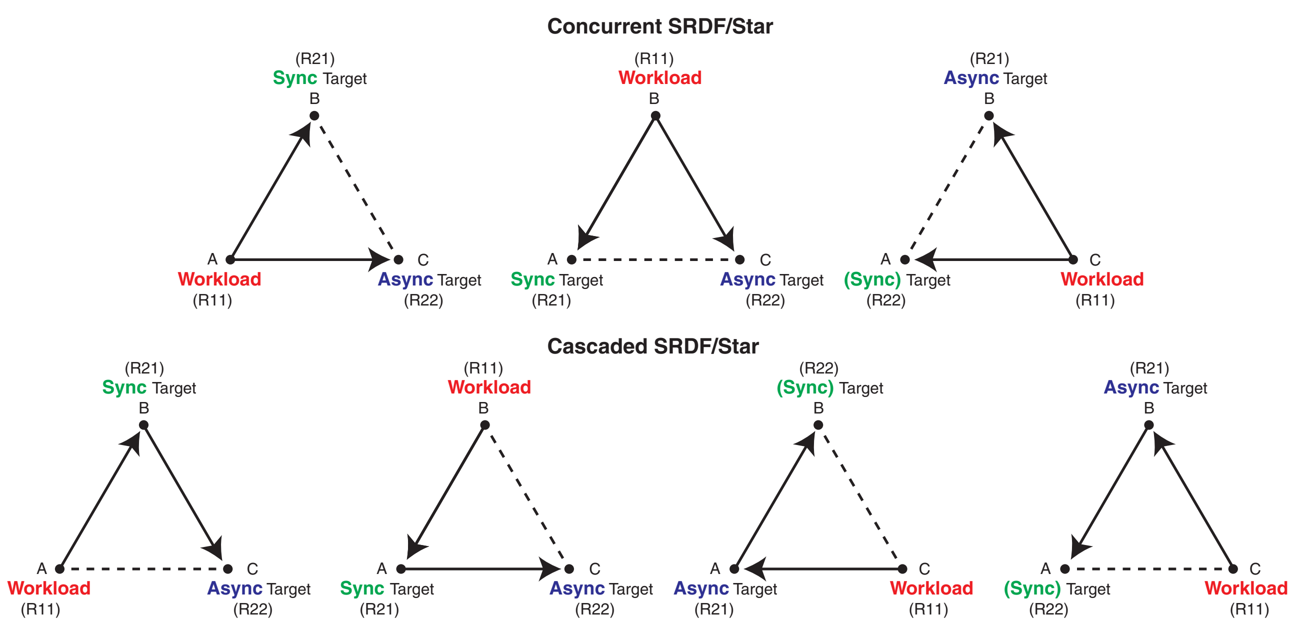
Transitions without concurrent devices

Figure 50 Site configuration transitions without concurrent devices



Transitions with concurrent devices (R22 Devices)

Figure 51 Site configuration transitions with concurrent devices



SRDF/Star operation categories

SRDF/Star operations can be broken into four categories.

Table 32 SRDF/Star operation categories

Operation Category	Description
Normal operations	Used to configure and setup SRDF/Star to achieve SRDF/Star protection. Includes the actions required to isolate a site for testing or other required data processing.
Transient fault operations	Used to recover from a temporary failure caused by loss of network connectivity or either target site. Transient faults do not disrupt production at the workload site, so these operations can be executed at the workload site.
Switch operations	• Planned: Used to move the production workload to a new site with a planned procedure. Planned switch operations are often used for maintenance purposes. They can also be used to return the workload to the original workload site after a disaster forced a move of production activity to one of the target sites. • Unplanned: Used to recover from faults caused by the loss of a workload site. The loss of a workload site requires an unplanned switch of the workload to one of the target sites.
Reconfigure operations	• Planned: Transitions the SRDF/Star setup from concurrent SRDF to cascaded SRDF or vice versa as part of a planned event. • Unplanned:

Table 32 SRDF/Star operation categories (continued)

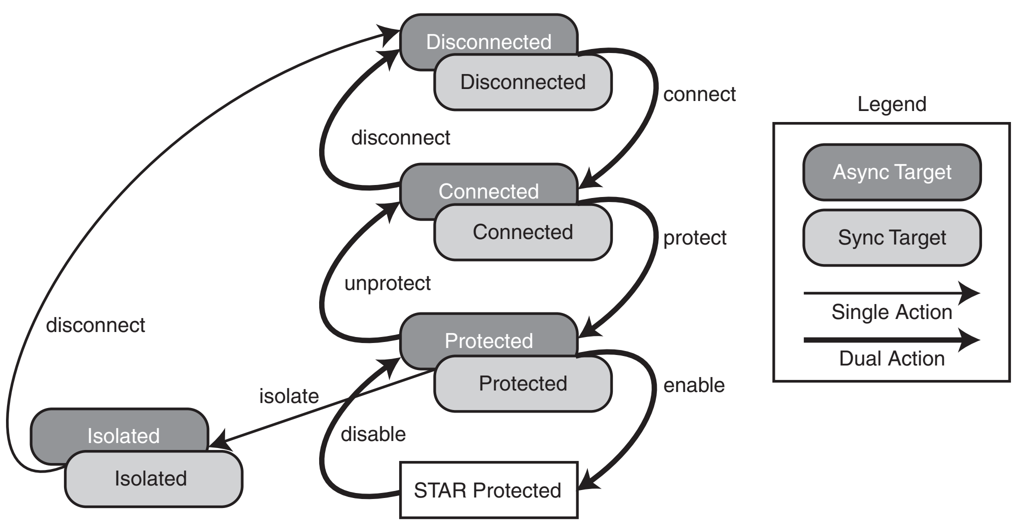
Operation Category	Description
	Transitions the SRDF/ Star setup from concurrent SRDF to cascaded SRDF or vice versa after a failure. Reconfigure operations can be used to resolve a transient fault or as part of a switch operation.

Required states for operations: Concurrent SRDF/Star

Normal operations

The following image shows the normal operations that are available from each state.

Figure 52 Concurrent SRDF/Star: normal operations

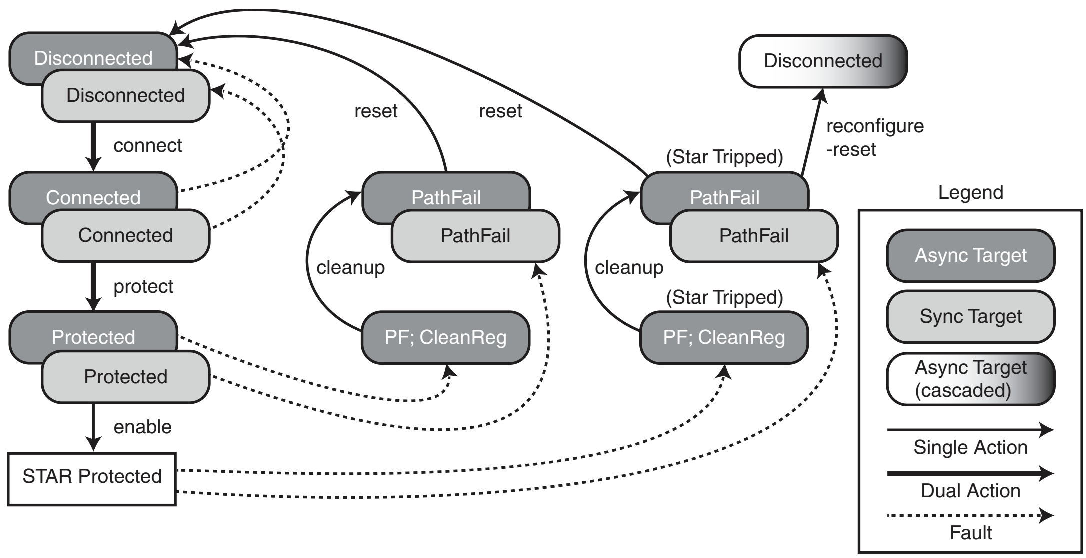


- The `connect` operation transitions the state from Disconnected to Connected.
- The `protect` operation transitions the state from Connected to Protected.
- The `enable` operation transitions all three sites into the Star Protected state.
- The `disable`, `unprotect`, and `disconnect` operations reverse the `connect`, `protect`, and `enable` operations and revert the configuration back to the previous state.
- The `isolate` operation isolates a site and bring it down for maintenance and testing. This operation requires the Protected target site state.

Transient fault operations

The following image shows the transient fault operations that are available from each state.

Figure 53 Concurrent SRDF/Star: transient fault operations



After a transient fault:

- The `reset` operation transitions the state from PathFail to Disconnected.
- The `cleanup` operation performs MSC cleanup at the target site and transitions the state from PathFail;CleanReq to PathFail if the transient fault resulted from the failure of the link to the asynchronous target site.
- The `reconfigure -reset` operation changes the setup to a cascaded SRDF/Star. This operation requires that the links between the synchronous target and the asynchronous target are working.
  A reconfiguration would leave the asynchronous site in the disconnected state.
- The `connect`, `protect`, and `enable` actions bring the system to the Star Protected state.

NOTICE

Dell EMC strongly recommends that you capture a gold copy at the failed target site after the `reset` action and before the `connect` operation.

Unplanned switch operations

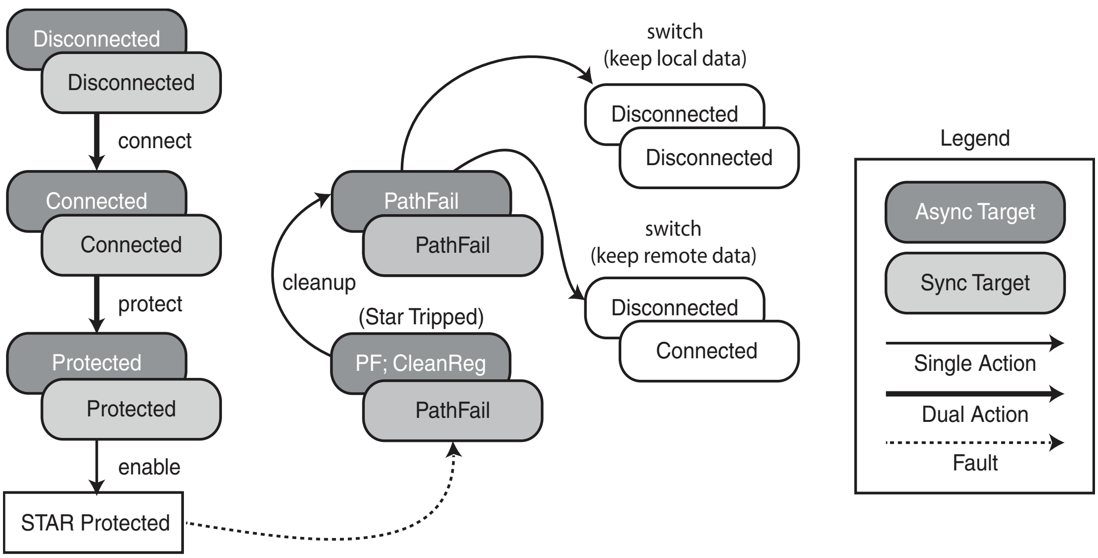
If the workload site fails, an unplanned `switch` operation is required to move the production workload to one of the target sites.

The following image shows the unplanned switch operations that are available from each state.

Note

The rounded rectangles that represent the target sites after a switch are not color coded because the definition of the workload site and the target sites can change after the switch.

Figure 54 Concurrent SRDF/Star: unplanned switch operations



When switching to a target site, the options are as follows:

- Keep the data at that site:
  - The `switch` operation transitions the remaining sites to the Disconnected state.
  - A `connect` operation is required to bring the sites to the Connected state.
- Keep the data at the other target site:
  - The `switch` operation transitions the other target site to the Connected state.

Planned switch operations

The `halt` operation is required for a planned switch whether you are returning the workload to the original site or moving the workload to another site.

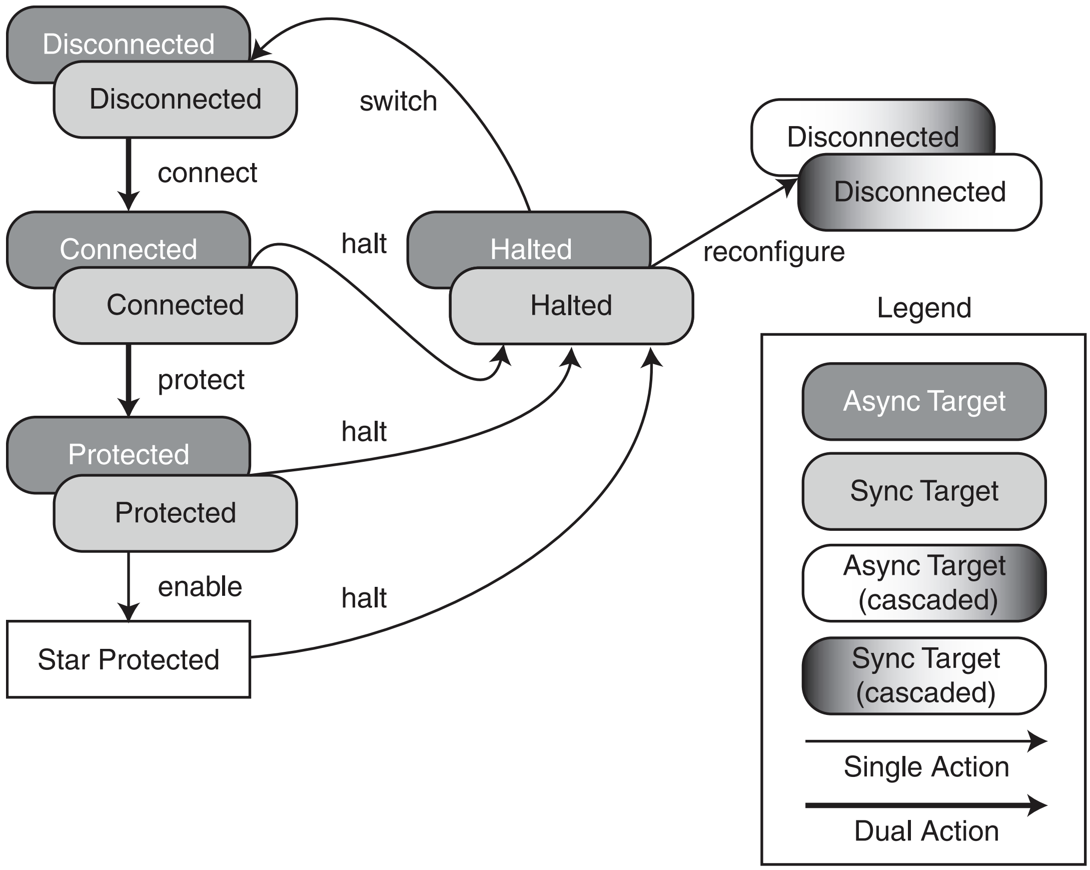
The `halt` operation write-disables the R1 devices, drains the data to the two target sites, and makes the data at all three sites the same.

NOTICE

Before initiating the `halt` operation, stop the application workload at the current workload site and unmount the file systems. If you change your mind after halting SRDF/Star, issue the `halt -reset` command to restart the workload at the current workload site.

The following image shows the planned switch operations that are available from each state.

Figure 55 Concurrent SRDF/Star: planned switch operations



Required states for operations: Cascaded SRDF/Star

Normal operations

In Cascaded SRDF/Star, the consistency of the asynchronous site data is dependent on the consistency of the synchronous site data.

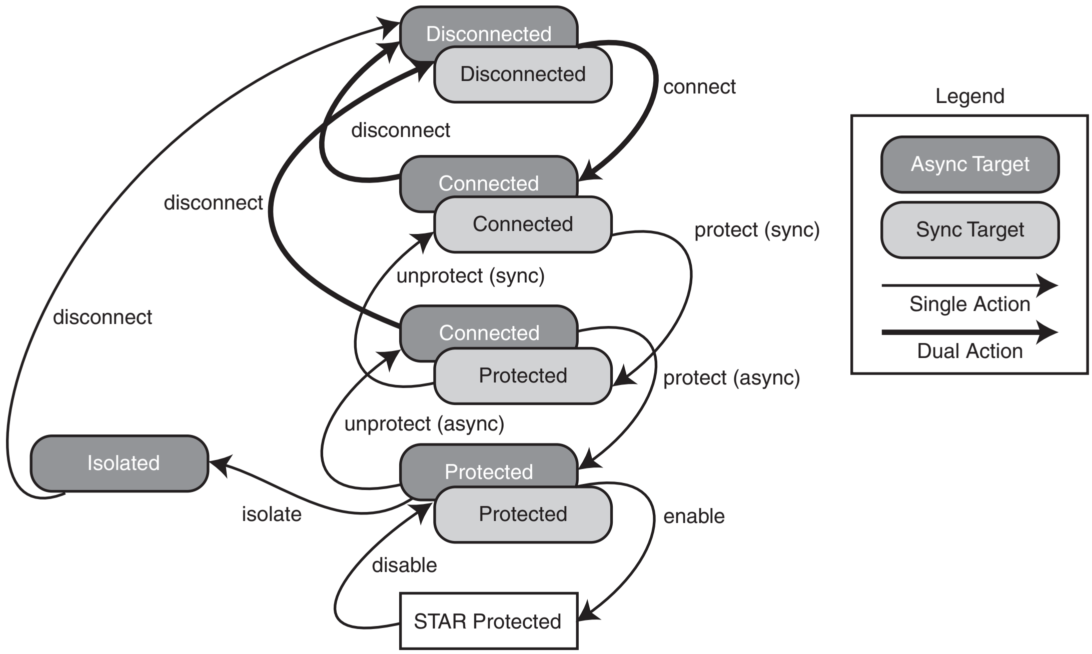
The asynchronous target can only be protected if the synchronous target is protected as well. After the two sites have been connected, the synchronous target must be protected first.

Note

The synchronous target site can be isolated if the asynchronous target site has a target site state of Disconnected, Isolated, or PathFail.

The following image shows the normal operations that are available from each state.

Figure 56 Cascaded SRDF/Star: normal operations



Transient fault operations

In Cascaded SRDF/Star, the loss of either target site does not interrupt production. However, the loss of the synchronous site can result in the loss of remote replication capability (unless SRDF/Star is reconfigured to run in Concurrent SRDF/Star).

Loss of the synchronous target means that Cascaded SRDF/Star is not performing replication.

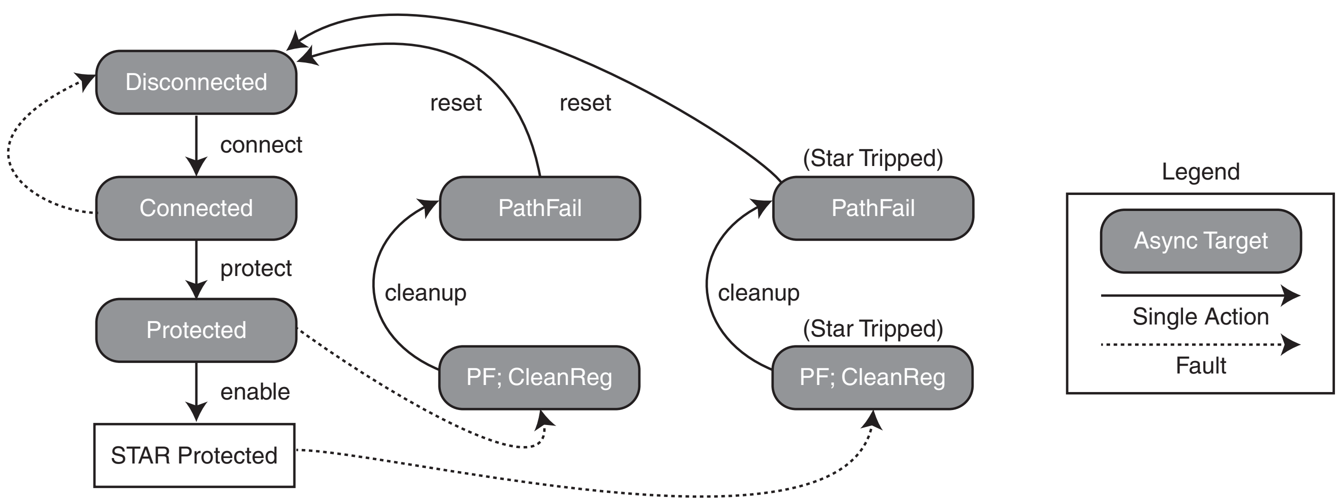
If the outage is expected to be brief, you can continue production at the workload site without remote replication. When the outage is restored, you can then reset the synchronous target.

The following image shows the transient fault operations that are available from each state after the loss of the asynchronous target site.

Note

This diagram assumes that the synchronous target stayed protected during the fault.

Figure 57 Cascaded SRDF/Star: transient fault operations (asynchronous loss)



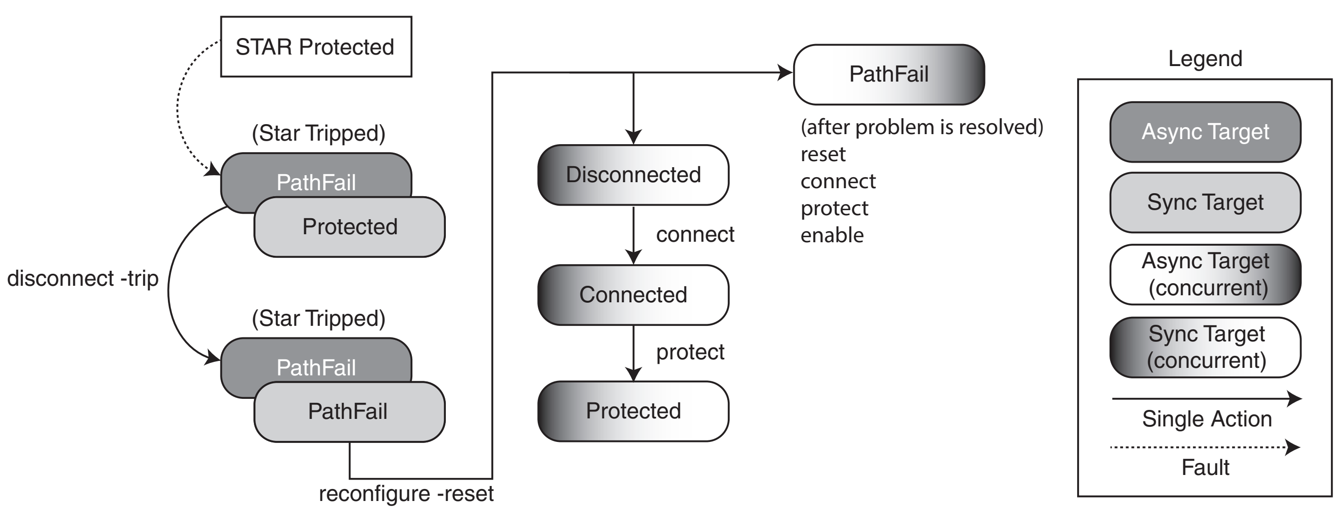
- The `reset` operation transitions the state from PathFail to Disconnected after a transient fault from the loss of the asynchronous target site.
- The `cleanup` operation (if required) performs MSC cleanup at the target site and transitions the state from PathFail;CleanReq to PathFail.

Convert Cascaded SRDF/Star to Concurrent SRDF/Star

Reconfigure Cascaded SRDF/Star to Concurrent SRDF/Star to have remote replication immediately after the synchronous target is lost.

The following image shows the use of the `reconfigure -reset` operation to convert to Concurrent SRDF/Star with the workload site communicating directly with the asynchronous target.

Figure 58 Cascaded SRDF/Star: transient fault operations (synchronous loss)



Unplanned switch operations

In Cascaded/SRDF, if the workload site fails, an unplanned `switch` operation is required to move the production workload to one of the target sites.

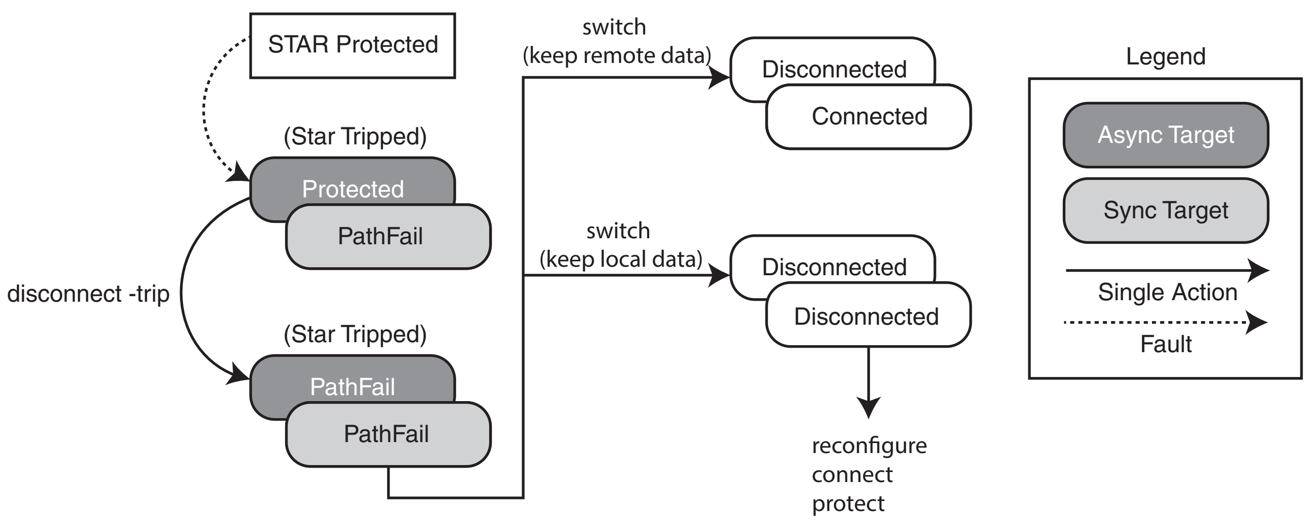
- To switch production to the synchronous target site, convert the configuration to Concurrent SRDF/Star.
  Only local data can be kept because the local data is ahead of the data at the asynchronous target site.
- When switching production to the asynchronous target site, the local data or the data at the synchronous target site can be kept.

The following image shows unplanned switch operations that are available from each state.

Note

The rounded rectangles that represent the target sites after a switch are not color coded because the definition of the workload site and the target sites can change after the switch.

Figure 59 Cascaded SRDF/Star: unplanned switch operations



SRDF/Star operations summary

Table 33 SRDF/Star control operations

Control operation	symstar action	Description	Workload or target
Configure and bring up SRDF/Star on page 292	setup -options buildcg (at the Target sites) connect protect enable	Sample procedure showing the basic steps to configure and activate the SRDF/Star environment after the CG has been created.	W
Displaying the symstar configuration on page 306 symstar show command on page 307 symstar list command on page 308	query show list	• Displays the status of a given SRDF/Star site configuration. • Displays the contents of the internal definition for a given SRDF/Star site configuration. • Lists each SRDF/Star composite group configuration, including workload name, mode of operation, CG and Star states, and target names and states.	W/T
Removal of a CG from SRDF/STAR control on page 309	setup -remove	Removes the CG from Star control.	
Isolate SRDF/Star sites on page 311	isolate	Isolates one target site from the SRDF/Star configuration and makes its R2 devices read/write enabled to their hosts.	W
Unprotect target sites on page 312	unprotect	Disables SRDF/Star consistency protection to the specified target site.	W
Halt target sites on page 312	halt	Used to prepare SRDF/Star for a planned switch of the workload to a target site. This action write-disables the R1 devices, drains all invalid tracks and MSC cycles so that NewYork=NewJersey=London, suspends SRDF links, disables all consistency protection, and sets adaptive copy disk mode.	W/T
Clean up metadata on page 313	cleanup	Cleans up internal meta information and cache at the remote site after a failure at the workload site.	T
SRDF/Star consistency group operations on page 313	modifycg	Maintains consistency protection when adding or removing device pairs from an SRDF/Star consistency group.	W
Upgrade an existing SRDF/ Star environment Transition SRDF/Star to use R22 devices on page 374	configure	Upgrades or transitions an existing SRDF/Star environment to employ R22 devices, provided the current SRDF/Star environment is operating in normal condition.	W

Table 33 SRDF/Star control operations (continued)

Control operation	symstar action	Description	Workload or target
Begin SRDF synchronization	connect	Starts the SRDF data flow in adaptive copy disk mode.	W
Enable full SRDF/Star protection	enable	Enables complete SRDF/Star consistency protection across the three sites.	W
SRDF/Star consistency group operations on page 313	protect	Synchronizes devices between the workload and target sites and enables SRDF/Star consistency protection to the specified target site.	W
Change the SRDF/Star replication path Reconfiguring mode: cascaded to concurrent on page 362,Reconfiguring cascaded paths on page 366,Reconfiguring mode: concurrent to cascaded on page 368,Reconfigure mode without halting the workload site on page 372	reconfigure	Transitions the SRDF/Star setup from concurrent SRDF to cascaded SRDF or vice versa after a site or link failure, or as part of a planned event.	W
Reset after a transient failure Recovery operations: Concurrent SRDF/Star on page 325, Recovery operations: Cascaded SRDF/Star on page 346	reset	Cleans up internal meta information and cache at the remote site after transient fault (such as a loss of connectivity to the synchronous or asynchronous target site).	W
Switch workload operations to a target site Workload switching: Concurrent SRDF/Star on page 329, Unplanned workload switching: cascaded SRDF/Star on page 352Unplanned workload switching to asynchronous target site: Cascaded SRDF/Star on page 358	switch	Transitions workload operations to a target site after a workload site failure or as part of a planned event.	T
Verify that the given site or SRDF/Star setup is in the desired state Displaying the symstar configuration on page 306	verify	Returns success if the state specified by the user matches the state of the Star setup.	W/T

symstar command options

Note

The `symstar` man page provides more detailed descriptions of the options used with the `symstar` command.

Table 34 symstar command options

Command option	Description
`-add`	The element of configuration to add.
`-c`	Specifies the number (count) of times to display or to acquire an exclusive lock on the host database, the local array, and the remote arrays. If this option is not specified and an interval (`-i`) is specified, the display shows continuously, or until the SRDF/Star operation starts.
`-cg`	Name of the host composite group.
`-cg_rdfg`	The SRDF group(s) within the SRDF/Star CG in which to add or remove devices. For a concurrent SRDF/Star CG, two SRDF groups must be specified, separated by a comma. These SRDF groups are associated with the SRDF groups in the `-stg_rdfg` option. This association is based on their order in this option and `-stg_rdfg`.
`-cg_r21_rdfg`	The SRDF group connecting the R21 and R2 arrays of a cascaded SRDF/Star CG. It is only valid for operations involving cascaded R1 devices. This SRDF group is associated with the SRDF group specified in the `-stg_r21_rdfg` option.
`-cleanreq`	Verifies the site is in the PathFail state and needs cleaning.
`-connected`	Verifies the site is in the `connected` state.
`-devs`	Specifies the ranges of devices to add or remove.
`-disconnected`	Verifies the site is in the `disconnected` state.
`-distribute`	Performs an automatic SRDF/Star definition file distribution. This form of setup does not disrupt an active protected SRDF/Star setup.
`-full`	• Used by `reconfigure`, `switch`, and `connect`. Performs a full SRDF resynchronization if SRDF incremental resynchronization is not available. • Used by the `list` action to display full names instead of abbreviations.
`-halted`	Verifies the site is in the `halted` state.
`-haltfail`	Verifies the site is in the `haltfail` state.
`-haltstarted`	Verifies the site is in the `haltstarted` state.

Table 34 symstar command options (continued)

Command option	Description
-i	Executes a command at repeat intervals to display information or to attempt to acquire an exclusive lock on the host database, the local array, and the remote arrays. The default interval is 10 seconds. The minimum interval is 5 seconds.
-isolated	Verifies the site is in the `isolated` state.
-keep_data	Identifies which site's data is retained when used with the switch and connect action. If you switch to the SyncTargetSite and choose to keep the data of the AsyncTargetSite, the SRDF devices are reconfigured to make a new R1-R2 pairing. For the `connect` action, an SRDF establish or restore operation is performed, depending on which site's data is retained. By default, the workload site data is retained.
-local	Lists only the locally defined CGs. Available only for the list action.
-offline	Obtains the data strictly from the configuration database. No connections are made to any arrays. The `symstar` command uses information previously gathered from the array and held in the host database as opposed to interrogating the array directly. The offline option can alternatively be set by assigning the environment variable SYMCLI_OFFLINE to 1.
-opmode	Specifies the mode of operation (concurrent or cascaded).
-path	Specifies the sites on which the new SRDF pairs are created when the reconfigure action is issued.
-pathfail	Verifies the site is in the `pathfail` state.
-pathfailinprog	Verifies the site is in the `pathfailinprog` state.
-protected	Verifies the site is in the `protected` state. If -site is not specified, verifies that SRDF/Star is in the `protected` state.
-noprompt	Suppresses the message asking you to confirm an SRDF control operation.
-reload_options	Reads the specified options file to update the SRDF/Star definition file when using the setup action. **Note** Do not change any SITE_NAME values with this option.
-remote	Indicates the remote data copy flag. Used with the `connect` action when keeping remote data and the concurrent link is ready. Data is also copied to the concurrent SRDF mirror. **Note** Not required if the concurrent link is suspended.

Table 34 symstar command options (continued)

Command option	Description
-remove	• For the reconfigure action, specifies the sites on which the SRDF pairs are removed. • For the setup action, specifies that all SRDF/Star mode settings for all SRDF groups be set to off if the CG is defined in the symapi database, and to remove all SRDF/Star metadata associated with the group. • For the modifycg action, indicated to remove the specified devices from the SRDF/Star CG to the staging area.
-reset	Performs a reset action on the path when the reconfigure action is issued. • When used with the halt action, allows the application to be restarted at the same site after the halt command has completed or failed. • When used with the configure action, specifies the element of the reset operation.
-site	Specifies the SiteName to apply the given action.
-stg_r21_rdfg	For modifycg operations, indicates the SRDF group comprising the staging area at the R21 array when the configuration is cascaded. Required for an add or remove operation when the setup is cascaded. This SRDF group is associated with the SRDF group in the -cg_r21_rdfg option.
-stg_rdfg	For the modifycg operations, indicates the SRDF group(s) comprising the staging area. For a concurrent CG, two groups must be specified, separated by a comma. These SRDF groups are associated with the SRDF groups in the -cg_rdfg option. This association is based on their order in this option and -cg_rdfg.
-trip	Transitions the site to pathfail state when used with disconnect action.
-tripped	Verifies SRDF/Star is in the tripped state.
-trip_inprogress	Verifies SRDF/Star is in the trip_inprogress state.
-unprotected	Verifies the site is in the unprotected state. If -site is not specified, verifies SRDF/Star is in the unprotected state.
-update	Allows the updating of the existing host composite group from the STAR definition file.
-v	Provides more detailed, verbose command output.
-wkload	Specifies the current workload site name if symstar fails to determine the current workload site name.

Command failure while in Connected state

While in the SRDF/Star Connected state, if an operation fails that indicates the SRDF mode is invalid, issue the `symstar configure -reset rdf_mode` command at the workload site.

This command resets the device pairs in the SRDF/Star CG to adaptive copy, and if the composite group has R22 devices, the SRDF mode for the recovery pairs is also set to adaptive copy.

Restrictions for cascaded mode

- The `symstar protect` command to the asynchronous target is allowed only if the synchronous target site is in a Protected state.
  An unprotected flow of data is not allowed from the workload site to the synchronous target site if the asynchronous target site is in a Protected state as this will result in an inconsistent data image at the asynchronous target site.
- If the asynchronous target site is in a Protected state, the `symstar connect` and `symstar unprotect` commands are not allowed to the synchronous target site as this will also result in an inconsistent data image at the asynchronous target site.
- The synchronous target site (first site) can be isolated if the consistency group is non-diskless on asynchronous site (second target site) and the first site is in a Protected state.

Configure and bring up SRDF/Star

This section lists the steps to configure and bring up the SRDF/Star environment and links to detailed instructions for each step:

Procedure

1. Verify the SRDF/Star control host is locally connected to *only* one of the three sites.

   Step 1: Verify SRDF/Star control host connectivity on page 293

2. Verify the settings for each array to be included in the SRDF/Star configuration.

   Step 2: Verify array settings on page 294

3. **Note**

   The RDF groups between all the SRDF/Star sites must exist and the RDF device pairs must be created between the applicable SRDF/Star sites, before creating the SRDF/Star composite group. Refer to Dynamic Operations on page 95, Concurrent Operations on page 235and Cascaded Operations on page 245.

   Create a composite group at the workload site.

   Step 3: Create an SRDF/Star composite group on page 294

4. Create an SRDF/Star options file containing specific parameters for the setup procedure.

Step 4: Create the SRDF/Star options file on page 299

5. Issue the SRDF/Star `symstar setup` command to read and validate the information in the host composite group definition, and build the SRDF/Star definition file that defines the R1 composite group.

   Step 5: Perform the symstar setup operation on page 302

6. Optionally, issue the `symstar buildcg` command to build the matching composite groups on the Star control hosts at the target sites.

   Step 6: Create composite groups on target sites on page 303

7. Optionally, add BCVs to the SRDF/Star configuration.

   Step 7: (Optional) Add BCV devices to the SRDF/Star configuration on page 304

8. Bring up the SRDF/Star configuration.

   Step 8: Bring up the SRDF/Star configuration on page 305

   To perform SRDF/Star operations with access control enabled, the SRDF, BASECTRL, BASE, and BCV access types are required.

   Dell EMC Solutions Enabler Array Controls and Management CLI User Guide provides more information.

   Note

   An SRDF/Star environment contains one or more triangles, where each triangle has a unique SRDF group for the synchronous link, the asynchronous link, and the recovery group link. No sharing of SRDF groups is allowed between any two SRDF/Star triangles.

   The examples in this section use the following names:

   - `StarGrp` - the composite group and
   - `NewYork` - workload site
   - `NewJersey` - synchronous target site
   - `London` - asynchronous target site

9. Optionally, configure a non-R22 STAR CG to an R22 STAR CG.

   Transition SRDF/Star to use R22 devices on page 374

Step 1: Verify SRDF/Star control host connectivity

The SRDF/Star control host must be connected locally to *only* one of the three sites.

Procedure

- Issue the `symcfg list` command to verify the configuration.

  The following output displays the required connectivity of `Local`, `Remote`, `Remote` under `Attachment`:

  `symcfg list`

```
                S Y M M E T R I X
```

```
                                        Mcode     Cache      Num Phys  Num Symm
SymmID       Attachment  Model      Version  Size (MB)  Devices   Devices
000194901217 Local       VMAX-1SE   5876       28672       369      6689
000194901235 Remote      VMAX-1SE   5876       28672         0      6890
000194901241 Remote      VMAX-1SE   5876       28672         0      7007
```

Step 2: Verify array settings

Procedure

- Verify that each array within SRDF/Star uses dynamic SRDF devices.

  Issue the `symrdf list` command with the `-dynamic` option to display SRDF devices configured as dynamic SRDF-capable.

- Verify that the SRDF directors are Fibre or GigE (RF or RE).

  Issue the `symcfg list -sid` *`SID`* `-rdfg all` command to display SRDF group-level settings for a specific group or all groups including director configuration.

- Issue the `symcfg list -v` command to verify that the following states exist for each array within SRDF/Star:
  - Concurrent SRDF Configuration State = Enabled
  - Dynamic SRDF Configuration State = Enabled
  - Concurrent Dynamic SRDF Configuration = Enabled
  - RDF Data Mobility Configuration State = Disabled

- Issue the `symcfg list -rdfg -v` command to verify that each SRDF group in the composite group has the following configuration:
  - Prevent RAs Online Upon Power On = Enabled
  - Prevent Auto Link Recovery = Enabled

  Note

  Preventing automatic recovery preserves the remote copy that was consistent at the time of the link failure.

Step 3: Create an SRDF/Star composite group

This step includes the following tasks:

Procedure

1. Create an RDF1 type composite group, with RDF consistency protection, on the Star control host for the array at the workload site (NewYork).

This step varies depending on the topology of the SRDF configuration:

- For Concurrent SRDF/Star, proceed to Step 3, option A: Create a composite group in Concurrent SRDF/Star on page 295.

- For Cascaded SRDF/Star, skip to Step 3, option B: Create a composite group in Cascaded SRDF/Star on page 297.

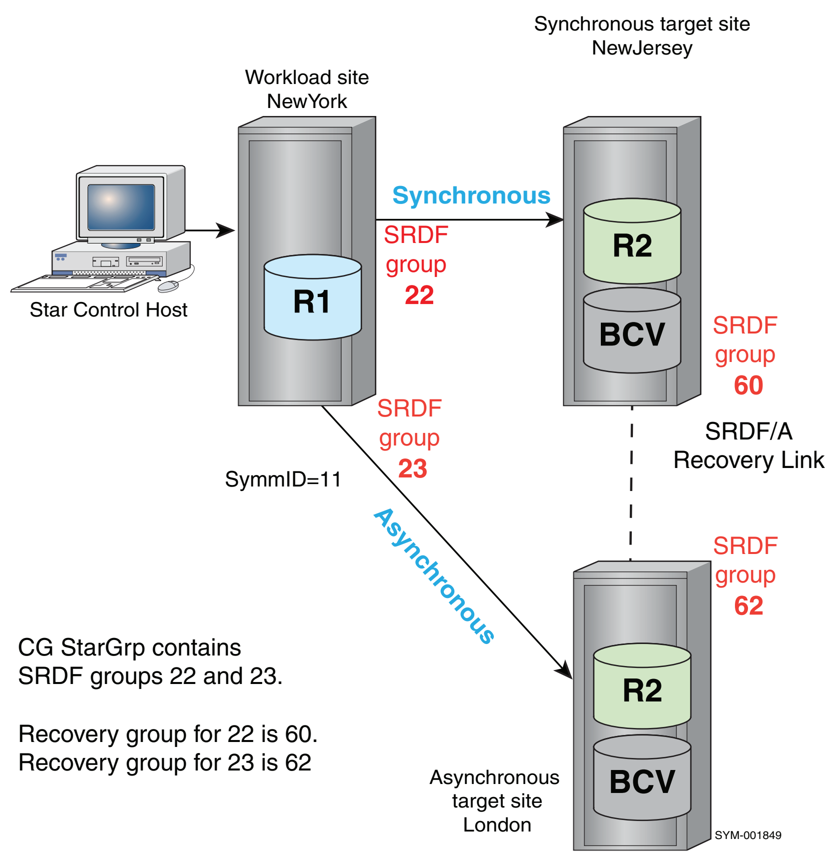
Step 3, option A: Create a composite group in Concurrent SRDF/Star

Follow these steps if the SRDF/Star configuration is a concurrent topology.

The following example procedure includes:

- A composite group named `StarGrp`,
- The workload site is `NewYork`,
- The synchronous target site is `NewJersey`, and
- The asynchronous target site is `London`.

Figure 60 Concurrent SRDF/Star setup using the StarGrp composite group



Note

Dell EMC Solutions Enabler Array Controls and Management CLI User Guide provides additional information on composite groups and using the `symcg -cg` command.

Complete the following steps to build an RDF1 type composite group on the Star control host of the SRDF/Star workload site (`NewYork, SID 11`) in a concurrent configuration:

Procedure

1. Determine which devices on the local array are configured as concurrent dynamic devices.

To list the concurrent dynamic devices for array 11:

```
symrdf list -sid 11 -concurrent -dynamic -both
```

Note

Specify the `-dynamic` and `-both` options to display dynamic SRDF pairs in which the paired devices can be either R1 or R2 devices.

---

2. Create an RDF1-type composite group with consistency protection on the Star control host at the workload site.

   To create composite group **StarGrp** on array **NewYork**:

```
symcg create StarGrp -type rdf1 -rdf_consistency
```

Note

The `-rdf_consistency` option specifies consistency protection for the group.

---

3. Add devices to the composite group from those SRDF groups that represent the concurrent links for the SRDF/Star configuration.

   To add all the devices in SRDF groups 23 and 22 to composite group **StarGrp**:

```
symcg -cg StarGrp -sid 11 addall dev -rdfg 23
```

Note

With concurrent SRDF, the command that adds one of the two concurrent groups adds both concurrent groups (in this example, the synchronous SRDF group 22 is automatically added with the asynchronous SRDF group 23).

---

4. Create two SRDF group names; one for all synchronous links and one for all asynchronous links.

   To create two SRDF group names `NewJersey` for SRDF group 22 on SID 11 and SRDF group name `London` for SRDF group 23 on SID 11:

```
symcg -cg StarGrp set -name NewJersey -rdfg 11:22
symcg -cg StarGrp set -name London -rdfg 11:23
```

Note

You could include additional synchronous SRDF groups in (synchronous) NewJersey using the `sid:rdfg` syntax. If the CG contains more than one triangle, you must issue the above command to set the SRDF group name for each additional SRDF group.

You must also include the names `NewJersey` and `London` in the SRDF/Star options file as the values for the synchronous and asynchronous target site names, respectively.

Step 4: Create the SRDF/Star options file on page 299 provides more information.

5. For each source SRDF group that you added to the composite group, define a corresponding recovery SRDF group at the remote site.

   A recovery SRDF group can be static or dynamic, but it cannot be shared. A recovery SRDF group cannot contain any devices.

   In the following example for a non-R22 Star CG:

   - SRDF group 60 is an empty static or dynamic group on the remote array to which source SRDF group 22 is linked.
   - Recovery SRDF group 62 was configured on the other remote array as a match for the source SRDF group 23.

   To set the remote recovery group for StarGp RDF group 22 to SRDF group 60 at the remote site:

```
symcg -cg StarGrp set -rdfg 11:22 -recovery_rdfg 60
```

   To set the remote recovery group for StarGp RDF group 23 to SRDF group 62 at the remote site:

```
symcg -cg StarGrp set -rdfg 11:23 -recovery_rdfg 62
```

   These two recovery group definitions represent one recovery SRDF group as viewed from each of the two target sites.

   Note

   If the CG contains more than one triangle, you must issue the above command to set the recovery group for each additional SRDF group.

6. Skip to Step 4: Create the SRDF/Star options file on page 299.

Step 3, option B: Create a composite group in Cascaded SRDF/Star

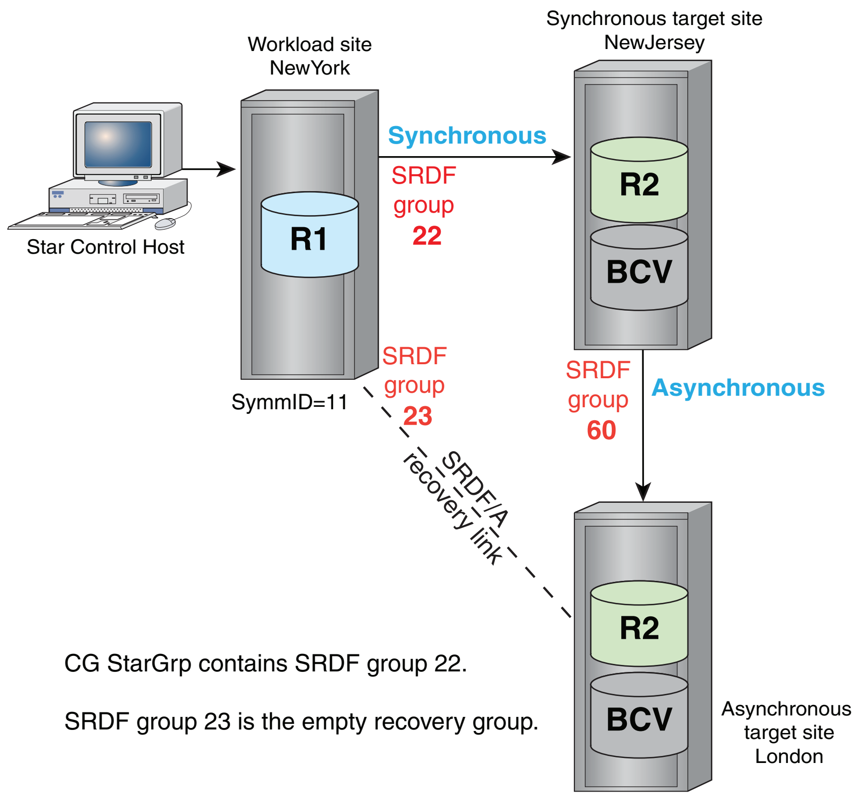
Follow these steps if the SRDF/Star configuration is a cascaded topology.

The following example procedure includes:

- A composite group named `StarGrp`
- The workload site is `NewYork`.
- The synchronous target site is `NewJersey`

- The asynchronous target site is London

Figure 61 Cascaded SRDF/Star setup using the StarGrp composite group



Complete the following steps to build an RDF1-type composite group on the Star control host of the SRDF/Star workload site (NewYork, SID 11) in a cascaded environment:

Procedure

1. Determine which devices on the local array (-sid 11) are configured as cascaded dynamic devices.

   To list the cascaded dynamic devices for array 11:

```
symrdf list -sid 11 -R1 -cascaded -dynamic -both
```

Note

Specify the -dynamic and -both options to display dynamic SRDF pairs in which the paired devices can be either R1 or R2 devices.

2. Create an RDF1-type composite group with consistency protection on the Star control host at the workload site.

   To create composite group StarGrp on NewYork:

```
symcg create StarGrp -type rdf1 -rdf_consistency
```

Note

Specify the `-rdf_consistency` option to specify consistency protection for the group.

3. Add devices to the composite group from those SRDF groups that represent the cascaded links for the SRDF/Star configuration.

   To add devices in SRDF group 22 to composite group `StarGrp`:

```
symcg -cg StarGrp -sid 11 addall dev -rdfg 22
```

4. Create one SRDF group name for all synchronous links.

   To create SRDF group name `NewJersey` for devices in SRDF group 22 on SID 11:

```
symcg -cg StarGrp set -name NewJersey -rdfg 11:22
```

Note

The site named `NewJersey` includes synchronous SRDF group 22 on array 11. If the CG contains more than one triangle, you must issue the above command to set the SRDF group name for each additional SRDF group.

Include the site names `NewJersey` and `London` in the SRDF/Star options file as the values for the synchronous and asynchronous target site names, respectively. Step 4: Create the SRDF/Star options file on page 299 provides more information.

5. For each source SRDF group added to the composite group, define a corresponding recovery SRDF group at the local (workload) site.

   The recovery SRDF group:

   - Can be static or dynamic.
   - Cannot be shared.
   - Cannot contain any devices.
   - Must be empty.

   For the cascaded setup in Figure 61 on page 298, the recovery SRDF group is the empty SRDF group 23 configured between the `NewYork` synchronous site and the `London` asynchronous site.

   To add this recovery SRDF group:

```
symcg -cg StarGrp set -rdfg 11:22 -recovery_rdfg 23
```

Step 4: Create the SRDF/Star options file

Description

The SRDF/Star options file specifies the names of each SRDF/Star site and other required parameters.

Syntax

The SRDF/Star options file must conform to the following syntax:

```
SYMCL_STAR_OPTION=Value
```

You can add comment lines that begin with "#".

```
#Comment
SYMCLI_STAR_WORKLOAD_SITE_NAME=WorkloadSiteName
SYMCLI_STAR_SYNCTARGET_SITE_NAME=SyncSiteName
SYMCLI_STAR_ASYNCTARGET_SITE_NAME=AsyncSiteName
SYMCLI_STAR_ADAPTIVE_COPY_TRACKS=NumberTracks
SYMCLI_STAR_ACTION_TIMEOUT=NumberSeconds
SYMCLI_STAR_TERM_SDDF=Yes|No
SYMCLI_STAR_ALLOW_CASCADED_CONFIGURATION=Yes|No
SYMCLI_STAR_SYNCTARGET_RDF_MODE=ACP|SYNC
SYMCLI_STAR_ASYNCTARGET_RDF_MODE=ACP|ASYNC
```

Note

If the options file contains the `SYMCLI_STAR_COMPATIBILITY_MODE` parameter, it must be set to `v70`.

Options

WorkloadSiteName

Configure a meaningful name for the workload site.

SyncSiteName

Configure a meaningful name for the synchronous target site. This name must match the SRDF group name used for the synchronous SRDF groups when building the composite group.

AsyncSiteName

Configure a meaningful name for the asynchronous target site. This name must match the SRDF group name that you used for the asynchronous SRDF groups when building the composite group for a Concurrent SRDF/Star configuration.

Note

There are no SRDF group names for the asynchronous site in a cascaded configuration.

NumberTracks

Maximum number of invalid tracks allowed for SRDF/Star to transition from adaptive copy mode to synchronous or asynchronous mode. SRDF/Star will wait until the number of invalid tracks is at or below the `NumberTracks` value before changing the SRDF mode.
The default is 30,000.

NumberSeconds

Maximum time (in seconds) that the system waits for a particular condition before returning a timeout failure.

The wait condition may be the time to achieve R2-recoverable SRDF/Star protection or SRDF consistency protection, or the time for SRDF devices to reach the specified number of invalid tracks while synchronizing.

The default is 1800 seconds (30 minutes). The smallest value allowed is 300 seconds (5 minutes).

SYMCLI_STAR_TERM_SDDF

Enables/disables termination of SDDF (Symmetrix Differential Data Facility) sessions on both the synchronous and asynchronous target sites during a `symstar disable`.

- `Yes` - Terminates SDDF sessions during a `symstar disable`.
- `No` - (Default setting) Deactivates (instead of terminates) the SDDF sessions during a `symstar disable`.

SYMCLI_STAR_ALLOW_CASCADED_CONFIGURATION

Enables/disables STAR mode for cascaded SRDF/Star configurations.

- `Yes` - STAR mode for a cascaded SRDF/Star configuration.
- `No` is the default setting.

SYMCLI_STAR_SYNCTARGET_RDF_MODE

Sets the SRDF mode between the workload site and the synchronous target site at the end of the `symstar unprotect` operation.

- `ACP` - (default setting) Sets the SRDF mode between the workload site and the synchronous target site transitions to adaptive copy mode at the end of the `symstar unprotect` operation.
- `SYNC` - Sets the SRDF mode between the workload site and synchronous target site remains synchronous at the end of the `symstar unprotect` action.

SYMCLI_STAR_ASYNCTARGET_RDF_MODE

Sets the SRDF mode between the workload site and the asynchronous target site at the end of the `symstar unprotect` operation.

- `ACP` - (default setting) Sets the SRDF mode between the workload site and the asynchronous target site to transition to adaptive copy mode at the end of the `symstar unprotect` operation.
- `ASYNC` - The SRDF mode between the workload site and asynchronous target site remains asynchronous at the end of the `symstar unprotect` action.

Examples

The following sample options file defines sites in **`NewYork`**, **`NewJersey`**, and **`London`** as operating points of a company's concurrent SRDF/Star storage environment:

```
#ABC Company's April 2012 financial Star storage environment
SYMCLI_STAR_WORKLOAD_SITE_NAME=NewYork
SYMCLI_STAR_SYNCTARGET_SITE_NAME=NewJersey
SYMCLI_STAR_ASYNCTARGET_SITE_NAME=London
SYMCLI_STAR_ADAPTIVE_COPY_TRACKS=30000
SYMCLI_STAR_ACTION_TIMEOUT=1800
SYMCLI_STAR_TERM_SDDF=No
```

```
SYMCLI_STAR_ALLOW_CASCADED_CONFIGURATION=No
SYMCLI_STAR_SYNCTARGET_RDF_MODE=ACP
```

Step 5: Perform the symstar setup operation

Note

Prior to performing the `symstar setup` action, ensure that the devices, at each SRDF/Star site, are mapped or masked to the host as required. Once the CG is configured for SRDF/Star, the mapping or masking of a device should not be changed. This can cause unexpected results when issuing `symstar` commands.

Description

The SRDF/Star `symstar setup` command:

- Reads and validates the information in the host composite group definition, and
- Builds the SRDF/Star definition file that defines the R1 consistency group for the workload site.

This information is combined with the settings in the SRDF/Star options file, and then automatically written in an internal format to the SFS on a array at each site.

Syntax

The following is the syntax for the `symstar setup` command:

```
symstar -cg CgName    setup -options FileName [-distribute]
        [-site SiteName]
        [-opmode <concurrent | cascaded>]
    setup -options FileName -reload_options
    setup -remove [-force]
```

Note

The `–opmode <concurrent | cascasded>` is required with `setup –options` for SRDF/Star Configurations with R22 devices. It is not allowed without R22 devices.

