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This guide documents the latest Solutions Enabler version management CLI capabilities for VMAX3, VMAX All Flash, and PowerMax arrays running HYPERMAX OS. This version of Solutions Enabler also supports arrays running Enginuity 5876, however management features specific to these arrays are not documented in this guide. These features, including Managing Quality of Service (symqos) are found in the Dell EMC Solutions Enabler Array Controls and Management CLI User Guide version 8.3 or higher.

References in this document to Enginuity version 5876 are limited to Chapter 19 "Non Disruptive Migration" where data migrations run between source arrays running Enginuity 5876 and target arrays running HYPERMAX OS or PowerMaxOS.
As part of an effort to improve its product lines, Dell EMC periodically releases revisions of its software and hardware. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

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

---

**Purpose**

This document describes how to use EMC® Solutions Enabler SYMCLI commands to configure and manage VMAX3 and VMAX All Flash arrays using HYPERMAX OS.

- **Setting up and Configuring Storage Arrays** on page 25 describes how to use the SYMCLI configuration commands to set up the array devices.
- **Querying and Reporting** on page 389 describes how to use the SYMCLI query commands and various reporting tools to monitor and manage storage array performance.
- **Migrating Data** on page 477 describes how to use SYMCLI Non-Disruptive Migration and Open Replicator to migrate data between arrays.
- **Security related settings and procedures** on page 589 includes the procedures used to configure security parameters for Solutions Enabler deployment.

---

**Audience**

This document is part of the Solutions Enabler documentation set, and is intended for use by advanced command-line users and script programmers to manage various types of control operations on VMAX3 and VMAX All Flash arrays and devices using the Solutions Enabler SYMCLI commands.

---

**Related documentation**

The following documents provide additional Solutions Enabler information:

- **Dell EMC Solutions Enabler, VSS Provider, and SMI-S Provider Release Notes**
  Describes new features and any known limitations.

- **Dell EMC Solutions Enabler Installation and Configuration Guide**
  Provides host-specific installation instructions.

- **Dell EMC Solutions Enabler CLI Reference Guide**
  Documents the SYMCLI commands, daemons, error codes and option file parameters provided with the Solutions Enabler man pages.

- **Dell EMC Solutions Enabler SRDF Family CLI User Guide**
  Describes how to configure and manage SRDF environments using SYMCLI commands.
Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide
Describes how to configure and manage TimeFinder SnapVX environments using SYMCLI commands.

EMC Solutions Enabler TimeFinder Family (Mirror, Clone, Snap, VP Snap) CLI User Guide
Describes how to configure and manage TimeFinder Mirror, Clone, Snap and VP Snap environments using SYMCLI commands.

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

EMC VMAX All Flash and VMAX3 Family Security Configuration Guide
Describes how to securely deploy a VMAX3 Family (100K, 200K, 400K) or VMAX All Flash (250F, 450F, 850F, 950F) array with HYPERMAX OS.

VMAX Management Software Events and Alerts Guide
Documents the SYMAPI daemon messages, asynchronous errors and message events, and SYMCLI return codes.

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:

Table 1 Typographical conventions used in this content

<table>
<thead>
<tr>
<th>Style</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bold</td>
<td>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)</td>
</tr>
<tr>
<td>Italic</td>
<td>Used for full titles of publications referenced in text</td>
</tr>
</tbody>
</table>
Table 1 Typographical conventions used in this content (continued)

<table>
<thead>
<tr>
<th>Monospace</th>
<th>Used for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monospace italic</td>
<td>Used for variables</td>
</tr>
<tr>
<td>Monospace bold</td>
<td>Used for user input</td>
</tr>
<tr>
<td>[ ]</td>
<td>Square brackets enclose optional values</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>{ }</td>
<td>Braces enclose content that the user must specify, such as x or y or z</td>
</tr>
<tr>
<td>...</td>
<td>Ellipses indicate nonessential information omitted from the example</td>
</tr>
</tbody>
</table>

Where to get help
EMC support, product, and licensing information can be obtained as follows:

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

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- EMEA: +353 (0) 21 4879862 and follow the voice prompts.

**Your comments**

Your suggestions help us improve the accuracy, organization, and overall quality of the documentation. Send your comments and feedback to: VMAXContentFeedback@emc.com
PART 1

Setting up and Configuring Storage Arrays

This section describes how to set up and configure storage array devices using the Solutions Enabler SYMCLI commands.