Options

-reload_options

Updates the options values in the SRDF/Star definition file.

Note

Do not use this option to update any site name values.

setup -remove

Changes the STAR mode setting of all participating SRDF groups to OFF and removes the SRDF/Star definition files from all reachable sites. It also removes the CG from SRDF/STAR control. Refer to Removal of a CG from SRDF/STAR control on page 309 for more information.
Specify the `setup -remove` option from the workload site and when the target sites are either in the Connected or Disconnected state.

setup -options ***FileName***

Validates the specified host composite group definition and builds the file that defines the R1 consistency group for the workload site.

-distribute

This option automatically distributes the SRDF/Star definition file to a array at each site without altering the state of the SRDF/Star setup.

Note

Specify the `-distribute` option from the workload site when both target sites are reachable.

Examples

To build the definition file for the `StarGrp` CG using the settings from the options file created in Step 4 (`MyOpFile.txt`):

```
symstar -cg StarGrp setup -options MyOpFile.txt
```

Step 6: Create composite groups on target sites

Description

Once the setup is complete and the SRDF/Star definition file is distributed to the SFS at the other sites, issue the `symstar buildcg` command, on the synchronous and asynchronous site Star control hosts, to create the composite groups needed for recovery operations at the synchronous and asynchronous target sites.

The `setup` and `buildcg` actions ignore BCV devices that you may have added to the composite group at the workload site (`NewYork`). If remote BCVs are protecting data during the resynchronization of the synchronous and asynchronous target sites, manually add the BCVs to the synchronous and asynchronous composite groups.

The next step varies depending on whether BCV devices are used:

- If BCV devices are used to retain a consistent restartable image of the data, proceed to Step 7: (Optional) Add BCV devices to the SRDF/Star configuration on page 304.
- If not, skip to Step 8: Bring up the SRDF/Star configuration on page 305.

Syntax

```
symstar -cg CgName [-noprompt]
    buildcg -site SiteName [-update]
```

Examples

To create the matching composite groups for `NewJersey` and `London`:

- Issue the following on the Star control host(s) that is locally-attached to the symm(s) at the NewJersey site:

  ```
  symstar -cg StarGrp buildcg -site NewJersey
  ```

- Issue the following on the Star control host(s) that is locally-attached to the symm(s) at the London site:

  ```
  symstar -cg StarGrp buildcg -site London
  ```

Restrictions

- The `setup` and `buildcg` actions ignore BCV devices that you may have added to the composite group at the workload site (`NewYork`).
- If remote BCVs are protecting data during the resynchronization of the synchronous and asynchronous target sites, manually add the BCVs to the synchronous and asynchronous composite groups.

Step 7: (Optional) Add BCV devices to the SRDF/Star configuration

Description

BCVs retain a consistent restartable image of the data volumes during periods of resynchronization.

BCVs are optional, but strongly recommended at both the synchronous and asynchronous target sites (`NewJersey` and `London`).

Use the following steps to add BCV devices to the SRDF/Star configuration:

1. Add BCVs at the remote target sites by associating the BCVs with the composite group.
   To associate the BCVs with the composite group StarGrp:

```
symbcv -cg StarGrp -sid 11 associateall dev -devs 182:19A -rdf -rdfg 22
```

   To associate the BCVs with the composite group **StarGrp** in a Concurrent SRDF/Star configuration:

```
symbcv -cg StarGrp -sid 11 associateall dev -devs 3B6:3C9 -rdf -rdfg 23
```

   Note

   Include the SRDF group number of the local R1 source devices.

2. Use the following commands to synchronize the remote BCV pairs.
   Data is copied from the R2 or R21 devices on the remote arrays to the BCV devices there.

   The `-rdf` option identifies the targets as the remote BCVs.

   The names `NewJersey` and `London` are those that were previously set for SRDF groups 22 and 23 (concurrent SRDF/Star setup only), respectively.

   The -star option is required for any TimeFinder operations that affect BCV devices in an SRDF/Star composite group.

   To synchronize the remote BCV pairs:

```
symmir -cg StarGrp establish -star -full -rdf -rdfg name:NewJersey
symmir -cg StarGrp establish -star -full -rdf -rdfg name:London
```

Note

You can associate BCVs to a composite group either before or after performing the `setup` operation. The `setup` operation does not save BCV information for the composite group, so any BCVs that were associated are excluded from the internal definitions file copied to the remote hosts.

Step 8: Bring up the SRDF/Star configuration

1. Use the `symstar query` command to determine if the target sites are in a Connected or Disconnected state.
   To query SRDF group **StarGrp**:

   ```
   symstar -cg StarGrp query -detail
   ```

   Note

   symstar query command on page 306 provides an example of the output returned with this command.

   ---

2. The next step varies depending on whether the system state is Connected or Disconnected.
   If the system state is:

   - `Connected` - The devices are already read/write (RW) on the SRDF link. Skip to Step 3.
   - `Disconnected` - Issue the following commands to connect SRDF/Star: first `NewJersey` and then `London`:

     ```
     symstar -cg StarGrp connect -site NewJersey
     symstar -cg StarGrp connect -site London
     ```

3. Use the following commands to bring up SRDF/Star: first `NewJersey` and then `London`:

   ```
   symstar -cg StarGrp protect -site NewJersey
   symstar -cg StarGrp protect -site London
   symstar -cg StarGrp enable
   ```

Options

connect

Sets the mode to adaptive copy disk and brings the devices to RW on the SRDF links, but does not wait for synchronization.

protect

Transitions to the correct SRDF mode (synchronous or asynchronous), enables SRDF consistency protection, waits for synchronization, and sets the STAR mode indicators.

enable

Provides complete SRDF/Star protection, including:

- Creates and initializes the SDDF sessions,
- Sets the STAR mode indicators on the recovery groups,
- Enables SRDF/Star to wait for R2-recoverable STAR protection across SRDF/S and SRDF/A before producing a STAR Protected state.

Note

To bring up `London` and then `NewJersey` in a concurrent SRDF/Star configuration, you can reverse the order of the `symstar protect` commands.

Displaying the symstar configuration

This section describes output of the following commands:

- `symstar query`
- `symstar show`
- `symstar list`

See also

- Commands to display, query, and verify SRDF configurations
- `symrdf list` command options

symstar query command

Description

The `symstar query` command displays the local and remote array information and the status of the SRDF pairs in the composite group.

Note

Using the `-detail` option with `symstar query` includes extended information, such as the full Symmetrix IDs, status flags, recovery SRDF groups, and SRDF mode in the output.

Examples

To display the status of the SRDF/Star site configuration for a composite group called **`StarGrp`**, enter:

`symstar query -cg StarGrp`

```
Site Name                                        : NewYork
Workload Site                                    : NewYork
1st Target Site                                  : NewJersey
2nd Target Site                                  : London
Composite Group Name                             : StarGrp
Composite Group Type                             : RDF1
Composite Group State                            : Valid
Workload Data Image Consistent                   : Yes
System State:
  {
  1st_Target_Site                                : Protected
  2nd_Target_Site                                : Protected
  STAR                                           : Protected
  Mode of Operation                              : Concurrent
  }
Last Action Performed                            : Enable
Last Action Status                               : Successful
Last Action Timestamp                            : 10/15/2010_16:07:39
STAR Information:
  {
  STAR Consistency Capable                       : Yes
  STAR Consistency Mode                          : STAR
  Synchronous Target Site                        : NewJersey
  Asynchronous Target Site                       : London
```

```
  Differential Resync Available               : Yes
  R2 Recoverable                              : Yes
  Asynchronous Target Site Data most Current  : No
  }
1st Target Site Information:
  {
  Source Site Name                            : NewYork
  Target Site Name                            : NewJersey
  RDF Consistency Capability                  : SYNC
  RDF Consistency Mode                        : SYNC
  Site Data Image Consistent                  : Yes
            Source Site                      Target Site
  ------------------------------ -- ------------------------------ - ------------
            ST                   LI            ST                  M
        RD   A                    N Rem   RD    A                  O
  Symm   F   T   R1 Inv   R2 Inv  K Symm   F    T   R1 Inv   R2 Inv D RDF Pair
  ID     G   E   Tracks   Tracks  S ID     G    E   Tracks   Tracks E STATE
  ----- --- -- -------- -------- -- ----- --- -- -------- -------- - ------------
  02011  22 RW         0        0 RW 00016 150 WD         0        0 S Synchronized
   Totals:  -- -------- -------- --            -- -------- -------- - ------------
            RW         0        0 RW           WD         0        0 S Synchronized
  }
2nd Target Site Information:
  {
  Source Site Name                            : NewYork
  Target Site Name                            : London
  RDF Consistency Capability                  : MSC
  RDF Consistency Mode                        : MSC
  Site Data Image Consistent                  : Yes
            Source Site                      Target Site
  ------------------------------ -- ------------------------------ - ------------
            ST                   LI            ST                  M
        RD   A                    N Rem   RD    A                  O
  Symm   F   T   R1 Inv   R2 Inv  K Symm   F    T   R1 Inv   R2 Inv D RDF Pair
  ID     G   E   Tracks   Tracks  S ID     G    E   Tracks   Tracks E STATE
  ----- --- -- -------- -------- -- ----- --- -- -------- -------- - ------------
  02011  23 RW         0        0 RW 00109 145 NR         0        0 A Consistent
   Totals:  -- -------- -------- --            -- -------- -------- - ------------
            RW         0        0 RW           NR         0        0 A Consistent
  }
Legend:
 Modes:
    Mode of Operation: A=Async, C=Adaptive Copy, S=Sync, O=Other, M=Mixed
```

symstar show command

Description

The `symstar show` command displays the contents of the SRDF/Star definition file that was created by the `symstar setup` command.

Note

To display all the devices with SRDF/Star, include the `-detail` option.

Examples

To display the SRDF/Star definition file for the **`StarGrp`** composite group, enter:

`symstar -cg StarGrp show`

```
Composite Group Name           : StarGrp

Recovery RDF Pairs configured : Yes
Diskless Device Site           : N/A
```

```
      Site NewYork to site NewJersey Information:
      ----------------------------------
       Workload   View  SyncTarget  View
      ----------------  ----------------
                   RD               RD
      Symmetrix     F  Symmetrix     F
      ID            G  ID            G
      ------------ --  ------------ ---
      000190102011 22 000190300016    8
      --------------------------------------

      Site NewYork to site London Information:
      {
      --------------------------------------
       Workload   View  ASyncTarget  View
      ----------------  ----------------
                   RD               RD
      Symmetrix     F  Symmetrix     F
      ID            G  ID            G
      ------------ --  ------------ ---
      000190102011 23 000190300109   14
      ---------------------------------------

      Site NewJersey to site London Information:
      --------------------------------------
       SyncTarget  View  ASyncTarget  View
      ----------------- -----------------
                   RD                RD
      Symmetrix     F   Symmetrix     F
      ID            G   ID            G
      ------------ --  ------------ ---
      000190300016 60 000190300109   62
      ---------------------------------------

Options file settings:

      WorkloadSite: NewYork
      SyncTargetSite: NewJersey
      AsyncTargetSite: London
      Adaptive_Copy_Tracks: 30000
      Action_Timeout: 1800
      Term_Sddf: Yes
      Allow_Cascaded_Configuration: No
            Star_Compatibility_Mode: v70
         Auto_Distribute_Internal_File: Yes
            SyncTarget_RDF_Mode: ACP
            AsyncTarget_RDF_Mode: ASYNC
```

symstar list command

Description

The `symstar list` command displays configuration information about the SRDF/Star composite groups that have the SRDF/Star definition file defined locally or on locally attached SFS devices.

Examples

To list the configurations for all the SRDF/Star composite groups, enter:

`symstar list`

```
S T A R   G R O U P S
-----------------------------------------------------------------------------
                                          First Target      Second Target
```

```
                  Flags Workload   Star   ----------------- -----------------
Name               MLC  Name       State  Name       State  Name       State
------------------------------------------------------------------------------
abc_test_cg_1      CW.  MyStarSit* Unprot MyStarSit* Conn   MyStarSit* Disc
boston_grp         CFV  Hopkinton  Trip   Westborou* Pfl    Southboro* Pfl
citi_west          CFV  Site_A     Unprot Site_B     Disc   Site_C     Conn
ha_apps_cg         CS.  Boston     Unprot Cambridge  Haltst SouthShor* Haltfl
ny                 CW.  A          Unprot B          Halt   C          Halt
star_cg            AS.  Boston     Prot   NewYork    Prot   Philly     Prot
ubs_core           AFI  A_Site     Trip   B_Site     Pfl    C_Site     Pfl
zcg                AW.  SITEA      -      SITEB      -      SITEC      -
zcg2               ..I  -          -      -          -      -          -
zcg3               ..I  -          -      -          -      -          -

Legend:

  Flags:
    M(ode of Operation) : C = Concurrent, A = Cascaded, . = Unknown
    L(ocal Site)        : W = Workload, F = First target,
                          S = Second target, . = Unknown
    C(G State)          : V = Valid, I = Invalid, R = RecoveryRequired,. = Not defined

  States:
    Star State          : Prot = Protected, Prprot = PartiallyProtected,
                          Trip = Tripped, Tripip = TripInprogress,
                          Unprot = Unprotected, - = Unknown

    Target State        : Conn = Connected, Disc = Disconnected, Halt = Halted,
                          Haltfl = HaltFail, Haltst = HaltStarted,
                          Isol = Isolated, Pfl = PathFail, Prot = Protected,
                          Pflip = PathFailInProg, Pflcl = Pathfail CleanReq,
                          - = Unknown
```

Note

An entry containing a dash or a dot in the `symstar list` output indicates the command was unable to determine this value.

Removal of a CG from SRDF/STAR control

When no longer required in a STAR configuration, the CG can be removed from SRDF/Star control. The following steps should be performed to properly remove a CG from SRDF/Star control.

Note

SRDF/Star must be disabled with both target sites in the Unprotected state.

The `symstar setup -remove` operation will set the STAR mode of all participating SRDF groups to OFF, terminate any SDDF sessions if needed, and remove the SRDF/Star definition files from all reachable sites.

Specify the `setup -remove` option from the workload site when the target sites are either in the Connected or Disconnected state.

Examples

To remove StarGrp CG from Star control from the workload site:

```
symstar setup -remove -cg StarGrp -nop
```

```
A STAR Setup operation is
in progress for composite group StarGrp. Please wait...

    Setup............................................................Started.
    Terminate STAR target SID:000197800188..........................Started.
    Terminate STAR target SID:000197800188..........................Done.
    Terminate STAR target SID:000197100084..........................Started.
    Terminate STAR target SID:000197100084..........................Done.
    Terminate STAR target SID:000196801476..........................Started.
    Terminate STAR target SID:000196801476..........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Setting Star data consistency indicators........................Started.
    Setting Star data consistency indicators........................Done.
    Deleting persistent state information...........................Started.
    Deleting persistent state information...........................Done.
    Deleting distributed setup information..........................Started.
    Deleting distributed setup information..........................Done.
    Deleting local setup information................................Started.
    Deleting local setup information ...............................Done.
    Setup............................................................Done.
```

Note

You can run `setup -remove -force` from a non-workload site when the remote sites are in the PathFail state or in a STAR Tripped state.

The `setup -remove -force` command removes all distributed SRDF/Star definition files associated with an SRDF/Star consistency group even when its definition no longer exists in the SYMAPI database. It also removes the host's local definition files for the SRDF/Star CG.

If a site is unreachable, you must run the `setup -remove -force` command at that site to remove the SRDF/Star definition file from the SFS, and remove the host's local definition files of the SRDF/Star CG.

Basic SRDF/Star operations

This section describes the following topics:

- Isolating the SRDF/Star sites
- Unprotecting the target sites
- Halting the target sites
- Cleaning up metadata

Isolate SRDF/Star sites

Description

There may be occasions when it is necessary to isolate one of the SRDF/Star sites, perhaps for testing purposes, and then rejoin the isolated site with the SRDF/Star configuration.

Note

In rejoining an isolated site to the SRDF/Star configuration, any updates made to London's R2 devices while isolated are discarded. That is, the data on the R1 devices overwrites the data on the R2 devices.

Issue the `symstar isolate` command to temporarily isolate one or all of the SRDF/Star sites. The `symstar isolate`command has the following requirements:

- SRDF/Star protection must be disabled.
- The site to be isolated must be in the Protected state.
- If there are BCVs at the target site that are paired with the SRDF/Star R2 devices, split these BCV pairs before executing the command.

Note

In a cascaded SRDF/Star configuration, you can isolate the synchronous site depending on the state of the asynchronous site, if the CG is non-diskless and the synchronous site is in a Protected state.

Isolate a protected target site

Description

If SRDF/Star is running normally and in the STAR Protected state, the `symstar disable` command disables STAR but leaves both target sites in the Protected state, from which you can isolate either site.

Examples

To isolate site **London** by splitting its SRDF pairs and making the R2 devices read/write-enabled to the **London** host:

```
symstar -cg StarGrp disable
symstar -cg StarGrp isolate -site London
```

Isolate a disconnected target site

Description

If the site you want to isolate is in the Disconnected state, first get it to the Protected state with the `connect` and `protect` commands.

Examples

```
symstar -cg StarGrp connect -site London
symstar -cg StarGrp protect -site London
symstar -cg StarGrp isolate -site London
```

Rejoin an isolated site

After performing testing or other tasks in **London** that require the isolation, rejoin the **London** site with the SRDF/Star configuration and enable SRDF/Star protection again. To do this, first transition **London** from the Isolated state to the Disconnected state. Then proceed to connect and protect.

After rejoining the London site, reestablish any **London** BCV pairs that are part of the **StarGrp** composite group.

Examples

```
symstar -cg StarGrp disconnect -site London
symstar -cg StarGrp connect -site London
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

Unprotect target sites

Description
To unprotect the target sites, first turn off SRDF/Star protection (assuming the system state is STAR Protected).

Options

disable

Disables SRDF/Star protection and terminates the SDDF sessions.

unprotect

Disables SRDF consistency protection and sets the STAR mode indicators.

Example
Execute the following command sequence from the workload site (`NewYork`):

```
symstar -cg StarGrp disable
symstar -cg StarGrp unprotect -site NewJersey
symstar -cg StarGrp unprotect -site London
```

Halt target sites

Description
The `halt` operation is used to prepare for a planned switch of the workload site to a target site. It suspends the SRDF links, disables all consistency protection, and sets the mode to adaptive copy disk. In addition, this operation write-disables the R1 devices and drains all invalid tracks to create a consistent copy of data at each site.

NOTICE

All RDF links between the 3 sites, including the RDF links for the recovery leg, must be online before you initiate the halt operation.

Examples

To halt SRDF/Star, enter:

```
symstar -cg StarGrp halt
```

Clean up metadata

Description

The `symstar cleanup` command cleans up internal metadata and array cache after a failure.

The cleanup action applies only to the asynchronous site.

Examples

To clean up any internal metadata or array cache for composite group **StarGrp** remaining at the asynchronous site (**London**) after the loss of the workload site:

```
symstar -cg StarGrp cleanup -site London
```

SRDF/Star consistency group operations

The following configurations allow for dynamically adding or removing devices from an SRDF/Star consistency group while maintaining consistency protection if the group is in the Connected, Protected, or STAR-enabled states:

- Concurrent SRDF/Star CG
- Concurrent SRDF/Star CG with R22 devices
- Cascaded SRDF/Star CG
- Cascaded SRDF/Star CG with R22 devices

In SRDF/Star configurations, the `symstar modifycg` command with the `add` and `remove` options performs dynamic modification of SRDF/Star consistency groups.

NOTICE

Run the `symstar modifycg` command from the workload site.

The `add` operation adds the device pairs from the SRDF groups in the staging areas to the SRDF/Star consistency group.

The `remove` operation moves the device pairs from the SRDF/Star consistency group into the SRDF groups in the staging areas.

Before you begin: SRDF daemon interaction

Before performing any control operations on a dynamic consistency group, you must understand how the SRDF daemon (`storrdfd`) maintains consistency protection of an SRDF/Star CG during modification.

- The SRDF daemon must be running locally on the Star control host where the `symstar modifycg` operation is issued.
- The SRDF daemon on the local host continuously monitors the SRDF/Star consistency group that is being changed.

- The SRDF daemons running on other hosts do the following:
  - On hosts *not* running GNS, SRDF daemons running on Solutions Enabler versions lower than 7.3.1 stop monitoring the SRDF/Star CG during dynamic modification. These daemons see the old CG definition until the `symstar buildcg -update` command is issued.
    `symstar buildcg -update` retrieves the new SRDF/Star CG definition file from the local array and replaces the old CG definition with the updated one on that Star control host.
  - On hosts running GNS, SRDF daemons monitor the consistency group while it is being modified.
    After the SRDF/Star CG definition is modified, the GNS daemon sends the new CG definition file to all hosts local to the workload array.

    Issue the `symstar buildcg -update` command from only one Star control host attached to each affected remote array.

    Depending on the timing of the GNS updates, there may be a brief period during which the SRDF daemon stops monitoring the SRDF/Star CG while waiting for the updated CG definition to propagate to the local GNS daemon.

    NOTICE

    Do not enable the `gns_remote_mirror` option in the GNS daemon's options file when using GNS with SRDF/Star. This option is not supported in SRDF/Star environments.

    `gns_remote_mirror` does not remotely mirror CGs that contain concurrent or cascaded devices. If you are using GNS, enabling the `gns_remote_mirror` option will not mirror the CG if it includes any devices as listed in the "Mirroring exceptions" in the . Refer to the guide for a detailed description of GNS.

    To switch to a remote site, issue the `symstar buildcg` command to build a definition of the CG at each site in the SRDF/Star configuration.

SRDF/Star consistency group restrictions

These restrictions apply to the `add` and `remove` options of the `symstar modifycg` command:

- The `symstar modifycg` command must be executed at the workload site.
- All arrays are reachable.
- The SRDF daemon must be running locally on the Star control host where the `symstar modifycg` command is issued.
- The `symstar modifycg` command can only move devices within one SRDF/Star triangle in the CG.
- The following options in the SRDF/Star options file must have these settings:
  SYMCLI_STAR_AUTO_DISTRIBUTE_INTERNAL_FILE=YES

  SYMCLI_STAR_COMPATIBILITY_MODE=v70
- If the `symstar modifycg` command is run when one of its target sites is in the Connected state, the SRDF mode must be adaptive copy.

Note

In the event the `symstar modifycg` command fails, you can rerun the command or issue `symstar recover`. No control operations are allowed on a CG until after a recover completes on that CG.

Prepare staging for SRDF/Star consistency group modification

Before dynamically modifying SRDF/Star consistency groups, create a staging area that mirrors the configuration of the CG being used for the Star triangle that is being modified. The staging area consists of:

- SRDF groups containing the device pairs to be added to an SRDF/Star consistency group (`symstar modifycg -add` operations).
- SRDF groups for receiving the device pairs removed from an SRDF/Star consistency group (`symstar modifycg -remove` operations).
- The SRDF groups in the staging area must be established between the same arrays as the SRDF groups in the SRDF/Star consistency group being used for the Star triangle being modified.

Restrictions: SRDF/Star staging

The restrictions described in this section are in addition to the following:

- SRDF/Star restrictions on page 274
- Restrictions: SRDF groups and devices for dynamic add operations on page 222

The following additional restrictions apply to the SRDF groups and devices in the staging area for dynamic `symstar modifycg add` operations:

- Staging area cannot be an SRDF/Metro configuration.
- All device pairs must be set in the same mode:
  - Adaptive copy disk
  - Adaptive copy write pending for diskless R21->R2 device pairs

  ---

  Note

  Adaptive copy write pending mode is not supported when the R1 side of the SRDF pair is on an array running HYPERMAX OS, and diskless R21 devices are not supported on arrays running HYPERMAX OS.

- Devices in the staging area must be in one of the following SRDF pair states for each SRDF group:
  - Synchronized
  - SyncInProg with no invalid tracks
  - Suspended with no invalid tracks
    If any device is Suspended on any of its SRDF groups, then all devices must be Suspended on all of their SRDF groups.
- All devices to be added in the staging area must be of the same configuration (and over the same arrays) as the SRDF/Star configuration being updated:
  - Concurrent R1 devices

- Cascaded R1 devices with diskless R21 devices
- Cascaded R1 devices with non-diskless R21 devices.

- No devices in the staging area can be configured as R22 devices, but they must have an available dynamic mirror position.
- Devices in the staging area cannot be enabled for consistency protection.
- Devices in the staging area cannot be defined with SRDF/Star SDDF sessions.

Add devices to a concurrent SRDF/Star consistency group

Description

The `symstar modifycg` command moves devices between the staging area and the SRDF/Star CG, and updates the CG definition.

Syntax

```
symstar -cg CgName
      -i Interval
      -c Count -noprompt
      -v
      -sid SID
      -devs SymDevStart:SymDevEnd or
         SymDevName, SymDevStart:SymDevEnd or
         SymDevName... or
   -file FileName}
      -stg_rdfg GrpNum,GrpNum
      -cg_rdfg CgGrpNum,CgGrpNum
      -stg_r21_rdfg GrpNum
      -cg_r21_rdfg CgGrpNum
modifycg -add [-force]
modifycg -remove
```

Options

-devs ***SymDevStart*:*SymDevEnd*** **or** ***SymDevName*, *SymDevStart*:*SymDevEnd*** **or** ***SymDevName*... or -file *FileName***

Specifies the ranges of devices to add or remove.

-stg_rdfg *GrpNum,GrpNum*

Indicates the SRDF group(s) comprising the staging area. For a concurrent CG, two groups must be specified, separated by a comma. These SRDF groups are associated with the SRDF groups in the `–cg_rdfg` option. This association is based on their order in `–stg_rdfg` and `–cg_rdfg`.

-cg_rdfg *CgGrpNum,CgGrpNum*

The SRDF group(s) within the SRDF/Star CG in which to add or remove devices. For a concurrent SRDF/Star CG, two SRDF groups must be specified, separated by a comma. These SRDF groups are associated with the SRDF groups in the `–stg_rdfg` option. This association is based on their order in `–cg_rdfg` and `–stg_rdfg`.

-stg_r21_rdfg *GrpNum*

The SRDF group comprising the staging area at the R21 array when the configuration is cascaded. It is required for an add or remove operation when the setup is cascaded. This SRDF group is associated with the SRDF group in the `–cg_r21_rdfg` option.

-cg_r21_rdfg *CgGrpNum*

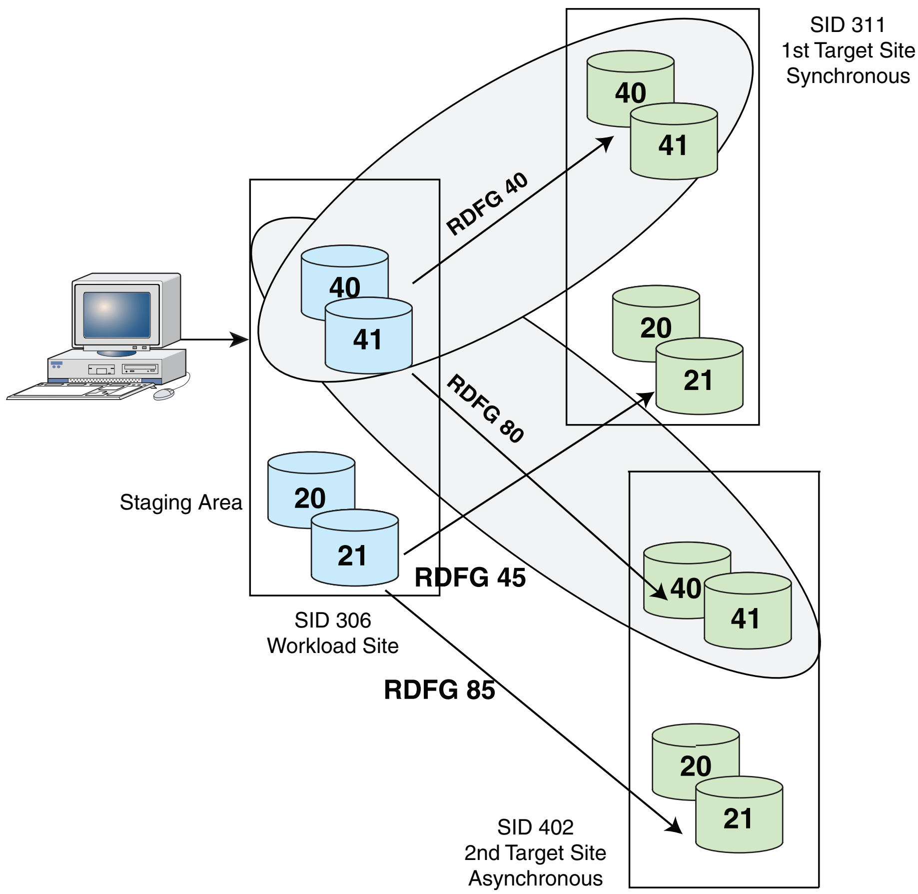
The SRDF group connecting the R21 and R2 arrays of a cascaded SRDF/Star CG. It is only valid for operations involving cascaded R1 devices. This SRDF group is associated with the SRDF group specified in the `-stg_r21_rdfg` option.

Examples

The following example shows:

- CG `ConStarCG` spans a concurrent SRDF/Star configuration.
- The 3 arrays are: 306, 311, and 402.
- The staging area contains devices 20 and 21.

Figure 62 Adding a device to a concurrent SRDF/Star CG

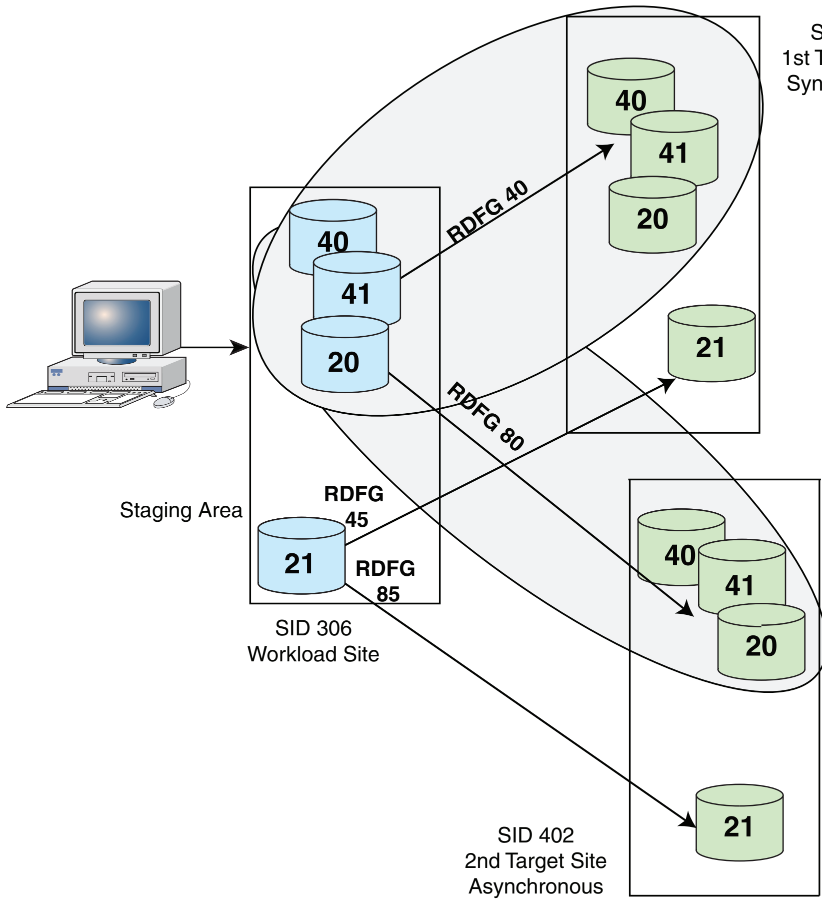


To add only device 20 from the staging area into SRDF groups 40 and 80 of `ConStarCG`:

```
symstar -cg ConStarCG modifycg -add -sid 306 -stg_rdfg 45,85 -devs 20 -cg_rdfg 40,80
```

The following image shows `ConStarCg` after device 20 was added. Note that device 21 is still in the staging area:

Figure 63 ConStarCG after a dynamic add operation



Restrictions

- The `add` operation can only add new device pairs to an existing Star triangle within the SRDF/Star CG. It cannot add a new Star triangle to the SRDF/Star CG.
- If the target of the operation is a concurrent SRDF/Star CG (with or without R22 devices), the devices to be added must be concurrent R1 devices.
- If the target of the operation is a cascaded SRDF/Star CG (with or without R22 devices), the devices to be added must be cascaded R1 devices.
- If the target of the operation is a cascaded SRDF/Star CG (with or without R22 devices) and the devices to be added are cascaded R1 devices with a diskless R21, then the R21 devices in the affected triangle of the SRDF/Star CG must also be diskless.
- If the target of the operation is a cascaded SRDF/Star CG (with or without R22 devices) and the devices to be added are cascaded R1 devices with a non-diskless R21, then the R21 devices in the affected triangle of the SRDF/Star CG must also be non-diskless.
- The following table lists the valid SRDF/Star states for adding device pairs to a CG in a concurrent SRDF/Star configuration.

Table 35 Allowable SRDF/Star states for adding device pairs to a concurrent CG

State of 1st target site (Synchronous)	State of 2nd target site (Asynchronous)	STAR state
Connected	Connected	Unprotected
Protected	Connected	Unprotected
Connected	Protected	Unprotected
Protected	Protected	Unprotected
Protected	Protected	Protected

Verify moved devices in concurrent CG

Description

Use the `symstar show -cg` *`CgName`* `-detail` command to check that the devices were moved to the concurrent CG.

Example

To check if device 20 was added to `ConStarCG`:

```
symstar show -cg ConStarCG -detail
```

Add devices to a cascaded SRDF/Star consistency group

The `symstar -cg` *`CgName`* `modifycg -add` command moves the devices from the staging area to the SRDF group(s).

Restrictions

The following table shows the valid states for adding device pairs to a CG in a cascaded SRDF/Star configuration.

Table 36 Allowable states for adding device pairs to a cascaded CG

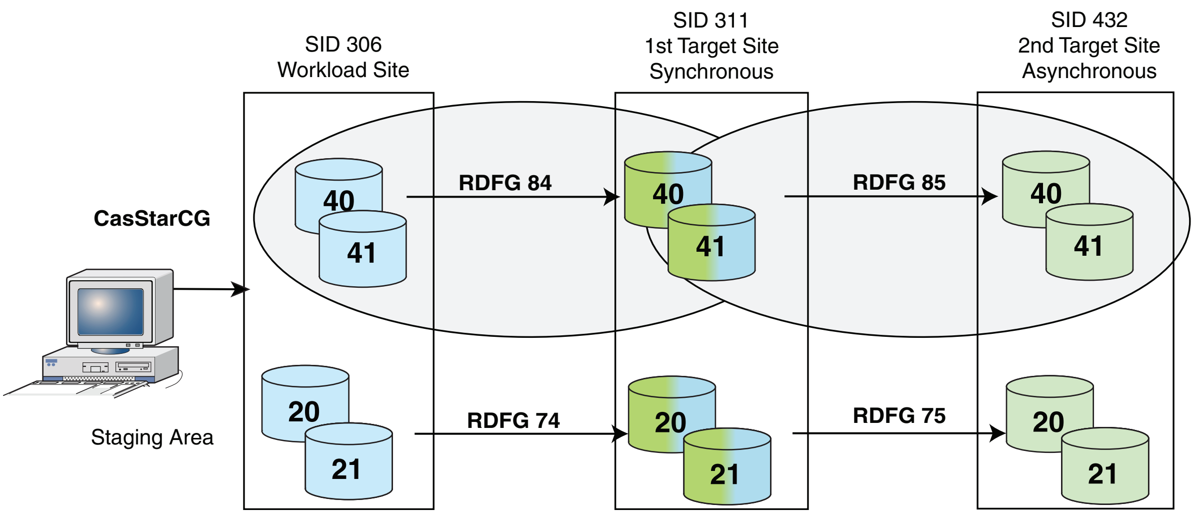
State of 1st target site (Synchronous)	State of 2nd target site (Asynchronous)	STAR state
Connected	Connected	Unprotected
Protected	Connected	Unprotected
Protected	Protected	Unprotected
Protected	Protected	Protected

Example

The following example shows:

- CG `CasStarCG` spans a cascaded SRDF/Star configuration.
- The 3 arrays are: 306, 311, and 402.
- The staging area contains devices 20 and 21.

Figure 64 Adding devices to a cascaded SRDF/Star CG



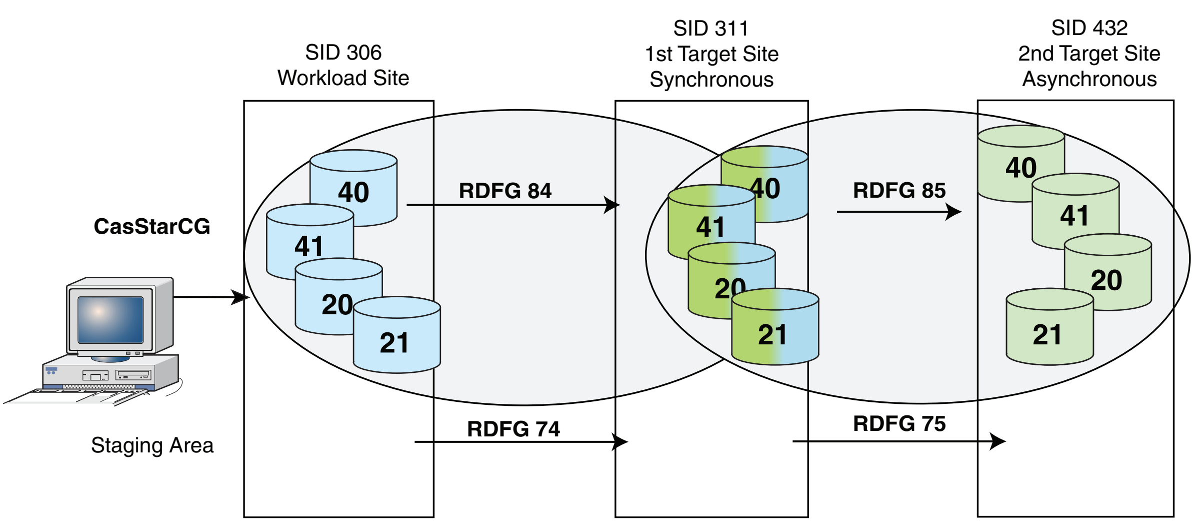
To move devices 20 and 21 from the staging area to SRDF groups 84 and 85 of **CasStarCG**:

```
symstar -cg CasStarCG modifycg -add -sid 306 -stg_rdfg 74 -devs 20:21 -stg_r21_rdfg 75 -
cg_rdfg 84 -cg_r21_rdfg 85
```

The following image shows the configuration after the move:

- Devices 20 and 21 were added to `CasStarCG`.
- The staging area contains empty SRDF groups 74 and 75:

Figure 65 CasStarCG after a dynamic add operation



Pair states of devices in a CG after symstar modifycg -add

The following table shows the pair states of the devices in the SRDF/Star CG after the `symstar modifycg -add` command completes. These pair states are based on the state of the SRDF/Star site and the SRDF mode of the device pairs in the CG.

Table 37 Pair states of the SRDF devices after symstar modifycg -add completion

State of SRDF/Star sites	Mode of device pairs in CG	Pair state of devices in CG after symstar modifycg -add	Possible delay for symstar modifycg -add command
Connected	Adaptive copy disk	Synchronized or SyncInProg	No delay because command completes when pair is SyncInProg.
Protected	SRDF/S	Synchronized	Completes when devices are synchronized.
	SRDF/A	Consistent without invalid tracks	Completes when the consistency exempt option (`-exempt`) clears on the devices added to the CG.
Star Protected	SRDF/S	Synchronized	Completes when devices are synchronized.
	SRDF/A	Consistent without invalid tracks	Completes when devices are recoverable.

Verifying moved devices in cascaded CG

Description

Use the `symstar show -cg` *`CgName`* `-detail` command to verify that the devices were moved.

Examples

To verify devices 20 and 21 were added to **`CasStarCG`**:

```
symstar show -cg CasStarCG -detail
```

Remove devices from consistency groups

The dynamic modifycg -remove operation moves the device pairs from an SRDF/Star consistency group to the staging area. If the SRDF/Star CG has R22 devices, a `deletepair` operation on the recovery links of the CG is performed automatically.

Note

Never use the dynamic `modifycg -remove` operation to remove an existing triangle from the SRDF/Star CG. You cannot remove the last device from a SRDF/Star triangle.

Restrictions

The following restrictions apply to the SRDF groups and devices in the staging area for dynamic `symstar modifycg -remove` operations:

- SRDF groups in the staging area are not in the STAR state.
- SRDF groups in the staging area are not in asynchronous mode.

Remove devices from an SRDF/Star concurrent consistency group

Example

To move device 35 from the RDG groups 40 and 80 of `ConStarCG` into SRDF groups 45 and 85 of the staging area:

```
symstar -cg ConStarCG modifycg -remove -sid 306 -stg_rdfg 45,85 -devs 35 -cg_rdfg 40,80
```

Restrictions

The following table shows the valid states for removing device pairs from a CG in a concurrent SRDF/Star configuration.

Table 38 Allowable states for removing device pairs from a concurrent SRDF/Star CG

State of 1st target site (Synchronous)	State of 2nd target site (Asynchronous)	Star state
Connected	Connected	Unprotected
Protected	Connected	Unprotected
Connected	Protected	Unprotected
Protected	Protected	Unprotected
Protected	Protected	Protected

Verify remove operation for concurrent CG

Example

To check if the dynamic remove operation was successful for `ConStarCG`:

```
symstar show -cg ConStarCG -detail
```

Remove devices from an SRDF/Star cascaded consistency group

Example

To move devices 21 and 22 from SRDF groups 84 and 85 of `ConStarCG` into SRDF groups 74 and 75 of the staging area:

```
symstar -cg ConStarCG modifycg -remove -sid 306 -stg_rdfg 74 -devs 21:22 -stg_r21_rdfg 75
-cg_rdfg 84 -cg_r21_rdfg 85
```

Restrictions

The following table shows the valid states for removing device pairs from a CG in a cascaded SRDF configuration.

Table 39 Allowable states for removing device pairs from a cascaded SRDF/Star CG

State of 1st target site (Synchronous)	State of 2nd target site (Asynchronous)	Star state
Connected	Connected	Unprotected
Protected	Connected	Unprotected
Protected	Protected	Unprotected
Protected	Protected	Protected

Verify remove operation for cascaded CG

Example

To check if the dynamic remove operation was successful for `ConStarCG`:

```
symstar -cg ConStarCG show -detail
```

Recovering from a failed consistency group modification

Details about change operations (target CG, SRDF groups, staging area, and operation type) are stored in the SFS.

If a `modifycg` operation fails and all SRDF/Star sites are reachable:

Procedure

1. Reissue the `modifycg` command using *exactly* the same parameters as the command that failed.
2. If the command fails again, execute the following command at the workload site:

   ```
   symstar -cg CgName recover
   ```

   If the workload site or any of the SRDF/Star CG sites are unreachable, specify `-force`:

   ```
   symstar -cg CgName recover -force
   ```

   The `symstar recover` command uses all existing information of a dynamic `modifycg` operation in SFS.

   The recover operation either completes the unfinished steps of the dynamic `modifycg` operation or rolls back any tasks performed on the CG by this operation, placing the CG into its original state before failure.

In this example, re-try of the `symstar modifycg -add` operation run from Site A fails due to a trip event at Site C:

1. From Site A, issue the `symstar -cg CgName query -detail` command to display whether the Composite Group State is RecoveryRequired.

To display CG **SampleCG**:

```
symstar -cg SampleGCG query -detail
```

2. Issue the `symstar -cg CgName recover -force` command to retry the failed operation.
   To retry the failed `symstar modifycg -add` for CG `SampleCG`:

```
symstar -cg SampleCG recover -force
```

Output varies depending on whether the recovery succeeds.

If the recovery succeeds, final line of output:

```
RecoverAdd.............................................Done
.
```

If the recovery determines that a rollback is necessary, SRDF rolls back the operation and removes any devices added before the failure. Final line of output:

```
RecoverRollBack........................................Done
.
```

SRDF pair states of devices in an SRDF/Star CG after a recovery

The following table shows the possible pair state of the devices in the SRDF/Star CG after the `symstar recover` operation completes.

The synchronous target site and/or the asynchronous target site can be in the Disconnected or PathFail state when the recover operation is issued for a concurrent SRDF/Star CG or a cascaded SRDF/Star CG.

Table 40 Possible pair states of the SRDF devices after a recovery

State of SRDF/Star sites	Mode of device pairs in CG	Pair state of devices in CG after a recovery
Disconnected	Adaptive copy disk	Suspended[a]
PathFail	SRDF/S	Suspended[a]
PathFail	SRDF/A	Suspended[a]

a. The SRDF pair state can be Partitioned instead of Suspended if the SRDF link is offline.

Command failure while in the Connected state

While in the SRDF/Star Connected state, if a dynamic modification operation fails and indicates the SRDF mode of one or more legs in the STAR CG is invalid, issue the `symstar configure -reset rdf_mode` command at the workload site. This command resets the device pairs in the SRDF/Star CG to adaptive copy mode. After the `symstar configure -reset rdf_mode` successfully completes, reissue the `symstar modifycg` operation.

Recovery operations: Concurrent SRDF/Star

This section describes Concurrent SRDF/Star recovery from transient faults with or without reconfiguration.

Recover from transient faults: concurrent SRDF/Star

A transient fault does not disrupt the production workload site. Only the transfer of data across the link is affected. Transient faults during normal SRDF/Star operations require a recovery action.

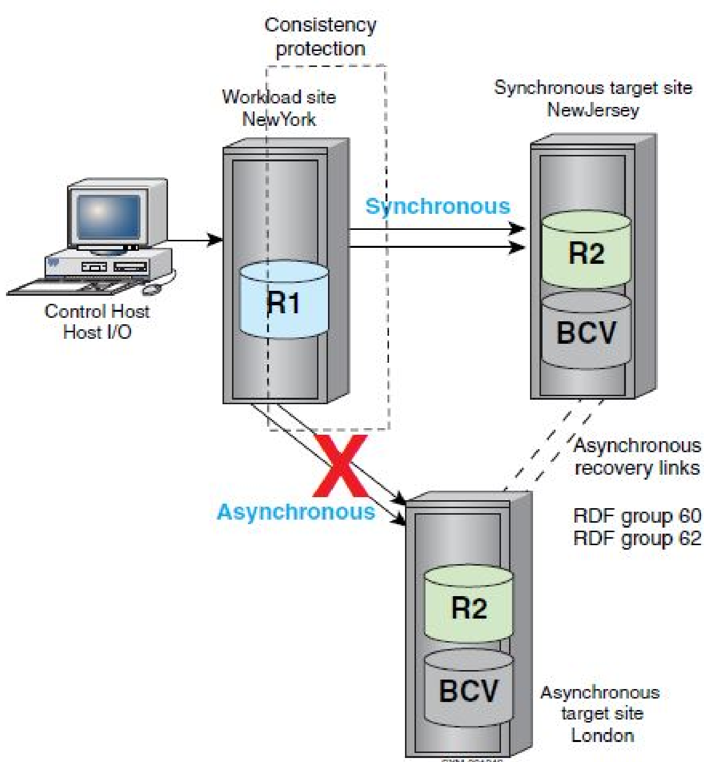
An SRDF/Star fault caused by network or remote storage controller faults is a transient fault.

This section describes recovery when a transient fault occurs while SRDF/Star is in the Protected or STAR Protected states.

If a transient fault occurs on a link that is in the Connected state, the link is disconnected. Restarting synchronization again from a Disconnected state (after correcting the cause of the failure) requires only the `connect` action.

The following image shows a temporary interruption on the SRDF/A link in a concurrent SRDF/Star environment:

Figure 66 Transient failure: concurrent SRDF/Star



There are two methods to clean up and restore SRDF/Star:

- When the transient fault is corrected, clean up the internal metadata and the cache at the asynchronous target site and return the site to SRDF/Star Protected. Recover from a transient fault without reconfiguration: concurrent

SRDF/Star on page 326 describes the steps to recover from a transient fault on the SRDF/A link when the fault has been repaired.

- If you cannot wait for the transient fault to be corrected, reconfigure SRDF/Star to recover the asynchronous site. Recover from transient fault with reconfiguration: concurrent SRDF/Star on page 327 describes the steps to avoid a long wait when the asynchronous site must be recovered sooner than the transient fault will be repaired.

Recover from a transient fault without reconfiguration: concurrent SRDF/Star

If the synchronous target (`NewJersey` in Figure 67 on page 327) state is Protected, and the asynchronous target (`London`) state is PathFail.

Procedure

1. Issue the `symstar -cg` *`CgName`* `reset` command to clean up any internal metadata or cache remaining at the asynchronous site after the transient fault occurred.

   To cleanup cache and metadata for CG `StarGrp` at site `London`:

   ```
   symstar -cg StarGrp reset -site London
   ```

   NOTICE

   If remote BCVs are configured, split the remote BCVs after a transient fault to maintain a consistent image of the data at the remote site until it is safe to reestablish the BCVs with the R2 devices. Resynchronization temporarily compromises the consistency of the R2 data until the resynchronization is fully completed. The split BCVs retain a consistent restartable image of the data volumes during periods of SRDF/Star resynchronization.

   The next step varies depending on whether SRDF/Star data at the remote site are protected with TimeFinder BCVs:

   - If SRDF/Star data at the remote site are protected with TimeFinder BCVs, proceed to Step 2.
   - If not, skip to Step 3.

2. If SRDF/Star data at the remote site are protected with TimeFinder BCVs, perform the appropriate TimeFinder actions.

   To split off a consistent restartable image of the data volumes prior to resynchronization at the asynchronous target (`London`) site:

   ```
   symmir -cg StarGrp split -star -rdf -rdfg name:London
   ```

3. Issue the `symstar -cg` *`CgName`* command with the `connect`, `protect`, and `enable` options to return the asynchronous site to the SRDF/Star configuration.

To connect, protect and enable the CG `StarGrp` at site `London`:

```
symstar -cg StarGrp connect -site London
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

4. If any `London` BCV pairs are part of the composite group, issue the `symmir -cg CgName establish` command to reestablish them.

   To reestablish the BCV pairs:

```
symmir -cg StarGrp establish -star -rdf -rdfg name:London
```

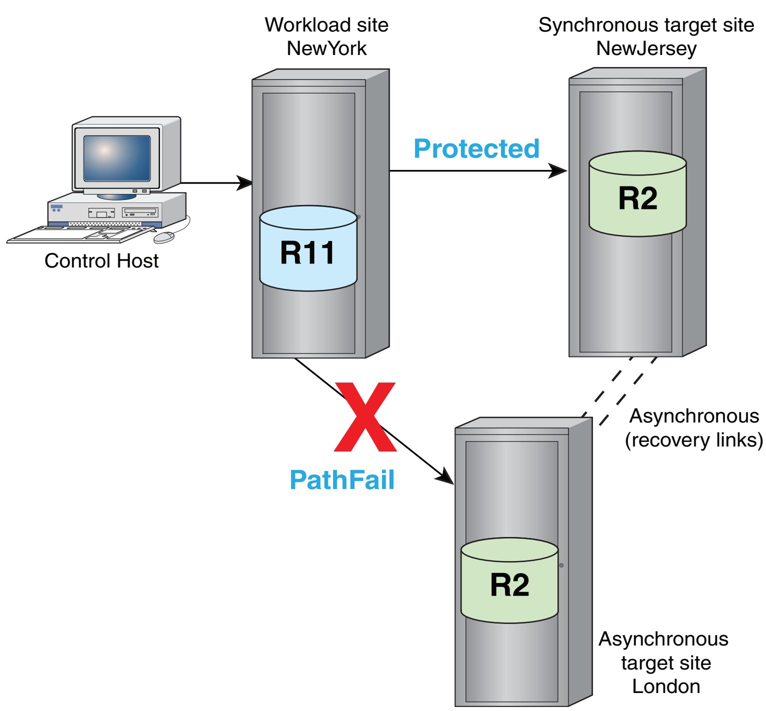
Recover from transient fault with reconfiguration: concurrent SRDF/Star

If the transient fault persists, you may not want to wait for the fault to be repaired to reestablish SRDF/Star protection.

The following procedure describes the steps to recover SRDF/Star by reconfiguring the path between the synchronous site and the asynchronous site.

This alternate method avoids a long wait when the asynchronous site needs to be recovered sooner than the transient fault will be repaired.

Figure 67 Transient fault recovery: before reconfiguration



The image shows a fault where the links between the workload site and the asynchronous target sites are lost.

- The asynchronous target site (`London`) is accessible by the recovery SRDF groups at the synchronous site (`NewJersey`).
- The failure causes SRDF/Star to enter a tripped state.

You can restore SRDF/Star protection to the asynchronous target site by reconfiguring from concurrent SRDF/Star to cascaded mode.

Recover using reconfigure operations

Use the `reconfigure` operation (to change the mode to Cascaded SRDF/Star) as the initial recovery step.

Syntax

```
symstar -cg CgName [-noprompt] [-i Interval][-c Count]
     -wkload SiteName
     -opmode concurrent | cascaded
     reconfigure
         -path SrcSiteName:TgtSiteName
         -site TgtSiteName
         -remove SrcSiteName:TgtSiteName
         -full
         -reset
         -force
```

Options

-path *SrcSiteName*:*TgtSiteName*

Specifies the sites on which the new SRDF pairs are created when the `reconfigure` command is issued.

-site *TgtSiteName*

Specifies the SiteName to apply the given action.

-reset

Performs a reset action on the path when the reconfigure action is issued.

-remove *SrcSiteName*:*TgtSiteName*

Specifies the sites on which the SRDF pairs are removed.

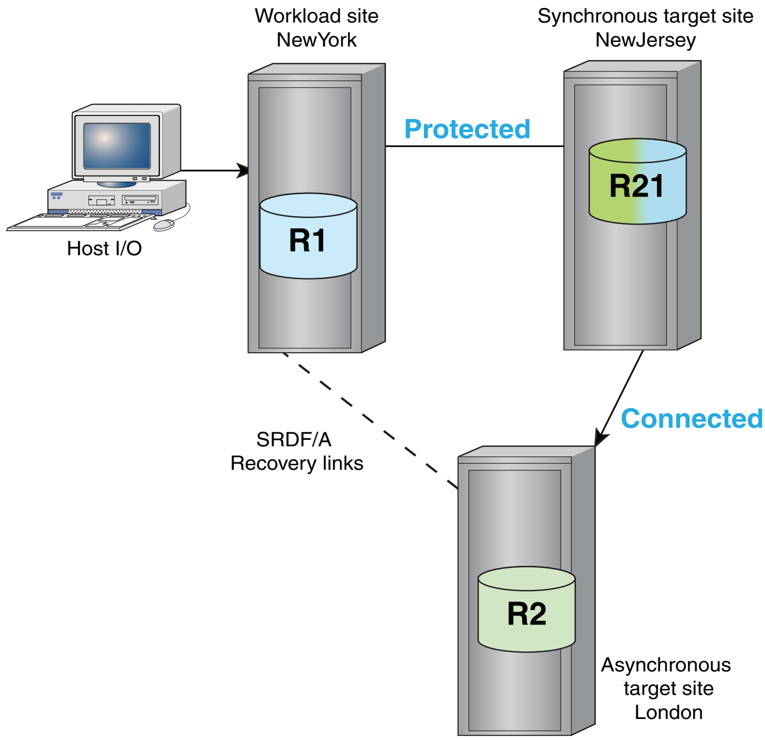
Example

To reconfigure CG `StarGrp` so that the path to `London` is `NewJersey` -> `London`:

```
symstar -cg StarGrp reconfigure -reset -site London -path
NewJersey:London
```

The topology of the configuration is now cascaded:

Figure 68 Transient fault recovery: after reconfiguration



Restrictions

- If the asynchronous target site is in the Disconnected state and STAR is unprotected, specify the `-full`.
- If the asynchronous target site is in the PathFail state and STAR is unprotected, specify the `-reset` and `-full` options.
- Specify the `-full` option only when an SRDF incremental resynchronization is not available.
- Perform the `recover` operation to recover from PathFail (asynchronous target site) and a tripped state (SRDF/Star).

Workload switching: Concurrent SRDF/Star

This section describes the following topics for a Concurrent SRDF/Star configuration:

- Planned workload switching
- Unplanned workload switching to synchronous or asynchronous target site
- Switch back to the original workload site

Planned workload switching: Concurrent SRDF/Star

A planned workload switch operation switches the workload function to one of the remote target sites, even when:

- The original workload site is operating normally,
- The system state is STAR Protected, or
- The target sites are at least Connected.

NOTICE

All RDF links between the 3 sites, including the RDF links for the recovery leg, must be online before you initiate the planned switch operation.

To switch the workload from the original site:

Procedure

1. Confirm the system state using the `symstar query` command.
2. Stop the application workload at the current workload site, unmount the file systems, and export the volume groups.
3. Perform the SRDF/Star `halt` action from the Star control host.

   To halt CG `StarGrp`:

   ```
   symstar -cg StarGrp halt
   ```

   Note

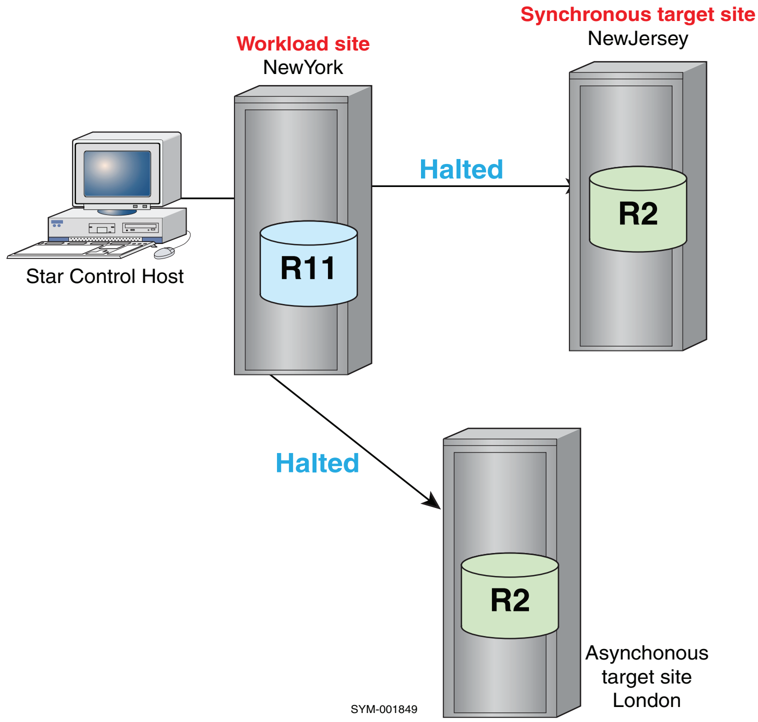
   If you change your mind after halting SRDF/Star, issue the `halt -reset` command to restart the workload site on the same Star control host.

   The `halt` action at the initial workload site (`NewYork`):

   - Disables the R1 devices,
   - Waits for all invalid tracks and cycles to drain,
   - Suspends the SRDF links,
   - Disables SRDF consistency protection, and
   - Sets the STAR mode indicators.

   The target sites transition to the Halted state, with all three sites having the data.

Figure 69 Concurrent SRDF/Star: halted

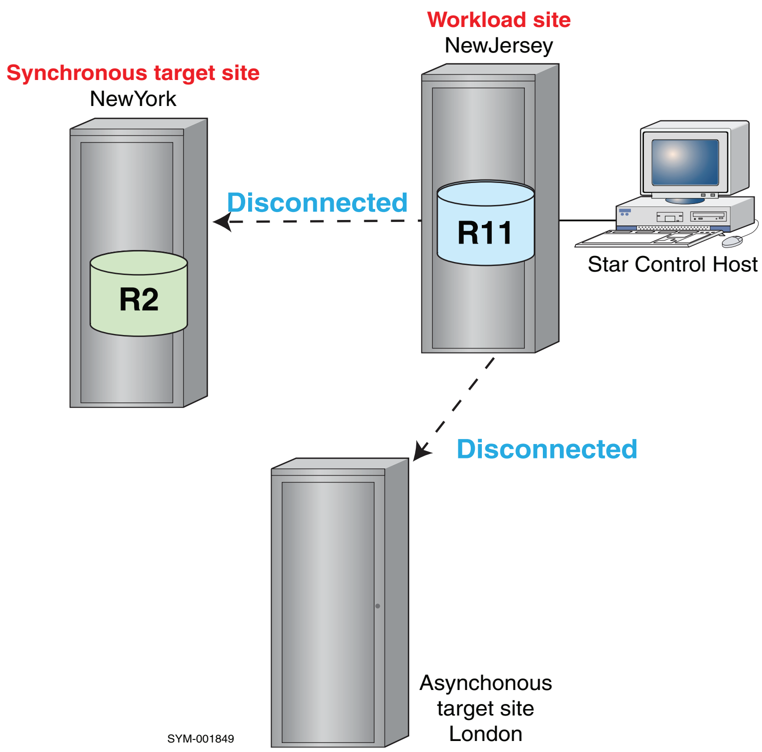


4. From a Star control host at the synchronous target site (`NewJersey`), issue the switch command to switch the workload to the synchronous target site (`NewJersey`).

```
symstar -cg StarGrp switch -site NewJersey
```

The following image shows the resulting SRDF/Star state:

Figure 70 Concurrent SRDF/Star: switched

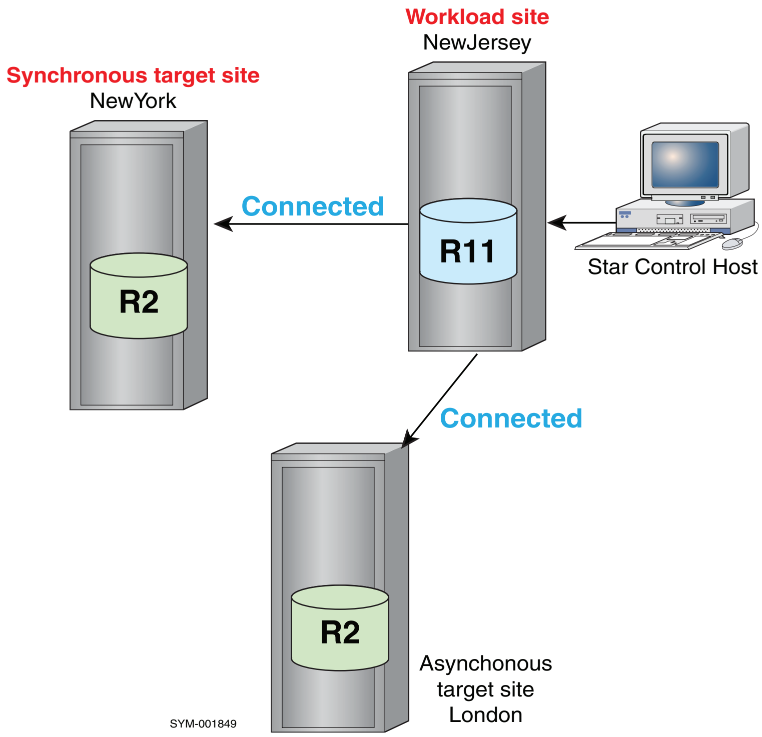


5. From a Star control host at the synchronous target site (`NewJersey`), issue two `connect` commands to:
   - Connect `NewJersey` to `NewYork` (synchronously)
   - Connect `NewJersey` to `London` (asynchronously):

```
symstar -cg StarGrp connect -site NewYork
symstar -cg StarGrp connect -site London
```

The following image shows the resulting SRDF/Star state:

Figure 71 Concurrent SRDF/Star: connected



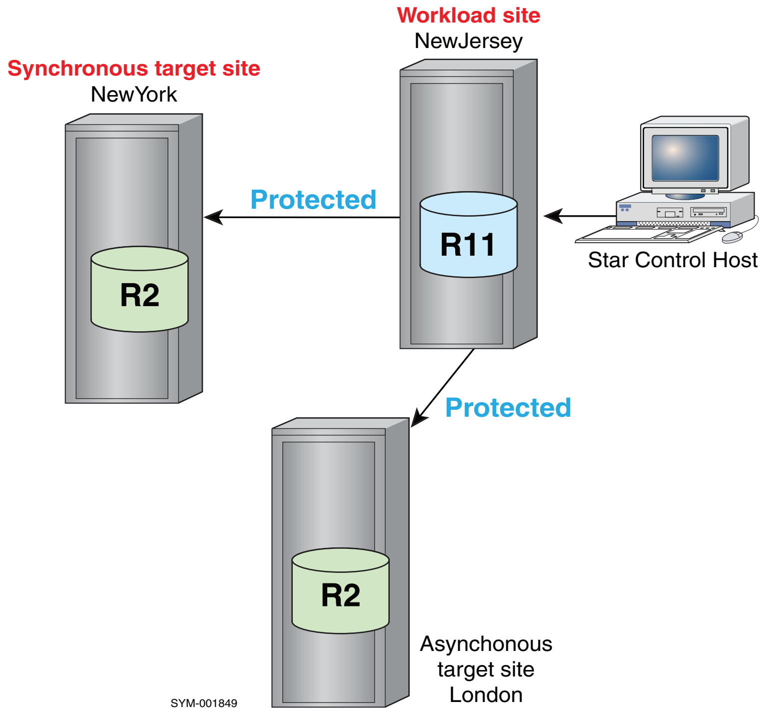
6. From a Star control host at the synchronous target site (`NewJersey`), issue two `protect` commands and the `enable` command to:

   - Protect `NewJersey` to `NewYork`
   - Protect `NewJersey` to `London`
   - Enable SRDF/Star

```
symstar -cg StarGrp protect -site NewYork
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

The following image shows the resulting SRDF/Star state:

Figure 72 Concurrent SRDF/Star: protected



Unplanned workload switching: concurrent SRDF/Star

Loss of the workload site (`NewYork`) is a disaster because it disrupts the workload.

Issue the `switch` command to:

- Switch the workload to either one of the remote sites, and
- Resume data replication

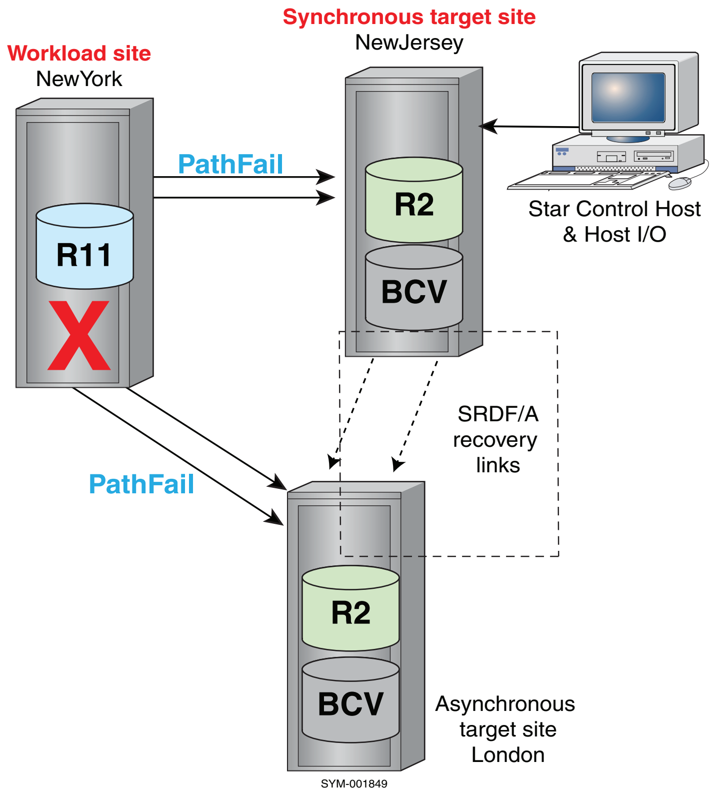
You can switch the workload to either the synchronous or asynchronous target site.

If the loss of the workload site was caused by a rolling disaster, the data at the synchronous target site can be ahead of the data at asynchronous site, or vice versa.

You can specify which site's data to keep.

The following image shows concurrent SRDF/Star where a disaster fault has caused the loss of the workload site (`NewYork`):

Figure 73 Loss of workload site: concurrent SRDF/Star



Unplanned workload switch to synchronous target site: concurrent SRDF/Star

In the following example, loss of the workload site (`NewYork`) has resulted in a system state of *NewJersey:Pathfail*, *London:Pathfail*, and *STAR:Tripped*.

Note

If you switch the workload to the synchronous target site but choose to keep the data from the asynchronous target site, there is a wait for all the SRDF data to synchronize before the application workload can be started at the synchronous site. The `symstar switch` command does not return control until the data is synchronized.

This procedure:

- Brings up the synchronous `NewJersey` site as the new workload site.
- Asynchronously replicates data from `NewJersey` data to the asynchronous target site (`London`).

Note

If the links from the workload to the asynchronous target are in the *TransmitIdle* state, issue the following command to get the asynchronous site to the *PathFail* state:

```
symstar -cg StarGrp disconnect -trip -site London
```

Procedure

1. From a Star control host at the synchronous target site (`NewJersey`), issue the `symstar cleanup` command to clean up any internal metadata or cache remaining at the asynchronous site.

   To clean up the `London` site:

   ```
   symstar -cg StarGrp cleanup -site London
   ```

   Note

   After a workload site failure, splitting the remote BCVs maintains a consistent image of the data at the remote site until it is safe to reestablish the BCVs with the R2 devices.

   The next step varies depending on whether SRDF/Star data at the remote site are protected with TimeFinder BCVs:

   - If SRDF/Star data at the remote site are protected with TimeFinder BCVs, proceed to Step 2.
   - If not, skip to Step 3.

2. If SRDF/Star data are protected with TimeFinder BCVs at the `London` site, perform the appropriate TimeFinder actions.

   Prior to the switch and resynchronization between `NewJersey` and `London`, there is no existing SRDF relationship between the synchronous and asynchronous target sites.

   BCV control operation must be performed with a separate device file instead of the composite group.

   In the following example, the device file (StarFileLondon) defines the BCV pairs on array 13 in `London`.

   To split off a consistent restartable image of the data volumes during the resynchronization process using the device file:

   ```
   symmir -f StarFileLondon split -star -sid 13
   ```

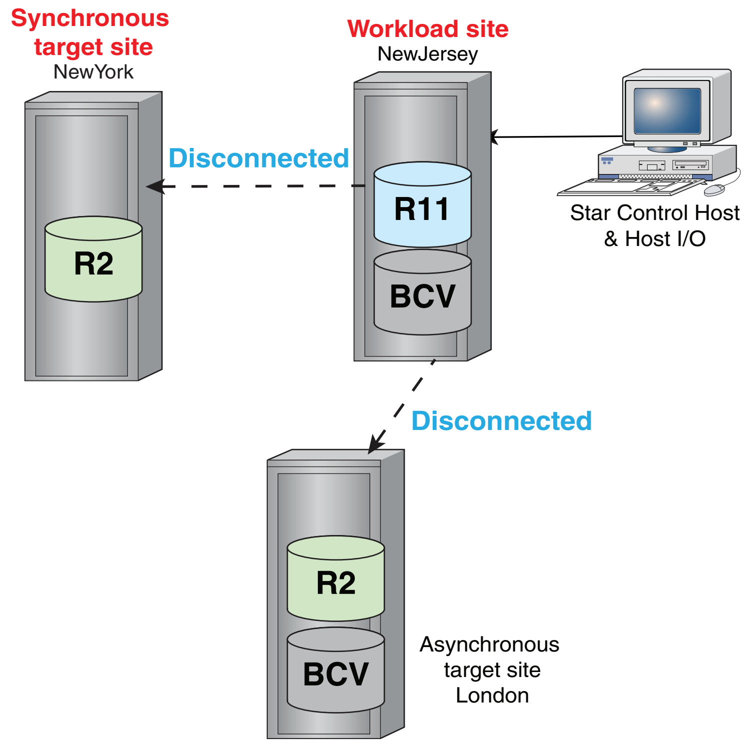
3. From a Star control host at the synchronous target site (`NewJersey`), issue the `symstar switch` command to start the workload at the specified site. The following command:

   - Specifies `NewJersey` as the new workload site (`-site NewJersey`)
   - Retains the data at the `NewJersey` data instead of the `London` data (`-keep_data NewJersey`):

   ```
   symstar -cg StarGrp switch -site NewJersey -keep_data
   NewJersey
   ```

   The following image shows the resulting SRDF/Star state:

Figure 74 Concurrent SRDF/Star: workload switched to synchronous site

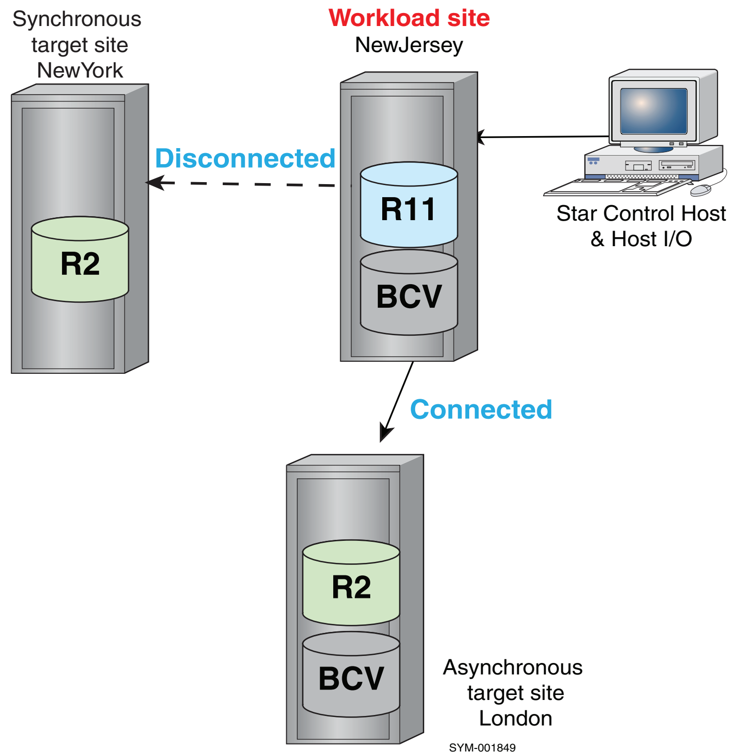


4. From a Star control host at the synchronous target site (`NewJersey`), issue the `connect` command to connect `NewJersey` to `London` (asynchronously):

```
symstar -cg StarGrp connect -site London
```

The following image shows the resulting SRDF/Star state:

Figure 75 Concurrent SRDF/Star: new workload site connected to asynchronous site



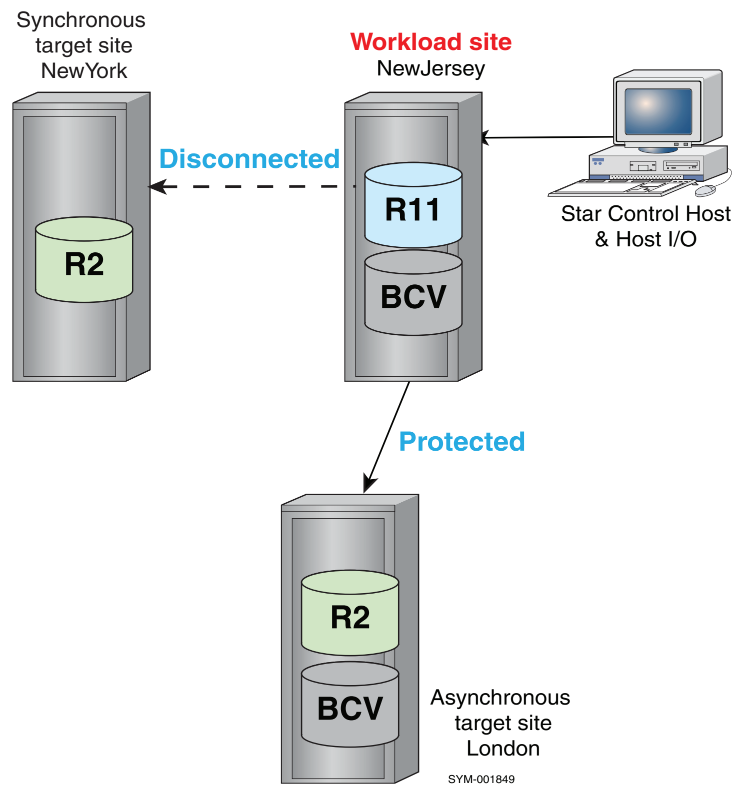
5. From a Star control host at the synchronous target site (`NewJersey`), issue the `protect` and `enable` commands to:

   - Protect `NewJersey` to `London`
   - Enable SRDF/Star

```
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

The following image shows the resulting SRDF/Star state:

Figure 76 Concurrent SRDF/Star: protected to asynchronous site



The `connect` and `protect` actions:

- Reconfigure the SRDF devices between `NewJersey` and `London` into SRDF pairs with R1 devices at site `NewJersey` paired with the R2 devices at site London.
- Perform the differential resynchronization of the data between `NewJersey` and `London`.

When the recovery tasks are complete, the `NewJersey` workload is remotely protected through an asynchronous link to `London`.

NOTICE

You can begin the workload at `NewJersey` any time after the `switch` action completes. However, if you start the workload before completing the `connect` and `protect` actions, you will have no remote protection until those actions complete.

The next step varies depending on whether SRDF/Star data at the remote site are protected with TimeFinder BCVs:

- If RDF/Star data at the remote site are protected with TimeFinder BCVs, proceed to Step 6.
- If not, skip to Step 7.

6. Reestablish any BCV pairs at the `London` site. Use either:
   - The device file syntax (`-f StarFileLondon`) or,
   - The `-cg` syntax (if you have associated the `London` BCV pairs with the `StarGrp` composite group on the Star control host).

To reestablish `London` BCV pairs in the composite group `StarGrp` using the –`cg` syntax:

```
symmir -cg StarGrp establish -star -rdf -rdfg name:London
```

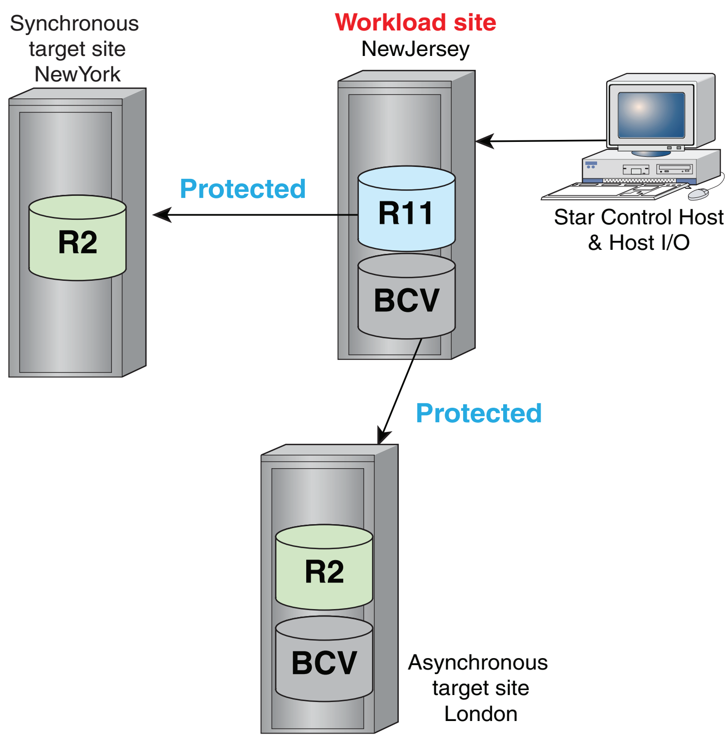
7. When the `NewYork` site is repaired, you may want to bring `NewYork` back into the SRDF/Star while retaining the workload site at `NewJersey`.

   For example, to recover and enable the `NewYork` site, enter the following commands from the `NewJersey` Star control host:

```
symstar -cg StarGrp connect -site NewYork
symstar -cg StarGrp protect -site NewYork
symstar -cg StarGrp enable
```

The following image shows the resulting SRDF/Star state:

Figure 77 Concurrent SRDF/Star: protect to all sites



Unplanned workload switch to asynchronous target site: concurrent SRDF/Star

In the following example, loss of the workload site (`NewYork`) has resulted in a system state of *NewJersey:Pathfail*, *London:Pathfail*, and *STAR:Tripped*.

Note

If you switch the workload to the asynchronous target site but choose to keep the data from the synchronous target site, there is a wait for all the SRDF data to synchronize before the application workload can be started at the asynchronous site. The `symstar switch` command does not return control until the data is synchronized.

This procedure:

- Brings up the asynchronous `London` site as the new workload site.
- Asynchronously replicates data from `London` data to the asynchronous target site (`NewJersey`).

Procedure

1. From a Star control host at the asynchronous target site (`London`), issue the `symstar cleanup` command to clean up any internal metadata or cache remaining at the asynchronous site.

   To clean up the `London` site:

   ```
   symstar -cg StarGrp cleanup -site London
   ```

   Note

   After a workload site failure, splitting the remote BCVs maintains a consistent image of the data at the remote site until it is safe to reestablish the BCVs with the R2 devices.

   The next step varies depending on whether SRDF/Star data at the remote site are protected with TimeFinder BCVs:

   - If SRDF/Star data at the remote site are protected with TimeFinder BCVs, proceed to Step 2.
   - If not, skip to Step 3.

2. If SRDF/Star data are protected with TimeFinder BCVs at the `NewJersey` site, perform the appropriate TimeFinder actions.

   Prior to the switch and resynchronization between `NewJersey` and `London`, there is no existing SRDF relationship between the synchronous and asynchronous target sites.

   BCV control operation must be performed with a separate device file instead of the composite group.

   In the following example, the device file (StarFileNewJersey) defines the BCV pairs on array 13 in `London`.

   To split off a consistent restartable image of the data volumes during the resynchronization process using the device file:

   ```
   symmir -f StarFileNewJersey split -star -sid 16
   ```

3. From a Star control host at the asynchronous target site (`London`), issue the `symstar switch` command to start the workload at the specified site. The following command:
   - Specifies `London` as the new workload site (`-site NewJersey`)
   - Retains the data at the `NewJersey` data instead of the `London` data (`-keep_data NewJersey`):

   ```
   symstar -cg StarGrp switch -site London -keep_data NewJersey
   ```

   The workload site switches to `London` and the R2 devices at London become R1 devices.

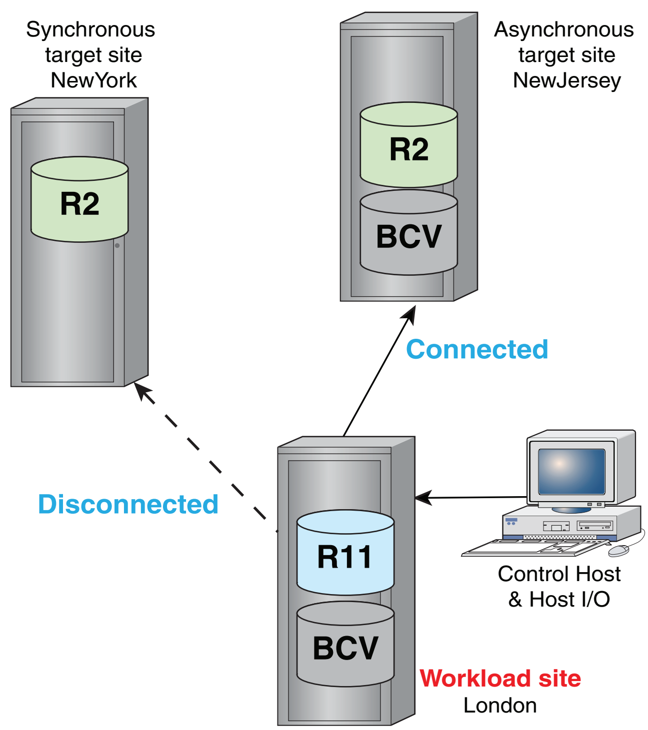
   The London site connects to the `NewJersey` site and retrieves the `NewJersey` data.

   Note

   The `connect` action is not required because the `switch` action specified that SRDF retrieve the remote data from the `NewJersey` site.

   The following image shows the resulting SRDF/Star state:

   Figure 78 Concurrent SRDF/Star: workload switched to asynchronous site

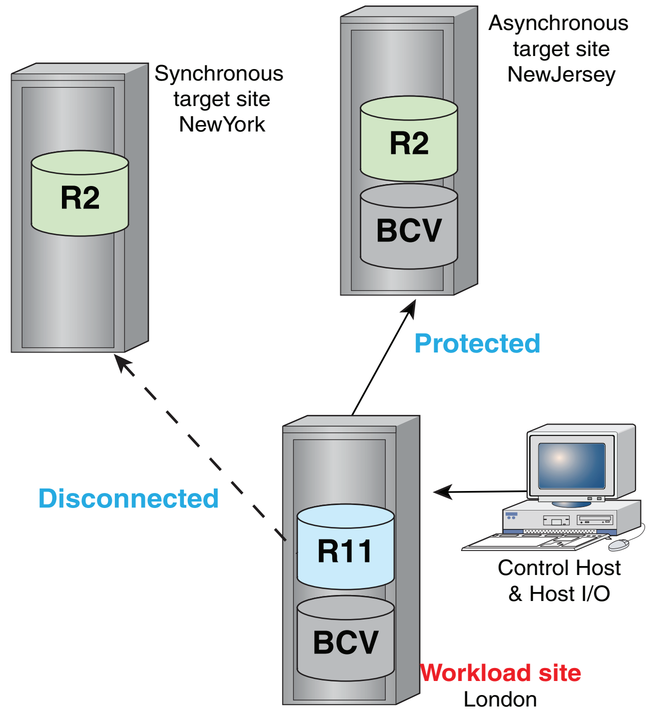


4. From a Star control host at the asynchronous target site (`London`), issue the `protect` command to protect `London` to `NewJersey`:

   ```
   symstar -cg StarGrp protect -site NewJersey
   ```

   The following image shows the resulting SRDF/Star state:

Figure 79 Concurrent SRDF/Star: protected to asynchronous site



NOTICE

London is now using the `NewJersey` data. You cannot start the application workload in `London` until the `switch` action completes. This ensures that all of the SRDF pairs are synchronized prior to starting the workload. The `symstar switch` command blocks other action until it completes.

The next step varies depending on whether SRDF/Star data at the remote site are protected with TimeFinder BCVs:

- If SRDF/Star data at the remote site are protected with TimeFinder BCVs, proceed to Step 5.
- If not, skip to Step 6.

5. Reestablish any BCV pairs at the `NewJersey` site.

   Use either:

   - The device file syntax (`-f StarFileNewJersey`), or
   - The `-cg` syntax (if you have associated the `NewJersey` BCV pairs with the `StarGrp` composite group on the Star control host).

   To reestablish `NewJersey` BCV pairs in the composite group `StarGrp` using the `-cg` syntax:

   ```
   symmir -cg StarGrp establish -star -rdf -rdfg name:NewJersey
   ```

6. The `London` site is at asynchronous distance from both `NewYork` and `NewJersey`. SRDF/Star supports only one asynchronous site.

When the NewYork site is repaired, you cannot connect and protect NewYork without switching the workload back to a configuration that has only one asynchronous site (NewYork or NewJersey).

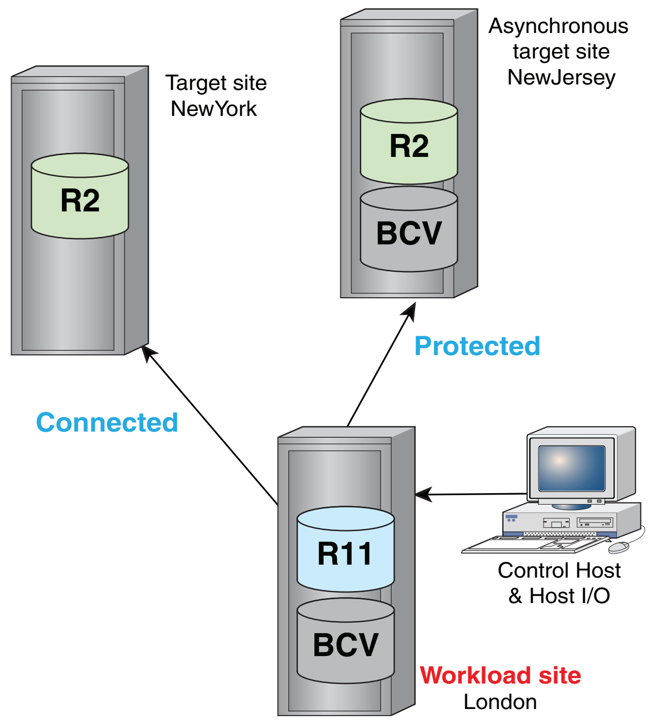
However, you can connect to NewYork. The connect action sets the mode to adaptive copy disk and brings the devices to RW on the SRDF links.

To connect to NewYork, issue the connect command from the London site:

```
symstar -cg StarGrp connect -site NewYork
```

The following image shows the resulting SRDF/Star state:

Figure 80 Concurrent SRDF/Star: one asynchronous site not protected



If the workload remains at the asynchronous London site, you can perform a protect action on NewYork only if you first unprotect NewJersey.

The protect action transitions the link from adaptive copy mode to asynchronous mode and enables SRDF consistency protection.

The symstar enable action is blocked because there is already one asynchronous link in the Star.

Note

Using SYMCLI to Implement SRDF/Star Technical Note provides expanded operational examples for SRDF/Star.

Switch back to the original workload site: concurrent SRDF/Star

When the original workload site returns to normal operations, switch back to the original workload site to reestablish the original SRDF/Star configuration.

To switch back to the original workload site:

- You must be able to completely synchronize the data at all three sites.
- The current workload site's SRDF links must be connected to the other two sites.

The states that allow switching back to the original workload site vary depending on whether the workload was switched to the synchronous target site or the asynchronous target site:

- When switched to the synchronous target site, one of the following states is required to switch back:
  - STAR Protected
  - Both target sites are Protected and Star is Unprotected
  - One target site is Protected and the other is Connected
  - Both target sites are Connected
- When switched to the asynchronous target site, the following states are required to switch back:
  - One target site is Protected and the other is Connected.
  - Both target sites are Connected.

The following procedure assumes the original workload site is `NewYork`, but the workload is now running at the synchronous site `NewJersey`. This configuration is depicted in Figure 77 on page 340.

Procedure

1. Stop the workload at the site where the Star control host is connected.
2. Issue the `halt` command from the Star control host where the workload is running.

   To halt SRDF from the `NewJersey` Star control host:

   ```
   symstar -cg StarGrp halt
   ```

   The `halt` action:

   - Disables the R1 devices,
   - Waits for all invalid tracks and cycles to drain,
   - Suspends the SRDF links,
   - Disables SRDF consistency protection, and
   - Sets the STAR indicators.

   The target sites transition to the Halted state, and all the data on all three sites is the same.

3. Run the following commands from the Star control host at the original site of the workload (`NewYork`):

   ```
   symstar -cg StarGrp switch -site NewYork
   symstar -cg StarGrp connect -site NewJersey
   symstar -cg StarGrp connect -site London
   symstar -cg StarGrp protect -site NewJersey
   symstar -cg StarGrp protect -site London
   symstar -cg StarGrp enable
   ```

- The workload is switched to `NewYork`, and
- NewYork is (synchronously) connected to `NewJersey`.
- NewYork is (asynchronously) connected to `London`.
- The state is *STAR Protected*.

Recovery operations: Cascaded SRDF/Star

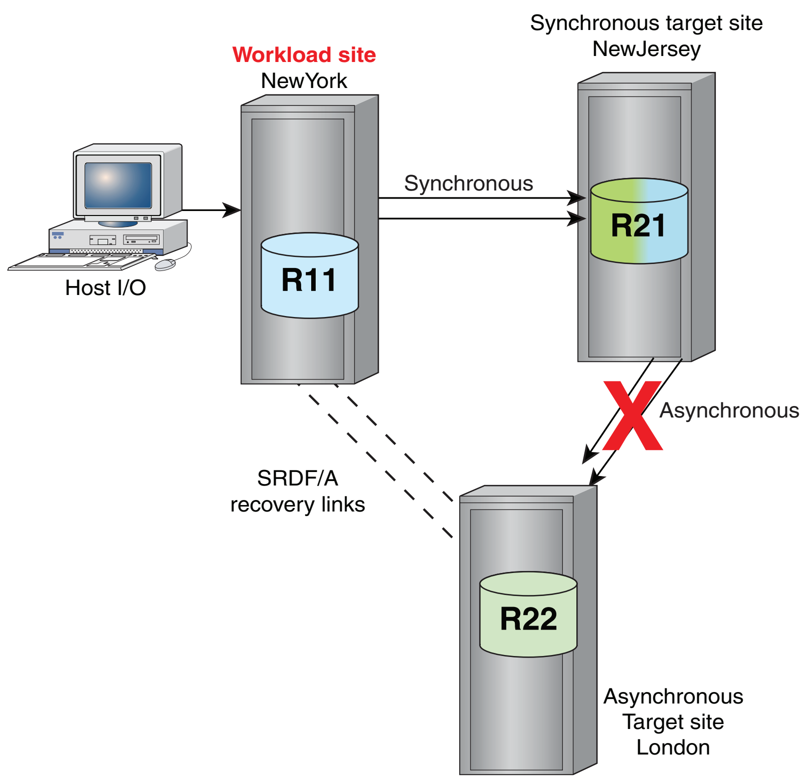
This section describes the following topics for a Cascaded SRDF/Star configuration:

- Recovering from transient faults without reconfiguration
- Recovering from transient faults with reconfiguration

Recovering from transient faults: Cascaded SRDF/Star

The following image shows a temporary interruption (transient fault) on the SRDF/A link in a cascaded SRDF/Star environment:

Figure 81 Transient fault: cascaded SRDF/Star



There are two methods to clean up and restore SRDF/Star:

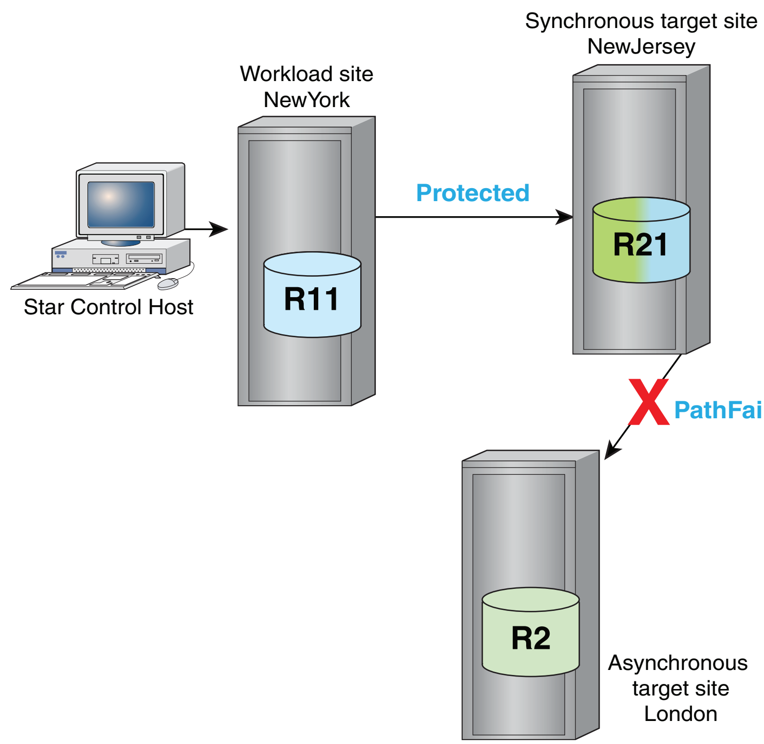
- When the transient fault is corrected, clean up the internal metadata and the array cache at the asynchronous target site and return the site to SRDF/Star Protected. Recovering from transient faults without reconfiguration: Cascaded SRDF/Star on page 347 describes the steps to recover from a transient fault on the SRDF/A link when the fault has been repaired.
- If you cannot wait for the transient fault to be corrected, reconfigure SRDF/Star to recover the asynchronous site. Recovering from transient faults with reconfiguration: Cascaded SRDF/Star on page 348 describes the steps to avoid a

long wait when the asynchronous site must be recovered sooner than the transient fault will be repaired.

Recovering from transient faults without reconfiguration: Cascaded SRDF/Star

The following image shows the SRDF states when links to the asynchronous target site are down:

Figure 82 Cascaded SRDF/Star with transient fault



The SRDF devices are now in the Suspended state.

Procedure

1. Display the state the state of SRDF devices and the SRDF links that connect them using the `symrdf list` command.

   See Table 6 on page 44 for a list of `symrdf list` command options.

   The next step varies depending on the state of the links to the asynchronous target site (London).

   - If the links to the asynchronous target are in the TransmitIdle state, proceed to Step 2.
   - If the links to the asynchronous target are in the PathFail state, skip to Step 3.

2. Transition links to the asynchronous site to the PathFail state using the `symstar -cg` *`CgName`* disconnect -trip command.

```
symstar -cg StarGrp disconnect -trip -site London
```

3. Issue the `symrdf list` command to verify the configuration is now has the following states:

   Synchronous target site (`NewJersey`): Protected

   Asynchronous target site (`London`): PathFail

   STAR state: Tripped

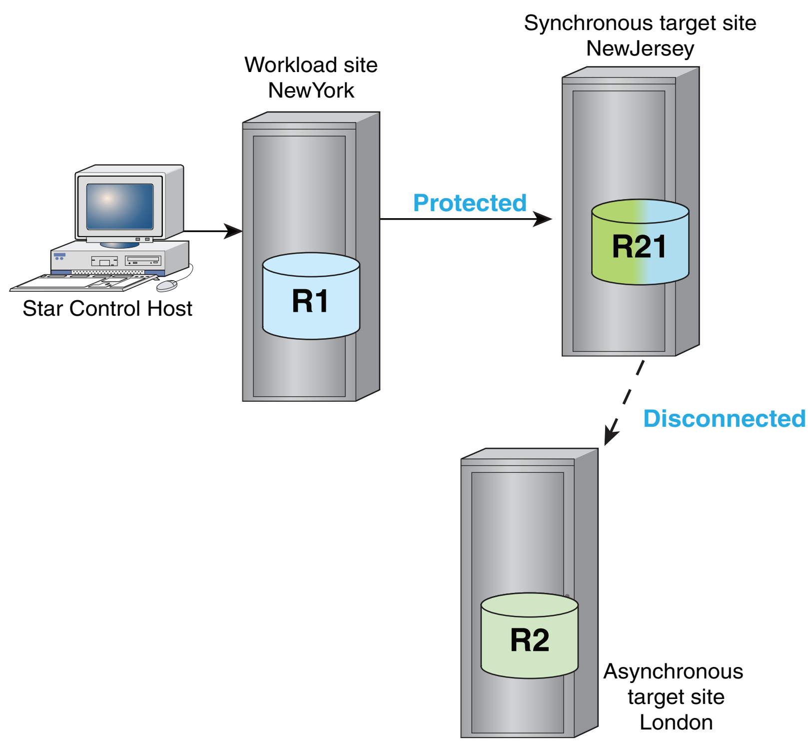
4. From the Star control host at the workload site, issue the `symstar -cg` *`CgName`* `reset` command to clean up any internal metadata or cache remaining at the asynchronous site after the transient fault occurred.

   To clean up cache and metadata for CG `StarGrp` at site `London`:

   ```
   symstar -cg StarGrp reset -site London
   ```

   The following image shows the resulting SRDF/Star states:

   Figure 83 Cascaded SRDF/Star: asynchronous site not protected



Recovering from transient faults with reconfiguration: Cascaded SRDF/Star

Note

Performing this operation changes the STAR mode of operation from cascaded to concurrent.

If:

- The asynchronous target site is no longer accessible, but
- The workload site is still operational, and

- The asynchronous target site is accessible through the recovery SRDF group,

You can:

- Reconfigure the SRDF/Star environment, and
- Resynchronize data between the workload site and the asynchronous target site to
- Achieve direct SRDF/A consistency protection between the workload site and the asynchronous target site.

Figure 82 on page 347 shows cascaded SRDF/Star with the workload site at `NewYork`, and a fault between the synchronous target site (`NewJersey`), and the asynchronous target site (`London`). The SRDF states are as follows:

- Synchronous target site (`NewJersey`): Protected
- Asynchronous target site (`London`): PathFail
- STAR state: Tripped

The first step varies depending on the state of the links to the asynchronous target site (`London`).

- If the links to the asynchronous target are in the TransmitIdle state, proceed to Step 1.
- If the links to the asynchronous target are in the PathFail state, skip to Step 2.

1. Transition links to the asynchronous site to the PathFail state using the `symstar -cg` *`CgName`* `disconnect -trip` command.

   ```
   symstar -cg StarGrp disconnect -trip -site London
   ```

2. Issue the `symstar reconfigure` command from the workload site (`NewYork`) Star control host.
   See Recover using reconfigure operations on page 328 and Restrictions on page 329.

   To reconfigure CG StarGrp as concurrent with the new SRDF pairs on the workload site (`NewYork`) and asynchronous target site (`London`), and perform a reset action:

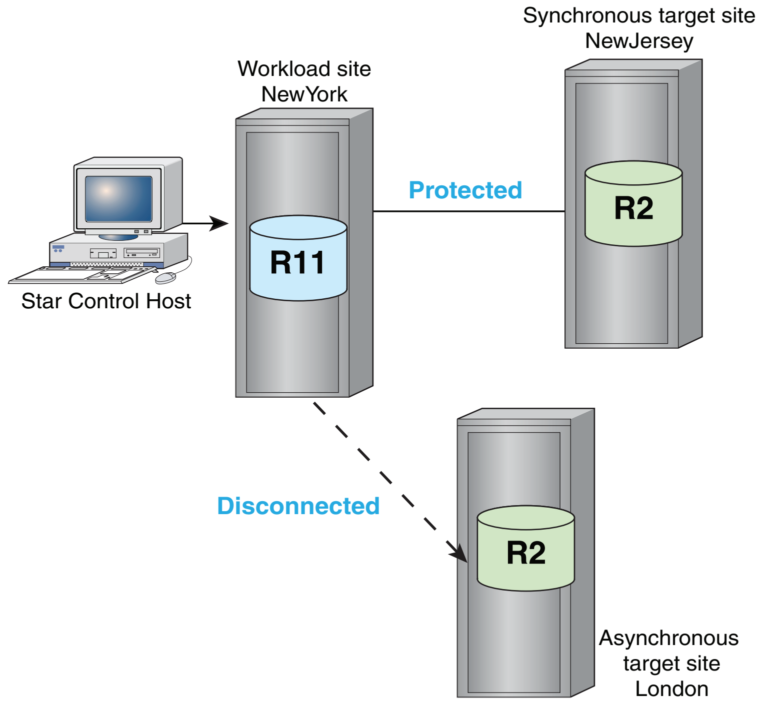
   ```
   symstar -cg StarGrp reconfigure -reset -site London -path
   NewYork:London
   ```

   Note

   If the system was not STAR Protected, specify the `-full` option to perform full resynchronization.

   The following image shows the resulting SRDF/Star states:

Figure 84 SRDF/Star: after reconfiguration to concurrent



Workload switching: Cascaded SRDF/Star

This section describes the following topics for a Cascaded SRDF/Star configuration:

- Planned workload switching
- Unplanned workload switching to synchronous or asynchronous target site

Planned workload switching: Cascaded SRDF/Star

Maintenance, testing and other activities may require switching the production workload site to another site.

This section describes the steps to switch workload sites when the operation can be scheduled in advance.

This operation requires you to:

- Stop the workload at the current production site,
- Halt the SRDF/Star environment (draining and synchronizing both remote sites in order for all three sites to have the same data), and
- Switching the production workload site to one of the remote sites.

When switching the workload to the synchronous target site, you can transition to the STAR Protected state.

There is limited support for this configuration.

When configured as Cascaded SRDF with the workload at `London`:

- Only the asynchronous link can be protected.
- The synchronous link (`NewJersey` -> `NewYork`) can only be connected.
- SRDF/Star cannot be enabled at `London`.

At the end of the switch operation the system comes up in the same STAR mode of operation that was configured before the `switch` operation was initiated.

Procedure

1. At the current workload site (`NewYork`), perform the SRDF/Star `halt` action.

   To halt CG `StarGrp`:

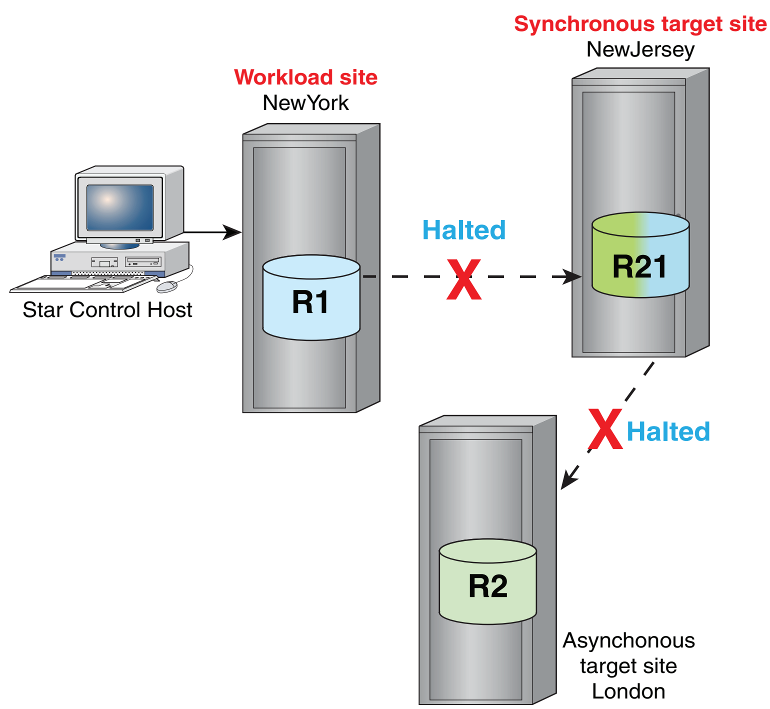
   ```
   symstar -cg StarGrp halt
   ```

   The `halt` action:

   - Disables the R1 devices,
   - Waits for all invalid tracks and cycles to drain,
   - Suspends the SRDF links,
   - Disables SRDF consistency protection, and
   - Sets the STAR mode indicators.

   The target sites transition to the Halted state, with all three sites having the data.

   Figure 85 Cascaded SRDF/Star: halted

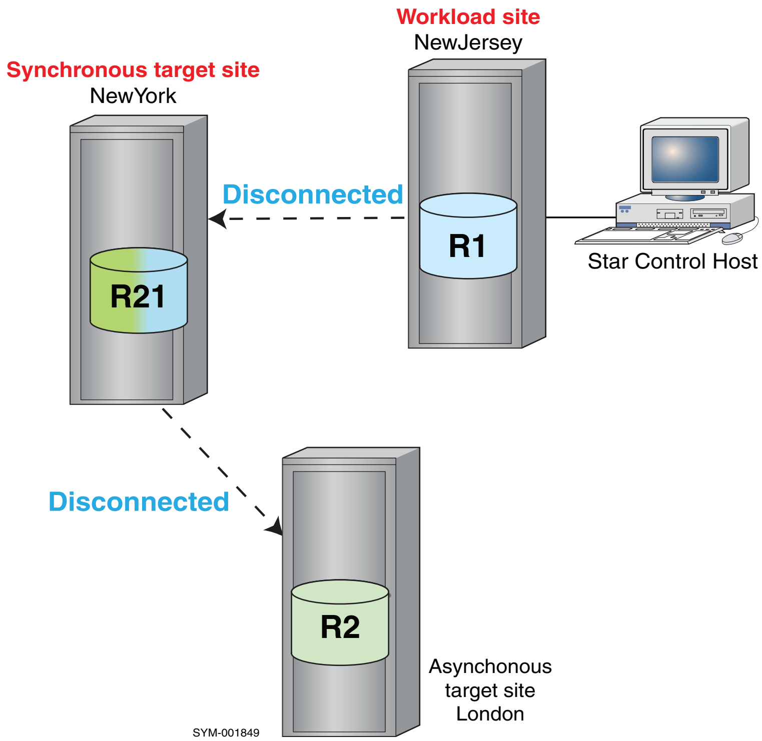


2. From a Star control host at the synchronous target site (`NewJersey`), issue the `switch` command to switch the workload to the synchronous target site (`NewJersey`).

   ```
   symstar -cg StarGrp switch -site NewJersey
   ```

   The following image shows the resulting SRDF/Star state:

Figure 86 Cascaded SRDF/Star: switched workload site



Note

The entire SRDF/Star environment can also be halted from a non-workload site.

Unplanned workload switching: cascaded SRDF/Star

This section describes the procedure for switching the workload site to the synchronous site because of an unplanned event, such as a hurricane, causing the current workload site to stop processing I/Os.

This type of operation assumes the system is STAR Protected.

Note

There is limited support when switching from `NewYork` to `London`. When configured as Cascaded SRDF/Star with the workload at `London`, only the long-distance link can be protected. The short-distance link can only be connected. SRDF/Star cannot be enabled at `London`.

Unplanned workload switch to synchronous target site: Cascaded SRDF/Star

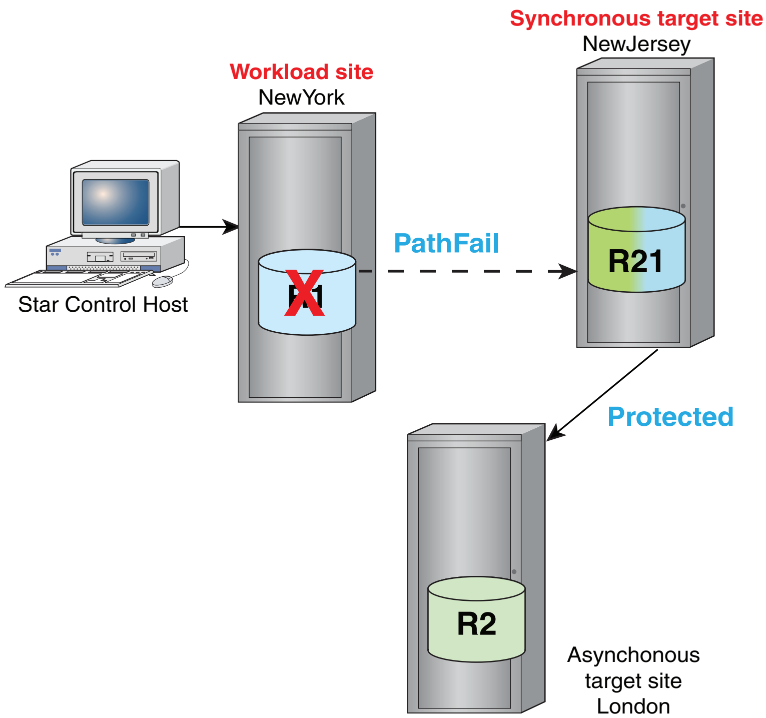
In cascaded mode, data at the synchronous target site is always more current than the data at asynchronous target site.

NOTICE

You cannot retain the data at the asynchronous target site if you move the workload to the synchronous target site.

In the following image, loss of the workload site (`NewYork`) has resulted in a system state of *NewJersey:Pathfail:*

Figure 87 Loss of workload site: cascaded SRDF/Star



Procedure

1. The first step varies depending on the state of the asynchronous target site (`London`).
   - If the asynchronous target site (`London`) is in Disconnected or PathFail state, skip to Step 2.
   - If the asynchronous target site (`London`) is in Protected state, issue a `disconnect` command from a Star control host at the synchronous target site (`NewJersey`) to get the asynchronous site to the PathFail state:

     ```
     symstar -cg StarGrp disconnect -trip -site London
     ```

2. From a Star control host at the synchronous target site (`NewJersey`), issue the `symstar cleanup` command to clean up any internal metadata or cache remaining at the asynchronous site.

   To clean up the `London` site:

   ```
   symstar -cg StarGrp cleanup -site London
   ```

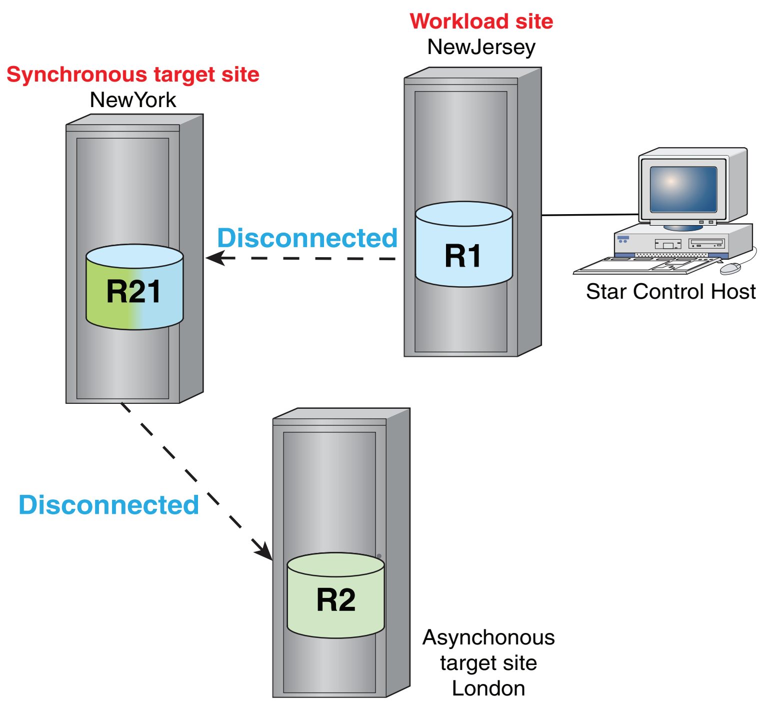
3. From a Star control host at the synchronous target site (`NewJersey`), issue the `symstar switch` command to start the workload at the specified site. The following command:
   - Specifies `NewJersey` as the new workload site (`-site NewJersey`)

- Retains the data at the NewJersey data instead of the London data (–keep_data NewJersey):

```
symstar -cg StarGrp switch -site NewJersey -keep_data
NewJersey
```

The following image shows the resulting SRDF/Star state:

Figure 88 Workload switched to synchronous target site: cascaded SRDF/Star



4. If data is protected with BCV devices, make a TimeFinder/Clone or TimeFinder/Mirror copy.

   For details, see Step 7: (Optional) Add BCV devices to the SRDF/Star configuration on page 304.

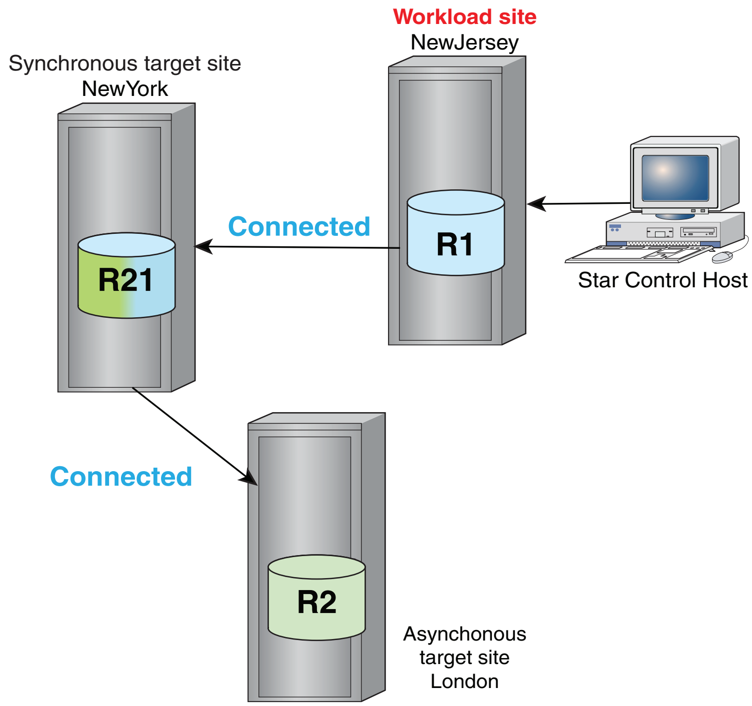
5. After the switch, you can bring up SRDF/Star in a cascaded mode or reconfigure to come up in concurrent mode. The following examples explain the steps required for each mode:
   - Proceed to Step 6 to bring up SRDF/Star in cascaded mode (the default).
   - Skip to Step 8 to reconfigure SRDF/Star in concurrent mode.

6. From a Star control host at the new workload site (NewJersey), issue two connectconnect commands to:
   - Connect NewJersey to NewYork (synchronously)
   - Connect NewYork to London (asynchronously):

```
symstar -cg StarGrp connect -site NewYork
symstar -cg StarGrp connect -site London
```

The following image shows the resulting SRDF/Star state:

Figure 89 After workload switch to synchronous site: cascaded SRDF/Star

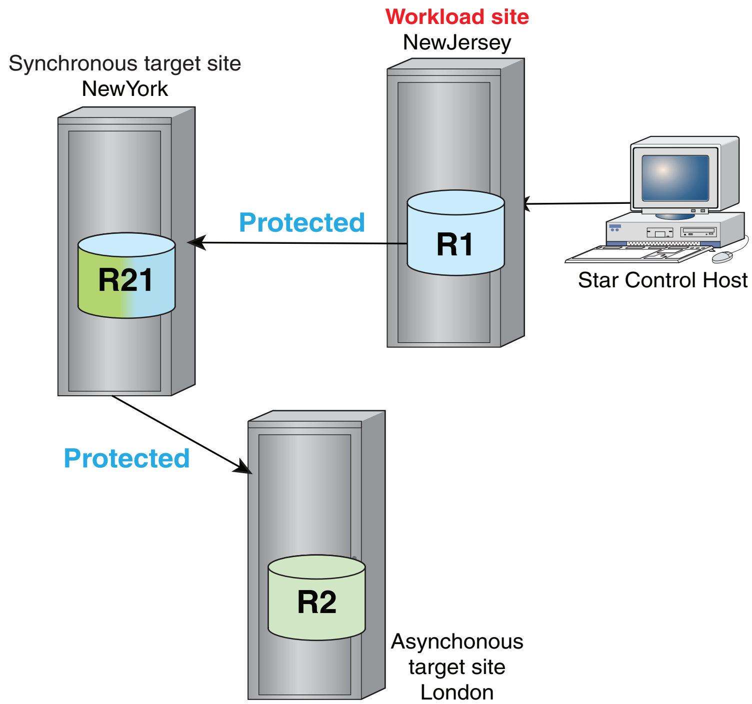


7. From a Star control host at the new workload site (`NewJersey`), issue two `protect` commands and the `enable` command to:
   - Protect `NewJersey` to `NewYork`
   - Protect `NewJersey` to `London`
   - Enable SRDF/Star

```
symstar -cg StarGrp protect -site NewYork
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

The following image shows the resulting SRDF/Star state:

Figure 90 Cascaded SRDF/Star after workload switch: protected



8. From a Star control host at the new workload site, issue the `symstar reconfigure` command from the workload site to change the mode to concurrent.

   See Recover using reconfigure operations on page 328.

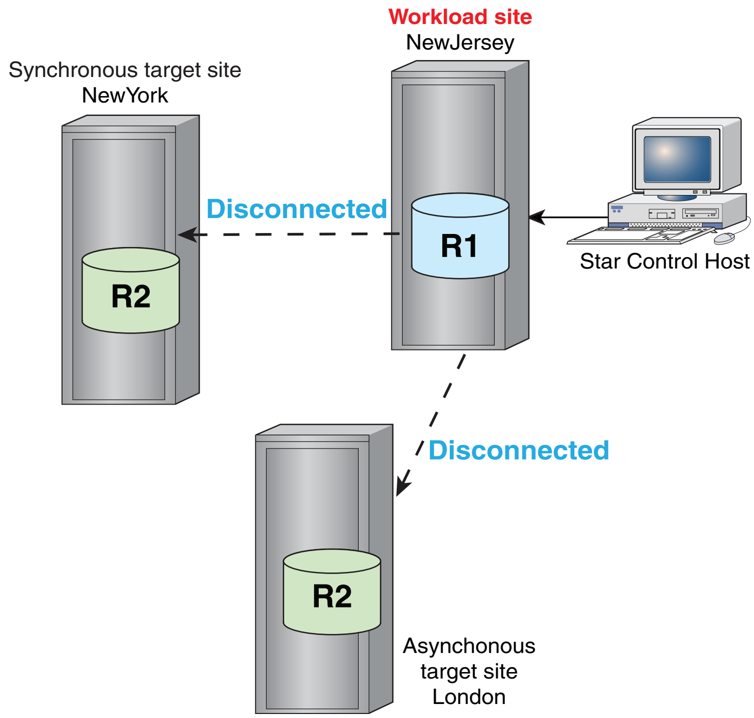
   To reconfigure SRDF/Star to operate in concurrent mode with:

   - The workload at `NewJersey`,
   - The synchronous target site at `NewYork`, and
   - The asynchronous target site at `London`:

   ```
   symstar -cg StarGrp reconfigure -site London -path
   NewJersey:London
   ```

   The following image shows the resulting SRDF/Star configuration:

Figure 91 After reconfiguration to concurrent mode

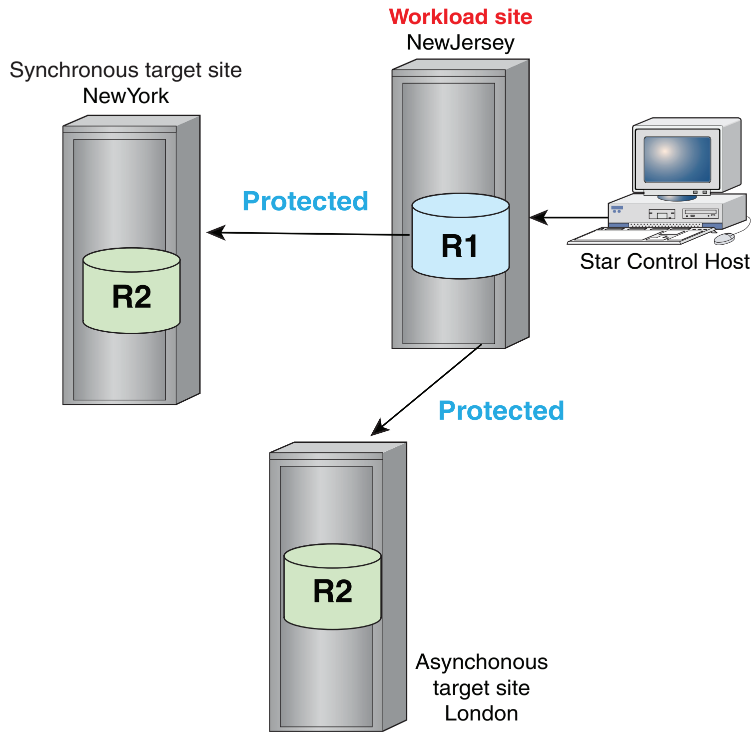


9. Run the following commands from a Star control host at the new workload site (`NewJersey`) to:
   - Connect `NewJersey` to `NewYork` (synchronously)
   - Connect `NewJersey` to `London` (asynchronously)
   - Protect `NewJersey` to `NewYork`
   - Protect `NewJersey` to `London`
   - Enable SRDF/Star

```
symstar -cg StarGrp connect -site NewYork
symstar -cg StarGrp connect -site London
symstar -cg StarGrp protect -site NewYork
symstar -cg StarGrp protect -site London
symstar -cg StarGrp enable
```

The following image shows the resulting SRDF/Star configuration:

Figure 92 Protected after reconfiguration from cascaded to concurrent mode



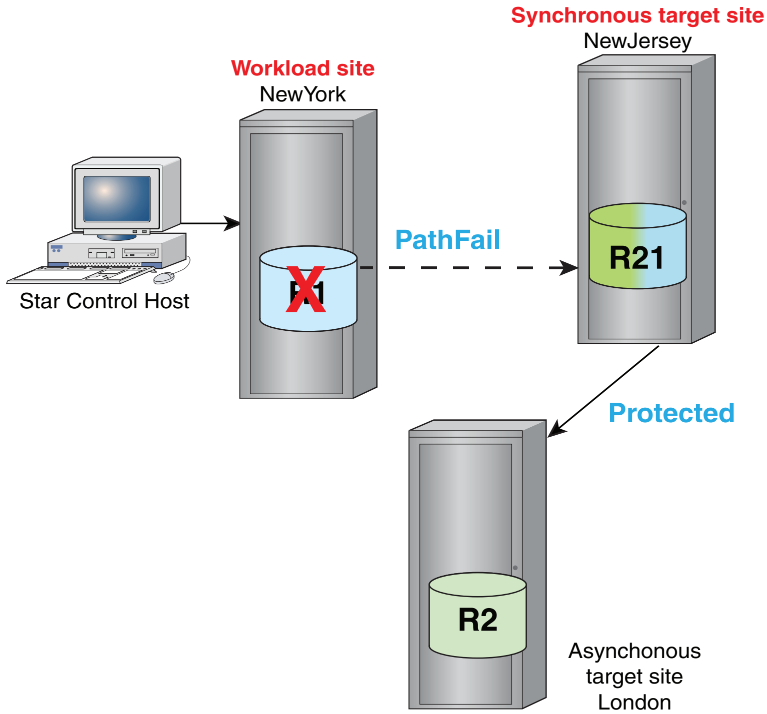
Unplanned workload switching to asynchronous target site: Cascaded SRDF/Star

This section describes two procedures to switch the workload to the asynchronous target site and keep the synchronous or asynchronous site's data.

Switch workload site: keep asynchronous site's data

In the following image, the workload site (`NewYork`) has been lost:

Figure 93 Loss of workload site: Cascaded SRDF/Star



From a Star control host at the asynchronous target site (`London`), perform the following steps to:

- Switch the workload site to `London`
- Keep the data from the asynchronous target site (`London`):

Procedure

1. If `London` is in a Protected state, issue the `disconnect` command:

   ```
   symstar -cg StarGrp disconnect -trip -site London
   ```

2. If the `disconnect` leaves `London` in a CleanReq state, issue the `cleanup` command:

   ```
   symstar -cg StarGrp cleanup -site London
   ```

3. Issue the `switch` command to switch the workload site to the asynchronous target site (`London`) and keep the asynchronous target's (`London`) data:

   ```
   symstar switch -cg StarGrp -site London -keep_data London
   ```

4. The `London` site is at asynchronous distance from both `NewYork` and `NewJersey`. SRDF/Star supports only one asynchronous site.

   When the `NewYork` site is repaired, you cannot connect and protect NewYork without switching the workload back to a configuration that has only one asynchronous site (`NewYork` or `NewJersey`).

   However, you can connect to `NewYork`. The `connect` action sets the mode to adaptive copy disk and brings the devices to RW on the SRDF links.

Issue two `connect` commands to connect the workload site (`London`) to both target sites (`NewJersey` and `NewYork`):

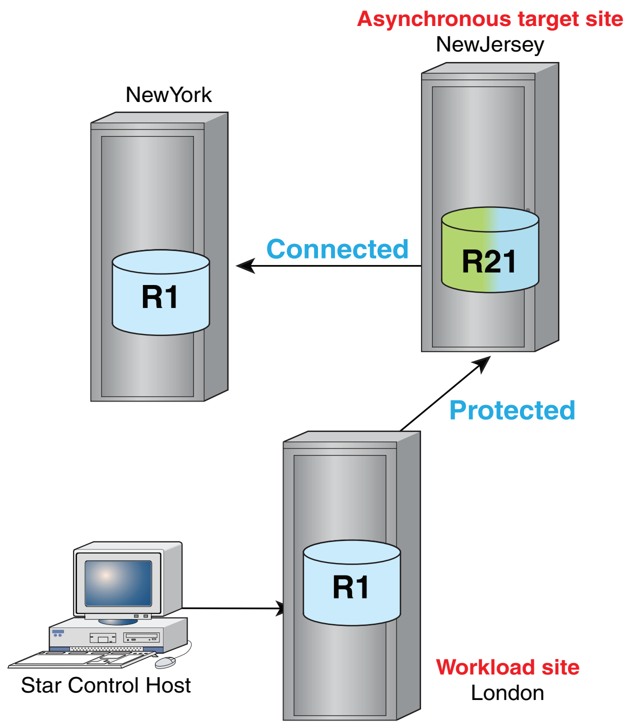
```
symstar -cg StarGrp connect -site NewJersey
symstar -cg StarGrp connect -site NewYork
```

5. Issue a `protect` command to protect one target site (`NewJersey`):

```
symstar -cg StarGrp protect -site NewJersey
```

The following image shows the resulting SRDF/Star configuration:

Figure 94 Cascaded SRDF: after switch to asynchronous site, connect, and protect



If data is protected with BCV devices, make a TimeFinder/Clone or TimeFinder/Mirror copy.

Step 7: (Optional) Add BCV devices to the SRDF/Star configuration on page 304

Switch back to the original workload site: concurrent SRDF/Star on page 344 describes the steps to switch the workload site back to the initial site (`NewYork`).

Switch workload site: keep synchronous site's data

From a Star control host at the asynchronous target site (`London`), perform the following steps to:

- Switch the workload site to `London`
- Keep the data from the synchronous target site (`NewJersey`):

Procedure

1. If `London` is in a Protected state, issue the `disconnect` command:

```
symstar -cg StarGrp disconnect -trip -site London
```

2. If the `disconnect` leaves `London` in a CleanReq state, issue the `cleanup` command:

```
symstar -cg StarGrp cleanup -site London
```

3. Issue the `switch` command to switch the workload site to the asynchronous target site (`London`) and keep the synchronous target's (`NewJersey`) data:

```
symstar switch -cg StarGrp -site London -keep_data NewJersey
```

The workload site switches to `London` and the R2 devices at `London` become R1 devices.

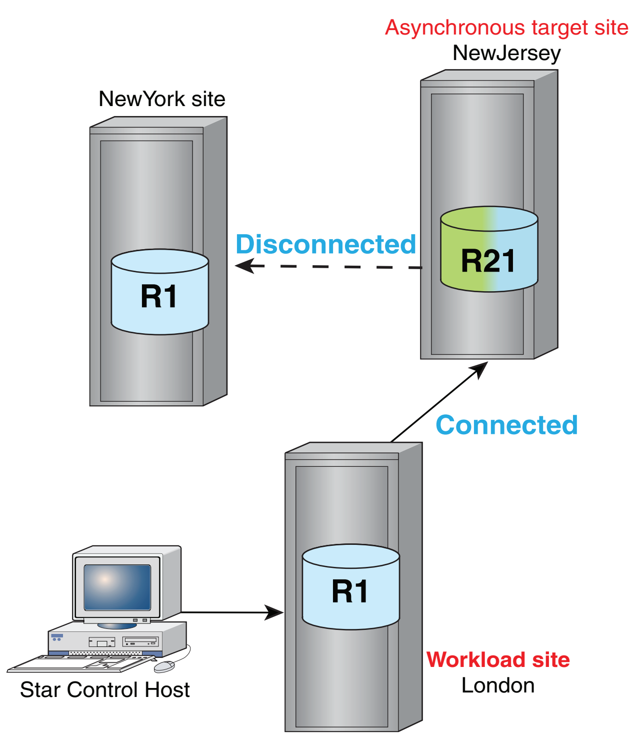
The `London` site connects to the `NewJersey` site and retrieves the `NewJersey` data.

Note

The `connect` action is not required because the `switch` action specified that SRDF retrieve the remote data from the `NewJersey` site.

The following image shows the resulting SRDF/Star state:

Figure 95 Cascaded SRDF: after switch to asynchronous site



If data is protected with BCV devices, make a TimeFinder/Clone or TimeFinder/Mirror copy.

See Step 7: (Optional) Add BCV devices to the SRDF/Star configuration on page 304.

Reconfiguration operations

This section describes the following topics:

- Reconfiguring from Cascaded SRDF/Star to Concurrent SRDF/Star
- Reconfiguring cascaded paths
- Reconfiguring from Concurrent SRDF/Star to Cascaded SRDF/Star
- Reconfiguring without halting the workload site

Before you begin reconfiguration operations

- Reconfiguration of the STAR mode of operation is allowed only from the Halted: Halted state and leaves the system in Halted: Halted state.
- When the workload site is at **`NewYork`** or **`NewJersey`**, only the path to the asynchronous target site can be reconfigured.
- When the workload site is at **`London`**, the path to either the synchronous target site or the asynchronous target site can be reconfigured.
- If you do not want to halt the workload site, see Reconfigure mode without halting the workload site on page 372.

Reconfiguring mode: cascaded to concurrent

This section describes changing the SRDF/Star mode to concurrent from the synchronous or asynchronous workload site.

Changing mode to concurrent: from synchronous workload site

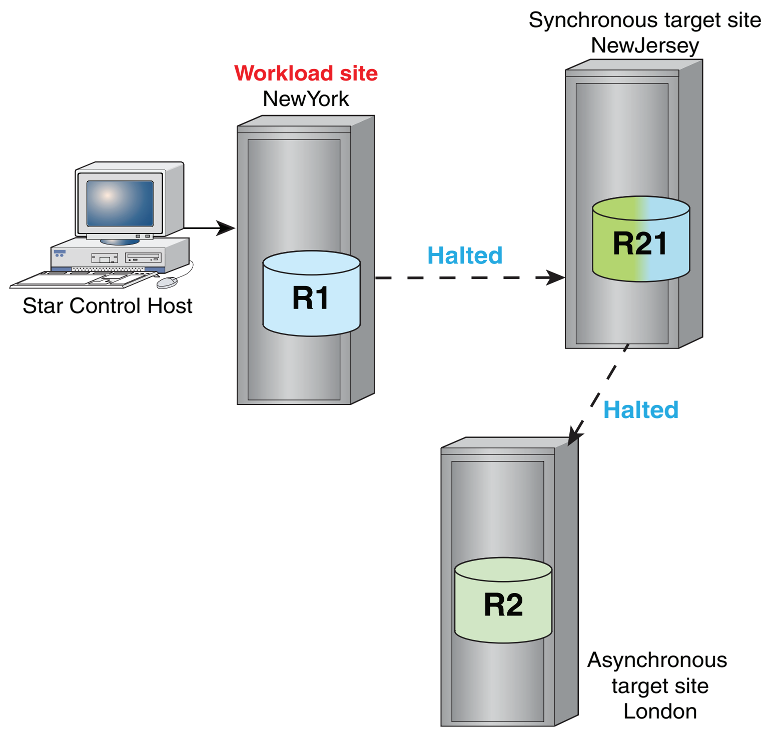
Procedure

1. From a Star control host at the workload site, issue the `halt` command to stop SRDF:

   ```
   symstar -cg StarGrp halt
   ```

   The following image shows the resulting SRDF/Star state:

Figure 96 Halted cascaded SRDF/Star



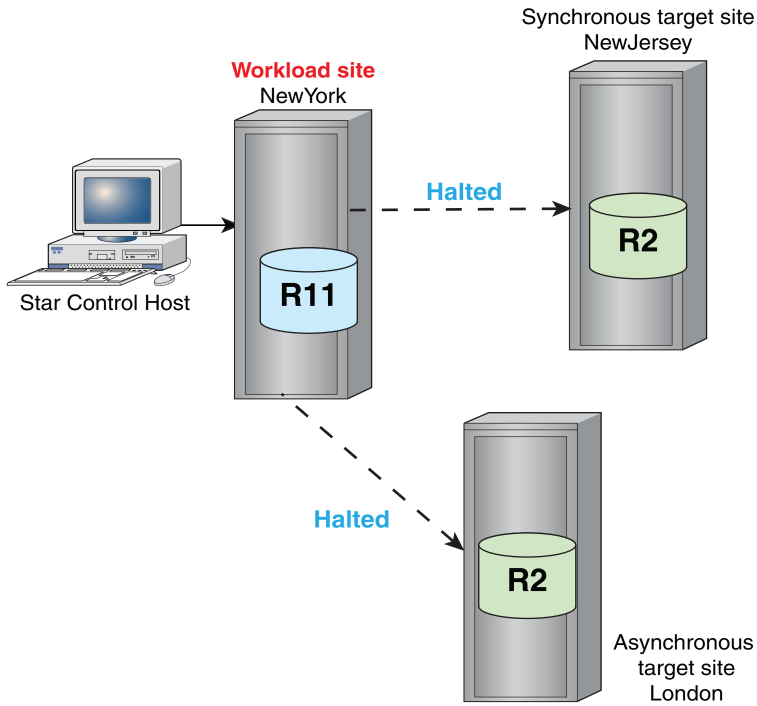
2. Issue the `symstar reconfigure` command to reconfigure the `NewYork` -> `NewJersey` -> `London` path to `NewYork` -> `London`:

```
symstar -cg StarGrp reconfigure -site London -path
NewYork:London
```

See Recover using reconfigure operations on page 328.

The following image shows the resulting SRDF/Star state:

Figure 97 After reconfiguration to concurrent



Changing mode to concurrent: from asynchronous workload site

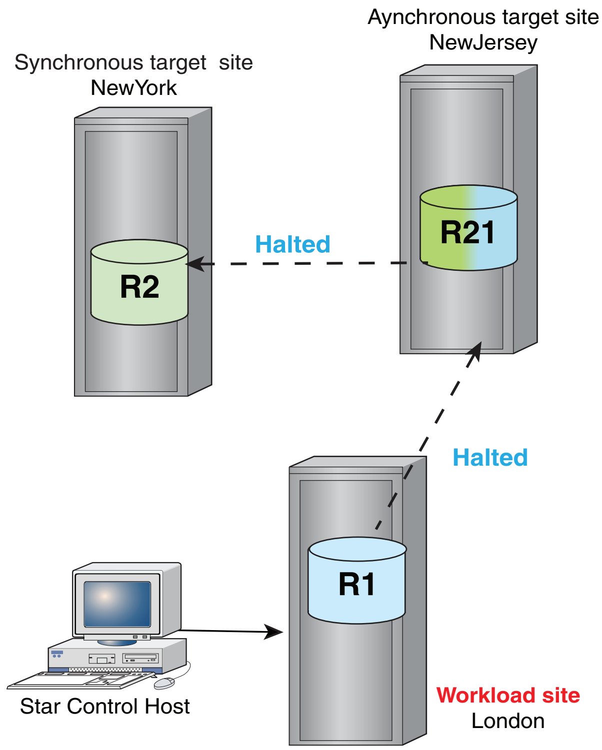
Procedure

1. From a Star control host at the workload site, issue the `halt` command to stop SRDF:

```
symstar -cg StarGrp halt
```

The following image shows the resulting SRDF/Star state:

Figure 98 Halted cascaded SRDF/Star



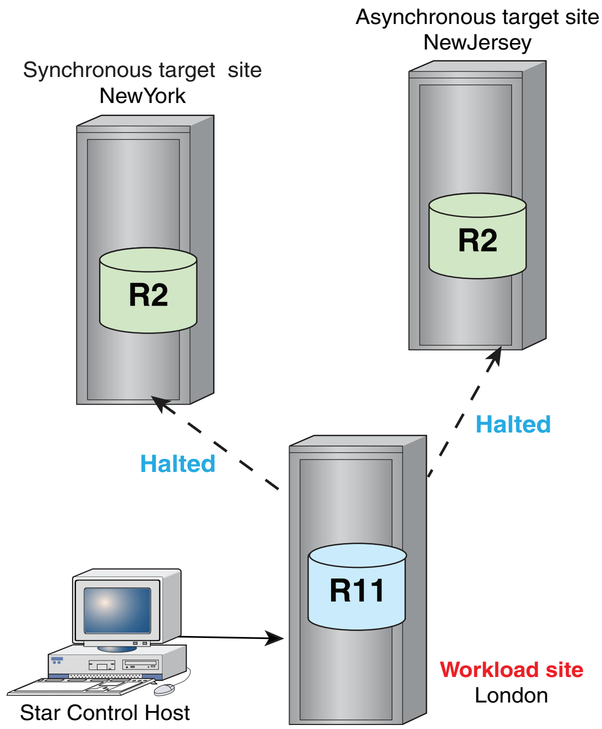
2. Issue the `symstar reconfigure` command to reconfigure the `London` -> `NewJersey` -> `NewYork` path to `London` -> `NewYork`:

   ```
   symstar -cg StarGrp reconfigure -site NewYork -path
   London:NewYork
   ```

   See Recover using reconfigure operations on page 328.

   The following image shows the resulting SRDF/Star state:

Figure 99 After reconfiguration to concurrent



Reconfiguring cascaded paths

In the following example:

- Both remote target sites are long distance sites from the workload site.
- The asynchronous target site is directly connected to the workload site.
- The other site is connected to the asynchronous target site is the synchronous target site.

Complete the following steps to reconfigure the path to the synchronous target site (`NewJersey`) when the workload site is at `London`.

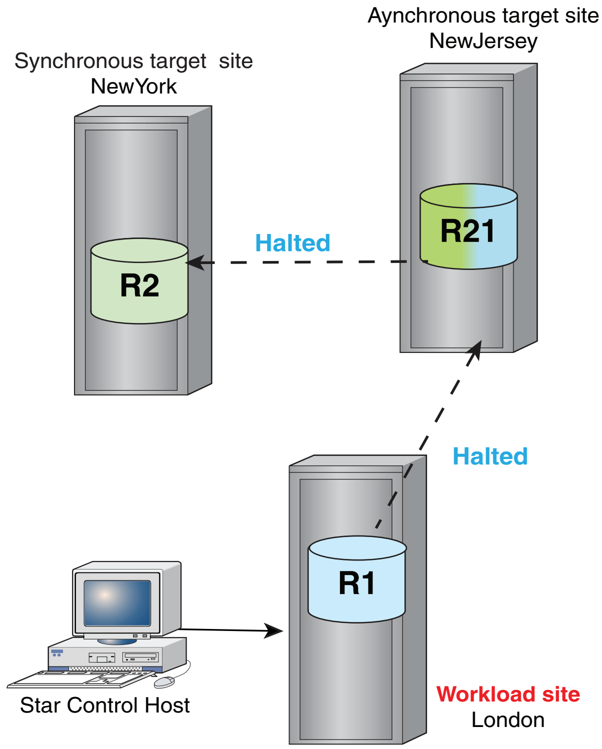
Procedure

1. From a Star control host at the workload site, issue the `halt` command to stop SRDF:

```
symstar -cg StarGrp halt
```

The following image shows the resulting SRDF/Star state:

Figure 100 Halted cascaded SRDF/Star



2. Issue the `symstar reconfigure` command with `-path` and `-remove` options to reconfigure the path from:

   `London` -> `NewJersey` -> `NewYork`

   to:

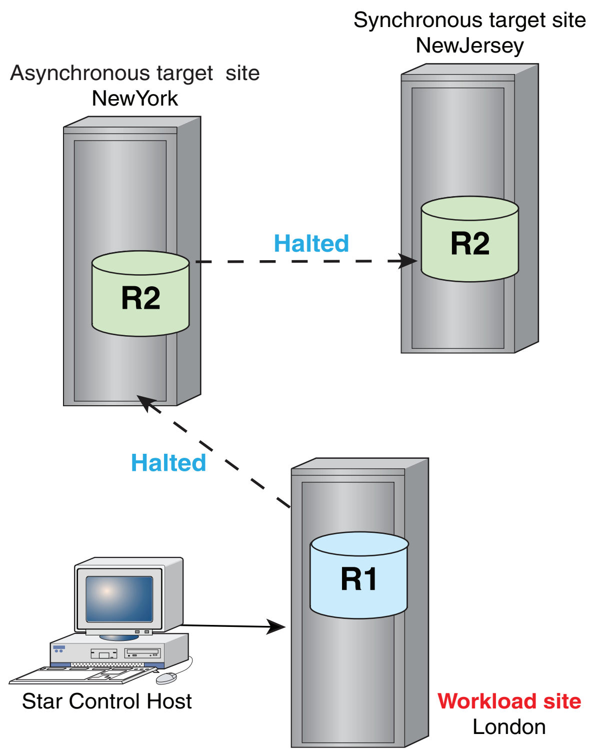
   `London` -> `NewYork` -> `NewJersey`:

   ```
   symstar -cg StarGrp reconfigure -site NewYork -path
   London:NewYork -remove London:NewJersey
   ```

   See Recover using reconfigure operations on page 328.

   The following image shows the resulting SRDF/Star state:

Figure 101 After cascaded path reconfiguration



Reconfiguring mode: concurrent to cascaded

This section describes changing the SRDF/Star mode to cascaded from the synchronous or asynchronous workload site.

Changing mode to cascaded: from synchronous workload site

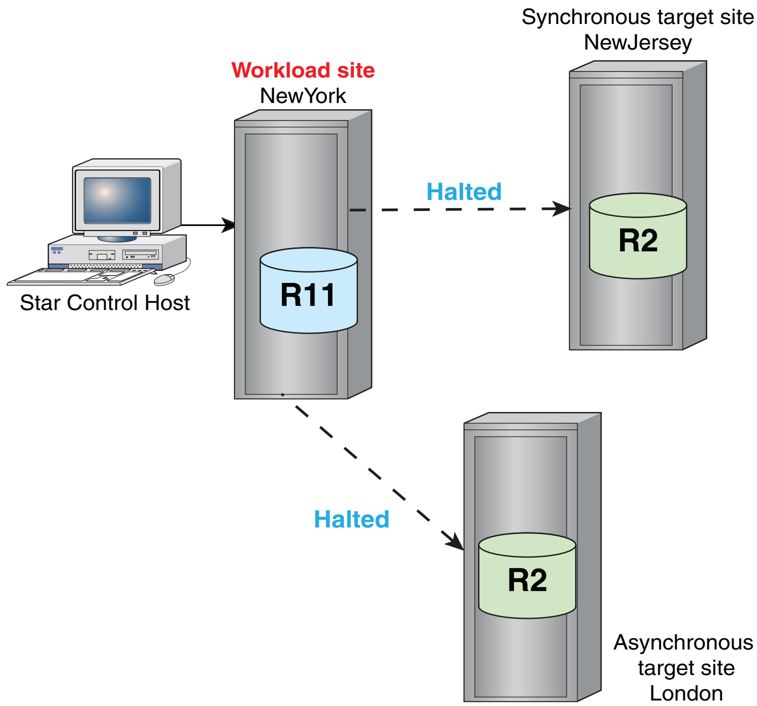
Procedure

1. From a Star control host at the workload site, issue the `halt` command to stop SRDF:

```
symstar -cg StarGrp halt
```

The following image shows the resulting SRDF/Star state:

Figure 102 Halted concurrent SRDF/Star



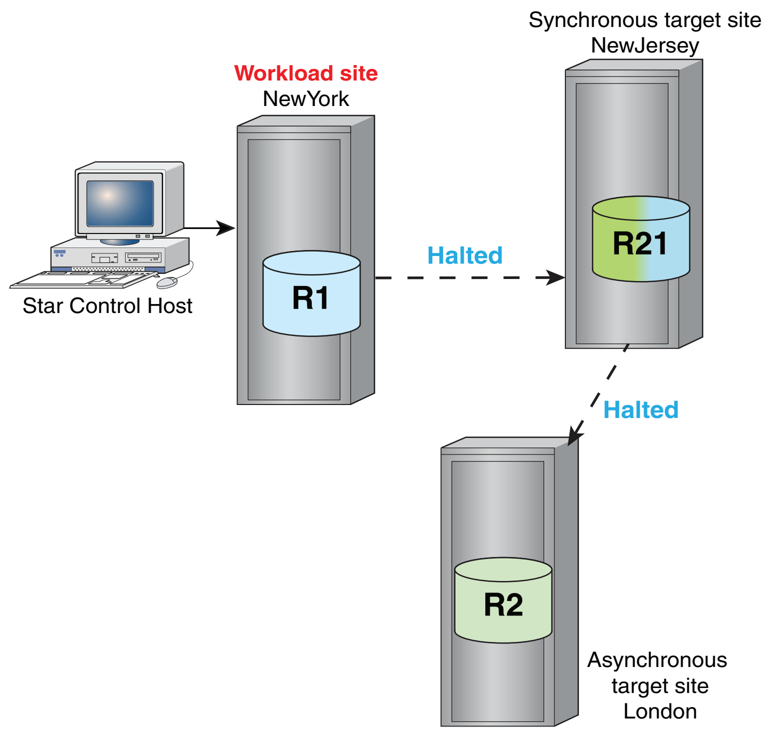
2. Issue the `symstar reconfigure` command to reconfigure the path from `NewYork` -> `London` to `NewYork` -> `NewJersey` -> `London`:

```
symstar -cg StarGrp reconfigure -site London -path
NewJersey:London
```

See Recover using reconfigure operations on page 328.

The following image shows the resulting SRDF/Star state:

Figure 103 After reconfiguration to cascaded



Changing mode to cascaded: from asynchronous workload site

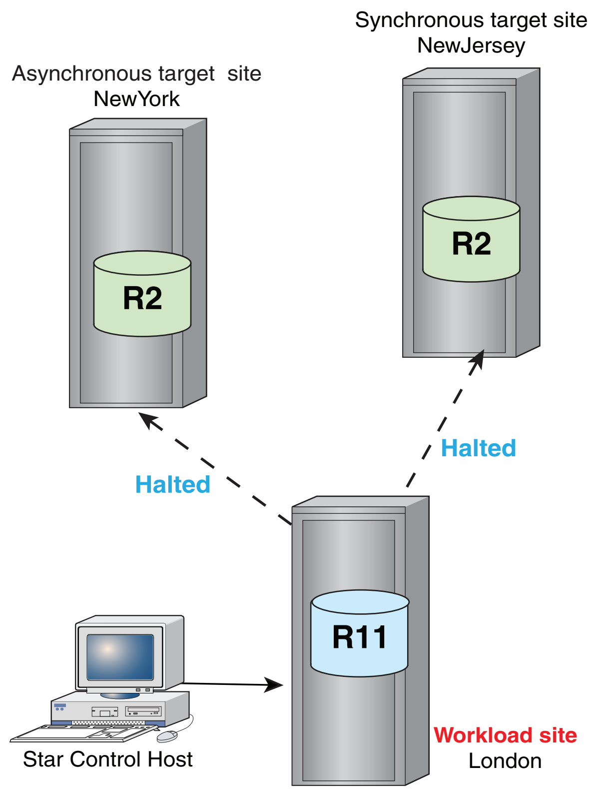
Procedure

1. From a Star control host at the workload site, issue the `halt` command to stop SRDF:

```
symstar -cg StarGrp halt
```

The following image shows the resulting SRDF/Star state:

Figure 104 Halted concurrent SRDF/Star



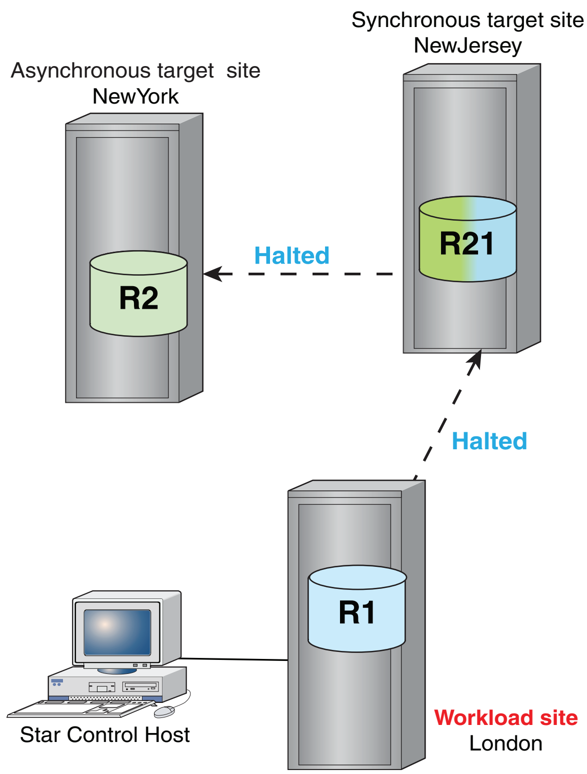
2. Issue the `symstar reconfigure` command to reconfigure the concurrent path from `London` -> `NewYork` to cascaded path `London` -> `NewJersey` -> `NewYork`:

```
symstar -cg StarGrp reconfigure -site London -path
NewJersey:London
```

See Recover using reconfigure operations on page 328.

The following image shows the resulting SRDF/Star state:

Figure 105 After reconfiguration to cascaded



Reconfigure mode without halting the workload site

This section describes the following topics:

- Reconfiguring cascaded mode to concurrent mode
- Reconfiguring concurrent mode to cascaded mode

Inject an disconnect/trip error to suspend the SRDF links to the asynchronous target site, and then follow the steps outlined in Recovering from transient faults with reconfiguration: Cascaded SRDF/Star on page 348.

NOTICE

These operations take the system out of the STAR Protected state.

Once reconfiguration is complete, re-enable STAR protection.

Reconfigure cascaded mode to concurrent mode

In the following example:

- The SRDF/Star environment is operating in cascaded mode.
- States are: Protected Sync, Protected Async, and Protected STAR.
- The workload is at `NewYork`.
- The `symstar disconnect` command drops the links between `NewJersey` and `London`.

- The reconfigure changes the mode to concurrent:

```
symstar -cg StarGrp disconnect -trip -site London
symstar -cg StarGrp reconfigure -reset -site London -path NewYork:London
```

Note

Always follow -trip with reconfigure -reset.

Reconfigure concurrent mode to cascaded mode

In the following example:

- The SRDF/Star environment is operating in concurrent mode.
- States are: Protected Sync, Protected Async, and Protected Star.
- The workload is at NewYork.
- The symstar disconnect drops the links between NewYork and London.
- The reconfigure changes the mode to cascaded.

```
symstar -cg StarGrp disconnect -trip -site London
symstar -cg StarGrp reconfigure -reset -site London -path
NewJersey:London
```

SRDF/Star configuration with R22 devices

This section describes the following topics:

- Before you begin SRDF/Star configuration with R22 devices
- Transitioning SRDF/Star to use R22 devices

Before you begin SRDF/Star configuration with R22 devices

When creating an SRDF/Star configuration with R22 devices, verify/perform the following:

- The STAR compatibility mode must be set to v70 (the default value).

```
SYMCLI_STAR_COMPATIBILITY_MODE=v70
```

See Step 4: Create the SRDF/Star options file on page 299.

- All devices at the workload site must be configured as concurrent (R11) devices with one mirror paired with the R2 mirror of the remote R21 device (synchronous target site) and the other mirror paired with an R2 mirror of the remote R22 device (asynchronous target site).
- All devices at the sync target site must be configured as R21 devices paired with an R1 remote partner at the workload site and an R2 remote partner at the asynchronous target site.
- All devices at the asynchronous target site must be configured as R22 devices paired with an R21 remote partner at the synchronous target site and an R11 remote partner at the workload site.

- Create the appropriate RDF1 composite group (CG), adding the devices to the CG, setting RDFG names, and so on. Note that in contrast to other SRDF/Star configurations, recovery SRDF groups do not need to be set in the CG for concurrent configurations.
- Once the configuration is ready, execute the `symstar setup` command using the `-opmode` option to choose either concurrent or cascaded operation.

The `symstar setup` command is allowed if the following SRDF pair states are Suspended, Synchronized, and SyncInProg:

- workload to synchronous target,
- workload to asynchronous target, or
- workload to synchronous target,
- synchronous target to asynchronous target site.

Example

```
symstar -cg StarGrp setup -options MyOptnFile.txt -opmode concurrent
A STAR Setup operation is
in progress for composite group StarGrp. Please wait...
Setup ..............................................Started
Reading options file options.txt ...................Started
Reading options file options.txt ...................Done
Analyzing Host Composite Grp: r22cg ................Started
Syncing    Symmetrix information ...................Started
Syncing    Symmetrix information ...................Done
Gathering  Symmetrix SID: 000192600077 RDFG: 66......Started
Gathering  Symmetrix SID: 000192600077 RDFG: 66......Done
Gathering  Symmetrix SID: 000192600077 RDFG: 67......Started
Gathering  Symmetrix SID: 000192600077 RDFG: 67......Done
...
Distributing setup information to remote sites ......Started
Distributing setup information to remote sites ......Done
Update persistent state information ................Started
Update persistent state information ................Done
Setup ..............................................Done
```

Transition SRDF/Star to use R22 devices

You can transition an existing SRDF/Star environment to use R22 devices if the following are true:

- The current SRDF/Star environment is operating in normal condition.
- All sites must be reachable.
- Relationships between the workload site and target sites must be properly configured.

Issue the `symstar configure` command from the workload site:

```
symstar -cg CgName configure -add recovery_rdf_pairs
      [-opmode concurrent|cascaded]
```

This command is allowed from the workload site only while in the following states:

- Disconnected/Connected/Halted (to synchronous target site) and
- Disconnected/Connected/Halted (to asynchronous target site)
  After the configure command completes, target sites are in the same states as they were in when the `configure` command was issued.

Example

To immediately upgrade SRDF/Star to use R22 devices:

symstar -cg StarGrp configure -add recovery_rdf_pairs -opmode cascaded

```
A STAR Configure operation is
in progress for composite group StarGrp. Please wait...
Configure: Adding Recovery RDF Pairs................. Started
Update persistent state information ................ Started
Update persistent state information ................ Done
SA Write Disable Devs SID:000192600090............... Started
SA Write Disable Devs SID:000192600090............... Done
Createpair SID:000192600083 RDFG:114................. Started
Createpair SID:000192600083 RDFG:68.................. Started
Createpair SID:000192600083 RDFG:114................. Done
Createpair SID:000192600083 RDFG:68.................. Done
SA Write Enable Devs SID:000192600090................ Started
SA Write Enable Devs SID:000192600090................ Done
Distributing setup information to remote sites .......Started
Distributing setup information to remote sites .......Done
Update persistent state information ................ Started
Update persistent state information ................ Done
Configure: Adding Recovery RDF Pairs ................ Done
```

Issue the `symstar show` command to verify R22 devices are configured as the recovery SRDF pairs. For example (truncated output):

```
Composite Group Name    : StarGrp

     Recovery RDF Pairs Configured   : Yes
      Site SiteA to site SiteB Information:
```

Issue the `symstar query` command to verify that adding recovery SRDF pairs was the last action performed. For example (truncated output):

```
symstar -cg CgName query

...
Last Action Performed           :ConfigureAddRcvryRDFPair
Last Action Status              :Successfull
Last Action timestamp           :03/15/2008_12:29:37
```

CHAPTER 10

Device Migration Operations

This chapter describes the following topics:

Device Migration operations overview

SRDF device migration allows you to replace an existing device in an SRDF pair with a new device on a different array.

During migration, a concurrent SRDF relationship is established to transfer data from an existing R1 device to a new device in adaptive copy disk mode.

When data transfer completes, the R1 device or the R2 device is replaced with the newly-populated device in the SRDF pair.

Device Migration operations requirements

- Each array must have a unique ID (sid).
- The existing SRDF device and the new devices must be dynamic R1 or R2 capable.

HYPERMAX OS

- Devices that are part of an SRDF/Metro configuration cannot be migrated.
- Adaptive copy write pending mode is not supported when the R1 side of the RDF pair is on an array running HYPERMAX OS.
  For configurations where the R1 side is on an array running HYPERMAX OS, and the R2 side is running Enginuity 5876, the mode of the new device pair is set to the RDF mode of the R1 device being replaced.
- The Geometry Compatibility Mode attribute (-gcm) allows devices on arrays running HYPERMAX OS to be paired with devices on arrays running Enginuity 5876 that have an odd number of cylinders. When GCM is set, migration operations are subject to the following restrictions:
  - If the new device is on an array running HYPERMAX OS:
    - If the R1 device is being replaced:
      If the existing R2 device is on an array running Enginuity 5876 with an odd number of cylinders, then the migration is allowed if the new device can be made the same size using the GCM attribute.

      If the existing R2 device is on an array running HYPERMAX OS with GCM set, then the migration is allowed if the new device can be made the same size by setting the GCM attribute.
    - If the R2 is being replaced:
      If the existing R1 device is on an array running Enginuity 5876 with an odd number of cylinders, then the migration is allowed if the new device can be made the same size by setting the GCM attribute.

      If the existing R1 device is on an array running HYPERMAX OS with GCM set, then the migration is allowed if the new device can be made the same size by setting the GCM attribute.
- If the new device is on an array running Enginuity 5876 and has an odd number of cylinders:
  - If the R1 is being replaced:
    If the existing R2 device is on an array running Enginuity 5876, then the new device must be the same configured size

If the existing R2 device is on an array running HYPERMAX OS with GCM set, then the migration is allowed if the new device has the same GCM size as the R2 device.

- If the R2 is being replaced:
  If the existing R1 device is on an array running Enginuity 5876, then the new device must be the same configured size.

  If the existing R1 device is on an array running HYPERMAX OS with GCM set, then the migration will be allowed if the new device has the same GCM size as the R1.

R1 device migration

Before you can migrate an R1 device to a new array, you must create a temporary concurrent SRDF configuration with the new array as one of the R2 sites.

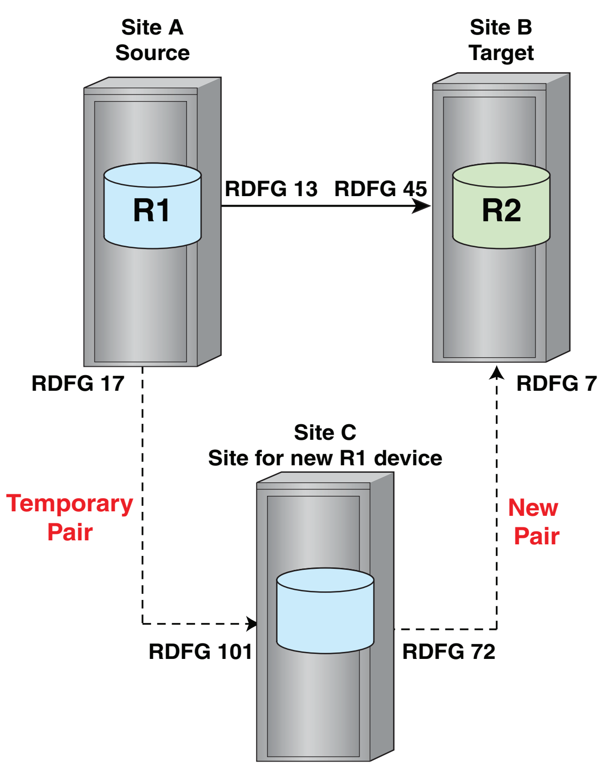
This section describes the steps to complete an R1 migration, including:

- Configure a temporary SRDF group on page 379 and R1 device to enable the migration.
- Establish a concurrent SRDF relationship on page 383to transfer data to the from the old R1 device to the device that will become the new R1.
- Replacing the R1 device on page 380 with the newly-populated device in the SRDF pair.

Configure a temporary SRDF group

Configure a temporary SRDF group to synchronize data from the existing R1 device to the new R1 device.

Figure 106 R1 migration: configuration setup



In the preceding example:

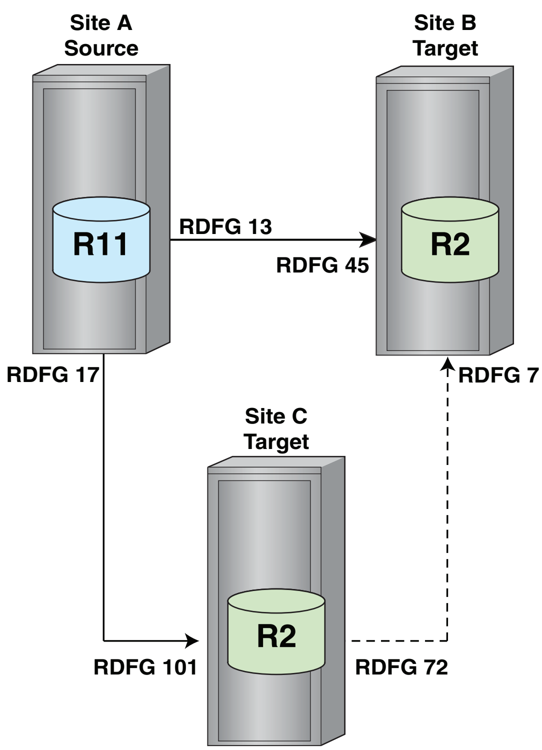
- Site A contains the existing R1 device paired with the R2 device in Site B,
- Site C contains the new non-SRDF device you want replace the existing R1 device. The dotted lines indicate that there are no SRDF relationships to Site C.
- A temporary SRDF group (RDFG 17) is used to synchronize data from the existing R1 to the new device in Site C.

The new R1 device replaces the existing R1 device during the migration.

Establish a concurrent SRDF relationship

Use the `symrdf migrate -setup` command to establish a concurrent relationship between the source device and two target devices.

Figure 107 R1 migration: establishing a concurrent relationship



In the preceding example:

- The R1 device becomes the concurrent R11 device writing to two R2devices.
- Data synchronization in adaptive copy disk mode begins between the device and the R2 device on Site C.
- No SRDF pairing exists between the devices on Site C and Site B.

Note

You may need to modify existing device group or composite group scripts to accommodate the new R11 configuration.

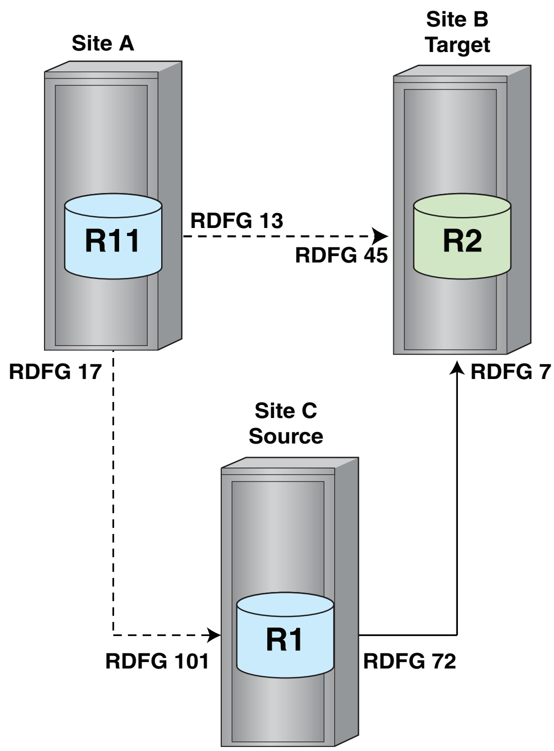
Replacing the R1 device

Procedure

1. Wait until the two R2 devices are near synchronization with the R11 device.

2. Shut down any applications writing to the source device.
3. Use the `symrdf migrate -replace R1` command to replace the source device.

Figure 108 R1 migration: replacing the source device



The `symrdf migrate -replace R1` command executes the following actions:

a. Sets the source device to USR-NR (user not ready).
This prevents applications writing to or reading from the R1 device.

b. Verifies the devices are in the correct pair state for replacement.
See also SRDF pair states for migration on page 396.

c. (If applicable) Waits until all invalid tracks are cleared.

d. (If applicable) Drains the SRDF/A session.

e. Removes the SRDF pairing between the devices on the current R11 (Site A) and the original R2 (Site B).

f. Removes the SRDF pairing between the devices on the current R11 (Site A) and the new R2 (Site C).

g. Sets an SRDF pairing between the devices on Site C and B using the original SRDF mode of Site A and B. No additional copying of data is required between this SRDF pair because data is already the same on both devices. No additional copying of data is required between this SRDF pair because data is already the same on both devices.

h. Makes the devices read/write on the SRDF links.

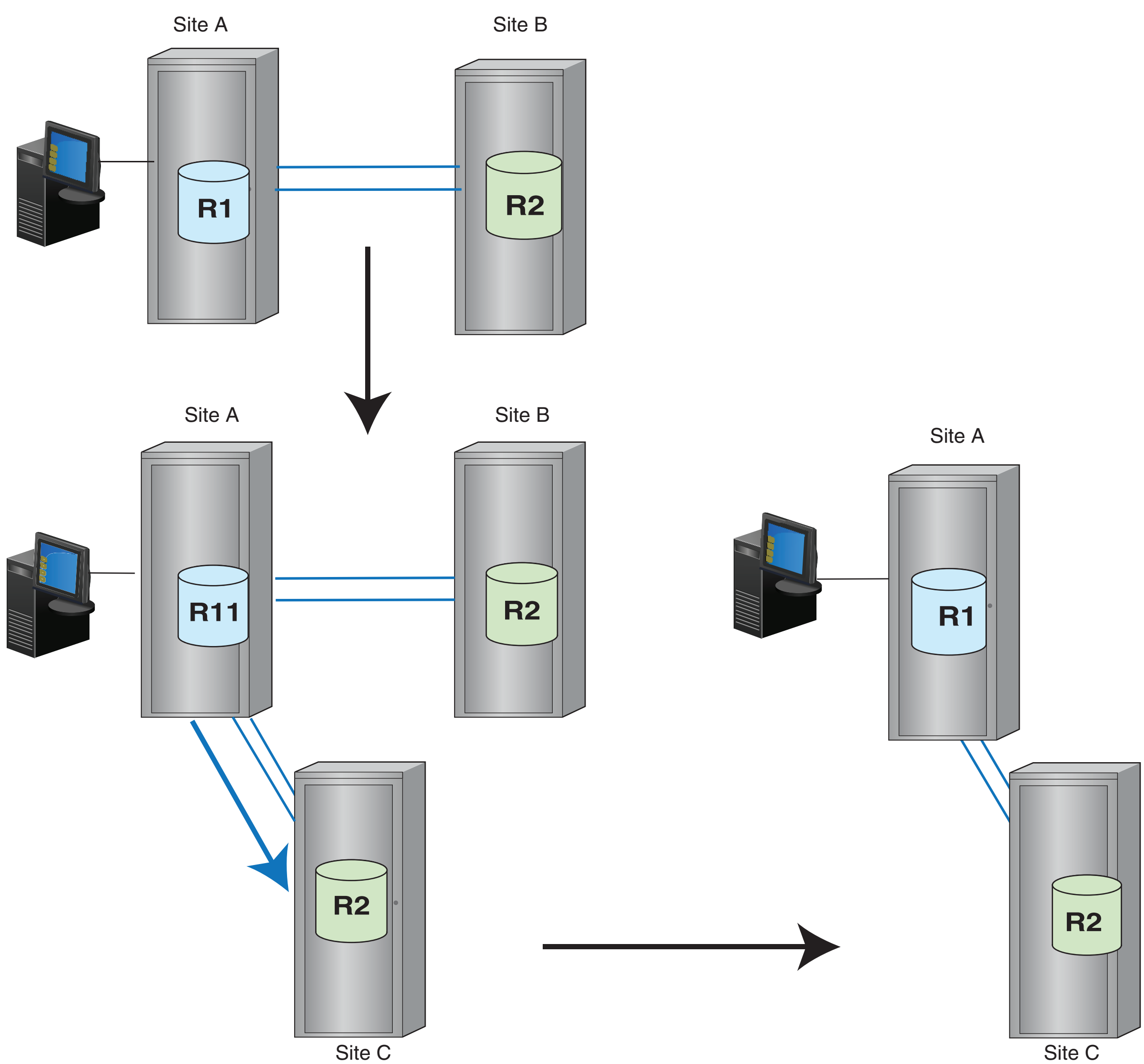
The new R1 device is ready. You can restart the applications writing to the new R1 device on Site C.

The original R1 device remains USR-NR.

R2 device migration

R2 device migration allows you to replace the original R2 devices with new R2 devices. It shows the initial two-site topology, the migration process, and the final SRDF topology.

Figure 109 Migrating R2 devices



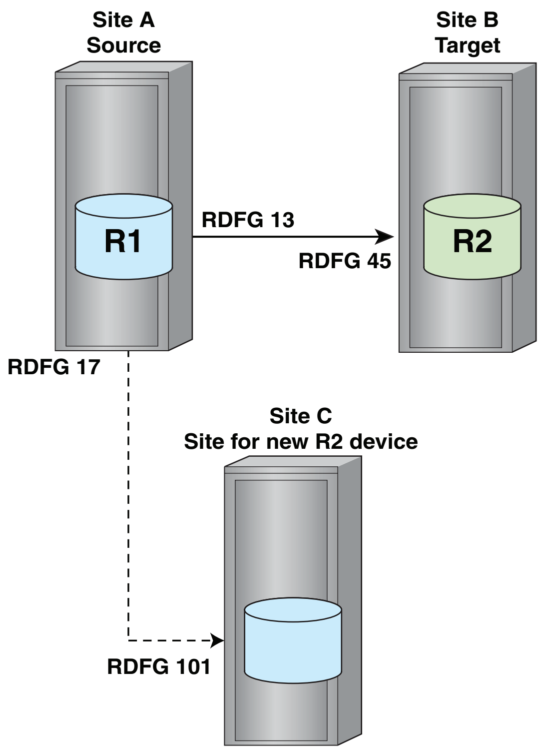
This section describes the steps to complete an R2 migration, including:

- Configure setup for R2 migration on page 382
- Establish a concurrent SRDF relationship on page 383to transfer data to the from the R1 device to the device that will become the new R2.
- Replacing the R2 device on page 384 with the newly-populated device in the SRDF pair.

Configure setup for R2 migration

Configure a replacement R2 as a non-SRDF device:

Figure 110 R2 migration: configuration setup



In the preceding example:

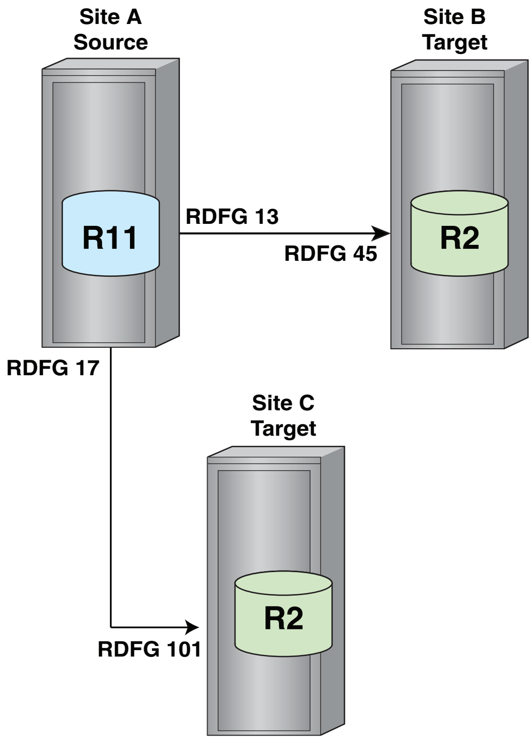
- Site A contains the R1 device paired with the existing R2 device in Site B,
- Site C contains the new non-SRDF device that will replace the R2 device.

The dotted lines indicate no SRDF pairing exists with Site C.

Establish a concurrent SRDF relationship

Use the `symrdf migrate -setup` command to establish a concurrent SRDF relationship among the three sites:

Figure 111 R2 migration: establishing a concurrent relationship



The establish action creates a concurrent SRDF relationship to transfer data from the existing source device to both target devices.

In the preceding example, the R1 becomes the R11 device writing to two target R2 devices.

- The source site continues to accept I/Os from the host.
- There is no need to shut down the applications writing to R1.
- No temporary pairing (like an R1 migration) is required.
- The source and target devices do not have to be close to synchronization.

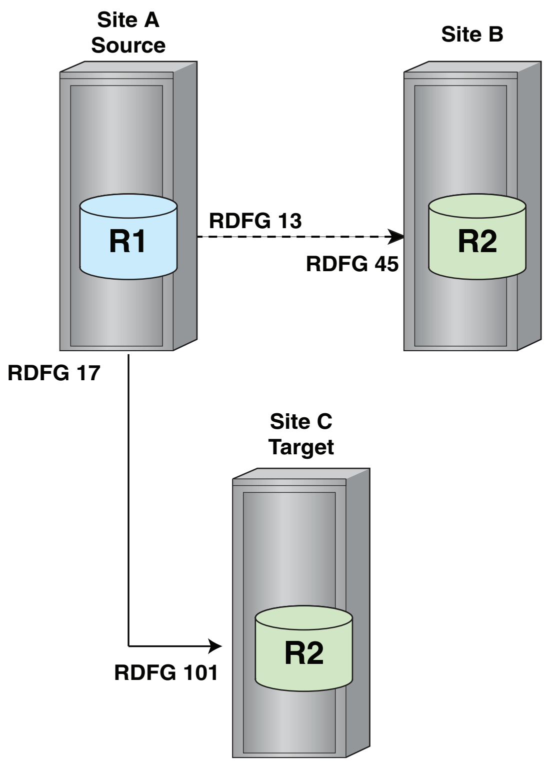
Note

It may be necessary to modify existing device group or composite group scripts to accommodate the new configuration.

Replacing the R2 device

Use the `symrdf migrate -replace R2` command to replace the existing R2 device with the new R2 device in the SRDF pair:

Figure 112 R2 migration: replacing the target device



The `symrdf migrate -replace R2` command executes the following actions:

1. Verifies the devices are in the correct pair state for replacement.
   SRDF pair states for migration on page 396 provides more information.
2. Removes the SRDF pairing between the devices on Site A and B.
3. Sets the mode of Site A and C using the original SRDF mode of Site A and B.

R1 and R2 migration procedures

Before you begin R1 and R2 migration

- Plan for each migration.
  If you have defined scripts for your existing R1/R2 pair, evaluate how you may need to modify those scripts with new SIDs, SRDF device pairings, device groups, and composite groups.

  Keep in mind that during a device migration, the R1/R2 pair transforms into a concurrent SRDF relationship (R2<-R11->R2), and then back into an R1->R2 relationship.
- An SRDF group must exist for the new device.
  If R1 is being replaced, this is the SRDF group between the new R1 and the existing R2.

  If R2 is being replaced, this is the SRDF group between the new R2 and the existing R1.
- For an R1 migration *only* , a temporary SRDF group is required to synchronize data from the existing R1 device to the new device.
  If performing an R1 migration, create this temporary SRDF group.

- Before replacing the R1 device, you must shut down all applications using it. Application shutdown is not required when replacing an R2 device.
- Review SRDF pair states for migration on page 396.

Restrictions for R1 and R2 migration

SRDF/A device pairs

- The attributes associated with an existing SRDF group pertaining to an SRDF/A session are not automatically associated with the new SRDF group after migration. You must issue the symconfigure command on the new SRDF group and set the appropriate attributes, such as the minimum_cycle_time and the DSE (Delta Set Extension) autostart settings.
- If replacing a device of an SRDF pair in SRDF/A mode, all existing rules for DSE apply if DSE autostart is enabled on the new SRDF group.
  For example, the DSE threshold must be less than the maximum cache usage for the new SRDF group.
- If replacing the R1 device of an SRDF pair in SRDF/A mode, the new SRDF group in the new R1 array must be SRDF/A capable.
- If replacing a device of an SRDF pair in SRDF/A mode and Cache partitioning is enabled on the new array, all new devices must belong to the same cache partition.
- If the existing device is in SRDF/A mode, the entire SRDF group must be migrated.
- If the existing device is in SRDF/A mode, the new SRDF group must be empty.
- If replacing the R1 device, the temporary SRDF group must not be in SRDF/A mode.
- The existing SRDF device pair cannot be in semi-synchronous mode.

Devices

- The new device (R1 or R2) cannot be an SRDF device before migration.
- The existing device (R1 or R2) and the replacement device cannot be diskless.
- The new R1 device cannot be larger than the existing R1 device.
- The existing R1 device cannot have any local invalid tracks.
- After migration, the R2 device cannot be larger than the R1 device.
- The existing (R1 or R2) and the new device cannot be configured for SRDF/Star.
- The existing device and the replacement device cannot be a source or a target device for TF/Mirror, TF/Snap, TF/Clone, Open Replicator, and Federated Live Migration.
  This restriction does not apply to the SRDF partner of the existing device.
- The existing R1/R2 device pair cannot be in a concurrent SRDF relationship.
  Set the `-config` option to equal `pair` in `symrdf migrate -setup` to indicate this pair is not part of such a configuration.
- An SRDF consistency protection group must be enabled at the RDFG-name level, **NOT** at the composite-group level.
  Otherwise, the `migrate -setup` command stops the monitoring/cycle switching of your composite group.

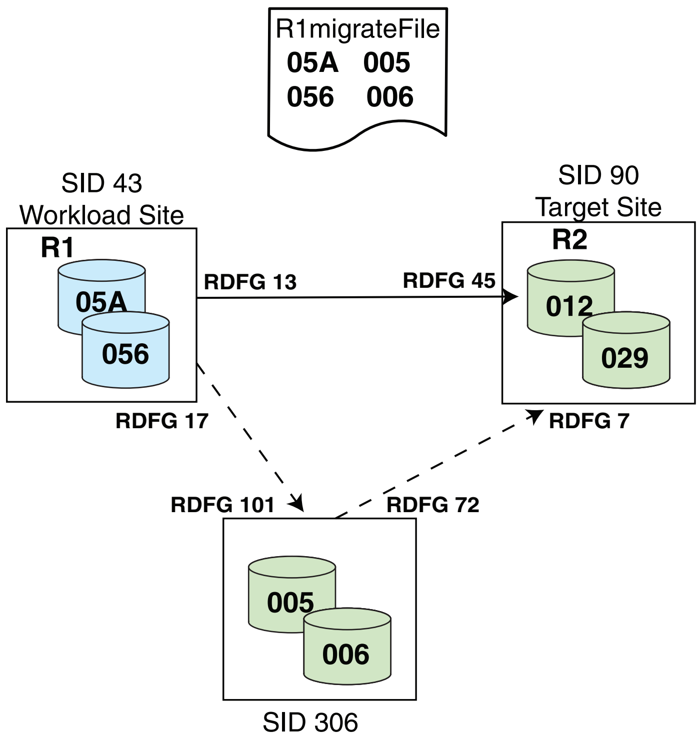
Sample procedure: migrating R1 devices on page 387, explains the procedure for an SRDF consistency protection group enabled at the composite-group level.

Sample procedure: migrating R1 devices

For this sample procedure, the SRDF consistency protection group is enabled at the composite-group level.

This procedure shows the steps to change this setting and enable SRDF consistency protection at the RDFG-name level.

Figure 113 R1 migration example: Initial configuration



The preceding image shows an R1 and R2 relationship between array 43 and array 90.

After R1 migration, the devices in array 306 will become the source devices for array 90.

Step 1: Querying the sample SRDF/A configuration

Use the `symrdf query -detail` command to query a configuration with SRDF consistency protection enabled at the composite-group level.

```
symrdf -cg MigrateRDF query -detail

Composite Group Name       :  MigrateRDF
Composite Group Type       :  RDF1
Number of Symmetrix Units  :  1
Number of RDF (RA) Groups  :  1
RDF Consistency Mode       :  MSC

RDFA MSC Consistency Info:{
    Session Status                  : Active
    Consistency State               : CONSISTENT
    }
Symmetrix ID                     : 000192600043 (Microcode Version: 5876)
```

```
Remote Symmetrix ID               : 000192600090 (Microcode Version: 5876)
RDF (RA) Group Number             :   1 (00) 13 (0C)
RDFA Info:
    {
    Cycle Number                         : 29
    Session Status                       : Active - MSC
    Consistency Exempt Devices           : No
    Minimum Cycle Time                   : 00:00:30
    Avg Cycle Time                       : 00:00:30
    Duration of Last cycle               : 00:00:30
    Session Priority                     : 33
    Tracks not Committed to the R2 Side: 0
    Time that R2 is behind R1            : 00:00:42
    R2 Image Capture Time                : Mon Sep 21 13:28:44 2015
    R2 Data is Consistent                : True
    R1 Side Percent Cache In Use         : 0
    R2 Side Percent Cache In Use         : 0
    R1 Side DSE Used Tracks              : 0
    R2 Side DSE Used Tracks              : 0
    Transmit Idle Time                   : 00:00:00
    }

        Source (R1) View             Target (R2) View       MODES
--------------------------------  ------------------------- ----- ------------
               ST                 LI       ST
Standard        A                  N        A
Logical   Sym   T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv       RDF Pair
Device    Dev   E  Tracks Tracks   S Dev    E  Tracks  Tracks MDACE STATE
--------------------------------- -- ------------------------ ----- ------------
DEV001   0005A NR       0       0 RW 00012 WD       0       0 A..X. Consistent
DEV002   000F8 NR       0       0 RW 00029 WD       0       0 A..X. Consistent

Total             ------- -------            ------- -------
Track(s)              0       0                  0       0
  MBs                 0.0     0.0                0.0     0.0
```

Step 2: Changing the SRDF consistency protection setting

To maintain consistency protection after establishing a concurrent SRDF relationship:

- Remove the SRDF consistency protection enabled at the composite-group level, and then
- Enable consistency protection at the RDFG-name level.

In the following example:

- The `symcg set -name siteb` command sets the SRDF group name to `siteb`.
- The `symcg disable` command disables SRDF consistency protection at the composite-group level
- The `symcg enable` command enables SRDF consistency protection at the RDFG-name level.

```
symcg -cg MigrateRDF -rdfg 043:13 set -name siteb
symcg -cg MigrateRDF disable

A consistency 'Disable' operation execution is
in progress for composite group 'MigrateRDF'. Please wait...

The consistency 'Disable' operation successfully executed for
composite group 'MigrateRDF'.

symcg -cg MigrateRDF -rdfg name:siteb enable

A consistency 'Enable' operation execution is
```

```
in progress for composite group 'MigrateRDF'. Please wait...

The consistency 'Enable' operation successfully executed for
composite group 'MigrateRDF'.
```

Verifying the changes

Use the `symrdf query -detail` command to verify that the changes and additions were made to the SRDF/A configuration.

In the following example, SRDF consistency protection is now enabled using the SRDF group name of **siteb**.

```
symrdf -cg MigrateRDF query -detail

Composite Group Name       :  MigrateRDF
Composite Group Type       :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode       :  NONE

RDFG Names:
    {
    RDFG Name                            : siteb
    RDF Consistency Mode                 : MSC
    MSC Consistency Info:
        {
        Session Status                   : Active
        Consistency State                : Consistent
        }
    }
```

Step 3: Pairing devices

Create a device file to pair SRDF devices with the new non-SRDF devices.

Create a device file on page 107 provides more information.

This pairing is used temporarily to transfer data from the existing R1 devices to the devices that will eventually replace them in an SRDF pair.

In the following example, device file R1MigrateFile contains two pairs:

```
05A 005
056 006
```

R1 devices 05A and 056 in array 43 are paired with the new devices 005 and 006 in array 306.

Step 4: Establishing a concurrent SRDF relationship

The `symrdf migrate -setup` command establishes a concurrent SRDF relationship between the existing R1 devices and the new devices in adaptive copy disk mode, and begins the synchronization of these devices.

Note

It may be necessary to modify existing device group or composite group scripts to accommodate the temporary change of the existing R1 devices to R11 devices.

The `symrdf -migrate -setup -config` pair -force command establishes a concurrent SRDF relationship between the R1 devices in array 43 and the new devices in array 306 using SRDF group 17.

This is a temporary relationship to transfer data from the existing R1 to its replacement.

Using the -force option

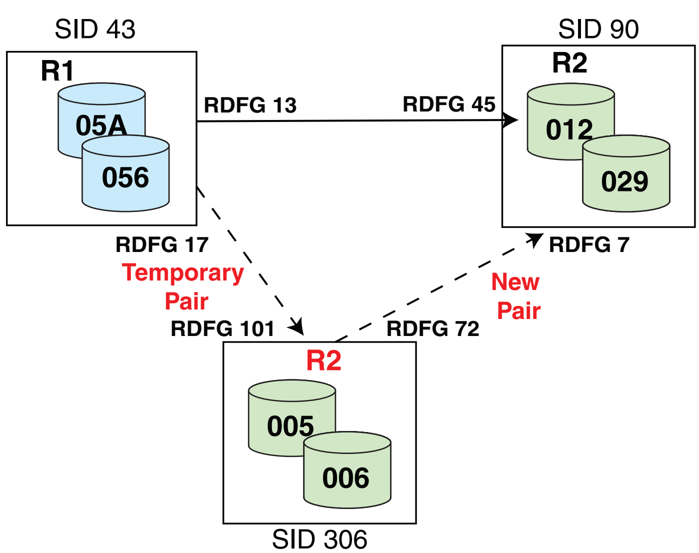
The `-force` option is used when SRDF consistency protection is enabled.

```
symrdf -sid 043 -rdfg 17 -f R1MigrateFile migrate -setup -config pair -force

An RDF 'Migrate Setup' operation execution is
in progress for device file 'R1migrateFile'. Please wait...

    Migrate Setup for R1 device(s) in (043,017).......................Started.
    Create RDF Pair in (0043,017)....................................Started.
    Create RDF Pair in (0043,017)....................................Done.
    Mark target device(s) in (0043,017) for full copy from source....Started.
    Devices: 06F0-06FF in (0043,017).............................. Marked.
    Mark target device(s) in (0043, 017) for full copy from source...Done.
    Merge track tables between source and target in (0043,017).......Started.
    Devices: 06F0-06FF in (0043,017).............................. Merged.
    Merge track tables between source and target in (0043,017).. ....Done.
    Resume RDF link(s) for device(s) in (0043,017)...................Started.
    Resume RDF link(s) for device(s) in (0043,017)...................Done.
    Migrate Setup for R1 device(s) in (0043,017) ....................Done.

The RDF 'Migrate Setup' operation finished successfully
for device file 'R1MigrateFile'.
```

Note

If the host is reading and writing to the R1 device during this action, a synchronized pair state may not be attainable because the pair is operating in adaptive copy disk mode.

Figure 114 Concurrent SRDF relationship



In the preceding image:

- Devices 05A and 056 are paired with devices 005 and 006 in a concurrent SRDF relationship using SRDF group 17.
- Devices 005 and 006 are made read/write on the SRDF links in adaptive copy disk mode.
- SRDF group 17 is used temporarily to transfer data from the R1 devices to the new devices.

Step 5: Replacing R1 devices with new devices

1. If consistency is enabled, use the `symcg disable` command to disable it.
   To disable SRDF consistency protection for composite group `MigrateRDF`:

   ```
   symcg -cg MigrateRDF -rdfg name:siteb disable

   A consistency 'Disable' operation execution is
   in progress for composite group 'MigrateRDF'. Please wait...

   The consistency 'Disable' operation successfully executed for
   composite group 'MigrateRDF'.
   ```

2. Terminate any TF/Mirror, TF/Snap, TF/Clone, Open Replicator, and Federated Live Migration sessions.
3. Use the `symrdf migrate -replace` command to set R1 (R11) device as USR-NR, complete the final synchronization of data between the existing and the new device, and reconfigure the devices into a new SRDF pair.
   The device pairings of the replaced devices are removed. The new devices become R1 devices paired with the existing R2 devices using the original SRDF mode of the replaced pair.

   Note

   The `migrate -replace R1` command waits for synchronization to finish and may take a long time. To avoid the locking of the SYMAPI database for this entire time, set the environment variable SYMCLI_CTL_ACCESS=PARALLEL. If you set this variable, you may need to run the `symcfg sync` command after the R1 migration is complete.

In the following example, the `migrate -replace R1` command specifies the new SRDF group 72 to reconfigure and connect the new R1 devices 005 and 006 in array 306 with the R2 devices 012 and 029 in Symmetix 90:

```
symrdf -sid 043 -rdfg 17 -f R1migrateFile migrate -replace r1 -config pair -new_rdfg 72

An RDF 'Migrate Replace R1' operation execution is
in progress for device file 'R1migrateFile'. Please wait...

    Migrate Replace R1 for new R1 device(s) in (0306, 072)...........Started.
    Waiting for invalid tracks to reach 0 in   (0043, 013)...........Started.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........Started.
    Waiting for invalid tracks to reach 0 in   (0043, 013)...........Done.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........915994 remaining.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........519572 remaining.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........245889 remaining.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........107613 remaining.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........1110 remaining.
    Waiting for invalid tracks to reach 0 in   (0043, 017)...........Done.
    Suspend RDF link(s) for device(s) in (0043,013)..................Started.
    Suspend RDF link(s) for device(s) in (0041,013)..................Done.
    Suspend RDF link(s) for device(s) in (0043,017)..................Done.
    Delete RDF Pair in (0043,013)....................................Started.
```

```
     Delete RDF Pair in (0043,017)....................................Started.
     Delete RDF Pair in (0043,013)....................................Done.
     Delete RDF Pair in (0043,017)....................................Done.
     Create RDF Pair in (0306,072)....................................Started.
     Create RDF Pair in (0306,072)....................................Done.
     Resume RDF link(s) for device(s) in (0306,072)...................Started.
     Merge track tables between source and target in (0306,072).......Started.
     Devices: 0690-069F in (0306,072)............................... Merged.
     Merge track tables between source and target in (0306,072).......Done.
     Resume RDF link(s) for device(s) in (0306,072)...................Done.
     Migrate Replace R1 for new R1 device(s) in (0306, 072)...........Done.

The RDF 'Migrate Replace R1' operation finished successfully
for device file 'R1migrateFile'.
```

After replacing the R1 devices:

- Recreate your device groups and/or composite groups,
- Possibly update your scripts, since the devices are no longer concurrent SRDF.
- Recreate any TF/Mirror, TF/Snap, TF/Clone, Open Replicator, and Federated Live Migration sessions (used on the original R1 devices) on the new R1 devices.

In the following example, the `MigrateRDF` consistency group is deleted and re-created:

- The `symcg delete` command deletes the `MigrateRDF` consistency group.
- The `symcg create` command recreates `MigrateRDF` as an RDF1 with consistency.
- The `symcg addall dev` command add devices `MigrateRDF`.
- The `symcg enable` command enables consistency protection.

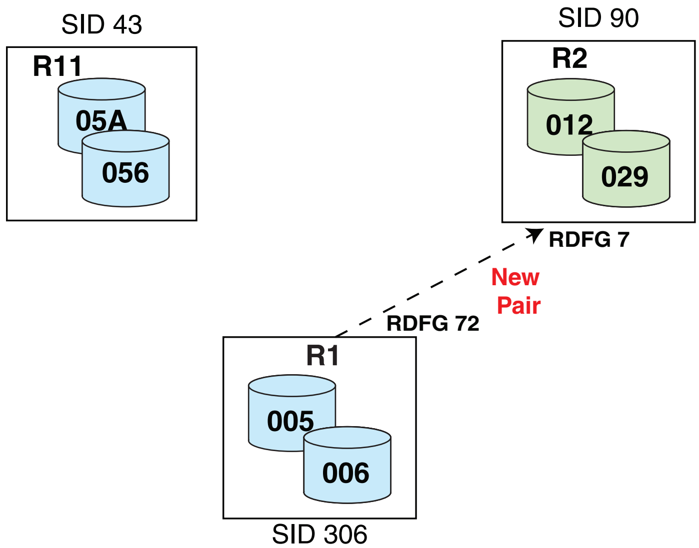
```
symcg -force delete MigrateRDF
symcg create MigrateRDF -type rdf1 -rdf_consistency
symcg -cg MigrateRDF -sid 306 -rdfg 72 addall dev
symcg -cg MigratRDF enable

A consistency 'Enable' operation execution is
in progress for composite group 'MigrateRDF'. Please wait...

The consistency 'Enable' operation successfully executed for
composite group 'MigrateRDF'.
```

When migration is complete (as shown in the following image):

- SID 306 devices are the R1 devices.
- SID 306 devices are paired with the R2 devices in SID 90.

This new SRDF pair uses the original SRDF mode of the replaced pair.

Figure 115 Migrated R1 devices



Step 6: Verifying the new pair and setting changes

Use the `symrdf query -detail` to verify that:

- The SID 306 devices are now the source devices for SID 90,
- Consistency protection is rebuilt.

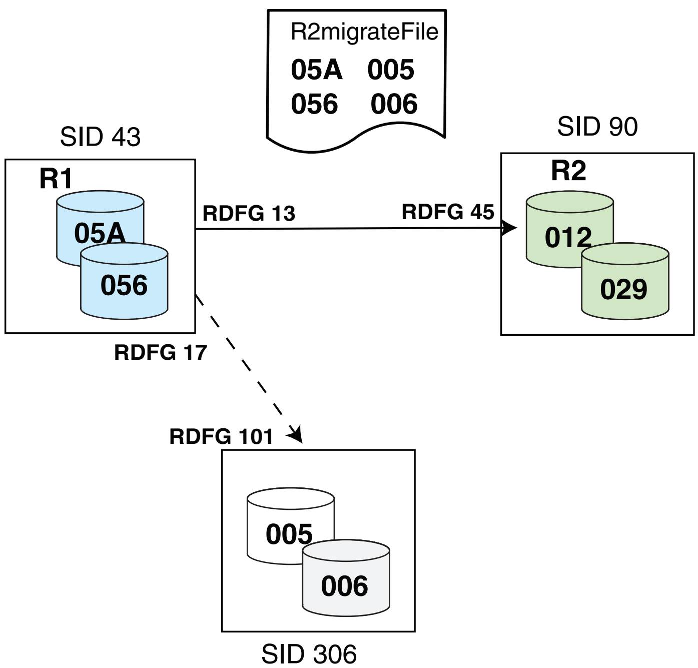
```
symrdf -cg MigrateRDF query -detail

Composite Group Name       :  MigrateRDF
Composite Group Type       :  RDF1
Number of Symmetrix Units :  1
Number of RDF (RA) Groups :  1
RDF Consistency Mode       :  MSC

RDFG MSC Consistency Info:{
      Session Status                  : Active
      Consistency State               : CONSISTENT
    }

Symmetrix ID                      : 000190100306 (Microcode Version: 5876)
Remote Symmetrix ID               : 000192600090 (Microcode Version: 5876)
RDF (RA) Group Number             :   3 (02) - siteb
RDFA Info:
    {
    Cycle Number                      : 3
    Session Status                    : Active - MSC
    Consistency Exempt Devices        : No
    Minimum Cycle Time                : 00:00:30
    Avg Cycle Time                    : 00:00:33
    Duration of Last cycle            : 00:00:30
    Session Priority                  : 33
    Tracks not Committed to the R2 Side: 0
    Time that R2 is behind R1         : 00:00:34
    R2 Image Capture Time             : Mon Sep 21 13:52:03 2015
    R2 Data is Consistent             : True
    R1 Side Percent Cache In Use      : 0
    R2 Side Percent Cache In Use      : 0
    R1 Side DSE Used Tracks           : 0
    R2 Side DSE Used Tracks           : 0
    Transmit Idle Time                : 00:00:00
    }
```

```
        Source (R1) View             Target (R2) View        MODES
--------------------------------  ------------------------- ----- ------------
              ST                 LI       ST
  Standard     A                  N        A
Logical  Sym   T  R1 Inv  R2 Inv  K        T  R1 Inv  R2 Inv       RDF Pair
Device   Dev   E  Tracks Tracks   S Dev    E  Tracks  Tracks MDACE STATE
--------------------------------- -- ------------------------ ----- ------------
DEV001   00005 RW       0       0 RW 00012 WD       0       0 A..X. Consistent
DEV002   00006 RW       0       0 RW 00029 WD       0       0 A..X. Consistent

Total            -------- -------           -------- -------
  Track(s)              0       0                  0       0
  MBs                 0.0     0.0                0.0     0.0
```

Sample procedure: migrating R2 devices

In this migration example, the devices in array 306 will become the R2 devices for array 43.

Figure 116 R2 migration example: Initial configuration



The preceding example shows the R1 and R2 relationship between array 43 and array 90.

Step 1: Pairing devices

Create a device file to pair SRDF devices with the new non-SRDF devices.

Create a device file on page 107 provides more information.

In the following example, device file R2MigrateFile contains two pairs:

```
05A 005
056 006
```

When migration is complete, R1 devices 05A and 056 in array 43 will be paired with the new devices 005 and 006 on array 306.

Step 2: Establishing a concurrent SRDF relationship

The `symrdf migrate -setup` command establishes a concurrent SRDF relationship between the existing R1 devices and the new devices in adaptive copy disk mode, and begins the synchronization of these devices.

Because this is an R2 migration, the R1 continues to process I/Os from its host, and synchronization is not required between the R1 and the new device.

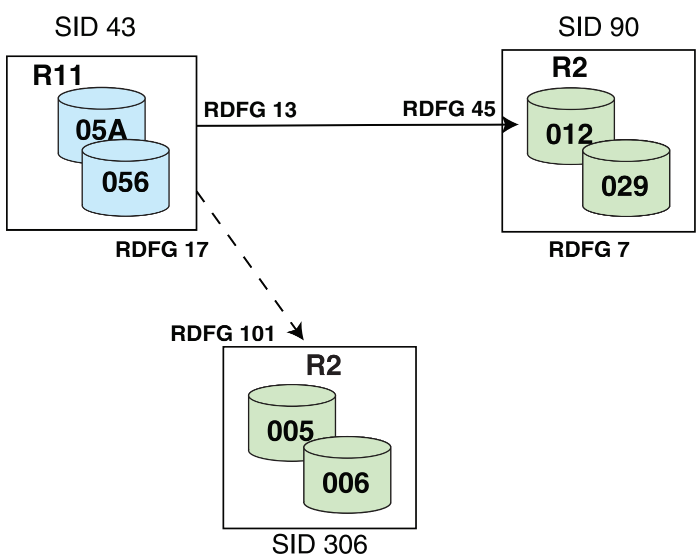
Note

You may need to modify existing device group or composite group scripts to accommodate the temporary change of the existing R1 devices to R11 devices.

The `symrdf migrate -setup -config` pair command establishes a concurrent SRDF relationship between the R1 devices 05A and 056 in array 43 and the new devices 005 and 006 in array 306 using SRDF group 17:

```
symrdf -file R2migrateFile -sid 043 -rdfg 17 migrate -setup -config
pair
```

Figure 117 Concurrent SRDF relationship



In the preceding example:

- Devices 05A and 056 are paired with devices 005 and 006 in a concurrent SRDF relationship using the SRDF group 17,
- Devices 005 and 006 are made read/write on the SRDF links in adaptive copy disk mode.
  Unlike an R1 device migration, the SRDF group 17 is permanent, and synchronizes data from the source to the target devices.

Step 3: Replacing R2 devices with new devices

1. If SRDF consistency protection is enabled, disable it.
2. Terminate any TF/Mirror, TF/Snap, TF/Clone, Open Replicator, and Federated Live Migration sessions.
3. Use the `symrdf migrate -replace R2` command to delete the SRDF pairing between array 43 and array 90.

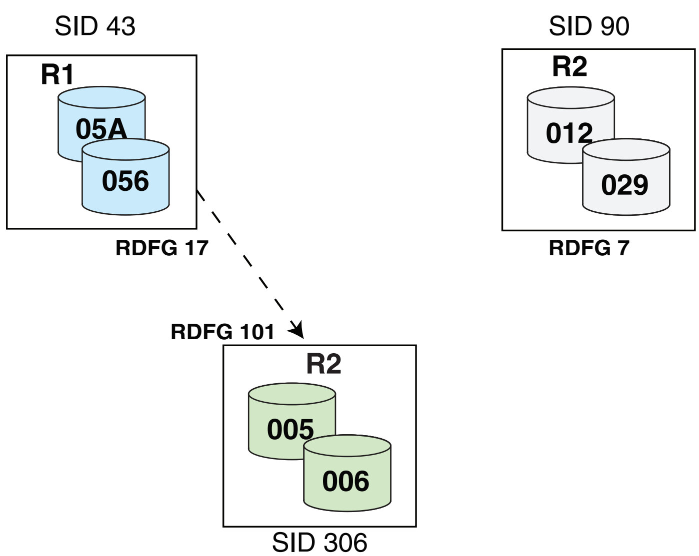
Note

After replacing R2, you must modify device groups and/or composite groups to remove all BCVs, VDEVS, TGTs from the original R2 and then add appropriate counterparts to the new R2. You must also recreate any TF/Mirror, TF/Snap, TF/Clone, Open Replicator, and Federated Live Migration sessions on the new R2.

In the following example, the `symrdf migrate -replace R2 -config pair` command uses the SRDF group 17 to reconfigure and connect the R1 devices 05A and 056 with the new R2 devices 005 and 006:

```
symrdf -file R2migrateFile -sid 043 -rdfg 17 migrate -replace R2 -
config pair
```

Figure 118 Migrated R2 devices



When migration is complete, the array 306 devices become the R2 devices and are paired with the R1 devices in Symmetix 43.

This new pair uses the original SRDF mode of the replaced pair.

SRDF pair states for migration

An existing R1 and R2 pair must in a specific SRDF state to perform certain migration control operations.

The following table lists the applicable pair states for `symrdf migrate -setup` for an R1 and an R2 migration.

Table 41 SRDF migrate -setup control operation and applicable pair states

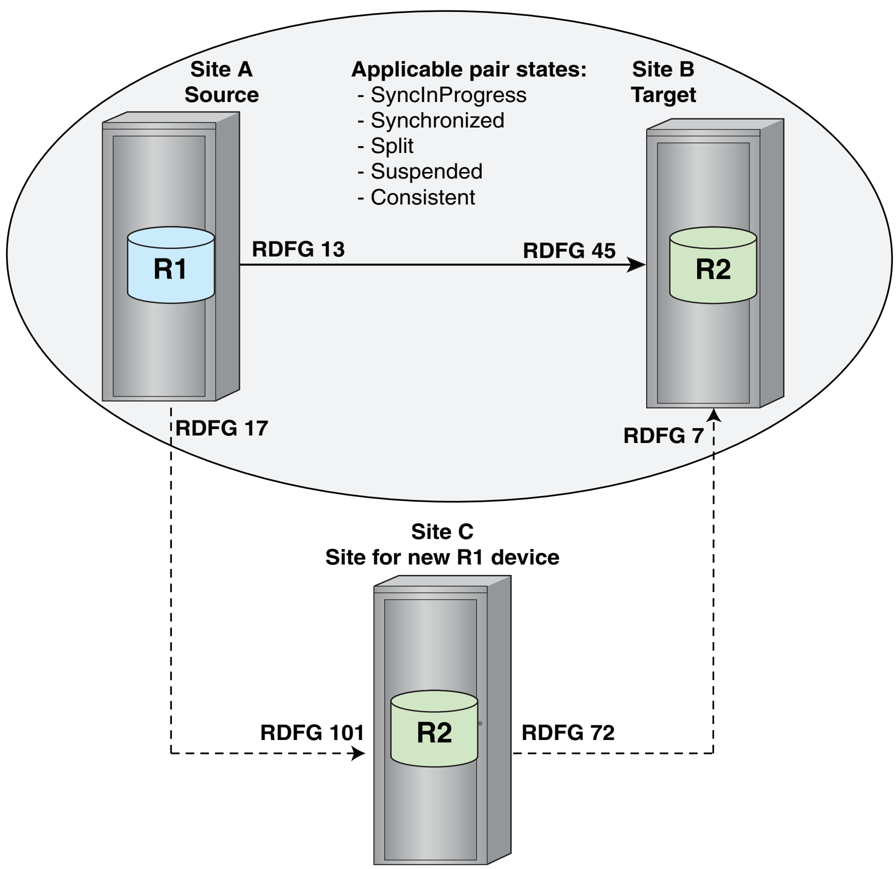
Control operation:	Pair state: existing R1->R2											
	SyncInProg	Syncronized	Split	Suspended	Failed over	Partitioned1 [a]	Partitioned2 [b]	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
migrate -setup	P	P	P[c]	P[c]							P	

a. The remote array is in the SYMAPI database (it was discovered).
b. The remote array is not in the SYMAPI database (it was not discovered or was removed).
c. Only when replacing the R2 devices.

Pair states for migrate -setup

The following image shows a sample configuration for an R1 migration:

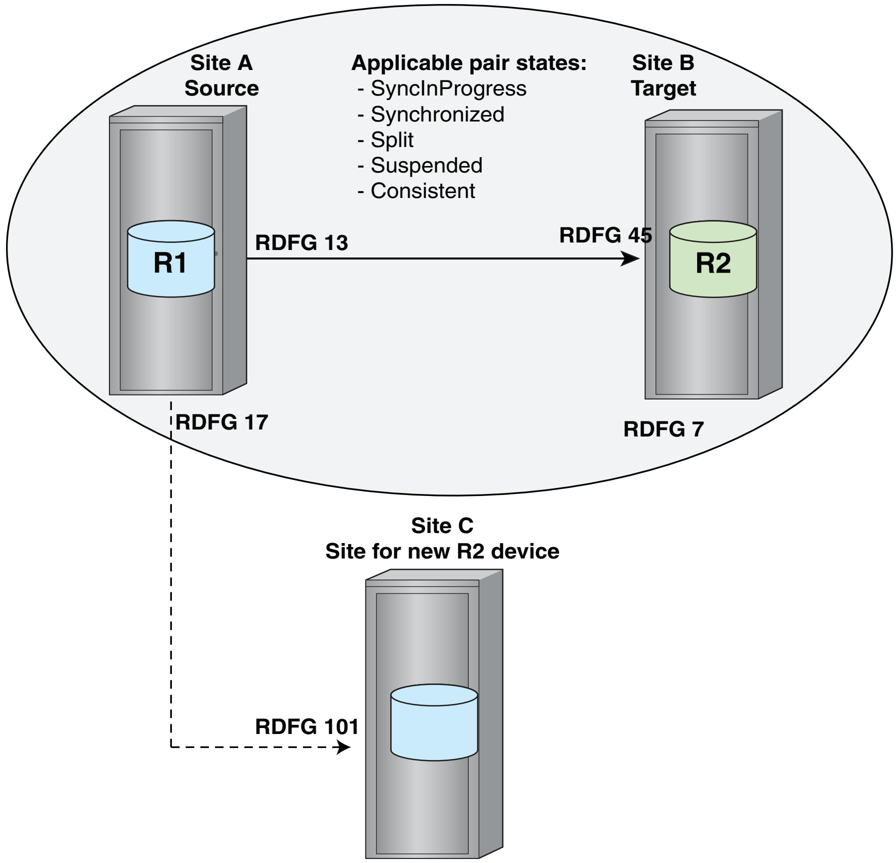
Figure 119 R1 migration: applicable R1/R2 pair states for migrate -setup



The R1 in array A and the R2 in array B must be in one of the applicable pair states before issuing the `symrdf migrate -setup` command, which establishes a concurrent SRDF relationship among the three sites.

The following image shows a sample configuration for an R2 migration:

Figure 120 R2 migration: applicable R1/R2 pair states for migrate -setup



The R1 in array A and the R2 in array B must be in one of the applicable pair states before issuing the `symrdf migrate -setup` command, which establishes a concurrent SRDF relationship among the three sites.

Pair states for migrate -replace for first leg of concurrent SRDF

Figure 121 on page 399 shows the SRDF pair state required before replacing an R1, the R11 and its existing device.

Figure 122 on page 400 shows the SRDF pair state required when replacing R2, the R11 and its existing R2 device. For the purpose of this discussion, this is the first leg of the concurrent SRDF relationship for both R1 and R2 migrations.

The following table lists the applicable pair states for `symrdf migrate -replace` for an R1 and an R2 migration.

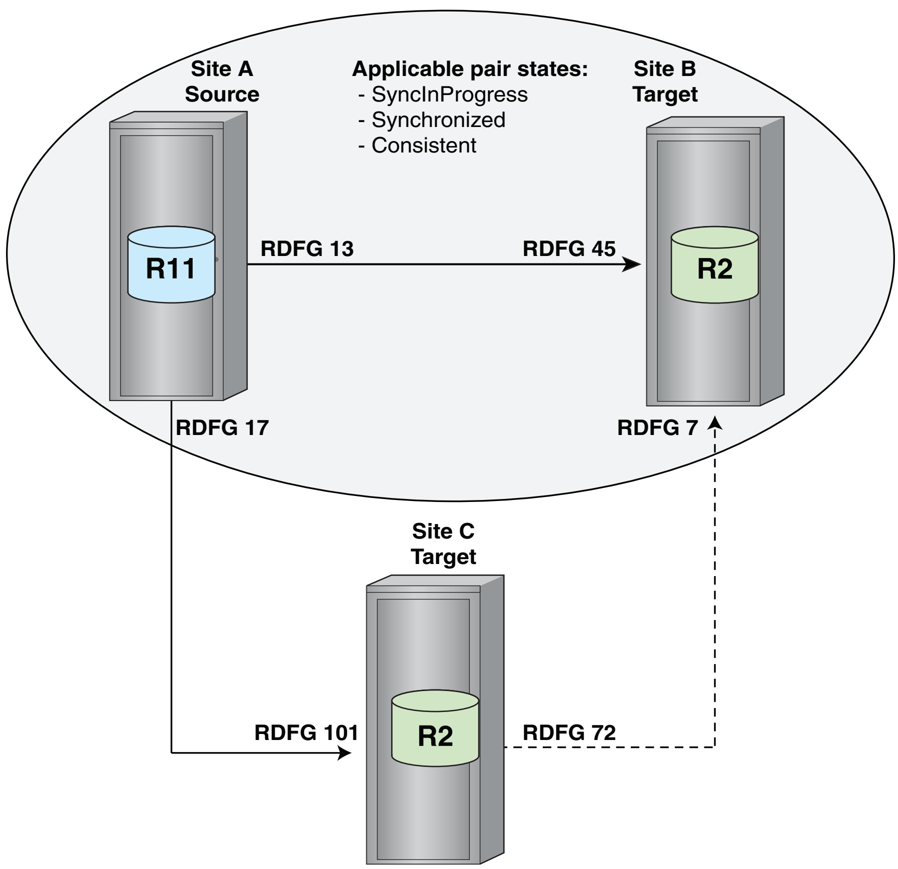
Table 42 SRDF migrate -replace control operation and applicable pair states

Control operation:	Pair state: Existing ->R2											
	SyncInProg	Syncronized	Split	Suspended	Failed over	Partitioned1 [a]	Partitioned2 [b]	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
migrate -replace	P	P	P	P							P	

a. The remote array is in the SYMAPI database (it was discovered).
b. The remote array is not in the SYMAPI database (it was not discovered or was removed).

The following image shows a sample concurrent SRDF configuration for an R1 migration:.

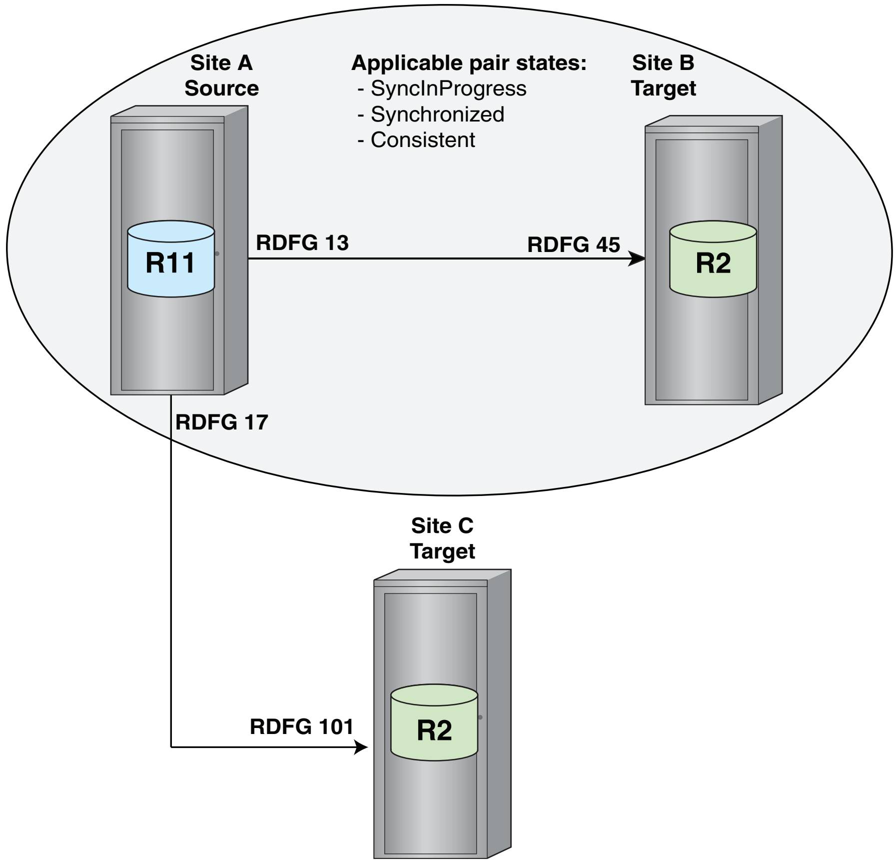
Figure 121 R1 migration: R11/R2 applicable pair states for migrate -replace (first leg)



The R11 in array A and the R2 device in array B must be in one of the applicable pair states before issuing the `symrdf migrate -replace` command.

The following image shows a sample concurrent SRDF configuration for an R2 migration:

Figure 122 R2 migration:R11/R2 applicable pair states for migrate -replace (first leg)



The R11 in array A and the R2 device in array B must be in one of the states before issuing the `symrdf migrate -replace` command

Pair states for migrate -replace for second leg of concurrent SRDF

Before replacing an R1, the R11 and its replacement device must in a specific SRDF pair state shown in Figure 123 on page 401. This temporary pairing was used to perform the concurrent SRDF data transfer to the new device. When replacing R2, the R11 and the new R2 device (new pair) must also be in a certain pair state shown in Figure 124 on page 402.

The following table lists the applicable pair states for `symrdf migrate -replace` for an R1 and an R2 migration.

Table 43 SRDF migrate -replace control operation and applicable pair states

Control operation:	Pair state: Temporary or New ->R2											
	SyncInProg	Syncronized	Split	Suspended	Failed over	Partitioned1 [a]	Partitioned2 [b]	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
migrate -	P	P									P	

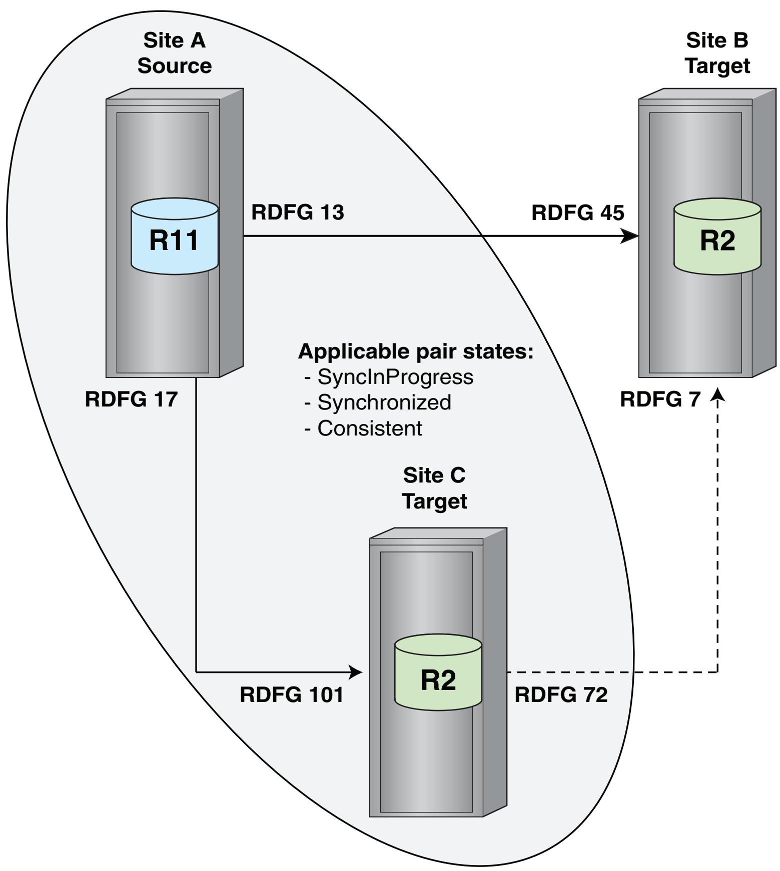
Table 43 SRDF migrate -replace control operation and applicable pair states

Control operation:	Pair state: Temporary or New ->R2											
	SyncInProg	Syncronized	Split	Suspended	Failed over	Partitioned1 [a]	Partitioned2 [b]	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle
replace												

a. The remote array is in the SYMAPI database (it was discovered).
b. The remote array is not in the SYMAPI database (it was not discovered or was removed).

The following image shows a sample concurrent SRDF configuration for an R1 migration.

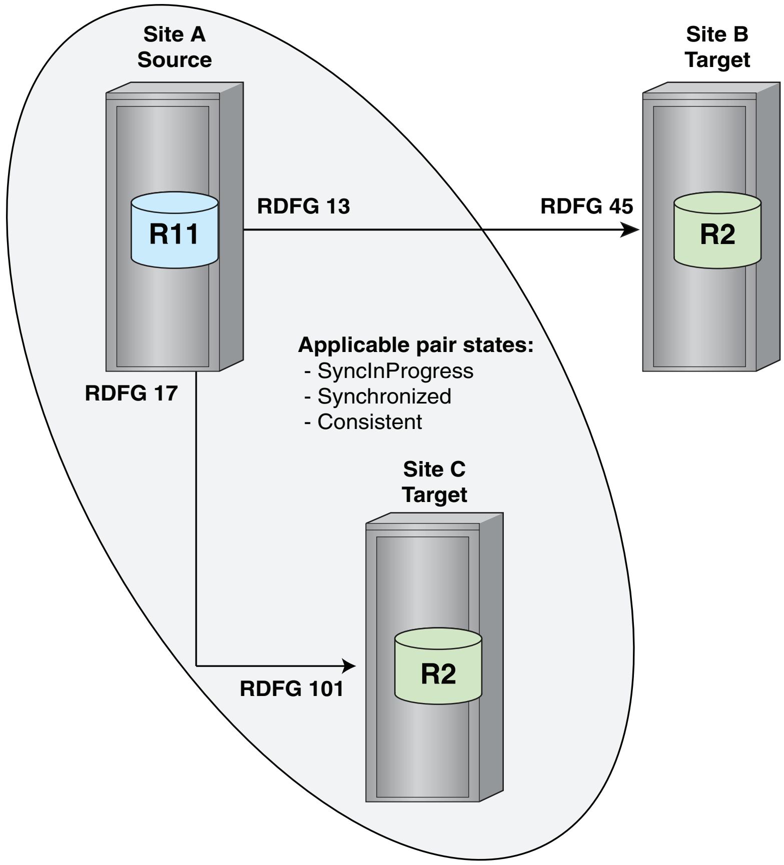
Figure 123 R1 migration: applicable R11/R2 pair states for migrate -replace (second leg)



The R11 device in array A and the R2 device in array C must be in one of the applicable pair states before issuing the `symrdf migrate -replace` command.

The following image shows a sample concurrent SRDF configuration for an R2 migration:

Figure 124 R2 migration: applicable R11/R2 pair states for migrate -replace (second leg)



The R11 in array A and the R2 device in array C must be in one of the states before issuing the `symrdf migrate -replace` command.

CHAPTER 11

SRDF/Automated Replication

This chapter describes the following topics:

SRDF/Automated Replication overview

SRDF/Automated Replication (SRDF/AR) provides a long-distance disaster restart solution. SRDF/AR can operate:

- In two-site topologies that use SRDF/DM in combination with TimeFinder.
- In three-site topologies that use a combination of SRDF/S, SRDF/DM, and TimeFinder.
  Three-site topologies operate in synchronous mode in the first hop and in adaptive copy mode in the second hop.

  Note

  Multi-hop SRDF/AR requires Enginuity version 5876.159.102 or higher.

SRDF/AR provides automated consistent replication of data from standard devices and RDF1 BCV devices over SRDF links to remote SRDF pairs.

SRDF/AR is invoked using the `symreplicate` command.

- `symreplicate` supports single-hop and multi-hop SRDF configurations.
- You can start, stop, or restart a `symreplicate` session without degrading the data copy.
- You can set up a concurrent BCV to have access to an independent copy of the replicating data during a `symreplicate` session.

By default, the `symreplicate` replication process is performed in the background.

Restrictions: SRDF/Automated Replication

- SRDF/AR is not supported with SRDF/Metro.
- SRDF/AR does not support SRDF/Asynchronous-capable devices.
- The `symreplicate` command operates on device groups and composite groups. Scope for the `symreplicate` command cannot be limited to a specific SRDF group using the `-rdfg` option.
- When running `symreplicate` against device groups and composite groups of type ANY:
  - Concurrent SRDF devices are not supported for device groups (DG) or composite groups (CG).
  - The following combinations of standard devices are supported when using the `-consistent` option:
    - All STDs are non-SRDF
    - All STDs are R1 devices
    - All STDs are R2 devices
    - STDs contain a mixture of R1s and non-SRDF devices
    - STDs contain a mixture of R2 and non-SRDF devices

Note

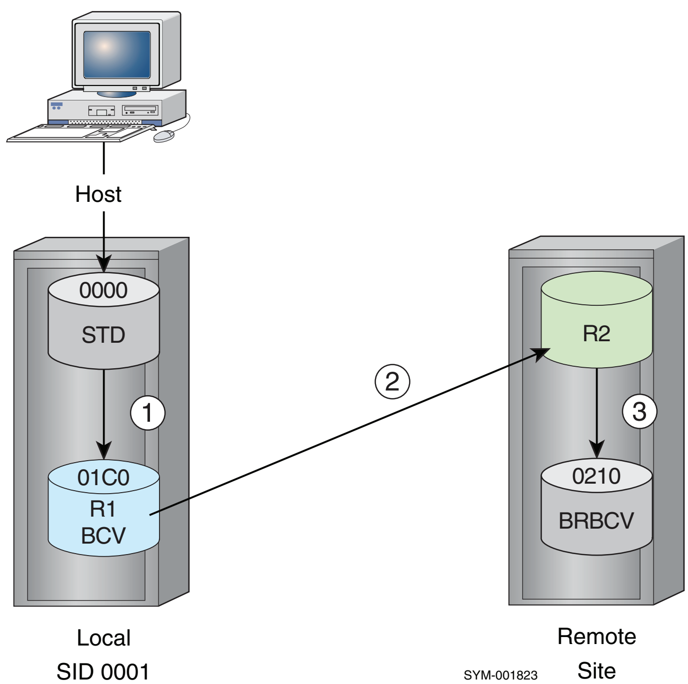
Device external locks in the array are held during the entire `symreplicate` session. Locks are necessary to block other applications from altering device states while the session executes. Manage locked devices on page 424 provides more information.

SRDF/Automated Replication operations

Configure single-hop sessions

The following image shows how **`symreplicate`** copies data in a single-hop configuration for a complete copy cycle:

Figure 125 Automated data copy path in single-hop SRDF systems



The copy process includes the following steps:

1. From the standard device to the BCV of the local array.
2. From the BCV device of the local array to the standard device of the remote array.
3. From the remote standard device to its BRBCV device.

Before you begin: setting the hop type parameter

You must set the replication type parameter in the replicate options file before you can configure a single-hop `symreplicate` session.

Setting the symreplicate control parameters on page 420 provides more information.

Set the parameter as follows:

```
SYMCLI_REPLICATE_HOP_TYPE=SINGLE
```

The `symreplicate` session:

- Incrementally establishes SRDF and BCV pairs, and
- Differentially splits BCV pairs to reduce data transfers.

Setting up single-hop data replication

To set up a single-hop `symreplicate` session:

Procedure

1. Select any number of standard devices of the same type (R1, R2, or non-SRDF).
2. Use the `symdg create` command to create a device group or composite group of the same type.

```
symdg create newdg
```

3. Use the `symdg add dev` command to add the devices to the device group.

```
symdg add dev 0000 -g newdg -sid 35002
symdg add dev 0001 -g newdg
```

4. Use the `symbcv associate` command to associate an equal number of R1-BCV devices of matching sizes.

```
symbcv associate dev 01C0 -g newdg
symbcv associate dev 01C1 -g newdg
```

5. Use the `symbcv associate` command to associate an equal number of BRBCV devices (remote BCVs), also of matching sizes.

```

symbcv associate dev 0210 -g newdg -bcv -rdf
symbcv associate dev 0211 -g newdg -bcv -rdf
    .
    .
    .
```

Note

The `symreplicate`command uses composite groups (`-cg`) to implement single-hop or multi-hop configurations for devices that span multiple arrays.

The following must be true before you start a `symreplicate` session:

- Both sets of BCV pairs must have a pairing relationship.
- The local BCV pairs must be established.
- The SRDF pairs must be in the Suspended pair state.
- The remote BCVs (BRBCVs) must be in the split pair state.
- No writes are allowed to the BRBCV by any directly attached host at the remote site.

Setting up pair states automatically

You can set up the required pair state pair for SRDF/AR automatically using either:

- `symreplicate setup` command
- `symreplicate start` command with the `-setup` option

Auto-replication setup sets up the required pair states for devices and executes one copy (auto-replication) cycle.

Setting up the device states ahead of time reduces replication processing time.

The `setup` commands execute one cycle of the `symreplicate` session (regardless of the number of cycles defined in the options file), and then exits.

The default setup operation provides no I/O optimization, and does not engage any special algorithm changes in the selection of pair assignments. For standard devices encountered without BCVs, the first unassigned BCV device found is paired with the standard.

Setup operations correct only pair states of devices in the group. If a BCV in the group is paired with a standard device outside of the group, setup does not correct it.

The setup command does not exit until the devices are in the required pair state to run the `symreplicate` session. This may take some time.

Note

Optionally, you can manually reproduce the single-hop replication cycle using a sequence of SRDF and TimeFinder CLI commands.

The following topics provide more information:

- Setting up single hop manually on page 408
- Setting up multi-hop manually on page 411
- Setting the symreplicate control parameters on page 420

Examples

To execute the`symreplicate setup`command on a device group (`DevGrp1`) using an options file (`OpFile`):

```
symreplicate -g DevGrp1 setup -options Opfile
```

The first cycle of the `symreplicate start -setup` command puts the devices into the required pair state.

To execute the `symreplicate start` command with the `-setup` option:

```
symreplicate -g DevGrp1 start -options Opfile -setup
```

-exact option

Use the `-exact` option to start the `symreplicate` session with the STD-BCV pair relationships in the exact order that they were associated/added to the device group or composite group.

-optimize option

Use the `-optimize` option in conjunction with the `-setup` option or the `setup` argument to optimize the disk I/O on standard/BCV pairs in the device or composite group.

The `-optimize` option splits all pairs and performs an optimized STD-BCV pairing within the specified group.

If you use the `-optimize` option with device groups, the device pair selection attempts to distribute I/O by pairing devices in the group that are not on the same disk adapter.

Note

Single-hop replication does a full optimization on all RA groups.

Syntax

Use the `-optimize` option with composite groups to specify the same pairing behavior for an RA group.

Use the `-optimize_rag` option with either the `-setup` option or the `setup` argument to configure pair assignments for RA groups that provide remote I/O optimization (distribution by using different remote disk adapters).

Examples

```
symreplicate setup -g DgName -optimize
```

```
symreplicate setup -cg CgName -optimize_rag
```

symreplicate consistent split option

Use the `-consistent` option with the `start` action to:

- Consistently split all of the BCV pairs on the local array in a typical SRDF configuration
- Consistently split all of the BCV pairs on the Hop 1 remote array in a multi-hop configuration.
  Consistent split operations are automatically retried if the split fails to complete within the allotted window. If a consistent split operation fails due to the consistency timing window closing before the split can complete `(SYMAPI_C_CONSISTENCY_WINDOW_CLOSED)`:
- The first-hop local BCV device pairs are automatically resynchronized, and
- The split operation is reattempted.

The consistent split error recovery operation is attempted the number of times specified in the `SYMCLI_REPLICATE_CONS_SPLIT_RETRY` file parameter, defined in the replicate options file.

If a value is not specified, then the recovery operation is attempted 3 times before terminating the `symreplicate` session.

Setting the symreplicate control parameters on page 420 provides more information.

Setting up single hop manually

To manually reproduce the single-hop replication cycle using a sequence of SRDF and TimeFinder CLI commands:

Procedure

1. Wait for any ongoing establish to complete.
2. Split the BCV pairs:

```
symmir split -g newdg
```

3. Establish the SRDF pairs:

```
symrdf establish -g newdg -bcv
```

4. Wait for any ongoing establish to complete.
5. Suspend the SRDF pairs:

```
symrdf suspend -g newdg -bcv
```

6. Establish the BCV pairs:

```
symmir establish -g newdg -exact
```

7. Establish the remote BRBCV pairs:

```
symmir establish -g newdg -bcv -rdf -exact
```

8. Wait for any ongoing establish to complete.
9. Split the remote BRBCV pairs:

```
symmir split -g newdg -bcv -rdf
```

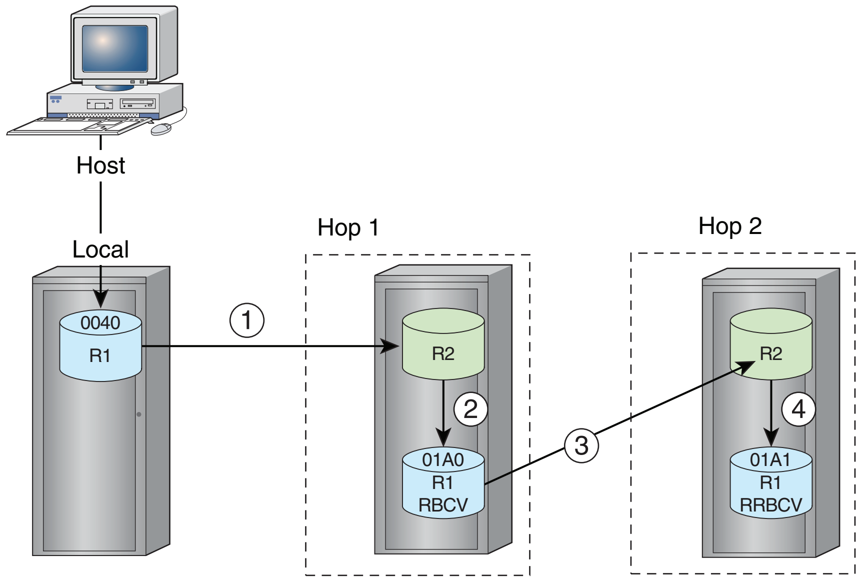
Note

You may have to include additional command options in some of the above steps (for example, `establish -full` for BCV pairs without relationships).

Configure multi-hop sessions

The following image shows a complete **`symreplicate`** copy cycle in a multi-hop configuration:

Figure 126 Automated data copy path in multi-hop SRDF



Data copy paths in the image above are:

1. From the local standard device to a standard device on the array at Hop 1
2. From the Hop 1 standard device to its BCV (RBCV)
3. From the RBCV device at Hop 1 to the standard device on the array at Hop 2
4. From the Hop 2 standard device to its BCV (RRBCV)
   Path 2d requires a BCV in the array at Hop 2. The BCV must not be disabled.

Before you begin: setting the hop type and use final parameters

Set the replication type parameter in the replicate options file before you configure a multi-hop `symreplicate` session.

Set the parameter as follows:

```
SYMCLI_REPLICATE_HOP_TYPE=MULTI
```

Set the replication use final BCV parameter in the replicate options file to `FALSE` to prevent the final Hop 2 BCV from being updated:

```
SYMCLI_REPLICATE_USE_FINAL_BCV=FALSE
```

Setting the symreplicate control parameters on page 420 provides more information.

Setting up for a multi-hop configuration

To set up a multi-hop `symreplicate` session:

Procedure

1. Use the `symdg create` command to create an R1 device group (`-g`) or composite group (`-cg`).

   ```
   symdg create newdg2 -type RDF1
   ```

2. Use the `symdg add dev` command to add any number of R1 devices.

```
symdg add dev 0040 -g newdg2 -sid 0001
```

3. Use the `symdg add dev` command to remotely associate an equal number of matching sized R1-BCVs or Hop 1 RBCV devices.

```
symbcv associate dev 01A0 -g newdg2 -rdf
symbcv associate dev 01A1 -g newdg2 -rrdf
```

The following must be true before you start a `symreplicate` session without a setup operation:

- The local SRDF pairs must be synchronized
- The BCV pairs must be established
- The remote SRDF pairs must be suspended.
- If the final BCVs in the second-hop array are used, the BCVs must be in the split state.

Device pair state can be configured automatically using the `symreplicate setup` command or the `-setup` option with the `symreplicate start` command.

Setting up pair states automatically on page 406 provides more information.

Setting up multi-hop manually

To manually reproduce the multi-hop replication cycle using a sequence of SRDF and TimeFinder CLI commands:

Procedure

1. Wait for any ongoing establish to complete.
2. Split the BCV pairs (2b in Figure 126 on page 410):

```
symmir split -g newdg2 -rdf -remote
```

The `-remote` option specifies that the remote SRDF pairs establish.

3. Wait for the establish to complete.
4. Suspend the remote SRDF pairs (2c in Figure 126 on page 410), and establish the BCV pairs (2b in Figure 126 on page 410):

```
symmir establish -g newdg2 -rdf -exact
```

5. Use either a device file or the `-rrbcv` option to establish the BCV pairs in the second hop (2d in Figure 126 on page 410):

```
symmir establish -f 2nd_hop_devs.txt -sid SymmID
```

or

```
symmir establish -g newdg2 -rrbc
```

Note

To use the `-rrbcv` option, the SRDF BCV devices must have been previously associated with the group, using `symbcv -rrdf`

6. Wait for any ongoing establish to complete.
7. Split the 2nd hop BCV pairs:

```
symmir split -f 2nd_hop_devs.txt
```

or

```
symmir split -g newdg2 -rrbcv
```

Perform Steps 5 and 7 when you want to use the final hop 2 BCVs in the replicate cycle.

Optionally, use the `-preaction` and `-postaction` options to specify scripts for `symreplicate` to run before and after splitting the BCVs (step 2).

Note

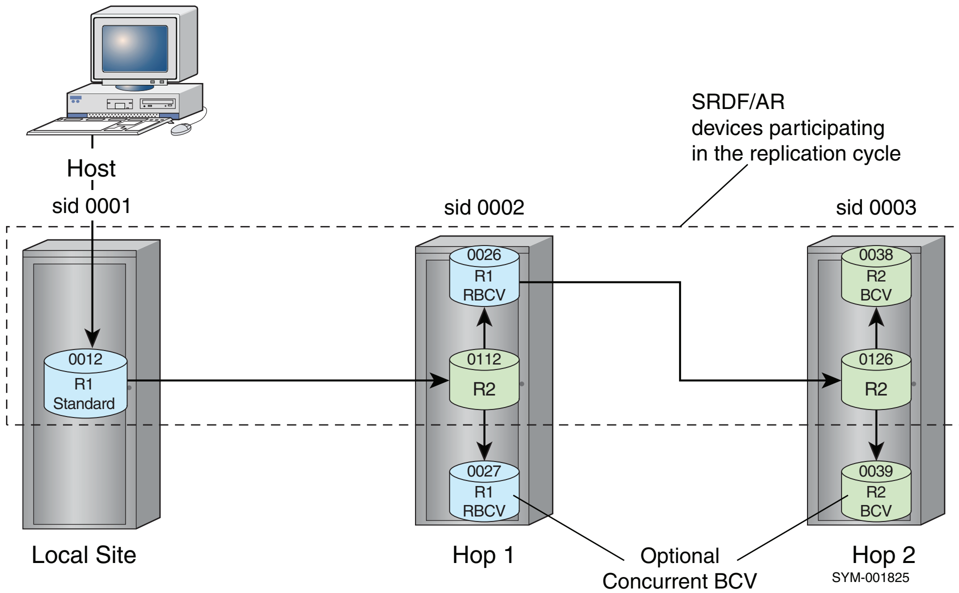
You may have to include additional command options in some of the above steps (such as `establish -full` for BCV pairs without relationships).

Concurrent BCVs with SRDF/AR

Set up concurrent BCVs if you need an independent copy of your data during a replication cycle.

- One BCV copy is associated with the SRDF/AR device group and
- The other BCV copy is not.
  The BCV not associated with the replication cycle receives the same data as the one associated with the SRDF/AR devices. This BCV can be accessed by its host during the `symreplicate` cycle.

Figure 127 Concurrent BCV in a multi-hop configuration



In the image above, Devices 0027 and 0039 are not part of the SRDF/AR copy cycle.

To access these devices from the production host during the SRDF/AR copy cycle, you must define separate device files on the host that include the standard R2 device and the R2 BCV on Hop 1 and Hop 2.

The device files are used to establish the BCV pairs, split BCV pairs, and access the BCV devices.

Setting replication cycle parameters

You can manipulate the replication cycle patterns to fit your needs by setting the following parameters in the symreplicate options file:

Parameters

SYMCLI_REPLICATE_CYCLE=*CycleTime*

CycleTime is a timer that specifies the period of time in minutes or *hours:minutes (hh:mm)* between when each copy action starts and when it starts again (how often the copy reoccurs). For example, a *CycleTime* of 120 would initiate a new copy every 2 hours.

SYMCLI_REPLICATE_NUM_CYCLES= *NumCycles*

NumCycles specifies the number of replication cycles (copies) to perform before `symreplicate` exits. For example, a value of zero (the default) results in continuous cycling until the `symreplicate stop` command is issued.

SYMCLI_REPLICATE_CYCLE_DELAY= *Delay*

Delay specifies the minimum amount of time to wait between the end of one copy cycle and the beginning of the next. For example, a *Delay* of 20 would always force a wait of 20 minutes or more between cycles.

SYMCLI_REPLICATE_CYCLE_OVERFLOW= *OvfMethod*

OvfMethod specifies the behavior when the actual copy time of data and/or data transfer is so large that it exceeds the *CycleTime* value. The initial copy event has overflowed into the period that should be for the next copy cycle. Possible behavior values are:

- `IMMEDIATE` — When overflowed, starts a new cycle immediately after the current copy finishes.
- `NEXT` — When overflowed, waits for the copy to finish, and then starts at the next expiration time (*CycleTime*). (Starts the copies on multiples of the *CycleTime* parameter.)

Example

For example, if a 1-hour copy cycle completed in 1.5 hours, the next cycle could be set to begin immediately (`IMMEDIATE`) or in half an hour (`NEXT`).

Set the first time cycle parameters

You may not have enough information to set the exact cycle time parameters when you first create the SRDF configuration.

Best practice

- Start the `symreplicate` session with the basic parameters set.
- Use `symreplicate query` to monitor session progress, and record the timing results of the initial copies.
- Adjust the various timing parameters to best accommodate the copy requirements for your needs.
  The following table lists two parameter setups for an initial `symreplicate` session trial:

Table 44 Initial setups for cycle timing parameters

SYMCLI_REPLICATE_CYCLE=60 SYMCLI_REPLICATE_CYCLE_DELAY=0 SYMCLI_REPLICATE_CYCLE_OVERFLOW=NEXT	Every hour if possible, or every 2, or 3 hours based on data throughput and size.
SYMCLI_REPLICATE_CYCLE=0 SYMCLI_REPLICATE_CYCLE_DELAY=60	Cycle through the first copy, then wait 60 minutes (delay), and then another cycle, delay, and so on.

View cycle time and invalid track statistics

Syntax

Use the `symreplicate stats` command to display statistical information for cycle time and invalid tracks.

Use the command to display cycle time and invalid tracks for a specified:

- Device group (-g)
- Composite group (-cg)
- Symmetrix ID (-sid)

Options

-log

Write information to a specified log file.

-cycle

Display only cycle time statistics for the last SRDF/AR cycle time, the maximum cycle time and the average cycle time.

-itrks

Display only invalid track statistics for the last SRDF/AR cycle, the maximum invalid tracks and the average number of invalid tracks per SRDF/AR cycle.

-all

(default) Display both the cycle time and invalid tracks statistics.

Example

To display both cycle time and invalid track statistics for device group `srdfar` on SID 1123:

```
symreplicate -g srdfar -sid 123 -all stats

Group Name: srdfar

Cycle Time (hh.mm.ss):
---------------------------------------
Last Cycle Time:  06:10:01
Max Cycle Time:   08:00:00
Avg Cycle time:   06:00:00

Invalid Tracks:
---------------------------------------
Last Cycle:  12345 ( 9055.5 MB)
Maximum:     10780 ( 8502.3 MB)
Average:     11562 ( 7500.0 MB)
```

Log symreplicate steps

To track the steps in a `symreplicate` session, set the log step entry in the options file to `TRU`E:

`SYMCLI_REPLICATE_LOG_STEP=TRUE`

When this option is enabled, `symreplicate` writes an entry to the SYMAPI log file after each step is completed.

Log entries contain the time that the step ended and whether it was successful.

Setting the symreplicate control parameters on page 420 provides more information.

Clustered SRDF/AR

Clustered SRDF/AR enables you to start, stop, and restart **`symreplicate`** sessions from any host connected to any local array participating in the **`symreplicate`** session.

In the clustered SRDF/AR environment, you can write the replication log file directly to the Symmetrix File System (SFS) instead of the local host directory of the node that began the session.

If the primary node should fail, then any locally attached host to the array containing the log file can restart the SRDF/AR session from where it left off.

Write log files to a specified SFS

Syntax

Use the `symreplicate start` command with the `-sid` and `-log` options to write the log file to the SFS. The following options must be specified:

Options

-sid

ID of the array where the log file is to be stored at the start of the `symreplicate` session.

-g or -cg

Group name.

-log *LogFilename*

(Optional) User log filename.

Restrictions

- If Symmetrix ID (`-sid`)is not specified at the start of the session, the log file is written to local disk using the default SYMAPI log directory. This is not restartable from another node.
- If a user log file name (`-log` *`LogFilename`*) is specified when a session is started, the `-log` option must be specified for all other commands in the session sequence.
- If only the group name (`-g` , `-cg`) is specified when a session is started:
  - The log file is given the same name as the group,
  - Specify only the `-g` or `-cg` option for all other commands in the session sequence.

HYPERMAX OS restrictions

In HYPERMAX OS 5977, the following options for the `symreplicate start` command are not supported, and the command fails with the message "Illegal option".

- - vxfs
- -rdb

Example

To write the log file for device group session1 to a file named srdfar1.log at the SFS on array 201:

```
symreplicate start -g session1 -log srdfar1.log -sid 201
```

Restart from another host

When log files are sent to the SFS, then any locally attached host to the array containing the log file can restart the SRDF/AR session from where it left off.

Syntax

Use the `symreplicate restart` command with the `-recover` option to restart the session using the specified log and recover the device locks from the previous session.

You do not need to specify the device or composite group name (`-g`, `-cg`) on the host where the session is restarted.

Options

-recover

Recovers the device locks from the previously started session. Verify that no other currently running `symreplicate` session is using the same devices before using the `-recover` option.

Example

To restart the SRDF/AR session from another local host:

```
symreplicate restart -g session1 -log srdfar1.log -sid 201 -recover
```

List log files written to the SFS

Syntax

Use the `symreplicate list` command with the `-sid` option to display a list of the current SRDF/AR log files written to the SFS at the specified SID.

Use the symreplicate list command with the `-sort` option to sort the log file list by name (default) or type.

Example

To list the log files at SID 201:

```
symreplicate list -sid 201
```

Show log files written to SFS

Syntax

Use the `symreplicate show -log` *`LogfileName`* `-sid` *`SID`* `-all` command to display the information content of a particular log file.

Dell EMC Solutions Enabler CLI Reference Guide provides more information.

Options

-log

Required. Log filename.

-sid

Required. Symmetrix ID.

-args

Display only command line arguments.

-devs

Display only devices.

-opts

Display only options.

-all

(default) Display all available information contained in the log.

Example

To display the log file srdfar1.log at SID 201:

```
symreplicate show -log srdfar1.log -sid 201 -all
```

Delete a log file written to SFS

Syntax

Use the `symreplicate delete -log` *`LogFile.log`* command to delete the specified log file written to SFS.

Specify either the group name (`-g`, `-cg`) or the log filename (`-log`) depending on whether a user log name was specified when the session was started.

Example

To delete log file srdfar1.log written to the SFS:

```
symreplicate delete -log srdfar1.log
```

Set symreplicate parameters in the options file

Modify parameters in the **`symreplicate`** options file to:

- Set replication retry and sleep timers
- Control replicate behavior

Note

If you specify an options file on restart, you may not change the following options:

- SYMCLI_REPLICATE_USE_FINAL_BCV=<TRUE|FALSE>
- SYMCLI_REPLICATE_HOP_TYPE=<RepType>

If you attempt to change these options, an error message is displayed. All other options may be changed, and the new values take effect immediately.

Note

You must specify the *RepType*. See:

- SYMCLI_REPLICATE_HOP_TYPE=<RepType>

Set a nonzero value for either a *CycleTime* or a *Delay* time, (even though their default values are zero). See:

- SYMCLI_REPLICATE_CYCLE=CycleTime
- SYMCLI_REPLICATE_CYCLE_DELAY=Delay

Format of the symreplicate options file

Make sure that your changes conform to the syntax in the example below.

The desired value is entered for the italicized text.

Lines beginning with a "#" (comment) are ignored by SYMCLI:

```
#Comment
SYMCLI_REPLICATE_HOP_TYPE=<RepType>
SYMCLI_REPLICATE_CYCLE=<CycleTime>
SYMCLI_REPLICATE_CYCLE_OVERFLOW=<OvfMethod>
SYMCLI_REPLICATE_CYCLE_DELAY=<Delay>
SYMCLI_REPLICATE_NUM_CYCLES=<NumCycles>
SYMCLI_REPLICATE_USE_FINAL_BCV=<TRUE|FALSE>
SYMCLI_REPLICATE_LOG_STEP=<TRUE|FALSE>
SYMCLI_REPLICATE_GEN_TIME_LIMIT=<TimeLimit>
SYMCLI_REPLICATE_GEN_SLEEP_TIME=<SleepTime>
SYMCLI_REPLICATE_RDF_TIME_LIMIT=<TimeLimit>
SYMCLI_REPLICATE_RDF_SLEEP_TIME=<SleepTime>
SYMCLI_REPLICATE_BCV_TIME_LIMIT=<TimeLimit>
SYMCLI_REPLICATE_BCV_SLEEP_TIME=<SleepTime>
SYMCLI_REPLICATE_MAX_BCV_SLEEP_TIME_FACTOR=<Factor>
SYMCLI_REPLICATE_MAX_RDF_SLEEP_TIME_FACTOR=<Factor>
SYMCLI_REPLICATE_PROTECT_BCVS=<Protection>
SYMCLI_REPLICATE_TF_CLONE_EMULATION=<TRUE|FALSE>
SYMCLI_REPLICATE_PERSISTENT_LOCKS=<TRUE|FALSE>
SYMCLI_REPLICATE_CONS_SPLIT_RETRY=<NumRetries>
SYMCLI_REPLICATE_R1_BCV_EST_TYPE=<EstablishType>
SYMCLI_REPLICATE_R1_BCV_DELAY=<EstablishDelay>
SYMCLI_REPLICATE_FINAL_BCV_EST_TYPE=<EstablishType>
SYMCLI_REPLICATE_FINAL_BCV_DELAY=<EstablishDelay>
SYMCLI_REPLICATE_ENABLE_STATS=<TRUE|FALSE>
SYMCLI_REPLICATE_STATS_RESET_ON_RESTART=<TRUE|FALSE>
```

Set replication retry and sleep times

Control how long and how often `symreplicate` executes control operations by setting the following parameters in the `symreplicate` options file:

symreplicate options file parameters

SYMCLI_REPLICATE_GEN_TIME_LIMIT=*TimeLimit*

Controls how long errors of a general nature, such as waiting for a lock, are retried.

SYMCLI_REPLICATE_RDF_TIME_LIMIT=*TimeLimit*

Controls how long to wait for SRDF devices to enter a specific state.

SYMCLI_REPLICATE_BCV_TIME_LIMIT=*TimeLimit*

Controls how long to wait for BCV devices to enter a specific state.

SYMCLI_REPLICATE_GEN_SLEEP_TIME=*SleepTime*

Controls how long `symreplicate` should sleep before retrying a general operation.

SYMCLI_REPLICATE_RDF_SLEEP_TIME=*SleepTime*

Controls the minimum time `symreplicate` should sleep before retrying an SRDF operation.

SYMCLI_REPLICATE_BCV_SLEEP_TIME=*SleepTime*

Controls the minimum time `symreplicate` should sleep before retrying a BCV operation.

SYMCLI_REPLICATE_MAX_BCV_SLEEP_TIME_FACTOR=*Factor*

Controls the maximum time that `symreplicate` sleeps before checking the BCV device state.

SYMCLI_REPLICATE_MAX_RDF_SLEEP_TIME_FACTOR=*Factor*

Controls the maximum time that `symreplicate` sleeps before checking the SRDF device state.

Setting the symreplicate control parameters

You can modify the following parameters in the `symreplicate` options file to control replicate behavior:

SYMCLI_REPLICATE_HOP_TYPE=<*RepType*>

Defines your configured environment in which to operate the data `symreplicate` session. This parameter is not optional and must be specified. Possible *RepType*values are:

SINGLE

Single-hop configuration.

MULTI

Multi-hop configuration.

SYMCLI_REPLICATE_USE_FINAL_BCV=<*TRUE|FALSE*>

Indicates whether to update the BCV in the final (last) remote array (for multi-hop only).

TRUE

(default) Replicates data copy the BCV in the final (last) remote array.

FALSE

The second hop BCV devices will be omitted.

SYMCLI_REPLICATE_PROTECT_BCVS= <NONE|BOTH|LOCAL|REMOTE|FIRST_HOP|SECOND_HOP>

NONE - (default) Establishes BCV-STD pairs without the protective establish behavior, relating to two-way mirrored BCV devices.
LOCAL or REMOTE - Causes the two mirrors of the BCV to be moved or joined to the standard device.
BOTH - Both the local BCV mirrors and the remote BCV mirrors get joined to their standard device.
FIRST_HOP or SECOND_HOP - Performs the protect BCV establish for first or second hop devices only in a multi-hop configuration.

SYMCLI_REPLICATE_CYCLE=<*CycleTime*>

Defines the period to wait between copy operations in total *minutes* or in an *hours:minutes (hh:mm)* format.

SYMCLI_REPLICATE_CYCLE_DELAY=<*Delay*>

Specifies the minimum time to wait between adjacent cycles. Even if a cycle overruns the specified *CycleTime* and *OvfMethod* is set to **`IMMEDIATE`** when *Delay* is specified, the session waits this delay time before beginning another cycle.

SYMCLI_REPLICATE_NUM_CYCLES=<*NumCycles*>

Specifies the number of cycles to perform before exiting.
The default for *NumCycles* is 0, the `symreplicate` session cycles forever.

SYMCLI_REPLICATE_CYCLE_OVERFLOW=<*OvfMethod*>

Describes what to do if the cycle overruns the specified *CycleTime*.
Valid values for *OvfMethod* are:

IMMEDIATE

(default) Begins next cycle immediately.

NEXT

Skips this copy cycle and wait for the next to begin

SYMCLI_REPLICATE_LOG_STEP=<*TRUE|FALSE*>

TRUE - Writes a log entry to the SYMAPI log file after each step of the `symreplicate` cycle is completed. The entry displays the time that the step ended and whether the step was successful.

SYMCLI_REPLICATE_GEN_TIME_LIMIT=<*TimeLimit*>

Indicates how long errors of a general nature should be retried (for example, attempting to acquire a array lock). Currently, the general *TimeLimit* only applies when initiating an SRDF split or establish operation.
TimeLimit value controls how long `symreplicate` retries certain types of operations.
The default general *TimeLimit* is 00:30 if not specified.
A *TimeLimit* value of zero (0) indicates that no time limit applies, and the operation to be retries indefinitely.
TimeLimit must be specified using one of the following formats:

hh:mm

Specifies the number of hours and minutes.

sss

Specifies the number of seconds

SYMCLI_REPLICATE_RDF_TIME_LIMIT=<*TimeLimit*>

Indicates how long to wait for SRDF devices to enter a specific state. For example, after successfully issuing the command to establish an R2 BCV device with the corresponding R1 standard device,`symreplicate` waits the indicated length of time for the devices to become synchronized.
The default SRDF *TimeLimit* is 04:00 if not specified.

SYMCLI_REPLICATE_BCV_TIME_LIMIT=<*TimeLimit*>

Indicates how long to wait for BCV devices to enter a specific state. For example, after successfully issuing the command to establish a BCV device with the corresponding standard device, `symreplicate` waits the indicated length of time for the devices to become synchronized.
The default BCV *TimeLimit* is 02:00 if not specified.

SYMCLI_REPLICATE_GEN_SLEEP_TIME=<*SleepTime*>

Indicates how long `symreplicate` should sleep before retrying a general operation (for example, attempting to acquire a array lock). Currently, the general *SleepTime*only applies when initiating an SRDF split or establish operation.
*SleepTime*must be greater than zero (0).
The default value for *SleepTime*is 10 seconds.

SleepTime must be specified using one of the following formats:

hh:mm

Specifies *SleepTime* in number of hours and minutes.

sss

Specifies *SleepTime* in seconds.

SYMCLI_REPLICATE_RDF_SLEEP_TIME=<*SleepTime*>

Indicates the minimum length of time that `symreplicate` should sleep before retrying an SRDF device operation. For example, after issuing the command to establish an R2 BCV device with the corresponding R1 standard device, `symreplicate` sleeps the indicated length of time before retrying the operation.
The default SRDF *SleepTime* is 15 seconds if not specified.

SYMCLI_REPLICATE_BCV_SLEEP_TIME=<*SleepTime*>

Indicates the minimum length of time that symreplicate should sleep before retrying a BCV device operation. For example, after issuing the command to establish a BCV device with the corresponding standard device,`symreplicate` sleeps the indicated length of time before retrying the operation.
The default BCV *SleepTime* is 10 seconds if not specified.

SYMCLI_REPLICATE_MAX_BCV_SLEEP_TIME_FACTOR=<*Factor*>

Provides a way to specify the maximum time that`symreplicate` sleeps before checking again to see if BCV devices have entered a specific state. The product of this value multiplied by the sleep time gives the maximum time that `symreplicate` sleeps.
The factor is specified using a nonzero integer. If not specified, the default factor is 3.
By default, `symreplicate` sleeps between 10 and 30 seconds when checking on the state of BCV devices, up to a maximum time of 2 hours.

SYMCLI_REPLICATE_MAX_RDF_SLEEP_TIME_FACTOR=<*Factor*>

Provides a way to specify the maximum time that `symreplicate` sleeps before checking again to see if SRDF devices have entered a specific state. The product of this value multiplied by the sleep time gives the maximum time that `symreplicate` sleeps. The factor is specified using a nonzero integer.
By default, `symreplicate` sleeps between 15 and 60 seconds when checking on the state of SRDF devices, up to a maximum time of 4 hours.
If not specified, the default factor is 4.

SYMCLI_REPLICATE_TF_CLONE_EMULATION=<*TRUE*|*FALSE*>

Note

By default, `symreplicate` sleeps between 15 and 60 seconds when checking on the state of SRDF devices, up to a maximum time of 4 hours.

By default, `symreplicate` sleeps between 15 and 60 seconds when checking on the state of SRDF devices, up to a maximum time of 4 hours.

Indicates that TF/Clone emulation is enabled/disabled.

FALSE

(default) The TF/Clone emulation default is disabled.

TRUE

Clone emulation is enabled.

SYMCLI_REPLICATE_PERSISTENT_LOCKS=<*TRUE*|*FALSE*>

Allows device locks to persist in the event of a system crash or component failure.

TRUE

Causes symreplicate to acquire the device locks for the `symreplicate` session with the `SYMAPI_DLOCK_FLAG_PERSISTENT` attribute.

FALSE

The persistent attribute will not be used to acquire the device locks for the session. If the base daemon (storapi daemon) is running and persistent locks are not set, the base daemon will release the device locks in the event of a failure.

SYMCLI_REPLICATE_CONS_SPLIT_RETRY=<*NumRetries*>

Specifies the number of error recovery attempts that will be made when a consistent split operation fails because the timing window closed before the split operation completed.

3 (default)

Used if the SYMCLI_REPLICATE_CONS_SPLIT_RETRY option parameter is not specified when a consistent split (-consistent) is requested.

0

No retry attempts are made

SYMCLI_REPLICATE_R1_BCV_EST_TYPE=<*EstablishType*>

Specifies the establish type for the local/first hop BCV devices. *EstablishType* specifies the way that BCV establish operations will be executed by TimeFinder. Valid values are:

SINGULAR

BCV devices will be established one at a time; the next device will not be established until the previous device has been established.

SERIAL

BCV devices will be established as fast as the establish requests can be accepted by the array.

PARALLEL

BCV devices establish requests will be passed in parallel to each of the servicing DA directors.

SYMCLI_REPLICATE_R1_BCV_DELAY=<*EstablishDelay*>

How long to wait between issuing establish requests. Establish types of `SINGULAR` and `PARALLEL`, for an <*EstablishDelay*> can be specified through the SYMCLI_REPLICATE_R1_BCV_DELAY file parameter.

SYMCLI_REPLICATE_FINAL_BCV_EST_TYPE=<*EstablishType*>

Identifies the establish type for the remote/second hop BCV devices.

SYMCLI_REPLICATE_FINAL_BCV_DELAY=<*EstablishDelay*>

Indicates how long to wait between issuing establish requests for the remote/second hop BCV devices. For an establish type of PARALLEL the delay value indicates how long to wait before passing the next establish request to an individual servicing DA director. Values for *EstablishDelay*:
Range: Delay of 0 to 30 seconds
Default: 0

SYMCLI_REPLICATE_ENABLE_STATS=<*TRUE|FALSE*>

Enables or disables the gathering of statistics.

TRUE

(default) Indicates that statistics gathering is enabled.

FALSE

Indicates that statistics gathering is to be disabled.

SYMCLI_REPLICATE_STATS_RESET_ON_RESTART=<*TRUE|FALSE*>

Resets statistics when a restart action is executed.

TRUE

Indicates that statistics are to be reset when restarting a `symreplicate` session.

FALSE (default)

Statistics are not reset upon restart of a `symreplicate` session.

Manage locked devices

Device external locks in the array are held during the entire `symreplicate` session. Device external locks block other applications from altering device states while the `symreplicate` session executes.

When a `symreplicate` session terminates because the SRDF link goes down unexpectedly, the locked devices prevent session restart when the SRDF link is restored.

You can recover, release or acquired to persist device locks.

Recover locks

Use the `symreplicate start` or `restart` command with the `-recover` option to recover the device locks and restart the session.

Note

Device locks can be recovered as long as exactly the same devices are still locked under the lock holder ID of the previous `symreplicate` session.

Release locks

Optionally, you can release the device external locks held in the array for a terminated SRDF/AR session.

Locks may need to be released manually if a session is terminated unexpectedly due to a system crash or component failure. Device locks for a terminated session can be released manually for a device group, composite group or log file without restarting the session.

Syntax

Use the `symreplicate release` command to release any device external locks associated with devices in the specified device group that are still held from when they were locked from the terminated SRDF/AR session.

Restrictions

- The SRDF/AR session for the targeted devices must not be active.
- Devices must have been locked by the previous session and the lock holder ID must match the previous session's ID.
- The number of devices to be unlocked must be less than or equal to the total number of devices in the previous SRDF/AR session.
  The force (-force) option is required to release device locks in the following situations:
- If the release action is requested in a clustered SRDF/AR environment on a host that did not initiate the session and the status of the session cannot be determined.
- If any of the devices' lock holder ID in the targeted SRDF/AR session do not match the session's lock hoder ID, and the user wants to release the devices locked with the session's lock holder ID.
- If the lock holder ID for some devices in the targeted SRDF/AR session do not match the lock holder ID of that session, and the user wants to release the devices locked with the session's original lock holder ID.

Example

To release devices locks on a terminated session for device group prod on array 35002:

```
symreplicate -g prod release -sid 35002
```

Acquire persistent locks

If the base daemon (SYMAPI daemon) is running, device locks are automatically released in the event of a system crash or component failure.

To acquire the device using the persistent attribute, set the persistent locks parameter in the symreplicate options file to **`TRUE`**:

`SYMCLI_REPLICATE_PERSISTENT_LOCKS=TRUE`

See SYMCLI_REPLICATE_PERSISTENT_LOCKS=<TRUE|FALSE>.

CHAPTER 12

TimeFinder and SRDF operations

This chapter describes the following topics:

TimeFinder consistent splits in SRDF configurations

TimeFinder consistent split allows you to split off a consistent, restartable copy of a database management array within seconds with no service interruption.

A concurrent split helps to avoid inconsistencies and restart problems that can occur when splitting database-related BCVs without first quiescing the database.

Consistent split operations are implemented using the Enginuity Consistency Assist (ECA) feature. ECA allows you to consistently activate copy sessions across multiple heterogeneous hosts.

Consistent split operations can also be used in conjunction with SRDF Automated Replication (SRDF/AR) to set up automatic remote mirroring according to a predefined copy schedule.

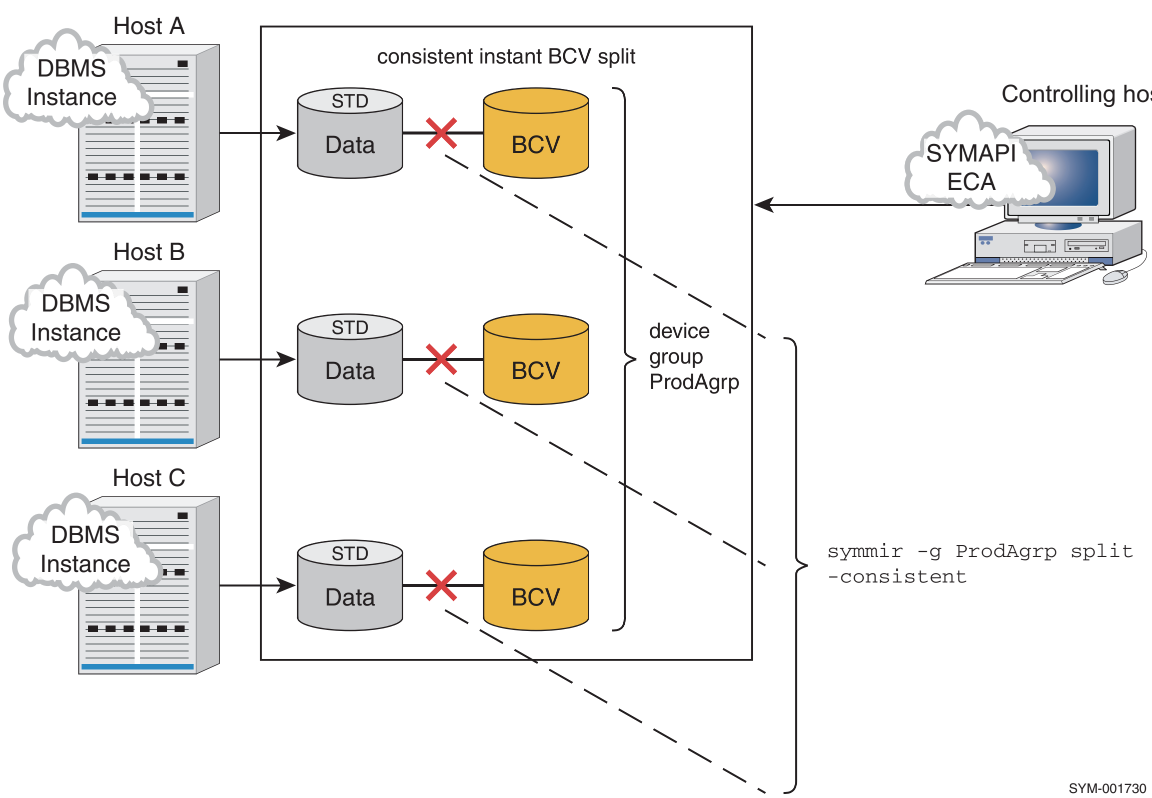
Enginuity Consistency Assist

Use the `symir` command with `-consistent` option to perform TimeFinder consistent split operations.

You can also use the `symreplicate` command with the `-consistent` option to run a copy cycle that freezes I/O to all devices in a device or composite group for both single-hop and multi-hop configurations.

The following image shows how a control host can perform ECA consistent splits for three database hosts that access devices on a array.

Figure 128 ECA consistent split



To consistently split BCV pairs using ECA:

- You must have either a control host with no database or a database host with a dedicated channel.
- Device or composite groups must be created on the controlling host for the target database to be consistently split.
  These 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, then you can consistently split all of the BCV pairs related to those hosts with a single command.

Multi-hop operations

You can manage various compounded remote configurations using both the TimeFinder and SRDF components of SYMCLI.

Figure 130 on page 432, shows multiple sites (remote Sites B and C) remotely mirroring to a local array at Site A.

The most typical configuration is a remote site (Site B in Figure 130 on page 432), functioning as a remote mirror to standard devices (Site A).

A third site (Site C) can remotely mirror just the BCV devices at Site A.

Multi-hop SRDF
You can also configure a multi-hop to a second-level SRDF.

In Figure 130 on page 432:

- Site D remotely mirrors standard devices at Site A, and
- Site E remotely mirrors Site A's BCV.
- The `symrdf` command manages the SRDF pairs within the SRDF link
- The `symmir` command manages the BCV pairs within any one site.

Before you begin: preparing for multi-hop operations

`symmir` operations require an existing group of SRDF devices.

To create a device group containing STD and BCV RDF1 devices:

Procedure

1. Use the `symdg create` command to create an empty device group:

   ```
   symdg create prod -type RDF1
   ```

2. Use the `symdg add dev` command to add devices to the new device group:

   ```
   symdg -g prod add dev 0001 -sid 344402 DEV001
   ```

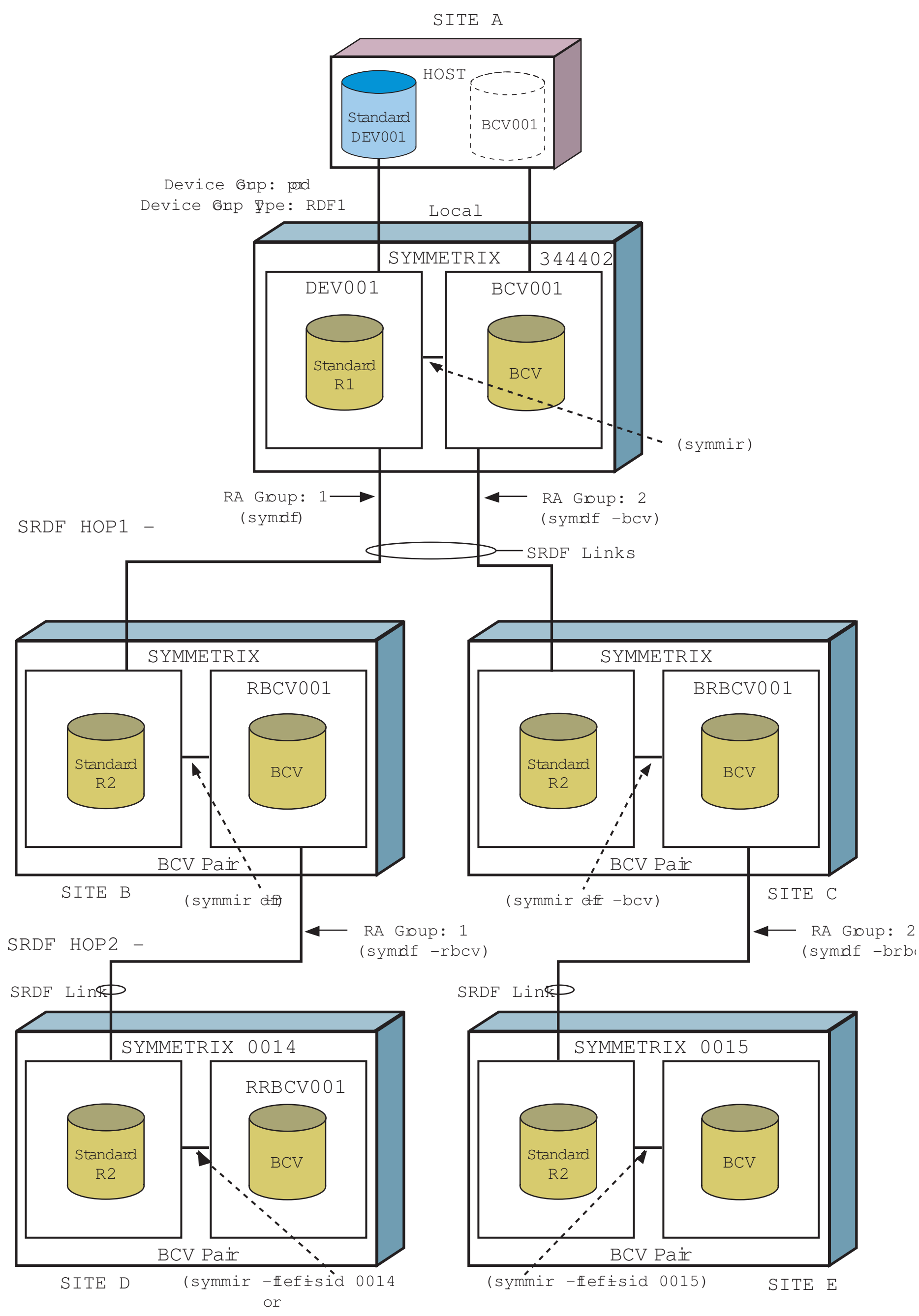
3. Use the `symbcv associate` commands to associate the devices with a local BCV, and remote BCVs:

   ```
   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
```

All devices must be established with the `symmir` and `symrdf` commands.

Figure 129 Commands used to perform splits in a complex configuration



Control basic operations in a multi-hop configuration

The following table lists the sequence of commands to perform basic control operations in a multi-hop configuration.

Each step number correlates to a bubble number in Figure 130 on page 432.

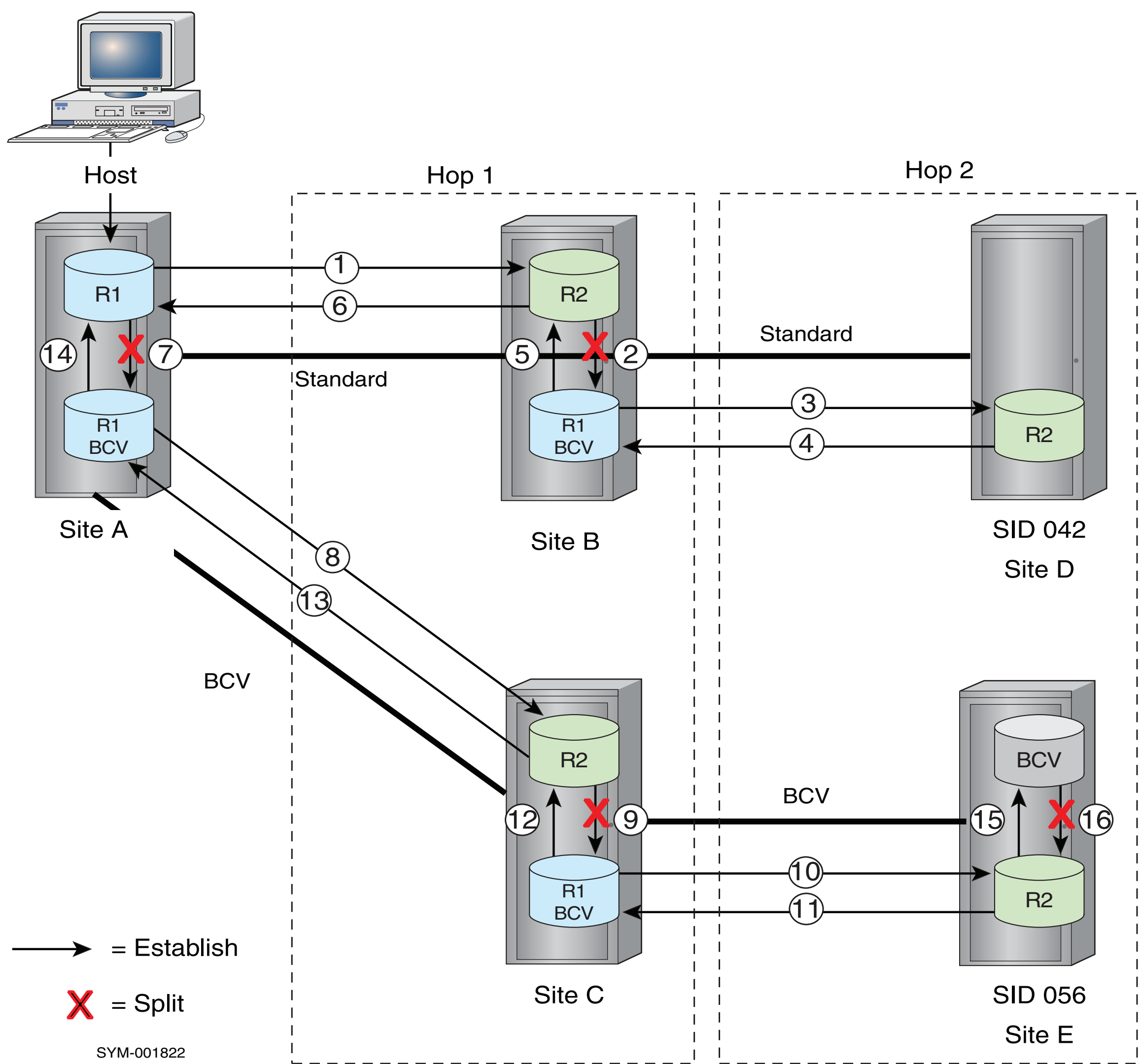
Table 45 Basic operations in a multi-hop configuration

Step	CLI control operation	Description
1	symrdf -g <> establish	Creates the standard associated hop 1 copy.
2	symmir -g <> split -rdf	Splits the standard associated hop 1 BCV device pair.
3	symrdf -g <> establish -rbcv	Creates the standard associated hop 2 copy.
4	symrdf -g <> restore -rbcv	Restores the standard associated hop 1 BCV with the hop 2 copy.
5	symmir -g <> restore -rdf	Restores the standard associated hop 1 copy with the hop 1 BCV.
6	symrdf -g <> restore	Restores the standard device with the hop 1 copy.
7	symmir -g <> split	Splits the standard/BCV pair.
8	symrdf -g <> establish -bcv	Creates the BCV associated hop 1 remote copy.
9	symmir -g <> split -rdf -bcv	Splits the BCV associated hop 1 device pair.
10	symrdf -g <> establish -brbcv	Creates the BCV associated hop 2 copy.
11	symrdf -g <> restore -brbcv	Restores the BCV associated hop 1 BCV with the hop 2 copy.
12	symmir -g <> restore -rdf -bcv	Restores the standard device associated hop 1 copy with the hop 1 BCV.
13	symrdf -g <> restore -bcv	Restores the BCV device with the hop 1 copy.
14	symmir -g <> restore	Restores the standard device with the BCV copy.

Table 45 Basic operations in a multi-hop configuration (continued)

Step	CLI control operation	Description
15	symmir -f <> -sid 056 establish or symmir -g <> -rrbcv establish	Creates the BCV associated hop 2 BCV copy.
16	symmir -f <> -sid 056 split or symmir -g <> -rrbcv	Splits the BCV-associated hop 2 device pair.

Figure 130 Basic operations in multi-hop SRDF configurations



System-wide split commands

Figure 130 on page 432 shows how the `symmir` and `symrdf` commands might be applied to split operations in a complex configuration.

Note

You must have established SRDF device groups before you perform any `symmir` and `symrdf` operations.

Perform operations such as `establish` and `restore` in the same manner for remote sites.

Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide provides more information.

Examples

To split the BCV pair within Site A:

```
symmir -g prod split
```

To split SRDF pairs at Site B from host-connected Site A:

```
symrdf -g prod split
```

To split the BCV pairs within Site B:

```
symmir -g prod -rdf split
```

To split BCV SRDF pairs at Site C from host-connected Site A:

```
symrdf -g prod -bcv split
```

To split the BCV pairs within Site C:

```
symmir -g prod -rdf -bcv split
```

To split BCV SRDF pairs at Site D from host standard-associated Site B:

```
symrdf -g prod -rbcv split
```

To split the BCV pairs within Site D:

```
symmir -f dfile -sid 0014 split
```

or

```
symmir -g prod -rrbcv split
```

To split BCV SRDF pairs at Site E from host BCV-associated Site C:

```
symrdf -g prod -brbcv split
```

To split the BCV pairs within Site E (hop 2):

```
symmir -f dfile -sid 0015 split
```

TimeFinder SnapVX and SRDF

HYPERMAX OS introduces TimeFinder SnapVX. SnapVX creates snapshots by storing changed tracks directly in the Storage Resource Pool of the source device. With SnapVX:

- You do not need to specify a target device and source/target pairs when you create a snapshot.
- You can create links from the snapshot to one or more target devices.
- You can link and relink until the correct snapshot is located.

NOTICE

From HYPERMAX OS 5977.272.177 you can manage SRDF operations using storage groups.

HYPERMAX OS uses emulations to transparently convert legacy commands (TimeFinder/Clone, TimeFinder VP Snap, and TimeFinder/Mirror) to SnapVX commands.

You can still run existing scripts that include legacy commands, but the underlying mechanism is SnapVX.

EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS and *Dell EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS* provide detailed information about TimeFinder SnapVX.

TimeFinder SnapVX and Cascaded SRDF

The following steps create device groups to manage TimeFinder operations in a cascaded SRDF configuration.

1. Create device group DeptAB, add local devices 00019:0001A as R1 (source) devices,and 0001D:0001E as TGT devices:

   ```
   symdg create DeptAB -type ANY
   symdg -g DeptAB -sid 000197300076 addall dev -devs 00019:0001A
   symdg -g DeptAB -sid 000197300076 addall dev -devs 0001D:0001E -
   tgt
   ```

2. Add devices 0001D:0001E on remote array (R21, 1st hop) as TGT devices.

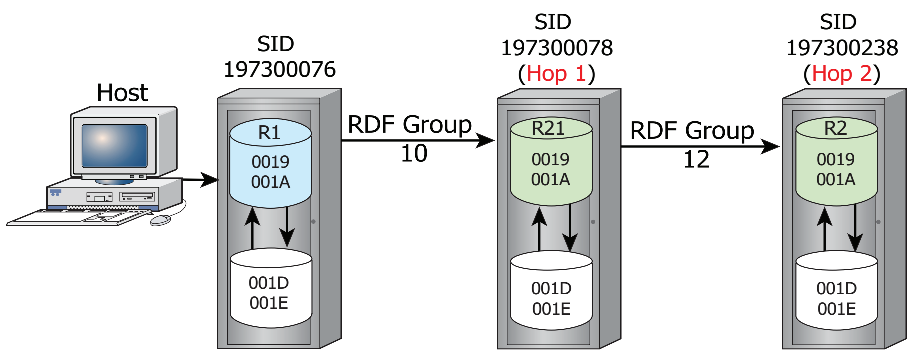
```
symdg -g DeptAB -sid 000197300076 addall dev -devs 0001D:0001E -
tgt -rdf
```

3. Add devices 0001D:0001E in RDF group 12 on remote array (R2, 2nd hop) as TGT devices:

```
symdg -g DeptAB -sid 000197300076 addall dev -devs 0001D:0001E -
tgt
-rdf
```

The following image shows the resulting configuration:

Figure 131 SnapVX and Cascaded SRDF



Examples

The following examples use the configuration shown in the preceding image:

- Create, activate, and link a SnapVX snapshot (named LocalSnap) on the local array:

```
symsnapvx -g DeptAB establish -name LocalSnap
symsnapvx -g DeptAB -snapshot_name LocalSnap link
```

- Create, activate, and link a SnapVX snapshot (named Hop1Snap) on the remote array at Hop 1:

```
symsnapvx -g DeptAB establish -name Hop1Snap -rdf
symsnapvx -g DeptAB -snapshot_name Hop1Snap link -rdf
```

- Create, activate, and link a SnapVX snapshot (named Hop2Snap) on the remote array at Hop 2:

```
symsnapvx -g DeptAB establish -name Hop2Snap -hop2
symsnapvx -g DeptAB -snapshot_name Hop2Snap link -hop2
```

TimeFinder SnapVX and Concurrent SRDF

The following steps create composite groups and add devices to manage TimeFinder operations in a concurrent SRDF configuration.

1. Create composite group DeptPR and with RDF consistency enabled, add devices in RDF group 20 as source (R11) devices:

```
symcg create DeptPR -rdf_consistency -type ANY
symcg -cg DeptPR addall dev -sel_rdfg 20 -sid 197300076
```

2. Set the name of RDF group 20 to SiteB and the name of RDF group 21 to SiteC:

```
symcg -cg DeptPR set -name SiteB -rdfg 000197300076:20
symcg -cg DeptPR set -name SiteC -rdfg 000197300076:21
```

3. Add devices local devices B8:BF as TGT devices:

```
symcg -cg DeptPR addall dev -devs b8:bf –tgt
```

4. Add devices B8:BF in RDF group 20 as RTGTs:

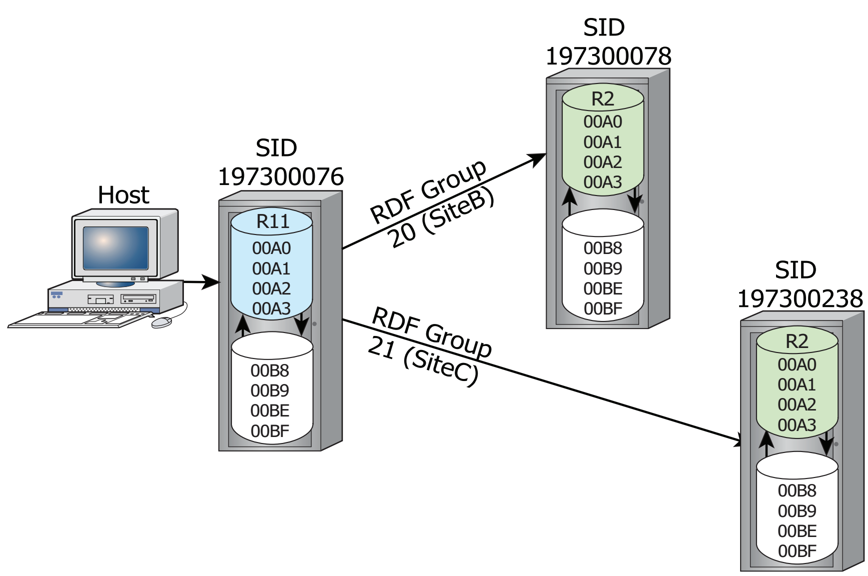
```
symcg -cg DeptPR addall dev -devs b8:bf -tgt -rdf -sid
000197300076 -rdfg 20
```

5. Add devices B8:BF in RDF group 21 as RTGTs:

```
symcg -cg DeptPR addall dev -devs b8:bf -tgt -rdf -sid
000197300076 -rdfg 21
```

The following image shows the resulting configuration:

Figure 132 SnapVX and Concurrent SRDF



Examples

The following examples use the configuration shown in the preceding image.

- Create, activate, and link a SnapVX snapshot (named LocalSnap) on the local array:

```
symsnapvx -cg DeptPR establish -name LocalSnap
symsnapvx -cg DeptPR -snapshot_name LocalSnap link
```

- Create, activate, and link a SnapVX snapshot (named SiteBSnap) of devices in RDF group SiteB at remote array 197300078:

```
symsnapvx -cg DeptPR establish -name SiteBSnap -rdfg name:SiteB
-rdf
symsnapvx -cg DeptPR -snapshot_name SiteBSnap -rdfg name:SiteB -
rdf link
```

- Create, activate, and link a SnapVX snapshot (namedSiteCSnap) on devices in RDF group SiteC at the remote array 197300238:

```
symsnapvx -cg DeptPR establish -name SiteCSnap -rdfg name:SiteC
-rdf
symsnapvx -cg DeptPR -snapshot_name SiteCSnap -rdfg name:SiteC -
rdf link
```

CHAPTER 13

SRDF Automated Recovery Operations

This chapter describes the following topics:

Automated Recovery overview

SRDF Automated Recovery is a utility for optimizing ever-ready fault management responses in basic SRDF environments. SRDF Automated Recovery runs in the background and monitors the state of various SRDF/S or SRDF/A sessions.

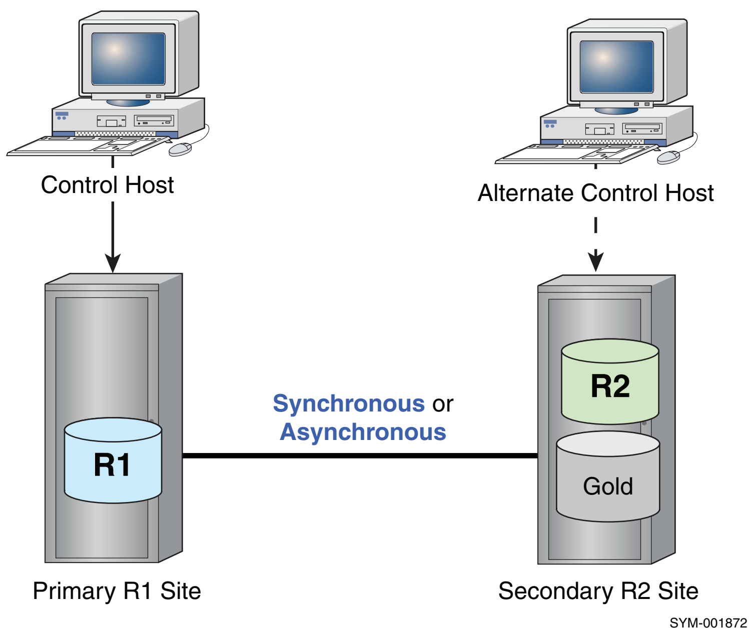
If SRDF Automated Recovery detects a session failure, it attempts an automatic recovery and restart of the session using the `symrecover` command. The restart uses the pre-configured settings specified in the `symrecover` options file.

This options file provides parameters for:

- Email notification for error logging and events
- Actions for monitoring, recovery, and restart

The following image shows a basic SRDF recovery environment:

Figure 133 SRDF recovery environment



In a basic recovery environment, a primary R1 site replicates to the secondary R2 site over a synchronous or asynchronous link. A gold copy (BCV or clone) can be built on the R2 site to augment recovery restart strategies.

Note

SRDF Automated Recovery is not supported in SRDF/Star environments.

SRDF Automated Recovery restrictions

- The `symrecover` session must be started either at the primary R1 site or the remote R2 site.
- If the group is concurrent, then `symrecover` must be run from the R1 workload site.
- SRDF/Metro configurations cannot be monitored by SRDF Automated Recovery.
- Solutions Enabler binaries must either be in the PATH or specified as a parameter.
- The `symrecover` command can only be run with the Perl script shipped with Solutions Enabler.
- The initial group state must be CONSISTENT or SYNCHRONIZED, depending on the target SRDF state, unless the `restart_group_on_startup` option is specified (not the default).

Consistency protection restrictions

- If consistency protection is desired, it must be enabled prior to starting `symrecover`.
- A `symrecover` session must be started on the same site where consistency was enabled via a consistency group.

Note

If you are using device groups, `symrecover` can be started at other sites.

Gold copy restrictions

- R2 gold copying can be performed with either native clones or Business Continuance Volumes (BCVs).
- BCV-to-STD association for the R2 gold copy is dynamic using the `symmir` defaults.

Restart restrictions

Note

symrecover options file parameters provides a complete list of parameters and optional recovery actions to be set in the `symrecover` options file.

- A recovery fails if monitoring a leg that has an R22 device when the other SRDF mirror of the R22 is read/write (RW) on the link (such states as `synchronized`, `syncinprog`, or `consistent`).
- The recovery does not start when the `-restart_group_on_startup` parameters are specified, and an R22 device has another SRDF mirror that is already RW on the link.

Consistency protection restrictions

- If consistency protection is desired, it must be enabled prior to starting `symrecover`. A `symrecover` session must be started on the same site where consistency was enabled via a consistency group.

Note

If you are managing using device groups, `symrecover` can be started at other sites.

Gold copy restrictions

- You can perform R2 gold copying with either Native Clones or Business Continuance Volumes (BCVs).
- BCV-to-STD association for the R2 gold copy is dynamic using the `symmir` defaults.

Restart restrictions

Note

See Table 46 on page 445 for a complete list of parameters and optional recovery actions to be set in the `symrecover` options file.

- A recovery fails if monitoring a leg that has an R22 device when the other SRDF mirror of the R22 is read/write (RW) on the link (such states as `synchronized`, `syncinprog`, or `consistent`).
- The recovery does not start when the `-restart_group_on_starup` parameters are specified, and an R22 device has another SRDF mirror that is already RW on the link.

Launch SRDF Automated Recovery

Use the `symrecover` command to launch and optimize SRDF Automated Recovery. The `symrecover` command can be run from either the R1 or the R2 side as long as all the SRDF standard devices in the device group or the composite group are local to the host. When devices in groups are not local to a host, they are marked as invalid to stop all control operations from being performed against them.

If an SRDF/A group becomes synchronous (SRDF/S), `symrecover` attempts to reset the SRDF link to SRDF/A mode.

Note

The **`symrecover`** command returns an error if used with an SRDF device pair containing thin and standard devices. The thin device must be on an array running Enginuity 5876 or HYPERMAX OS 5977. The standard device must be on an array running Enginuity 5876.

The `symrecover` command can be invoked manually from the command line, is typically configured to run continuously in the background using one of the following:

- Windows Scheduled Tasks
- UNIX CRON/scheduled task
- UNIX (RC.2) file

Syntax

Use the following syntax to launch SRDF Automated Recovery operations:

```
symrecover [-h]
symrecover [-env | -version]

symrecover start {-g DgName | -cg CgName}
[-mode {SYNC | ASYNC}] [-out LogPath]
[-options FileName]
```

Options

Note

Either a device group (`-g DgName`) or composite group (`-cg CgName`)must be specified.

-g *DgName*

Specifies a device group.

-cg *CgName*

Specifies a composite group.

-mode {SYNC | ASYNC}

Specifies the SRDF session type, either synchronous or asynchronous. There is no default; this option must be specified.

-out *LogPath*

Specifies an alternate fully-qualified directory location for the log file.

-options *FileName*

Specifies the fully-qualified name of the file that contains program options. See symrecover options file parametersfor a list of possible settings.

Restrictions

- You can define devices in groups on the R2 side with a corresponding partner but `symrecover` cannot start in this environment. You cannot monitor groups on the R2 side when the remote partner is concurrent. You must monitor these groups from the host.
- The `symrecover` command does not support the monitoring or recovery of a device group or composite group that is set with an ANY group type.
- Any options specified on the command line take precedence over the options specified by `-options FileName`.
- In a cascaded SRDF environment:
  - Specify the target composite group.
  - Do not use the `-mode` option.

Examples

To start a recovery in a basic SRDF/S environment:

```
symrecover start -g DgName -mode sync -options OptnFile
```

To start a recovery in a cascaded SRDF environment:

```
symrecover start -cg CgName -cascaded_monitor_both_hops -options
OptnFile
```

To manually start recovery for an SRDF/A composite group named `RDFAmon`, using the options file named `cg_mon_opts`:

```
symrecover start -cg RDFAmon -mode async -options cg_mon_opts
```

where the `cg_mon_opts` options file includes the following settings and default values for a BCV gold copy:

```
# Options file for symrecover
#######################################################
goldcopy_clone_list = TGT
goldcopy_location = R2
goldcopy_max_wait = 1800
goldcopy_resync_interval = 0
goldcopy_state_post_restart = ACTIVATED
goldcopy_state_startup = ACTIVATED
goldcopy_type = CLONE
help = 0
log_level = 3
monitor_cycle_time = 300
monitor_only = 0
out = /var/symapi/log
restart_adcopy_resynch_threshold = 30000
restart_attempt_pause = 60
restart_delay = 30
restart_group_on_startup = 0
restart_max_attempts = 5
restart_max_wait_adcopy_sync = 0
restart_max_wait_state_change = 0
restart_max_wait_warn_interval = 600
restart_rdfa_min_cycle_warn_interval = 300
restart_rdfa_min_cycle_warn_value = 0
restart_state_syncinprog_wait_time = 120
restart_state_syncinprog_warn_interval = 300
restart_state_transmit_wait_time = 120
restart_state_transmit_warn_interval = 300
restart_sync_type = ADCOPY
restart_window = 3600
run_once = 0
run_until_first_failure = 0
```

Recover cascaded SRDF

Syntax

To recover a cascaded SRDF environment, add the following parameter settings to the options file in the previous example:

```
cascaded_monitor_both_hops = 1
goldcopy_location = All
```

Options

cascaded_monitor_both_hops = 1

Allows recovery on both hops.

goldcopy_location = All

Builds gold copies at the R21 and R2 sites.

The hop2 (R21->R2 link) restarts quickly and safely in ADCOPY mode, during the R2 resynchronization period.

Stop SRDF Automated Recovery

To stop `symrecover` manually, enter a Ctrl/C.

To stop a `symrecover` task running in the background use one of the following options:

- Windows - Cancel the task in the Scheduled Tasks, or use End Task in the Task Manager.
- UNIX - Use the kill command.

symrecover options file parameters

The following table describes the valid settings in the `symrecover` options file.

Table 46 symrecover options file parameters

Setting	Description
`cascaded_monitor_both_hops=[0|1]`	0 - (default) Monitors/recovers a single hop only invoked from any site. 1 - For cascaded SRDF environments, the `symrecover` session monitors both hops linking the cascaded sites. The `symrecover` session ignores the `–mode` option and can be invoked at either the R1 primary or the remote R2 tertiary site only (not at R21 site).
`email_addr_target=<e_addr1, e_addr2, ..., ...>`	Email notification address on errors. If any of the `email_*` options are specified, then this option must also be specified to activate email alerts.

Table 46 symrecover options file parameters (continued)

Setting	Description
	Multiple comma delimited addresses may be specified. There is no default value.
`email_addr_source= e_addr1`	Specifies an address that will be used as the 'from' field for any e-mails that `symrecover` sends. No validity checks are done for the e-mail address. If this setting is not specified, then a default value is generated based on the array's hostname and current user account.
`email_server= e_srvr_addr`	Specifies the host target email server. If any of the `email_*` options are specified then this option must also be specified to activate email alerts. There is no default value.
`email_subject= err_subject_string`	Specifies the email notification subject on errors. The default value is: `SymRecover Alert: Host [HostName] Group [GrpName]`
`email_log_level= SeverityLevel`	The severity level desired for the email alert triggering message. Valid values are: 0 = Off 1 = Only errors are reported 2 = Errors and warnings are reported 3 = Errors, warnings, and informational messages are reported 4 = All messages are reported, including all SYMCLI commands and responses **Note** For each message that meets the particular logging level requirement, an email is sent with that message. It is highly recommended to set the severity level to either a 1 or a 2. If the required email options (`email_server` and `email_addr_target`) are not specified, the default value is 0. If they are specified, the default value is 1.
`goldcopy_location= LocationValue`	Specifies the location of the backup gold copy. Valid (case-insensitive) values are:

Table 46 symrecover options file parameters (continued)

Setting	Description
	NONE = No gold copy is desired. All other gold copy optional parameters in this list are ignored. R2 = A gold copy on the R2 site is desired. This is the default setting. Any R2 BCV pairs must already defined before calling `symrecover`.
`goldcopy_type=CopyType`	Specifies the type of gold copy to create on the R2 side. Valid (case-insensitive) values are: NONE = No gold copy is desired. All other `goldcopy_*` options are ignored. BCV = BCV gold copy on the R2 side is created. This is the default. CLONE = Clone gold copy on the R2 is created. **Note** For the BCV gold copy, the R2 BCVs must be paired with the R2 devices before starting `symrecover`. For the clone gold copy, the target devices must have a clone session with the R2 devices before starting `symrecover`.
`goldcopy_state_startup=CopyType`	Specifies the desired state of the R2 gold copy upon routine startup. Valid (case-insensitive) values are: ESTABLISH = The devices must be established (BCV gold copy only). SPLIT = The devices must be split (BCV gold copy only). ACTIVATED = The devices must be in the copied state (clone gold copy only). CREATED = The devices must be in the precopy state (clone gold copy only). NONE = The devices must be unchanged. This is the default. **Note** If the gold copy type is BCV and the default state of the BCVs is ESTABLISH, this is likely to increase SRDF/A session drops.

Table 46 symrecover options file parameters (continued)

Setting	Description
`goldcopy_state_post_restart= CopyState`	Following a successful SRDF/A session restart or BCV resync, specifies which state the R2 gold copy should be. Valid (case-insensitive) values are: ESTABLISH = The devices must be left established (BCV gold copy only). SPLIT = The devices must be split, which is the default (BCV gold copy only). ACTIVATED = The devices must be in the copied state (clone only). CREATED = The devices must be in the precopy state (clone only). **Note** If the gold copy type is BCV and the default state of the BCVs is ESTABLISH, this is likely to increase SRDF/A session drops.
`goldcopy_max_wait= MaxWaitTime`	Specifies the length of time, in seconds, for `symrecover` to wait for synchronization. Valid values are 0 to **`maxint`** (2147483647). The default is 0, which indicates for `symrecover` to wait forever. For clone gold copies, if the `goldcopy_state_post_restart` option is set to **`activated`**, it waits for the clone copied state to be reached before performing synchronization. If this option is set to **`created`**, it waits for the clone precopied state to be reached.
`goldcopy_resync_interval= resynctime`	Defines the resync interval, in minutes, for `symrecover` to automatically create a new clone gold copy or a new BCV gold copy, which overrides the existing gold copy. This action only takes place during non-error periods. Valid values are 0, and 15 to **`maxint`**. Zero (0) indicates that the mirrors are never to be automatically synchronized outside of error-producing events. The default setting is 15.

Table 46 symrecover options file parameters (continued)

Setting	Description
	Note If the gold copy type is BCV, the act of frequently synchronizing the R2 BCVs is likely to increase SRDF/A session drops.
`goldcopy_clone_list= List`	For a clone gold copy, this option tells `symrecover` which list within the device group or the composite group to search for clone devices. Valid (case-insensitive) values are: TGT = Uses the TGT list. BCV = Uses the BCV list.
`monitor_cycle_time= cycletime`	Defines the number of seconds to pause between monitor status scans. The minimum value is 30 seconds, the maximum is 3600 seconds. The default value is 300 seconds.
`monitor_only= [0|1]`	Specifies to only monitor the state of specified group. No recovery actions will take place. Valid values are: 0 = Disable the option. This is the default. 1 = Enable monitoring. **Note** `monitor_only`, `run_once`, and `run_until_first_failure` are mutually exclusive options.
`run_once= [0|1]`	Specifies to check the status of the group once. If the group needs recovery actions perform them. Exit after one check. This option ignores the setting of `restart_max_attempts`. Valid values are: 0 = Disable the option. This is the default. 1 = Enable status check. **Note** `monitor_only`, `run_once`, and `run_until_first_failure` are mutually exclusive options.
`run_until_first_failure= [0|1]`	Specifies to monitor the group until the first failure occurs and then exit without

Table 46 symrecover options file parameters (continued)

Setting	Description
	performing any recovery action. This option ignores the setting of `restart_max_attempts`. Valid values are: 0 = Disable the option. This is the default. 1 = Enable monitoring. **Note** `monitor_only`, `run_once`, and `run_until_first_failure` are mutually exclusive options.
`rdfg= rdfgvalue`	When working with device groups or composite groups that contain concurrent devices, `symrecover` supports monitoring only one of the SRDF groups that contain mirrors of the concurrent devices. Use the `rdfg` option to indicate the SRDF group that `symrecover` should monitor. Note that monitoring of concurrent SRDF defined groups is only supported when `symrecover` is executed from the R1 side. The value is taken directly as specified and no data validation is performed on it. This option is not set by default and non-concurrent SRDF groups are assumed. **Note** If the group is a composite group, and consistency is enabled, this must be of the "name:" format and this value is case sensitive.
`restart_adcopy_resynch_threshold= tracks`	Specifies the number of tracks outstanding that during recovery will trigger a switch over to SRDF/A or SRDF/S. The default value is 30000.
`restart_attempt_pause= time`	Inserts a specified wait time before an attempt is made to restart a failed session to allow for things to settle down. After the `restart_attempt_pause` is complete, `symrecover` redrives the overall monitor loop. If there is still a problem, the restart failure count is incremented and a restart is attempted.

Table 46 symrecover options file parameters (continued)

Setting	Description
	Valid values are 30 to 3600 seconds. The default is 60 seconds.
`restart_delay= time`	Inserts a specified wait time after an attempt is made to restart a failed session and the attempt itself fails. Valid values are 0 (no delay, immediately restart) to maxint. The default is 30 seconds.
`restart_group_on_startup= [0|1]`	On `symrecover` startup, if the group being monitored is not initially in a Consistent state (for SRDF/A) or a Synchronized state (for SRDF/S), `symrecover` considers this an error condition and exits. If this option is specified, `symrecover` will attempt to recover the group on startup. Valid values are: 0 = Disable the option. This is the default. 1 = Attempt recovery on startup.
`restart_max_attempts= attempts`	Specifies the maximum number of restart attempts that are performed within the `restart_window` interval. After this limit is reached the program terminates. The range is from 0 to maxint. The value of 0 specifies to attempt indefinitely. The default value is 5 attempts.
`restart_max_wait_adcopy_sync= time`	Specifies the length of time (in seconds) during a restart for a program to wait for a group to achieve the `restart_adcopy_resync_threshold` number of tracks pending. Valid values are 0 to maxint. The value of 0 specifies to wait forever. The default is 0.
`restart_max_wait_state_change = statetime`	Specifies the length of time (in seconds) during a restart for a program to wait for a group to change to a desired state (once requested). Valid values are 0 to maxint. The value of 0 specifies to wait forever. The default is 0.
`restart_max_wait_warn_interval= warntime`	Specifies the length of time (in seconds) to display a progress warning message

Table 46 symrecover options file parameters (continued)

Setting	Description
	while waiting for a state change to occur during a restart. Valid values are 0 and 30 to maxint. The value of 0 specifies to wait forever. The default is 600 seconds.
`restart_rdfa_min_cycle_warn_interval= cyclewarntime`	Specifies the length of time (in seconds) before repetitively displaying a warning when the RDFA minimum cycle time exceeds the `restart_rdfa_min_cycle_warn_value` parameter. Valid values are 30 to `maxint`.The default is 600.
`restart_rdfa_min_cycle_warn_value= warntime`	Specifies the maximum value (in seconds) to which a trigger can occur with a warning message, indicating the RDFA minimum cycle time has exceeded this value. Valid values are 0 and 30 to **`maxint`**. The value of 0 means this feature is turned off, which is the default.
`restart_state_syncinprog_wait_time time`	The maximum length of time (in seconds) during a group syncinprog state that sleep is done before rechecking the group status. Valid values are [30] to [maxint]. The default is [120] seconds.
`restart_state_transmit_warn_interval= time`	Specifies the interval of time (in seconds) that while a group remains in a transmit idle state, to generate a warning message. Valid values are 0 to **`maxint`**. The default is 300 seconds.
`restart_state_transmit_wait_time= transwaittime`	Specifies the maximum length of time (in seconds) that during a group transmit idle state, a sleep is done before rechecking the group status. Valid values are 30 to maxint. The default is 120 seconds.
`restart_sync_type= synctype`	Specifies the type of synchronization to be used following the detection of a failed SRDF/A session. Valid values are: ADCOPY = adaptive copy disk (default). SYNC = synchronous mode.

Table 46 symrecover options file parameters (continued)

Setting	Description
	NONE = No intermediate track resynch stage will be attempted. A direct re-establish using the existing SRDF session mode will be attempted. Note that if `cascaded_monitor_both_hops` is set, `restart_sync_type` is ignored as ADCOPY is used in the R21->R2 link at restart.
`restart_window= time`	Specifies a time window (in seconds) during which no more than `restart_max_attempts` failures and accompanying restart attempts will be tolerated before monitoring is terminated. The window begins at the time of the first failure and ends `restart_window` seconds later. A new window begins with a failure after expiration of the previous window.
`log_level= level`	The desired logging level. Valid values are: 0 = Off 1 = Only errors are reported 2 = Errors and warnings are reported 3 = Errors, warnings, and informational messages are reported (default) 4 = All messages are reported

APPENDIX A

SRDF operations and pair states

This appendix describes the following topics:

SRDF operations and applicable pair states

When a command to perform an SRDF control operation is issued, SRDF verifies the state of the device pairs.

If the device pair is not in a legal SRDF state to initiate the control operation, the action is blocked.

Use the `-force` option to perform the control operation, regardless of the pair state.

The `-force` option is required for devices that are part of an SRDF/Metro configuration.

The `-force` option is required for restore, update R1, and failback operations for devices that are running in SRDF/A mode.

Examples:
To initiate a failover on all SRDF pairs in the **prod** group that are in the Split state:

```
symrdf -g prod failover
```

To initiate a failover on one SRDF pair, DEV001, in the **prod** group that is n the SyncInProg state:

```
symrdf -g prod failover DEV001
```

NOTICE

The **-force** option may place the SRDF pair into an undesirable state. After using this option, always check the pair state.

Control operations for R1 - R2 pair states

In the following table, the first column lists the control operations that can be invoked for the listed pair states.

Allowed actions are noted by Ys.

The **Partitoned1** pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 47 SRDF control operations and applicable pair states

	R1 -> R2 pair state													
Control operation	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
deletepair			Y[a,b, c]	Y[a,b, c]	Y[a,b, c]									

Table 47 SRDF control operations and applicable pair states (continued)

Control operation	R1 -> R2 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
half_deletepair			Y[a,b,c]	Y[a,b,c]	Y[a,b]	Y[a,b,c]	Y[a,b,c]							
movepair			Y	Y	Y									
half_movepair			Y	Y	Y	Y	Y							
swap			Y[d]	Y[d,e]	Y[d]			Y[d]						
swap -refresh R1			Y[d,f]	Y[d,e,f]	Y[d,f]			Y[d,f]						
swap -refresh R2			Y[d,f]	Y[d,e,f]	Y[d,f]									
half_swap			Y[d]	Y[d]	Y[d]	Y[d]	Y[d]							
establish			Y[g]	Y[g]	Y[g,h]			Y[g,h]		Y[i]				
establish -full			Y[g]	Y[g]	Y[g,h]			Y[g,h]		Y[i,j]				
split	Y[a,b,c,k,l]	Y		Y[a,b,c,l]				Y[a,b,c,l]			Y[a,b,c,l]			
restore			Y[f]	Y[f,n]	Y[f,h]			Y[f,h]		Y[m]				
restore -full			Y[f]	Y[f,n]	Y[f,h]			Y[f,h]		Y[m,o]				
update				Y[a,f,p,q]	Y[a,f,q]			Y[a,f,q]						
failback			Y[a,f,g]	Y[a,f,g,p]	Y[a,f,g]	Y[g,r,s]	Y[g,r,s]	Y[a,f,g]	Y[a,f,g]					
failover	Y[k,l,t,u,v]	Y[l,t,u,v]	Y[l,s,t,u,v]	Y[l,t,u,v]		Y[l,u,v,w]	Y[l,u,v,w]	Y[l,t,u,v]	Y[k,l,t,u,v]	Y[l,s,t,u,v]	Y[l,t,u,v]	Y[l,t,u,v]		
failover -establish	Y[d,f,j,k,t]	Y[d,f,t]	Y[d,l,s,t]	Y[d,f,t]	Y[d,f,t]			Y[d,f,t]	Y[d,f,k,t]	Y[d,f,s,t]				
failover -restore	Y[d,g,k,x]	Y[d,g,x]	Y[d,g,s,x]	Y[d,g,x]	Y[d,g,s,x]					Y[d,g,s,x]	Y[d,g,x]			
invalidate R1				Y[f,y]										
invalidate R2				Y[g]										
merge				Y[n,z,aa]	Y[s,z,aa]									
msc_cleanup			Y	Y	Y	Y[w]	Y[w]							
not_ready R1	Y[e,ab]	Y[e,ab]	Y[e,ab]	Y[e,ab]	Y[ab]	Y[e,r,ab]	Y[e,r,ab]	Y[ab]	Y[,ab]	Y[e,ab]	Y[e,ab]	Y[e,r,ab]		

Table 47 SRDF control operations and applicable pair states (continued)

Control operation	R1 -> R2 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
not_ready R2	Y[j,ab,ac]	Y[ab,ac]	Y[ab,ac]	Y[ab]	Y[ab,ac]	Y[ab,w,ad]	Y[ab,w,ad]	Y[ab,ac]	Y[ab,ac]	Y[j,ab,ac]				
ready R1	Y[ab]	Y[ab]	Y[ab]	Y[ab]	Y[ab]	Y[r,ab]	Y[r,ab]	Y[ab]	Y[ab]	Y[ab]	Y[ab]	Y[ab]		
ready R2	Y[j,ab]	Y[ab]	Y[ab]	Y[ab]	Y[ab]	Y[ab,w]	Y[ab,w]	Y[ab]	Y[ab]	Y[j,ab]				
refresh R1				Y[p,ae,af]	Y[s,af]									
refresh R2				Y[g,p,s]										
resume				Y										
suspend	Y[a,b,c,k,l,ag]	Y	Y[a,b,c,l,s,ag, ah]	Y[a,b,c,l,ad,ag]	Y[a,b,c,h,l,ag]	Y[a,b,c,l,ag]	Y[a,b,c,ag]	Y[a,b,c,ag]	Y[a,b,c,k,ag]	Y[a,b,c,l,,ag]	Y[a,b,c,l,ae,ag]	Y[a,b,c,l,ae,ag]	Y[s]	Y[s]
disable	Y[u]	Y[u]	Y[u]	Y[u]	Y[u]	Y[s,u]	Y[s,u]	Y[u]	Y[u]	Y[u]	Y[u]			
enable	Y[ai]		Y[ai]	Y[ai]	Y[ai]			Y[ai]	Y[ai]	Y[ai]	Y			
rw_disable R2	Y[j]	Y	Y[aj]	Y	Y[aj]	Y[w,ad]	Y[w,ad]	Y[aj]	Y[aj]	Y[j]				
rw_enable R1	Y[p]	Y[p]		Y[p]	Y[s]	Y[p,r]	Y[p,r]			Y[p]	Y[p]	Y[p,r]		
rw_enable R2				Y[ad]		Y[w,ad]	Y[w,ad]							
write_disable R1	Y[s]	Y[s]	Y[,s]	Y[s]		Y[r,ak]	Y[r,ak]			Y[s]	Y[s]	Y[r,ak]		
write_disable R2			Y[s]	Y[s]	Y[s]	Y[ac,w]	Y[ac,w]	Y[s]	Y[s]	Y[s]		Y[ac,w]		
activate -rdfa_dse	Y[al]										Y	Y[ao]		
deactivate -rdfa_dse	Y[al]										Y	Y[ao]		
activate -rdfa_devpace	Y[al,am]										Y[am]	Y[am,ao]		
deactivate -rdfa_devpace	Y[al,am]										Y[am]	Y[am,an,ao]		
activate -rdfa_pace	Y[al]										Y	Y[ao]		
deactivate -rdfa_pace	Y[al]										Y	Y[an,ao]		
activate -rdfa_wpace	Y[al]										Y	Y[ao]		

Table 47 SRDF control operations and applicable pair states (continued)

Control operation	R1 -> R2 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
deactivate -rdfa_wpace	Y[al]										Y	Y[ao]		
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y			Y	Y		Y			
deactivate - rdfa_wpace_exempt	Y	Y	Y	Y	Y			Y	Y		Y			

a. If remote invalid tracks are on the source side, must use -force.
b. If there are local invalid tracks on the source side, must use -symforce if the source is not an R11 or R21.
c. If there are local invalid tracks on the target side, must use -symforce if the target is not an R11 or R21.
d. Not allowed if enabled for SRDF consistency protection.
e. Write Disabled on the source.
f. No local invalid tracks on the target side.
g. No local invalid tracks on the source side.
h. Source is not visible to any host.
i. Source and target are Not Ready but the SRDF link is Ready and there are no local or remote invalid tracks on the source or the target.
j. Not allowed when SRDF/A is active.
k. Can use -symforce.
l. If enabled for SRDF consistency protection, must use -force.
m. Source and target are Not Ready but the SRDF link is Ready and there are no remote invalid tracks on the source side.
n. SA is Write Disabled, or is Not Ready on the source side, or must use -force.
o. Source and target are Not Ready but the SRDF link is Ready and there are no local or remote invalid tracks on the source side.
p. SA is Write Disabled or is Not Ready on the source side.
q. Not allowed if the R1 array is running Enginuity 5876 and the R2 array is running Enginuity 5977 or higher.
r. Host application running while connected to the source.
s. Must use -force.
t. If remote invalid tracks are on the source side, must use -symforce.
u. If enabled for CG SRDF consistency protection, must use -force.
v. If local invalid tracks are on the target side, must use –symforce.
w. Host application running while connected to the target.
x. If remote invalid tracks are on the target side, must use -force.
y. SA is Write Disabled, or is Not Ready on the source side, or must use -nowd.
z. Source device is Read Write Enabled and there are no local and remote invalid tracks on the target side.
aa. Target device is Read Write Enabled and there are no local and remote invalid tracks on the target side.
ab. Not allowed on a diskless device.
ac. RA is Ready on the target side.
ad. SA or RA is Write Disabled or is Not Ready on the target side.
ae. Must use -immediate.
af. No local invalid tracks on the target side and no remote invalid tracks on the source side and must use -force.
ag. Write Disabled on the SRDF link and must use -force.
ah. Write Disabled on the SRDF link.
ai. Must be in async mode.
aj. RA is Write Disabled on the target side.
ak. SA is Ready on the source side.
al. SRDF/A must be active.
am. Not allowed if the R1 or R2 array is running Enginuity 5977 or higher
an. Only allowed on the R1 side and must use -symforce.
ao. Source must be reachable.

Cascaded SRDF control operations and applicable pair states

Allowable control operations vary depending on the type of SRDF device. This section describes allowable operations by device pair types in cascaded configurations.

Cascaded SRDF: R1 - R21 control operations allowed for R21- R2 pair states

The following table lists the allowable control operations for the R1 -> R21 pair given the pair states for the R21 -> R2 pair.

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 48 R1 -> R21 cascaded SRDF control operations and applicable pair states

R1 -> R21 control operation:	R21 -> R2 pair state: Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
createpair -establish	Y[a,b,c,j,o,d,e,f]	Y[a,b,d]	Y[a,p,d,e]	Y[a,p,d,e,f]	Y[a,p,n,d,e]	Y[a,p,d,e,f]					Y[a,b,c,j,o,e]	Y[a,b,c,j,o,e]		
createpair -restore	Y[a,g,j,d h,e,f]	Y[a,d]	Y[a,p,d,e]	Y[a,p,d,e,f]	Y[a,p,n,d,e]	Y[a,i,p,d,e,f]					Y[a,i,j,o,e]	Y[a,g,j,o,e]		
createpair -invalidate R1	Y[a,g,j,d,e,f]	Y[a,i,d]	Y[a,d,e]	Y[a,d,e,f]	Y[a,d,e]	Y[a,d,e,f]		Y[a,d,e]	Y[a,d,e]		Y[a,j,e]	Y[a,g,j,e]		
createpair -invalidate R2	Y[a,i,j,d,e,f]	Y[a,i,d]	Y[a,i,d,e]	Y[a,i,d,e,f]	Y[a,i,d,e]	Y[a,i,d,e,f]		Y[a,i,d,e]	Y[a,i,d,e]		Y[a,j,e]	Y[a,j,e]		
deletepair	Y[a,p]	Y[a,p]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a,p]	Y[a,p]	Y[a,p]	Y[a,k]	Y[a,p]	Y[a,p]		
half_deletepair	Y[a,p]	Y[a,p]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a,p]	Y[a,p]	Y[a,p]	Y[a,k]	Y[a,p]	Y[a,p]		
movepair	Y[a,f,h]	Y[a]	Y[a]	Y[a,f]	Y[a,l]	Y[a]	Y[a,l]	Y[a,l]	Y[a,l]	Y[a,l]	Y[a,h]	Y[a,h]		
half_movepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]		
swap	Y[a,p]	Y[a,p]	Y[a]	Y[a]	Y[a]	Y[a]		Y[a,p]	Y[a,p]		Y[a,p]	Y[a,p]		
half_swap	Y[a,p]	Y[a,p]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a,p]	Y[a,p]	Y[a,p]		Y[a,p]	Y[a,p]		
swap -refresh R1	Y[a,p]	Y[a,p]	Y[a]	Y[a]	Y[a]	Y[a]		Y[a,p]	Y[a,p]		Y[a,p]	Y[a,p]		
swap -refresh R2			Y[a]	Y[a]	Y[a,n]	Y[a]								

Table 48 R1 -> R21 cascaded SRDF control operations and applicable pair states (continued)

	R21 -> R2 pair state:													
R1 -> R21 control operation:	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
establish	Y[c,o]	Y[m]	Y[p]	Y[p]	Y[p,n]	Y[p]					Y[m,c,o]	Y[m,b,c,o]		
establish -full	Y[b,c,o]	Y[b]	Y[p]	Y[p]	Y[p,n]	Y[p]					Y[m,b,c,o]	Y[m,b,c,o]		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
restore	Y[g,o,h]	Y	Y[p]	Y[p]	Y[p,n]	Y[i,p]					Y[,o]	Y[g,i,o]		
restore -full	Y[g,o,h]	Y		Y[p]	Y[p,n]	Y[i,p]					Y[,o]	Y[g,i,o]		
update	Y[g,o]	Y	Y[p]	Y[p]	Y[p]	Y[p]		Y	Y		Y[o]	Y[g,o]		
failback	Y[g,o,h]	Y	Y[p]	Y[p]	Y[p,n]	Y[i,p]					Y	Y[g,i,o]		
failover	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y		
failover -establish	Y[a,p]	Y[a,p]	Y[a,p]	Y[a,p]	Y[a,p,n]	Y[a,p]					Y[a,p]	Y[a,p]		
failover -restore	Y[a,q,r,p]	Y[a,r,p]	Y[a,p]	Y[a,p]	Y[a ,p ,n]	Y[a,p]	Y[a,r,p]			Y[r,p]	Y[a,q,r,p]	Y[a,q,r,p]		
invalidate -R1	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
invalidate -R2	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
merge	Y[s]	Y[s]	Y[s]	Y[s]	Y[s]	Y[s]		Y[s]	Y[s]		Y[s]	Y[s]		
msc_cleanup														
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R1	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
refresh R2			Y	Y	Y	Y		Y	Y					
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
resume	Y[c,g,o]	Y[g]	Y[p]	Y[p]	Y[p,n]	Y[p]					Y[m,c,o]	Y[m,b,c,g,o]		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

Table 48 R1 -> R21 cascaded SRDF control operations and applicable pair states (continued)

R1 -> R21 control operation:	R21 -> R2 pair state:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

a. If the other pair (the one not being controlled) is enabled for SRDF consistency protection, must use -force. This operation can change the composite group type, causing SRDF consistency monitoring to stop.
b. Must use -force.
c. Not allowed if operation results in R1->R21<-R2 data resynchronization.
d. Not allowed when what will become the R21->R2 is in Synchronous mode.
e. No more than one of the R21's RDF device pairs can be operating in Asynchronous RDF mode.
f. No more than one of the R21's RDF device pairs can be part of an SRDF/Metro group.
g. Not allowed if R21 is diskless and operation will result in R1<-R21->R2 data resynchronization.
h. Not allowed if the R1->R21 is in Active mode and tracks are owed to the R21 from the R2.
i. If tracks are owed to R21 while R21->R2 is in the Transmit Idle state, data resynchronization between R1->R21 cannot complete.
j. Not allowed if SRDF/A group-level write pacing or SRDF/A device-level write pacing is active and supported on the R1 mirror of what will become the R21 and the R21 array is running an Enginuity level lower than 5876 Q42012 SR.
k. Not allowed if R1 is diskless and the SRDF link of the other pair is RW.
l. Movepair not allowed into SRDF/Metro group.
m. If the other pair (not being controlled) is enabled for SRDF consistency protection, must use -force.
n. The R21 is not visible to any host.
o. If the pair being controlled is the R1->R21 pair and is operating in adaptive copy mode and the R1 mirror of the R21 has either SRDF/A group-level or SRDF/A device-level write pacing activated and supported, must use -force.
p. Not allowed if R21 is diskless.
q. Not allowed if R2 owes tracks to R21.
r. Must use -remote.
s. Not allowed if R21 is diskless and both mirrors of R21 have invalid tracks.

Cascaded SRDF: R21 - R2 control operations allowed for R1 - R21 pair states

The following table lists the allowable control operations for the R21 - >R2 pair given the SRDF pair states for the R1 -> R21 pair.

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 49 R21 -> R2 cascaded SRDF control operations and applicable pair states

R21 -> R2 control operation	R1 -> R21 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
createpair -establish	Y[a,b,c,d,e]	Y[a,b]	Y[a,f,d]	Y[a,f,c,d,e]	Y[a,f,d]	Y[a,f,c,d,e]		Y[a,d]	Y[a,d]		Y[a,d]	Y[a,d]	Y[c,e]	Y[c,e]
createpair -restore			Y[a,g,d]	Y[a,c,d,e]	Y[a,g,d]	Y[a,g,c,d,e]		Y[a,d]	Y[a,d]					
createpair -invalidate R1	Y[a,c,d,e]	Y[a]	Y[a,d]	Y[a,c,d,e]	Y[a,g,d]	Y[a,g,c,d,e]		Y[a,d]	Y[a,d]		Y[a,d]	Y[a,d]	Y[e]	Y[e]
createpair -invalidate R2	Y[a,c,d,e]	Y[a]	Y[a,f,d]	Y[a,f,c,d,e]	Y[a,f,d]	Y[a,f,c,d,e]		Y[a,d]	Y[a,d]		Y[a,g,d]	Y[a,d]	Y[e]	Y[e]
deletepair	Y[a,h]	Y[a,h]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a,h]	Y[a,h]	Y[a,h]	Y[a]	Y[a,h]	Y[a,h]	Y	Y
half_deletepair	Y[a,h]	Y[a,h]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a,h]	Y[a,h]	Y[a,h]	Y[a]	Y[a,h]	Y[a,h]	Y	Y
movepair	Y[a,c,i]	Y[a, i]	Y[a, i]	Y[a, c, d, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[a, i]	Y[i]	Y[i]
half_movepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y
swap	Y[a,h,j]	Y[a,h]	Y[a]	Y[a,j]	Y[a]	Y[a,k,j]		Y[a,h]	Y[a,k]		Y[a,h]	Y[a,h]		
half_swap	Y[a,h,l]	Y[a,h]	Y[a]	Y[a,l]	Y[a]	Y[a,j]	Y[a,h,j]	Y[a,h]	Y[a,h]		Y[a,h]	Y[a,h]		
swap -refresh R1	Y[a,h,j]	Y[a,h]	Y[a]	Y[a,j]	Y[a]	Y[a,j]		Y[a,h]	Y[a,h]		Y[a,h]	Y[a,h]		
swap -refresh R2	Y[a,h,j]	Y[a,h]	Y[a]	Y[a,j]	Y[a,]	Y[a,j]		Y[a,h]	Y[a,h]		Y[a,h]	Y[a,h]		
establish	Y[b]	Y[b]	Y[f]	Y[f]	Y[f]	Y[f]		Y	Y		Y	Y	Y	Y
establish -full	Y[b]	Y[b]	Y[f]	Y[f]	Y[f]	Y[f]		Y	Y		Y		Y	Y
split	Y[h]	Y[h]	Y	Y	Y	Y	Y[h]	Y[h]	Y[h]	Y[m]	Y	Y	Y	Y
restore			Y	Y	Y	Y		Y	Y					
restore -full			Y	Y	Y	Y		Y	Y					
update			Y	Y	Y	Y		Y	Y					

Table 49 R21 -> R2 cascaded SRDF control operations and applicable pair states (continued)

R21 -> R2 control operation	R1 -> R21 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
failback			Y	Y	Y	Y^{h}		Y	Y					
failover			Y	Y	Y	Y	Y^{j}	Y^{h}	Y^{h}	$Y^{j,m}$				
failover -establish			$Y^{a,h}$	$Y^{a,h,j}$	$Y^{a,h,n}$	$Y^{a,j}$								
failover -restore			$Y^{a,f,h}$	$Y^{a,h,j}$	$Y^{a,h,n}$									
invalidate -R1	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y
merge	$Y^{f,o}$	$Y^{f,o}$	Y^{f}	Y^{f}	$Y^{f,o}$	$Y^{f,o}$		$Y^{f,o}$	$Y^{f,o}$		$Y^{f,o}$	$Y^{f,o}$	Y^{o}	Y^{o}
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y^{j}	Y	Y	Y^{j}	Y	Y^{j}	Y^{j}	Y	Y	Y^{j}	Y	Y		
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1			Y	Y	Y^{n}	Y								
refresh R2	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y
suspend	Y^{h}	Y^{h}	Y	Y	Y	Y	Y^{h}	Y^{h}	Y^{h}	Y^{m}	Y	Y	Y	Y
resume	$Y^{p,b}$	$Y^{p,b}$	Y^{f}	Y^{f}	Y^{f}	Y^{f}		Y	Y		Y^{p}	$Y^{g,p}$	Y^{p}	Y^{p}
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y^{j}	Y	Y	Y^{j}	Y	Y^{j}	Y^{j}	Y	Y	Y^{j}	Y	Y		
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y^{q}	Y^{q}	Y	Y	Y	Y		Y^{q}	Y^{q}		Y	Y		
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y^{q}	Y^{q}	Y	Y	Y	Y		Y^{q}	Y^{q}		Y	Y	Y	Y

Table 49 R21 -> R2 cascaded SRDF control operations and applicable pair states (continued)

R21 -> R2 control operation	R1 -> R21 pair state													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace	Y[q]	Y[q]	Y	Y	Y	Y		Y[q]	Y[q]		Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. If the other pair (the one not being controlled) is enabled for SRDF consistency protection, must use -force. This operation can change the composite group type, causing SRDF consistency monitoring to stop.
b. If the pair being controlled is (or will become) the R21->R2 pair and is operating in asynchronous mode with SRDF/A device-level or group-level write pacing configured for autostart on the R1 mirror of the R21, and the R1->R21 pair is operating in adaptive copy mode and is read/write (RW) on the SRDF link, must use -force.
c. If either of the R21's RDF device pairs is in Active RDF mode, its other RDF device pair cannot be in Synchronous RDF mode.
d. No more than one of the R21's RDF device pairs can be operating in Asynchronous RDF mode.
e. No more than one of the R21's RDF device pairs can be operating in Active RDF mode.
f. Not allowed if R21 is diskless and operation will result in R1 <-R21-> R2 data resynchronization.
g. If tracks are owed to R21 while R21->R2 is in the Transmit Idle state, data resynchronization between R1->R21 cannot complete.
h. Not allowed if R21 is diskless.
i. Movepair into an SRDF/Metro group not allowed.
j. Not allowed if the R1->R21 pair is operating in Active RDF mode.
k. If the other pair (not being controlled) is enabled for SRDF consistency protection, must use -force.
l. Not allowed on the R21 device if the R1->R21 pair is operating in Active RDF mode.
m. Not allowed if R1 is diskless and the SRDF link of the other pair is RW.
n. The R21 is not visible to any host.
o. Not allowed if operation results in local invalid tracks on the R21 device.
p. Not allowed if operation results in data flowing from R2 -> R21.
q. If the R1->R21 pair is operating in adaptive copy mode and is read/write (RW) on the SRDF link, must use –force.

Cascaded SRDF set operations and applicable pair states

Allowable set operations vary depending on the type of SRDF device. This section describes allowable operations by device pair types in cascaded configurations.

Note

Devices that are part of an SRDF/Metro configuration cannot also be part of a cascaded configuration. There are no columns for ActiveActive or ActiveBias pair states in the tables in this section.

Cascaded SRDF: R1 - R21 set operations allowed for R21 - R2 pair states

The following table lists the allowable control operations for the R21 -> R2 pair given the SRDF pair states for the R1 -> R21 pair.

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 50 R1 -> R21 Cascaded RDF Set Operations and Applicable Pair States

	R21 -> R2 pair state													
R1 -> R21 set operation:	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
set mode async	Y[a]	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]				
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
set mode acp_disk	Y[b]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b]	Y[b]		
set mode acp_wp	Y[b,c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[c]	Y[b,c]	Y[b,c]		

a. Async mode is not supported on both sides of an R21. It is only supported on one side or the other.
b. You must use -force if SRDF/A device-level and/or group-level write pacing is activated and supported for the SRDF/A session that includes the R21->R2 RDF device pair, and the R1->R21 SRDF device pair (that is being controlled) is read/write (RW) on the SRDF link.
c. Not allowed if the R1 is running HYPERMAX OS 5977 or later.

Cascaded SRDF: R21 - R2 set operations allowed for R1 - R21 pair states

The following table lists the allowable control operations for the R21 -> R2 pair given the SRDF pair states for the R1 -> R21 pair.

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 51 R21 -> R2 Cascaded RDF Set Operations and Applicable Pair States

	R1 -> R21 pair state													
R21 -> R2 set operation:	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
set mode async	Y[a,b]	Y[a]	Y[b]	Y[b]	Y[b]	Y[b]	Y[c,b]	Y[a,b]	Y[a,b]	Y[c,b]			Y	Y
set mode sync	Y[d]	Y	Y	Y[d]	Y	Y[d]	Y[d]	Y	Y	Y[d]	Y	Y		
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		

a. Must use -force if all of these conditions apply:

1. SRDF/A device-level and/or group-level write pacing is configured for autostart for the SRDF/A session that includes the R21->R2 SRDF device pair.
2. The R21->R2 SRDF device pair (that is being controlled) is read/write (RW) on the SRDF link.
3. The R1->R21 SRDF device pair (that is not being controlled) is operating in adaptive copy mode and is read/write (RW) on the SRDF link.

b. Async mode is not supported on both sides of an R21. It is only supported on one side or the other.

c. Not allowed if SRDF/A device-level and/or group-level write pacing is configured for autostart for the SRDF/A session that includes the R21->R2 device pair.

d. Not allowed if R1->R21 SRDF device pair is operating in Active mode.

e. Not allowed if the R21 is running HYPERMAX OS 5977 or later.

Concurrent SRDF operations and applicable pair states

This section provides the concurrent SRDF control operations and their applicable pair states for concurrent R1 (R11) and concurrent R2 (R22), including:

- Concurrent SRDF: 1st leg R1- 2nd leg R1 pair states on page 468
- Concurrent SRDF: 1st leg R2 - 2nd leg R2 pair states on page 471

Note

Devices that are part of an SRDF/Metro configuration cannot be R22 devices.

About concurrent R1

In a concurrent R1 relationship, there are two separate links, or legs, sending data from one R1 device to two separate R2 mirrors. You can perform a control operation on one of these legs only if the other leg is in a certain pair state.

Note

If a concurrent R1 device is made RW (read write) from either of the SRDF relationships, it is also seen as RW from the other relationship. The commands to make a concurrent R1 device RW are: rw_enable R2, split, and failover.

Concurrent SRDF: 1st leg R1- 2nd leg R1 pair states

The following table lists the allowable control operations for the first leg of the concurrent R1 pair (the one being controlled by an SRDF action) given the pair state of the second leg (the one not being controlled).

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 52 SRDF control operations and applicable states for concurrent R1 pairs

Control operation of 1st leg of concurrent SRDF R1 pair:	Pair state of 2nd leg of concurrent SRDF R1 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
createpair -establish	Y[a,b,c]	Y[a,b]	Y[a,b]	Y[a,b,c]	Y[a,b]	Y[a,b,c]	Y[a,b,c]	Y[a,b]	Y[a,b]		Y[a]	Y[a]	Y[b,c]	Y[b,c]
createpair -restore	Y[a,d,e,b,f]	Y[a,e,b]	Y[a,b]	Y[a,b,c]	Y[a,b]	Y[a,b,c]	Y[a,e,b,c,f]			f	Y[a,d,e]	Y[a,d,e]		
createpair -invalidate R1	Y[a,d,b,c]	Y[a,b]	Y[a,b]	Y[a,b,c]	Y[a,b]	Y[a,b,c]	Y[a,b,c]	Y[a,b]	Y[a,d,b]		Y[a,d]	Y[a,d]	Y[b,c]	Y[b,c]

Table 52 SRDF control operations and applicable states for concurrent R1 pairs (continued)

Control operation of 1st leg of concurrent SRDF R1 pair:	Pair state of 2nd leg of concurrent SRDF R1 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
createpair -invalidate R2	Y[a,b,c]	Y[a,b]	Y[a,b]	Y[a,b,c]	Y[a,b]	Y[a,b,c]	Y[a,b,c]	Y[a,b]	Y[a,b]		Y[a]	Y[a]	Y[b,c]	Y[b,c]
deletepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y
half_deletepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y
movepair	Y[a, b, c, t]	Y[a, b]	Y[a]	Y[a, b, c]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a, t]	Y[a, t]	Y[b, c]	Y[b, c]
half_movepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y
swap	Y[a,g,h,i,f,j]	Y[a,h,i]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,g,i,j]	Y[a,g,i,j]		
half_swap	Y[a,g,h,i,f,j]	Y[a,h,i]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,j]		Y[a,g,i,j]	Y[a,i,j]		
swap -refresh R1	Y[a,d,g,h,i,f,j]	Y[a,h,i]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,d,h,i,j]	Y[a,h,i,f,j]	Y[a,d,g,i,j]	Y[a,d,g,i,j]		
swap -refresh R2	Y[a,g,h,i,f,j]	Y[a,h,i]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,h,i,f,j]	Y[a,h,i,j]	Y[a,h,i,j]	Y[a,h,i,f,j]	Y[a,g,i,j]	Y[a,g,i,j]		
establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
establish -full	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
split	Y	Y	Y	Y	Y[k]	Y	Y	Y[l]		Y	Y	Y	Y	Y
restore	Y[d,e,f]	Y[e]	Y	Y	Y	Y	Y[e,f]			Y[e,f]	Y[d,e]	Y[d,e]		
restore -full	Y[d,e,f]	Y[e]	Y	Y	Y	Y	Y[e,f]			Y[e,f]	Y[d,e]	Y[d,e]		
update	Y[d,e,f]	Y[e]	Y	Y	Y	Y	Y[f]			Y[e,f]	Y[d,e]	Y[d,e]		
failback	Y[d, f]	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[f]	Y[d]	Y[e, f]	Y[d]	Y[d]		
failover	Y[f]	Y	Y	Y	Y	Y	Y[f]	Y[f]	Y	Y[f]	Y	Y		
failover -establish	Y[a,g,m,i,f,j]	Y[a,i]	Y[a,n,i,j]	Y[a,n,i,f,j]	Y[a,n,o,i,j]	Y[a,n,i,f,j]	Y[a,n,i,f,j]				Y[a,g,m,i,j]	Y[a,g,m,i,j]		
failover -restore	Y[a,p,g,m,i,f,j]	Y[a,i]	Y[a,n,i,j]	Y[a,n,i,f,j]	Y[a,n,o,i,j]	Y[a,n,i,f,j]	Y[a,n,i,f,j]				Y[a,g,m,i,j]	Y[a,q,p,g,m,i,j]		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y[d]	Y	Y	Y	Y	Y	Y	Y	Y[d]		Y[d]	Y[d]	Y[d]	Y[d]

Table 52 SRDF control operations and applicable states for concurrent R1 pairs (continued)

Control operation of 1st leg of concurrent SRDF R1 pair:	Pair state of 2nd leg of concurrent SRDF R1 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y [f,r]	Y	Y	Y[f,]	Y	Y[f,]	Y[f,]	Y	Y	Y [f]	Y	Y		
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y[d,f]	Y	Y	Y	Y	Y	Y [f]	Y	Y[d]	Y [f]	Y[d]	Y[d]		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y[d,s,t]	Y[s]	Y	Y	Y	Y	Y[e,f]	Y	Y[d]	Y[d,e,f]	Y[d,s]	Y[d,s]	Y[u]	Y[u]
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y[f,]	Y	Y	Y[f,]	Y	Y[f,]	Y[f,]	Y	Y	Y[f,]	Y	Y		
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate - rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate - rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate - rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate - rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate - rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate - rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 52 SRDF control operations and applicable states for concurrent R1 pairs (continued)

Control operation of 1st leg of concurrent SRDF R1 pair:	Pair state of 2nd leg of concurrent SRDF R1 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. If the other pair (the one not being controlled) is enabled for SRDF consistency protection, must use -force. This operation can change the composite group type, causing SRDF consistency monitoring to stop.
b. If either of the R11's RDF device pairs is in Active RDF mode, its other RDF device pair cannot be in Synchronous RDF mode.
c. No more than one of the R11's RDF device pairs can be operating in Active RDF mode.
d. Not allowed if R2->R11<-R2 data resynchronization will result.
e. Must use -remote.
f. Not allowed if the other pair (the one not being controlled) is operating in Active RDF mode.
g. Not allowed if SRDF/A group-level write pacing or SRDF/A device-level write pacing is active and supported on the other R1 mirror what will become the R21 and the R21 array is running an Enginuity level lower than 5876 Q42012 SR.
h. Not allowed when what will become the R21->R2 is in Synchronous mode.
i. Not allowed if what will become the R21, R1 or R2 array is running HYPERMAX OS/Solutions Enabler 8.0.1.
j. Not allowed if both of the R11's RDF pairs are operating in Asynchronous RDF mode.
k. Must use -force. The state of the other pair changes to Suspended.
l. Changes the state of the other pair to Split.
m. If the pair being controlled is operating in adaptive copy mode, must use -force if the R1 mirror of what will become the R21 has SRDF/A group-level and/or device-level write pacing activated and supported.
n. Not allowed if R11 is diskless.
o. The R11 is not visible to any host.
p. Not allowed if a diskless device and will become an R21 device and results in R1<-R21->R2 data resynchronization.
q. If device will become an R21 and the other pair is in Transmit Idle pair state, data synchronization between R1->R21 cannot complete.
r. Not allowed if the other pair (the one not being controlled) is part of a Non-Disruptive Data Migration session.
s. Only allowed if data flows from R2 to R11 and -remote is used.
t. Not allowed if data will flow from the R2 to the R11 and the other pair (the one not being controlled) is operating in Active RDF mode.
u. Not allowed if data will flow from the R2 to the R11.

Concurrent SRDF: 1st leg R2 - 2nd leg R2 pair states

Concurrent R2 devices are intended for SRDF/Star configurations.

In a concurrent R2 configuration, an R2 device has two remote mirrors, only one of which can be active (read/write) at a given time.

The following table lists the allowable control operations for the R21->R2 pair given the SRDF pair states for the R1->R21 pair. lists the allowable control operations for the first leg (the one being controlled by an SRDF action) of the concurrent R2 pair given the pair state of the second leg (the one not being controlled).

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 53 SRDF control operations and applicable states for concurrent R2 pairs

Control operation of 1st leg of concurrent SRDF R2 pair:	Pair state of 2nd leg of concurrent SRDF R2 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
createpair -establish			Y[a,b,c]	Y[a,c,d]	Y[a,b,c]	Y[a,c,d]								
createpair -restore			Y[a,b,c]	Y[a,c,d]	Y[a,b,c]	Y[a,c,d]								
createpair -invalidate R1	Y[a,c,d]	Y[a,c]	Y[a,b,c]	Y[a,c,d]	Y[a,b,c]	Y[a,c,d]		Y[a,c]	Y[a,c]		Y[a,c]	Y[a,c]		
createpair -invalidate R2	Y[a,c,d]	Y[a,c]	Y[a,b,c]	Y[a,c,d]	Y[a,b,c]	Y[a,c,d]		Y[a,c]	Y[a,c]		Y[a,c]	Y[a,c]		
deletepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]		
half_deletepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]		
movepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]		
half_movepair	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]		
swap	Y[a,c,e]	Y[a,c]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		
half_swap	Y[a,c,e]	Y[a,c]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		
swap -refresh R1	Y[a,c,e]	Y[a,c]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		Y[a,c,e]	Y[a,c,e]		
swap -refresh R2				Y[a,c,e]		Y[a,c,e]								
establish			Y[b]	Y	Y[b]	Y								
establish -full			Y[b]	Y	Y[b]	Y								
split			Y	Y[f]	Y	Y		Y	Y	Y				
restore			Y[b]	Y	Y[b]	Y								
restore -full			Y[b]	Y	Y[b]	Y								
update			Y	Y	Y	Y								
failback			Y[b]	Y	Y[b]	Y								
failover			Y	Y[f]	Y	Y	Y			Y				
failover -establish			Y[c,e]	Y[f,c,e]	Y[g,c,e]	Y[e]								

Table 53 SRDF control operations and applicable states for concurrent R2 pairs (continued)

Control operation of 1st leg of concurrent SRDF R2 pair:	Pair state of 2nd leg of concurrent SRDF R2 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
failover -restore			Y[a,c,e]	Y[a,f,c,e]	Y[a,g,c,e]	Y[a,c,e]		Y[a,h,c,e]	Y[a,h,c,e]					
invalidate -R1	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
invalidate -R2	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
merge			Y	Y	Y	Y								
msc_cleanup			Y	Y	Y	Y	Y							
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
not_ready R2	Y	Y	Y[b]	Y	Y[b]	Y	Y	Y[b]	Y[b]	Y	Y	Y		
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R1	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		
refresh R2				Y		Y								
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
resume			Y[b]	Y	Y[b]	Y								
rw_disable R2	Y	Y	Y[b]	Y	Y[b]	Y		Y[b]	Y[b]		Y	Y		
rw_enable R1	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		
rw_enable R2			Y	Y[f]	Y	Y	Y	Y	Y	Y				
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
write_disable R2	Y	Y	Y[b]	Y	Y[b]	Y		Y[b]	Y[b]		Y	Y		
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

Table 53 SRDF control operations and applicable states for concurrent R2 pairs (continued)

Control operation of 1st leg of concurrent SRDF R2 pair:	Pair state of 2nd leg of concurrent SRDF R2 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

a. If the other pair (the one not being controlled) is enabled for SRDF consistency protection, must use -force. This operation can change the composite group type, causing SRDF consistency monitoring to stop.
b. Must use -force. The state of the other pair changes to Suspended.
c. Not allowed if what will become the R21, R1 or R2 array is running HYPERMAX OS.
d. Not allowed if the other pair (the one not being controlled) is operating in Active RDF mode.
e. Not allowed if both of the R22's RDF pairs are operating in Asynchronous RDF mode.
f. Changes the state of the other pair to Split.
g. The other pair's (the one not being controlled) R1 is not visible to any host.
h. If the pair being controlled is operating in asynchronous mode, with SRDF/A group-level and/or device-level write pacing enabled for autostart on what will be the R1 mirror of the resulting R21, must use -force if the other pair (that is not being controlled) is operating in adaptive copy mode.

Concurrent SRDF set operations and applicable pair states

This section provides the concurrent SRDF set control operations and their applicable pair states for concurrent R1 (R11) and concurrent R2 (R22), including:

- Concurrent SRDF: R11 (1st leg R1- 2nd leg R1) pair states on page 475
- Concurrent SRDF: R22 (1st leg R2- 2nd leg R2) pair states on page 475

Note

Devices that are part of an SRDF/Metro configuration cannot be R22 devices.

Concurrent SRDF: R11 (1st leg R1- 2nd leg R1) pair states

The following table lists the allowable set operations for the first leg of the concurrent R1 pair (the one being controlled by an SRDF action) given the pair state of the second leg (the one not being controlled).

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 54 SRDF set operations and applicable states for concurrent R1 pairs

Set operation on one leg of concurrent SRDF R1 pair:	Pair state of other leg of concurrent SRDF R1 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode sync	Y[a]	Y	Y	Y[a]	Y	Y[a]	Y[a]	Y	Y	Y[a]	Y	Y		
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]		

a. Not allowed if the other pair (the one not being controlled) is operating in Active RDF mode.
b. Not allowed if the R1 is running HYPERMAX OS 5977 or later.

Concurrent SRDF: R22 (1st leg R2- 2nd leg R2) pair states

The following table lists the allowable set operations for the first leg of the concurrent R2 pair (the one being controlled by an SRDF action) given the pair state of the second leg (the one not being controlled).

Allowed actions are noted by Ys.

Partitoned1 pair state indicates that the remote array is in the SYMAPI database and was discovered.

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

Table 55 SRDF set operations and applicable states for concurrent R2 pairs

Set operation on one leg of concurrent SRDF R2 pair:	Pair state of other leg of concurrent SRDF R2 pair:													
	Sync in prog	Syncronized	Split	Suspended	Failed over	Partitioned1	Partitioned2	R1 updated	R1 updinprog	Invalid	Consistent	TransmitIdle	ActiveActive	ActiveBias
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
set mode sync	Y[a]	Y	Y	Y[a]	Y	Y[a]	Y[a]	Y	Y	Y[a]	Y	Y		
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
set mode acp_wp	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]	Y[b]		

a. Not allowed if the other pair (the one not being controlled) is operating in Active RDF mode.
b. Not allowed if the R1 is running HyperMax OS 5977 or later.

Consistency group operations and applicable pair states

Content-Reference to:

APPENDIX B

SRDF operations and TimeFinder sessions

This appendix describes the following topics:

SRDF operations during TimeFinder/Snap/VP Snap sessions

This section lists the allowable SRDF operations for TimeFinder/Snap and TimeFinder VP Snap copy sessions on the R1 source and target and the R2 source and target.

Note

TimeFinder/Snap and TimeFinder VP Snap are separate features. They are combined in this section because their interactions with SRDF are very similar.

Some footnotes in the tables below refer to devices that cannot be paced. For additional details, see Devices that cannot be paced in a cascaded SRDF configuration on page 159.

SRDF operations when R1 is source of TimeFinder Snap/VP Snap

The following table identifies the allowable SRDF actions when the R1 is the source of a TimeFinder/Snap or VP Snap session.

Table 56 Allowable SRDF operations when R1 is the source of a TimeFinder/Snap or VP Snap

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -exempt -metro	Y	Y	Y	Y	Y	Y		Y	Y		
createpair -establish	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
createpair -restore	Y	Y	Y	Y	Y[b]	Y	Y[b]	Y	Y		
createpair -invalidate R1	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
createpair -invalidate R2	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
createpair -format	Y										
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y [c]	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y		
swap	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		
half_swap	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		
swap -refresh R1	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		

Table 56 Allowable SRDF operations when R1 is the source of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
swap -refresh R2	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		
establish	Y	Y	Y	Y	Y	Y	Y[a , e]	Y	Y		
establish -full	Y	Y	Y	Y	Y	Y	Y[a, e]	Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y	Y	Y	Y	Y	Y[a, e]	Y	Y		
restore -full	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
update	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
failback	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		
failover -restore	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]			Y[d]		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 56 Allowable SRDF operations when R1 is the source of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfawpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Only allowed for TimeFinder VP Snap.
b. Allowed for TimeFinder VP Snap. If not TimeFinder VP Snap, must use -force.
c. Not allowed for movepair into an SRDF/Metro group.
d. Not allowed if the devices are in asynchronous mode and R1 and R2 array are running Enginuity 5876 and there is a TimeFinder/Snap off of the R1 and either:
   1. The SRDF pair is an R22->R1 of a concurrent R2 setup in which SRDF/A device-level write pacing is not configured for autostart on the R2 side.
   2. The SRDF pair is not an R22->R1 of a concurrent R2 setup and SRDF/A device-level write pacing is not configured for autostart on the R2 side.
e. Not allowed if devices are part of an SRDF/Metro group.

SRDF operations when R1 is target of TimeFinder Snap/VP Snap

The following table identifies the allowable SRDF actions when R1 is the target of a TimeFinder/Snap or VP Snap session.

Table 57 Allowable SRDF operations when R1 is the target of a TimeFinder/Snap or VP Snap

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -restore	Y					Y		Y	Y		
createpair -invalidate R1	Y					Y		Y	Y		
createpair -invalidate R2	Y					Y		Y	Y		
createpair -format	Y										
createpair -exempt -metro	Y					Y		Y	Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y [a]	Y	Y	Y	Y	Y	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y		
swap	Y								Y		
half_swap	Y								Y		
swap -refresh R1	Y								Y		
swap -refresh R2	Y								Y		
establish	Y					Y		Y	Y		
establish-full	Y					Y		Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y					Y		Y	Y		
restore -full	Y					Y		Y	Y		
update	Y					Y		Y	Y		
failback	Y					Y		Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y								Y		
failover -restore	Y								Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 57 Allowable SRDF operations when R1 is the target of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
merge	Y					Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y					Y		Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y					Y		Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 57 Allowable SRDF operations when R1 is the target of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro session with the –exempt flag.

Note

There are no subscripts for TimeFinder/Snap R1 targets.

SRDF operations when R2 is source of TimeFinder Snap/VP Snap

The following table identifies the allowable SRDF actions when the R2 is the source of a TimeFinder/Snap or VP Snap copy session.

Table 58 Allowable SRDF operations when R2 is the source of a TimeFinder/Snap or VP Snap

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]			Y[e]		
createpair -restore	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]			Y[e]		
createpair -invalidate R1	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]			Y[e]		
createpair -invalidate R2	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]			Y[e]		
createpair -format	Y										
createpair -exempt -metro	Y	Y	Y	Y	Y	Y			Y		

Table 58 Allowable SRDF operations when R2 is the source of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y [a, b]	Y	Y[a]		
half_movepair	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y	Y[a]		
swap	Y	Y	Y	Y	Y	Y		Y	Y		
half_swap	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R1	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R2	Y	Y	Y	Y	Y	Y		Y	Y		
establish	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		Y[e]	Y[e]		
establish -full	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		Y[e]	Y[e]		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[c, d]	Y[e]	Y[e]		
restore -full	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]	Y[c, d]	Y[e]	Y[e]		
update	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		Y[e]	Y[e]		
failback	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		Y[e]	Y[e]		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y	Y	Y	Y	Y		Y	Y		
failover -restore	Y	Y	Y	Y	Y	Y		Y	Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 58 Allowable SRDF operations when R2 is the source of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y		Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y[e]		Y[e]	Y[e]		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]	Y[f]		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 58 Allowable SRDF operations when R2 is the source of a TimeFinder/Snap or VP Snap (continued)

a. Not allowed if the devices are moving to a group operating in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Snap off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group

b. Not allowed for movepair into an SRDF/Metro group.

c. Only allowed if the required Enginuity levels or patches are detected. If TimeFinder VP Snap, requires Enginuity version 5876 Q42012 SR and higher.

d. Not allowed if the devices are part of an SRDF/Metro group.

e. Not allowed if the devices are in asynchronous mode and R1 and R2 array are running Enginuity 5876 and there is a TimeFinder/Snap off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R21 side.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side.

f. If the SRDF/A session is in the Transmit Idle state, you must issue the command with -symforce from the R1 side.

SRDF operations when R2 is target of TimeFinder Snap/VP Snap

The following table identifies the allowable SRDF actions when the R2 is the target of a TimeFinder/Snap or VP Snap copy session.

Table 59 Allowable SRDF operations when R2 is the target of a TimeFinder/Snap or VP Snap

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y								Y		
createpair -restore	Y								Y		
createpair -invalidate R1	Y								Y		
createpair -invalidate R2	Y								Y		
createpair -format	Y										
createpair -exempt -metro	Y								Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y[a]	Y	Y	Y	Y	Y	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y					Y		Y	Y		
half_swap	Y					Y		Y	Y		

Table 59 Allowable SRDF operations when R2 is the target of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
swap -refresh R1	Y					Y		Y	Y		
swap -refresh R2	Y					Y		Y	Y		
establish	Y					Y		Y	Y		
establish -full	Y					Y		Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y					Y		Y	Y		
restore -full	Y					Y		Y	Y		
update	Y					Y		Y	Y		
failback	Y					Y		Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y					Y		Y	Y		
failover -restore	Y					Y		Y	Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y					Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y					Y		Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y					Y		Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 59 Allowable SRDF operations when R2 is the target of a TimeFinder/Snap or VP Snap (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.

SRDF set operations for TimeFinder/Snap sessions

This section lists the allowable SRDF set operations for TimeFinder /Snap copy sessions on the R1 source and target and the R2 source and target.

SRDF set operations when R1 is source of TimeFinder/Snap

The following table identifies the allowable SRDF set actions when the R1 is the source of a TimeFinder/Snap copy session.

Table 60 Allowable SRDF set operations when R1 is the source of a TimeFinder/Snap

	SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
	set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R1 is target of TimeFinder/Snap

The following table identifies the allowable SRDF set actions when the R1 is the target for a TimeFinder/Snap copy session.

Table 61 Allowable SRDF set operations when R1 is the target of a TimeFinder/Snap

	SRDF control operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
	set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R2 is source of TimeFinder/Snap

The following table identifies the allowable SRDF set actions when the R2 is the source of a TimeFinder/Snap copy session.

Table 62 Allowable SRDF set operations when R2 is the source of a TimeFinder/Snap

SRDF set operation:	No session	Create in prog	Created	Recreated	Copy on write	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y[a]	Y[a]	Y[a]	Y[a]		Y[a]	Y[a]		
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. If the R2 is not an extent-based TimeFinder/Snap source device and R1 and R2 arrays are running Enginuity 5876 then not allowed if either of the following is true:

1. The RDF device pair is the R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 group of the R21 device.
2. The SRDF pair is not the R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 group.

SRDF set operations when R2 is target of TimeFinder/Snap

The following table identifies the allowable SRDF set when the R2 is the target of a TimeFinder/Snap copy session.

Table 63 Allowable SRDF set operations when R2 is the target of a TimeFinder/Snap

SRDF set operation:	No session	Create in prog	Created	Recreated	Copy on write	Copied	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y										
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF operations for TimeFinder/Clone sessions

This section lists the allowable SRDF operations for TimeFinder /Clone copy sessions on the R1 source and target and the R2 source and target.

SRDF operations when R1 is source of TimeFinder Clone

The following table identifies the allowable SRDF actions when the R1 is the source of a TimeFinder/Clone copy session.

Table 64 Allowable SRDF operations when R1 is the source of a TimeFinder/Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -invalidate R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -invalidate R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -format	Y														
createpair -exempt -metro	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y	Y[b]	Y	Y	Y	Y	Y	Y	Y	Y			Y		
half_swap	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
swap -refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
swap -refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[c]	Y	Y		
establish -full	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

Table 64 Allowable SRDF operations when R1 is the source of a TimeFinder/Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
restore -full	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
update	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
failback	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
failover -restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 64 Allowable SRDF operations when R1 is the source of a TimeFinder/Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.

b. Not allowed if the devices are in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Clone off of the R1 and either:

1. The SRDF pair is an R22->R1 of a concurrent R2 setup in which SRDF/A device-level write pacing is not configured for autostart on the R2 side.
2. The SRDF device pair is not an R22->R1 of a concurrent R2 setup and SRDF/A device-level write pacing is not configured for autostart on the R2 side.

c. Not allowed if the devices are part of an SRDF/Metro group.

SRDF operations when R1 is target of TimeFinder Clone

The following table identifies the allowable SRDF actions when the R1 is the target of a TimeFinder/Clone copy session.

Table 65 Allowable SRDF operations when R1 is the target of a TimeFinder/Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y						Y			Y		Y	Y		
createpair -restore	Y						Y			Y		Y	Y		
createpair -invalidate R1	Y						Y			Y		Y	Y		
createpair -invalidate R2	Y						Y			Y		Y	Y		

Table 65 Allowable SRDF operations when R1 is the target of a TimeFinder/Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -format	Y														
createpair -exempt -metro	Y						Y			Y		Y	Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y	Y[a]	Y[a]	Y	Y[a]	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
swap	Y												Y		
half_swap	Y												Y		
swap -refresh R1	Y												Y		
swap -refresh R2	Y												Y		
establish	Y					Y[b]	Y			Y		Y	Y		
full establish	Y					Y[b]	Y			Y		Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y						Y			Y		Y	Y		
restore -full	Y						Y			Y		Y	Y		
update	Y						Y			Y		Y	Y		
failback	Y						Y			Y		Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y												Y		
failover -restore	Y												Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y						Y			Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 65 Allowable SRDF operations when R1 is the target of a TimeFinder/Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y						Y			Y		Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y					Y	Y			Y		Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.
b. Not allowed if the devices are in Active RDF mode.

SRDF operations when R2 is source of TimeFinder Clone

The following table identifies the allowable SRDF actions when the R2 is the source of a TimeFinder/Clone copy session.

Table 66 Allowable SRDF operations when R2 is the source of a TimeFinder/Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[a,f]	Y[f]	Y			Y[f]		
createpair -restore	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y			Y[f]		
createpair -invalidate R1	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y			Y		
createpair -invalidate R2	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y			Y		
createpair -format	Y														
createpair -exempt -metro	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y				Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y	Y[c]	Y	Y[b]		
half_movepair	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y	Y	Y	Y[b]		
swap	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
half_swap	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
establish	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y	Y[d]	Y[f]	Y[f]		
establish -full	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[a,f]	Y[f]	Y	Y[d]	Y[f]	Y[f]		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y	Y[e, d]	Y[d]	Y[f]		
restore -full	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y[d]	Y[e,d]	Y[d]	Y[f]		
update	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y		Y	Y[f]		
failback	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y		Y	Y[f]		

Table 66 Allowable SRDF operations when R2 is the source of a TimeFinder/Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
failover -restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y		Y	Y[f]		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y	Y[f]	Y	Y[f]		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y[f]	Y[f]	Y[f]	Y	Y	Y	Y[f]	Y[f]	Y	Y[f]	Y	Y[f]		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 66 Allowable SRDF operations when R2 is the source of a TimeFinder/Clone (continued)

	SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
	deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	deactivate - rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Only allowed if required Enginuity levels or patches are detected and not a TimeFinder VP Snap.

b. Not allowed if the devices are moving to a group operating in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Clone off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group.

c. Not allowed for movepair into an SRDF/Metro group.

d. Not allowed if devices are part of an SRDF/Metro group.

e. Not allowed if the devices are in async mode and there is a TimeFinder/Clone off of the R2 either:

   1. The SRDF pair will become an R21->R2 for which any of the following apply:
      a. The R21 array is running Enginuity 5876 lower than 5876 Q42012 SR.
      b. SRDF/A device-level write pacing is not configured for autostart on the R1 side.
      c. If the R21->R2 pair will be read/write (RW) on the SRDF link, the R21 must be pace-capable.
   2. The SRDF device pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side.

f. Not allowed if the devices are in asynchronous mode and R1 and R2 array are running Enginuity 5876 and there is a TimeFinder/Clone off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R21 side.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side.

SRDF operations when R2 is target of TimeFinder Clone

The following table identifies the allowable SRDF actions when the R2 is the target of a TimeFinder/Clone copy session.

Table 67 Allowable SRDF operations when R2 is the target of a TimeFinder/Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y												Y		
createpair -restore	Y												Y		
createpair -invalidate R1	Y												Y		
createpair -invalidate R2	Y												Y		
createpair -format	Y														
createpair -exempt -metro	Y												Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y [a]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
swap	Y						Y			Y		Y	Y		
half_swap	Y						Y			Y		Y	Y		
swap -refresh R1	Y						Y			Y		Y	Y		
swap -refresh R2	Y						Y			Y		Y	Y		
establish	Y						Y			Y		Y	Y		
establish -full	Y						Y			Y		Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y						Y			Y		Y	Y		
restore -full	Y						Y			Y		Y	Y		
update	Y						Y			Y		Y	Y		
failback	Y						Y			Y		Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y						Y			Y		Y	Y		

Table 67 Allowable SRDF operations when R2 is the target of a TimeFinder/Clone (continued)

	SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
	failover -restore	Y						Y			Y		Y	Y		
	invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	merge	Y						Y			Y		Y	Y		
	msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	ready R2	Y						Y			Y		Y	Y		
	refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	resume	Y						Y			Y		Y	Y		
	rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 67 Allowable SRDF operations when R2 is the target of a TimeFinder/Clone (continued)

	SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
	deactivate - rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.

Note

There are no subscripts for the TimeFinder/Clone R2 targets.

SRDF set operations for TimeFinder/Clone sessions

This section lists the allowable SRDF set operations for TimeFinder /Clone copy sessions on the R1 and R2 source and the R1 and R2 target.

SRDF set operations when R1 is source of TimeFinder/Clone

The following table identifies the allowable SRDF set actions when the R1 is the source of a TimeFinder/Clone copy session.

Table 68 Allowable SRDF set operations when R1 is the source of a TimeFinder/Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R1 is target of TimeFinder/Clone

The following table identifies the allowable SRDF set actions when the R1 is the target of a TimeFinder/Clone copy session.

Table 69 Allowable SRDF set operations when R1 is the target of a TimeFinder/Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y [a]	Y [a]	Y [a]	Y	Y	Y	Y		Y	Y	Y	Y		
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed if TimeFinder/Clone pair was created with -copy.

SRDF set operations when R2 is source of TimeFinder/Clone

The following table identifies the allowable SRDF set actions when the R2 is the source of a TimeFinder/Clone copy session.

Table 70 Allowable SRDF set operations when R2 is the source of a TimeFinder/Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y[a]	Y[a]	Y[a]	Y	Y	Y	Y[a]	Y[a]	Y		Y	Y[a]		
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. If the R2 is not an extent-based TimeFinder/Clone source device and R1 and R2 array are running Enginuity 5876 then not allowed if either of the following is true:

1. The RDF device pair is the R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 group of the R21 device.
2. The SRDF pair is not the R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 group.

SRDF set operations when R2 is target of TimeFinder/Clone

The following table identifies the allowable SRDF set actions when the R2 is the target of a TimeFinder/Clone copy session.

Table 71 Allowable SRDF set operations when R2 is the target of a TimeFinder/Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y														
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF operations for Extent-level TimeFinder/Clone sessions

This section lists the allowable SRDF operations for Extent-level TimeFinder /Clone copy sessions on the R1 source and target and the R2 source and target.

SRDF operations when R1 is source of Extent-level Clone

The following table identifies the allowable SRDF actions when the R1 is the source of an Extent-level TimeFinder/Clone copy session.

Table 72 Allowable SRDF operations when R1 is the source of an Extent-level Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -invalidate R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -invalidate R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
createpair -format	Y														
createpair -exempt -metro	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[a]	Y	Y		
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y			Y[b]		
half_swap	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y			Y[b]		
swap -refresh R1	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y			Y[b]		
swap -refresh R2	Y	Y[b]	Y[b]	Y[b]	Y	Y	Y	Y[b]	Y[b]	Y			Y[b]		
establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[c]	Y	Y		
establish -full	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

Table 72 Allowable SRDF operations when R1 is the source of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
restore -full	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
update	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
failback	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y[b]	Y[b]	Y b	Y	Y	Y	Y b	Y b	Y			Y b		
failover -restore	Y	Y[b]	Y[b]	Y b	Y	Y	Y	Y b	Y b	Y			Y b		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 72 Allowable SRDF operations when R1 is the source of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.

b. Not allowed if the devices are operating in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Clone off of the R1 and either:

   1. The SRDF pair is an R22->R1 of a concurrent R2 setup in which SRDF/A device-level write pacing is not configured for autostart on the R2 side.
   2. The SRDF device pair is not an R22->R1 of a concurrent R2 setup and SRDF/A device-level write pacing is not configured for autostart on the R2 side.

c. Not allowed if devices are part of an SRDF/Metro group.

SRDF operations when R1 is target of Extent-level Clone

The following table identifies the allowable SRDF actions when the R1 is the target of an Extent-level TimeFinder/Clone copy session.

Table 73 Allowable SRDF operations when the R1 is the target of an Extent-level Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y														
createpair -restore	Y														
createpair -invalidate R1	Y														
createpair -invalidate R2	Y														
createpair -format	Y														

Table 73 Allowable SRDF operations when the R1 is the target of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -exempt -metro	Y														
deletepair	Y														
half_deletepair	Y														
movepair	Y														
half_movepair	Y														
swap	Y														
half_swap	Y														
swap -refresh R1	Y														
swap -refresh R2	Y														
establish	Y					Y	Y			Y		Y	Y		
establish -full	Y					Y	Y			Y		Y	Y		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y														
restore -full	Y														
update	Y														
failback	Y														
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y														
failover -restore	Y														
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y														
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not _ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y														
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

Table 73 Allowable SRDF operations when the R1 is the target of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y					Y	Y			Y		Y	Y		
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the Extent-level TimeFinder/Clone R1 targets.

SRDF operations when R2 is source of Extent-level Clone

The following table identifies the allowable SRDF actions when the R2 is the source of an Extent-level TimeFinder/Clone copy session.

Table 74 Allowable SRDF operations when R2 is the source of an Extent-level Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y	Y[e]	Y[e]	Y[e]		Y	Y	Y[a,e]	Y[e]	Y			Y[e]		
createpair -restore	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y			Y[e]		
createpair -invalidate R1	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y			Y		
createpair -invalidate R2	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y[e]			Y		
createpair -format	Y														
createpair -exempt -metro	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y[c]	Y[c]	Y[c]	Y	Y	Y	Y[c]	Y[c]	Y	Y[b]	Y	Y[c]		
half_movepair	Y	Y[c]	Y[c]	Y[c]	Y	Y	Y	Y[c]	Y[c]	Y	Y	Y	Y[c]		
swap	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
half_swap	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
swap -refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
establish	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y		Y	Y[e]		
establish -full	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[a,e]	Y[e]	Y		Y	Y[e]		
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y	Y[d,b]	Y	Y[e]		
restore -full	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y	Y[d,b]	Y	Y[e]		
update	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y		Y	Y[e]		
failback	Y	Y[e]	Y[e]	Y[e]	Y[e]	Y	Y	Y[e]	Y[e]	Y		Y	Y[e]		
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 74 Allowable SRDF operations when R2 is the source of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
failover -establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
failover -restore	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not _ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y		Y	Y[e]		
rw_disable R2	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y	Y[e]	Y	Y[e]		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y[e]	Y[e]	Y[e]	Y	Y	Y	Y[e]	Y[e]	Y	Y[e]	Y	Y[e]		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 74 Allowable SRDF operations when R2 is the source of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Only allowed if required Enginuity levels or patches are detected.

b. Not allowed for movepair into an SRDF/Metro group.

c. Not allowed if the devices are moving to a group operating in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Clone off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side of the new group.

d. Not allowed if the devices are in async mode and there is a TimeFinder/Clone off of the R2 and either:

   1. The SRDF pair will become an R21->R2 for which any of the following apply:
      a. The R21 array is running Enginuity level 5876 lower than 5876 Q42012 SR.
      b. SRDF/A device-level write pacing is not configured for autostart on the R1 side.
      c. If the R21->R2 pair will be read/write (RW) on the SRDF link, the R21 must be pace-capable.
   2. The SRDF device pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side.

e. Not allowed if the devices are in asynchronous mode and R1 and R2 arrays are running Enginuity 5876 and there is a TimeFinder/Clone off of the R2 and either:

   1. The SRDF pair is an R21->R2 of a cascaded setup in which SRDF/A device-level write pacing is not configured for autostart on the R21 side.
   2. The SRDF pair is not an R21->R2 of a cascaded setup and SRDF/A device-level write pacing is not configured for autostart on the R1 side.

SRDF operations when R2 is target of Extent-level Clone

The following table identifies the allowable SRDF actions when the R2 is the target of an Extent-level TimeFinder/Clone copy session.

Table 75 Allowable SRDF operations when the R2 is the target of an Extent-level Clone

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
createpair -establish	Y														
createpair -restore	Y														
createpair -invalidate R1	Y														
createpair -invalidate R2	Y														
createpair -format	Y														
createpair -exempt -metro	Y														
deletepair	Y														
half_deletepair	Y														
movepair	Y														
half_movepair	Y														
swap	Y														
half_swap	Y														
swap -refresh R1	Y														
swap -refresh R2	Y														
establish	Y														
establish -full	Y														
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y														
restore -full	Y														
update	Y														
failback	Y														
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y														
failover -restore	Y														
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y														
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 75 Allowable SRDF operations when the R2 is the target of an Extent-level Clone (continued)

SRDF control operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
refresh R2	Y														
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y														
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for Extent-level TimeFinder/Clone R2 targets.

SRDF set operations for Extent-level TimeFinder/Clone sessions

This section lists the allowable SRDF set operations for Extent-level TimeFinder / Clone copy sessions on the R1 and R2 source and the R1 and R2 target.

SRDF set operations when R1 is source of Extent-level Clone

The following table identifies the allowable SRDF set actions when the R1 is the source of an Extent-level TimeFinder/Clone copy session.

Table 76 Allowable SRDF set operations when R1 is the source of an Extent-level Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R1 is target of Extent-level Clone

The following table identifies the allowable SRDF set actions when the R1 is the target of an Extent-level TimeFinder/Clone copy session.

Table 77 Allowable SRDF set operations when R1 is the target of an Extent-level Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R2 is source of Extent-level Clone

The following table identifies the allowable SRDF set actions when the R2 is the source of an Extent-level TimeFinder/Clone copy session.

Table 78 Allowable SRDF set operations when the R2 is the source of an Extent-level Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note

There are no subscripts for the operations in this table.

SRDF set operations when R2 is target of Extent-level Clone

The following table identifies the allowable SRDF set actions when the R2 is the target of an Extent-level TimeFinder/Clone copy session.

Table 79 Allowable SRDF set operations when R2 is the target of an Extent-level Clone

SRDF set operation:	No session	Create in prog	Created	Recreated	Precopy	Copy in prog	Copied	Copy on write	Copy on access	Split	Restore in prog	Restored	Terminate in prog	Invalid	Failed
set mode async	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode sync	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

SRDF operations for TimeFinder Snapvx

This section lists the allowable SRDF operations for TimeFinder Snapvx sessions on VMAX 3 arrays running HYPERMAX OS.

Determine SnapVX states-SRDF operations interaction rules

The following table describes how Snap VX states are identified for SRDF operations allowed with Snap VX source devices.

Table 80 SnapVX State Determination

Snap VX State	Snap VX CLI	Determine State
Established	symsnapvx list	The flags field indicates: `(F)ailed: = . for No Failure`
Restore In Progress	symsnapvx list -restored -detail	The Done(%) field is not at 100%.
Restored	syms‘napvx list -restored –detail	The Done(%) field is at 100%.
Terminate in Progress	symsnapvx list	The snapshot is still seen on the display.
Terminated	symsnapvx list	The snapshot is not seen on the display.
Failed	symsnapvx list	The flags field indicates: `(F)ailed = X for Failed`
Link Copy In Progress	symsnapvx list –link –tgt –detail	The flags field indicates: `(C)opy = I for CopyInProg` The Done (%) field is not at 100%.
Link Copied	symsnapvx list –link –tgt –detail	The flags field indicates: `(C)opy = C for Copied or D for Copied/Destaged` The Done (%) field is at 100%
Linked	symsnapvx list -linked	The flags field indicates : `(C)opy = . for NoCopy Link`

SRDF operations when R1 is source of Snapvx

The following table identifies allowable SRDF operations when the R1 is the source of a TimeFinder Snapvx session

Table 81 Allowable SRDF operations when R1 is the source of a TimeFinder Snapvx

SRDF control operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
createpair - establish	Y	Y	Y		Y	Y	
createpair - restore	Y	Y	Y		Y	Y	
createpair - invalidate R1	Y	Y	Y		Y	Y	
createpair - invalidate R2	Y	Y	Y		Y	Y	
createpair - format	Y						
createpair -exempt -metro	Y	Y	Y		Y	Y	
deletepair	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y [a]
half_movepair	Y	Y	Y	Y	Y	Y	Y
swap	Y	Y	Y			Y	
half_swap	Y	Y	Y			Y	
swap -refresh R1	Y	Y	Y			Y	
swap -refresh R2	Y	Y	Y			Y	
establish	Y	Y	Y		Y	Y	
establish -full	Y	Y	Y		Y	Y	
split	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y	Y		Y	Y	
restore -full	Y	Y	Y		Y	Y	
update	Y	Y	Y		Y	Y	
failback	Y	Y	Y		Y	Y	
failover	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y	Y			Y	
failover -restore	Y	Y	Y			Y	
invalidate -R1	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y		Y	Y	
msc_cleanup	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y

Table 81 Allowable SRDF operations when R1 is the source of a TimeFinder Snapvx (continued)

SRDF control operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
not_ready R2	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y		Y	Y	
refresh R2	Y	Y	Y	Y	Y	Y	
suspend	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y	Y		Y	Y	
rw_disable R2	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y
deactivate - rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y

a. Not allowed for movepair into an SRDF/Metro group.

SRDF operations when R1 is target for Snapvx

The following table identifies allowable SRDF operations when the R1 is the target of a TimeFinder Snapvx session

Table 82 Allowable SRDF operations when R1 is the target of a TimeFinder Snapvx

SRDF control operation:	No Link	Link copy in progress	Link copied	Linked	Failed
createpair - establish	Y		Y		
createpair - restore	Y		Y		
createpair - invalidate R1	Y		Y		
createpair - invalidate R2	Y		Y		
createpair - format	Y				
createpair -exempt -metro	Y		Y		
deletepair	Y	Y	Y		Y
half_deletepair	Y	Y	Y		Y
movepair	Y	Y[a]	Y		Y [a]
half_movepair	Y	Y	Y		Y
swap	Y				
half_swap	Y				
swap -refresh R1	Y				
swap -refresh R2	Y				
establish	Y	Y[b]	Y		
establish -full	Y	Y[b]	Y		
split	Y	Y	Y		Y
restore	Y		Y		
restore -full	Y		Y		
update	Y		Y		
failback	Y		Y		
failover	Y	Y	Y		Y
failover -establish	Y				
failover -restore	Y				
invalidate -R1	Y	Y	Y		Y
invalidate -R2	Y	Y	Y		Y
merge	Y		Y		
msc_cleanup	Y	Y	Y		Y
not_ready R1	Y	Y	Y		Y

Table 82 Allowable SRDF operations when R1 is the target of a TimeFinder Snapvx (continued)

SRDF control operation:	No Link	Link copy in progress	Link copied	Linked	Failed
not_ready R2	Y	Y	Y		Y
ready R1	Y	Y	Y		Y
ready R2	Y	Y	Y		Y
refresh R1	Y		Y		
refresh R2	Y	Y	Y		
suspend	Y	Y	Y		Y
resume	Y		Y		
rw_disable R2	Y	Y	Y		Y
rw_enable R1	Y	Y	Y		Y
rw_enable R2	Y	Y	Y		Y
write_disable R1	Y	Y	Y		Y
write_disable R2	Y	Y	Y		Y
activate -rdfa_dse	Y	Y	Y		Y
deactivate -rdfa_dse	Y	Y	Y		Y
activate -rdfa_devpace	Y	Y	Y		Y
deactivate -rdfa_devpace	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y		Y
deactivate -rdfa_pace	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y		Y
deactivate -rdfa_wpace	Y	Y	Y		Y
activate -rdfa_wpace_exempt	Y	Y	Y		Y
deactivate -rdfa_wpace_exempt	Y	Y	Y		Y

a. Not allowed for movepair into an SRDF/Metro group.
b. Not allowed if the devices are in Active RDF mode.

SRDF operations when R2 is source of Snapvx

The following table identifies allowable SRDF operations when the R2 is the source of a TimeFinder Snapvx session

Table 83 Allowable SRDF operations when R2 is the source of a TimeFinder Snapvx

SRDF control operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
createpair - establish	Y	Y	Y[a]			Y	
createpair - restore	Y	Y	Y			Y	
createpair - invalidate R1	Y	Y	Y			Y	
createpair - invalidate R2	Y	Y	Y			Y	
createpair - format	Y						
createpair -exempt -metro	Y	Y	Y			Y	
deletepair	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y[b]	Y	Y	
half_movepair	Y	Y	Y	Y	Y	Y	
swap	Y	Y	Y		Y	Y	
half_swap	Y	Y	Y		Y	Y	
swap -refresh R1	Y	Y	Y		Y	Y	
swap -refresh R2	Y	Y	Y		Y	Y	
establish	Y	Y	Y		Y	Y	
establish -full	Y	Y	Y[a]		Y	Y	
split	Y	Y	Y	Y	Y	Y	Y
restore	Y	Y	Y	Y[c]	Y	Y	
restore -full	Y	Y	Y	Y [c]	Y	Y	
update	Y	Y	Y		Y	Y	
failback	Y	Y	Y		Y	Y	
failover	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y	Y	Y		Y	Y	
failover -restore	Y	Y	Y		Y	Y	
invalidate -R1	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y		Y	Y	
msc_cleanup	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y

Table 83 Allowable SRDF operations when R2 is the source of a TimeFinder Snapvx (continued)

SRDF control operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
not_ready R2	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	
refresh R2	Y	Y	Y		Y	Y	
suspend	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y	Y		Y	Y	
rw_disable R2	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y

a. Must use -force
b. Not allowed for movepair into an SRDF/Metro group.
c. Not allowed if devices are part of an SRDF/Metro group.
d. If the SRDF/A session is in Transmit Idle state, you must use symforce from the R1 side.

SRDF operations when R2 is target for Snapvx

The following table identifies allowable SRDF operations when the R2 is the target of a TimeFinder Snapvx session.

Table 84 Allowable SRDF operations when R2 is the target of a TimeFinder Snapvx

SRDF control operation:	No Link	Link copy in progress	Link copied	Linked	Failed
createpair - establish	Y				
createpair - restore	Y				
createpair - invalidate R1	Y				
createpair - invalidate R2	Y				
createpair - format	Y				
createpair -exempt -metro	Y				
deletepair	Y	Y	Y		Y
half_deletepair	Y	Y	Y		Y
movepair	Y	Y [a]	Y		Y
half_movepair	Y	Y	Y		Y
swap	Y		Y		
half_swap	Y		Y		
swap -refresh R1	Y		Y		
swap -refresh R2	Y		Y		
establish	Y		Y		
establish -full	Y		Y		
split	Y	Y	Y		Y
restore	Y		Y		
restore -full	Y		Y		
update	Y		Y		
failback	Y		Y		
failover	Y	Y	Y		Y
failover -establish	Y		Y		
failover -restore	Y		Y		
invalidate -R1	Y	Y	Y		Y
invalidate -R2	Y	Y	Y		Y
merge	Y		Y		
msc_cleanup	Y	Y	Y		Y
not_ready R1	Y	Y	Y		Y

Table 84 Allowable SRDF operations when R2 is the target of a TimeFinder Snapvx (continued)

SRDF control operation:	No Link	Link copy in progress	Link copied	Linked	Failed
not_ready R2	Y	Y	Y		Y
ready R1	Y	Y	Y		Y
ready R2	Y		Y		
refresh R1	Y	Y	Y		
refresh R2	Y	Y	Y		
suspend	Y	Y	Y		Y
resume	Y		Y		
rw_disable R2	Y	Y	Y		Y
rw_enable R1	Y	Y	Y		Y
rw_enable R2	Y	Y	Y		Y
write_disable R1	Y	Y	Y		Y
write_disable R2	Y	Y	Y		Y
activate -rdfa_dse	Y	Y	Y		Y
deactivate -rdfa_dse	Y	Y	Y		Y
activate -rdfa_devpace	Y	Y	Y		Y
deactivate -rdfa_devpace	Y	Y	Y		
activate -rdfa_pace	Y	Y	Y		Y
deactivate -rdfa_pace	Y	Y	Y		
activate -rdfa_wpace	Y	Y	Y		Y
deactivate -rdfa_wpace	Y	Y	Y		Y
activate -rdfa_wpace_exempt	Y	Y	Y		Y
deactivate -rdfa_wpace_exempt	Y	Y	Y		Y

a. Not allowed for movepair into an SRDF/Metro group.

SRDF set operations for TimeFinder Snapvx sessions

This section lists the allowable SRDF set operations for Timefinder Snapvx sessions on the R1 and R2 source, and the R1 and R2 target.

SRDF set operations when R1 is source of TimeFinder Snapvx

The following table identifies allowable SRDF set operations when the R1 is the source of a TimeFinder Snapvx session.

Table 85 Allowable SRDF set operations when R1 is the source of a TimeFinder Snapvx

SRDF set operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
set mode async	Y	Y	Y	Y	Y	Y	
set mode sync	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y

SRDF set operations when R1 is target of TimeFinder Snapvx

The following table identifies allowable SRDF set operations when the R1 is the target of a TimeFinder Snapvx session.

Table 86 Allowable SRDF set operations when R1 is the target of a TimeFinder Snapvx

SRDF set operation:	No Link	Link copy in progress	Link copied	Linked	Failed
set mode async	Y	Y	Y	Y	
set mode sync	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y

SRDF set operations when R2 is source of TimeFinder Snapvx

The following table identifies allowable SRDF set operations when the R2 is the source of a TimeFinder Snapvx session.

Table 87 Allowable SRDF set operations when R2 is the source of a TimeFinder Snapvx

SRDF set operation:	No snapshot	Establish in progress	Established	Restore in prog	Restored	Terminate in prog	Failed
set mode async	Y	Y	Y		Y	Y	
set mode sync	Y	Y	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y	Y	Y

SRDF set operations when R2 is target of TimeFinder Snapvx

The following table identifies allowable SRDF set operations when the R2 is the target of a TimeFinder Snapvx session.

Table 88 Allowable SRDF set operations when R2 is the target of a TimeFinder Snapvx

SRDF set operation:	No Link	Link copy in progress	Link copied	Linked	Failed
set mode async	Y				
set mode sync	Y	Y	Y	Y	Y
set mode acp_disk	Y	Y	Y	Y	Y
set mode acp_wp	Y	Y	Y	Y	Y

APPENDIX C

SRDF operations and rcopy states

This appendix describes the following topics:

rcopy session on the R1 side

This section lists the allowable SRDF operations and the applicable rcopy states when there is an rcopy session on the R1.

Allowable SRDF operations when R1 is part of an rcopy PUSH

The following table identifies the allowable SRDF operations and applicable rcopy states when there is an rcopy PUSH session on the R2.

Allowed SRDF operations are noted by Ys.

Table 89 Allowed SRDF operations when the R1 is part of an rcopy PUSH

	rcopy state:																	
SRDF control operation:	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
createpair -establish	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[b, a]	Y[a]	Y[a]	Y[a]	Y[a]
createpair -restore	Y		Y[a]			Y[a]		Y[a]					Y[b, a]					
createpair -invalidate R1	Y		Y[a]			Y[a]		Y[a]					Y[b, a]					
createpair -invalidate R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b, a]	Y	Y	Y	Y	Y
createpair -format	Y																	
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y																	
half_swap	Y																	
swap -refresh R1	Y																	
swap -refresh R2	Y																	
establish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[c]	Y[b]	Y	Y	Y	Y
establish -full	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[d]	Y[b]	Y	Y	Y	Y
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[d]	Y	Y	Y	Y	Y
restore	Y		Y			Y		Y					Y[b]					

Table 89 Allowed SRDF operations when the R1 is part of an rcopy PUSH (continued)

SRDF control operation:	rcopy state:																	
	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
restore -full	Y		Y			Y		Y					Y[b]					
update R1	Y		Y			Y		Y					Y[b]					
failback	Y		Y			Y		Y					Y[b]					
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y																	
failover -restore	Y																	
invalidate -R1	Y		Y			Y		Y					Y[b]					
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b]	Y[b]	Y	Y	Y	Y
merge	Y	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y		Y			Y					Y[b]							
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b]	Y[b]	Y	Y	Y	Y	Y	Y
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y[d]	Y[e]	Y[d]	Y[d]	Y[e]	Y[d]	Y[e]	Y[d]	Y[d]	Y[d, b]	Y[d, b]	Y[e]	Y[d]	Y[d]	Y[d]	Y[d]	Y[d]
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 89 Allowed SRDF operations when the R1 is part of an rcopy PUSH (continued)

SRDF control operation:	rcopy state:																	
	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed if the R1 array is running HYPERMAX OS (5977) or above.
b. Not allowed if the Rcopy session has front end zero detect.
c. Not allowed if the Rcopy session has front end zero detect.
d. Not allowed if the R2 owes data to the R1.
e. If R2 owes data to the R1, not allowed if donor update specified.

Allowable SRDF operations when R1 is part of an rcopy PULL

The following table identifies the allowable SRDF operations and applicable rcopy states when there is an rcopy PULL session on the R1.

Allowed SRDF operations are noted by Ys.

Table 90 Allowed SRDF operations when the R1 is part of an rcopy PULL

SRDF control operation:	rcopy state:													
	None	Create in prog	Created	Copy in prog	Copy on access	Copied	Terminate in prog	Failed	Invalid	Verify in progress	Sync in prog	Syncronized	Stopped	Failback
createpair -establish	Y													
createpair -restore	Y													
createpair -invalidate R1	Y													
createpair -invalidate R2	Y													

Table 90 Allowed SRDF operations when the R1 is part of an rcopy PULL (continued)

SRDF control operation:	rcopy state:													
	None	Create in prog	Created	Copy in prog	Copy on access	Copied	Terminate in prog	Failed	Invalid	Verify in progress	Sync in prog	Syncronized	Stopped	Failback
createpair -format	Y													
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y													
half_swap	Y													
swap -refresh R1	Y													
swap -refresh R2	Y													
establish	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]
establish -full	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y													
restore -full	Y													
update	Y													
failback	Y													
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y													
failover -restore	Y													
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]	Y[a]
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
refresh R1	Y													

Table 90 Allowed SRDF operations when the R1 is part of an rcopy PULL (continued)

SRDF control operation:	rcopy state: None	Create in prog	Created	Copy in prog	Copy on access	Copied	Terminate in prog	Failed	Invalid	Verify in progress	Sync in prog	Syncronized	Stopped	Failback
refresh R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y	Y[a,b]	Y[b]	Y[a]	Y[a,a]	Y[b]	Y[a,b]	Y[a,b]	Y[a,b]	Y[a,b]	Y[a,b]	Y[a,b]	Y[a,b]	Y[a,b]
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed if the R2 owes data to the R1.
b. Not allowed if the Rcopy session has front end zero detect.

rcopy session on the R2 side

This section lists the allowable SRDF operations and the applicable rcopy states when there is an rcopy session on the R2.

Allowable SRDF operations when R2 is part of an rcopy PUSH

The following table identifies the allowable SRDF operations and applicable rcopy states when there is an rcopy PUSH session on the R2.

Allowed SRDF operations are noted by Ys.

Table 91 Allowed SRDF operations when the R2 is part of an rcopy PUSH

	rcopy state:																	
SRDF control operation:	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
createpair -establish	Y																	
createpair -restore	Y																	
createpair -invalidate R1	Y																	
createpair -invalidate R2	Y																	
createpair -format	Y																	
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y																	
half_swap	Y																	
swap -refresh R1	Y																	
swap -refresh R2	Y																	
establish	Y		Y			Y		Y					Y[a, b]					
establish -full	Y		Y			Y		Y					Y[a, b]					
split	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[b]	Y[b]	Y	Y	Y	Y
restore -full	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b]	Y[b]	Y	Y	Y	Y
update	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y[b]	Y	Y	Y	Y	Y
failback	Y																	
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y																	

Table 91 Allowed SRDF operations when the R2 is part of an rcopy PUSH (continued)

SRDF control operation:	rcopy state:																	
	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
failover -restore	Y																	
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R2	Y																	
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y		Y			Y		Y					Y[a, b]					
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 91 Allowed SRDF operations when the R2 is part of an rcopy PUSH (continued)

	rcopy state:																	
SRDF control operation:	None	Create in prog	Created	Copy in prog	Copy on write	Copied	Recreate in progress	Recreated	Terminate in prog	Failed	Invalid	Verify in progress	Restored	Restore in prog	Precopy	Sync in prog	Syncronized	Stopped
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

a. Not allowed if donor update specified.
b. Not allowed if the Rcopy session has front end zero detect.

Allowable SRDF operations when R2 is part of an rcopy PULL

The following table identifies the allowable SRDF operations and applicable rcopy states when there is an rcopy PULL session on the R2.

Allowed SRDF operations are noted by Ys.

Table 92 Allowed SRDF operations when the R2 is part of an rcopy PULL

	rcopy state:													
SRDF control operation:	None	Create in prog	Created	Copy in prog	Copy on access	Copied	Terminate in prog	Failed	Invalid	Verify in progress	Sync in prog	Syncronized	Stopped	Failback
createpair -establish	Y													
createpair -restore	Y													
createpair -invalidate R1	Y													
createpair -invalidate R2	Y													
createpair -format	Y													
deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_deletepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
half_movepair	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
swap	Y													
half_swap	Y													

Table 92 Allowed SRDF operations when the R2 is part of an rcopy PULL (continued)

	rcopy state:													
SRDF control operation:	**None**	**Create in prog**	**Created**	**Copy in prog**	**Copy on access**	**Copied**	**Terminate in prog**	**Failed**	**Invalid**	**Verify in progress**	**Sync in prog**	**Syncronized**	**Stopped**	**Failback**
swap -refresh R1	Y													
swap -refresh R2	Y													
establish	Y													
establish -full	Y													
split	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
restore	Y													
restore -full	Y													
update	Y													
failback	Y													
failover	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
failover -establish	Y													
failover -restore	Y													
invalidate -R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
invalidate -R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
merge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
msc_cleanup	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
not_ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ready R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
refresh R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
refresh R2	Y													
suspend	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
resume	Y													
rw_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
rw_enable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
write_disable R1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 92 Allowed SRDF operations when the R2 is part of an rcopy PULL (continued)

SRDF control operation:	rcopy state:													
	None	Create in prog	Created	Copy in prog	Copy on access	Copied	Terminate in prog	Failed	Invalid	Verify in progress	Sync in prog	Syncronized	Stopped	Failback
write_disable R2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_dse	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_devpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_pace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
activate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
deactivate -rdfa_wpace_exempt	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y