Chapters include:

Chapter 1, "Introduction"
Chapter 2, "Discovery"
Chapter 3, "User and Group Authorization"
Chapter 4, "Host-based Access Control"
Chapter 5, "Thin Device Management"
Chapter 6, "Grouping Devices"
Chapter 7, "Inline Compression"
Chapter 8, "Fully Automated Storage Tiering"
Chapter 9, "Manage Configuration Changes"
Chapter 10, "Manage multiple iSCSI targets"
Chapter 11, "Manage storage environment for VMware VVols"
Chapter 12, "Array integration with RecoverPoint"
Chapter 13, "FAST.X"
Chapter 14, "Device masking with Auto-Provisioning Groups"
Setting up and Configuring Storage Arrays
CHAPTER 1

Introduction

This chapter introduces the Solutions Enabler Symmetrix command line interface (SYMCLI), which is used to manage your storage environment.

- Solutions Enabler overview

28
**Solutions Enabler overview**

The Dell EMC Solutions Enabler SYMCLI provides management capabilities for storage environments. The SYMCLI is a specialized library consisting of commands run at the command line, or used within scripts. These commands monitor device configuration and status, and perform control operations on devices and data objects within a VMAX-based storage environment.

SYMCLI commands are run from the host operating system command line (shell). The SYMCLI commands are built on top of SYMAPI library functions, which use system calls that generate low-level I/O SCSI commands to the storage arrays. To reduce the number of inquiries from the host to the storage arrays, configuration and status information is maintained in a host database file (called the Symmetrix configuration database; symapi_db.bin by default).

---

**Note**

TimeFinder and SRDF CLI operational commands are not discussed in this guide. Refer to the EMC Solutions Enabler TimeFinder Family (Mirror, Clone, Snap, VP Snap) CLI User Guide, Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide, or the Dell EMC Solutions Enabler SRDF Family CLI User Guide for SYMCLI commands for replication operations.

---

**Note**

When using PowerShell, any part of the SYMCLI command that requires a comma must be enclosed in quotes otherwise the command returns an error. See the following example:

**SYMCLI:**
```
symrdf addgrp -label Metro53 -rdfg 53 -sid 130 -dir 1G:5,2G:5 -remote_rdfg 53 -remote_sid 176 -remote_dir 1G:25,2G:25 -gige -nop
```

**PowerShell:**
```
symrdf addgrp -label Metro53 -rdfg 53 -sid 130 -dir "1G:5,2G:5" -remote_rdfg 53 -remote_sid 176 -remote_dir "1G:25,2G:25" -gige -nop
```

---

**SYMCLI help options**

SYMCLI provides the following multiple options to obtain top-level help using the command set:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>symcli</td>
<td>Provides the version number of the installed command line interface.</td>
</tr>
<tr>
<td>symcli -h</td>
<td>Describes how to use the SYMCLI command.</td>
</tr>
</tbody>
</table>
Table 2 SYMCLI help options (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>symcli -v</td>
<td>Displays the SYMCLI commands and a brief description of each command.</td>
</tr>
<tr>
<td>symcli -env</td>
<td>Displays a list of the environment variables that can be set for a SYMCLI session.</td>
</tr>
<tr>
<td>symcli -def</td>
<td>Displays a list of the environment variables that are set for the current SYMCLI session.</td>
</tr>
</tbody>
</table>

Individual command help

Syntax
To display command line help for a specific command, use the following syntax:

```
command -h
```

Examples
To display help for the `symcfg` command, enter:

```
symcfg -h
```

Each command has its own man page for command line reference. To view the man page for the `symcfg` command, enter:

```
man symcfg
```

In a UNIX environment, the SYMCLI man page directory (/usr/symcli/man/) must be included in your MANPATH environment variable.

In a Windows environment, the default directory for man pages is C:\Program Files \EMC\symcli\man.

Device and object references

There are a number of different terms used with SYMCLI commands to identify and specify a VMAX array device:

- `PdevName` or `pd` — Indicates a physical (host) device name
- `SymDevName` or `dev` — Indicates array device name
- `LdevName` or `ld` — Indicates a logical device name
- `-devs` — Indicates a range or list of devices
Environment variables

Environment variables are set to streamline the command line session. Setting environment variables to commonly used values, eliminates the need to specify those arguments on the command line.

Display environment variables

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

`symcli -env`

To view the current environment variables, enter:

`symcli -def`

Enable environment variables

Syntax
From UNIX host, set an environment variable, use the following syntax:

`setenv variable_name value`

From Windows host, set an environment variable, use the following syntax:

`set <environment variable> = <value>`

Examples
For UNIX host, to enable the `SYMCLI_VERBOSE` variable to set the default command behavior to always display command output with details:

Note
For UNIX host, `setenv` commands can be run in Cshell (csh).

```
setenv SYMCLI_VERBOSE 1
```

For Windows host, to enable the `SYMCLI_VERBOSE` variable to set the default command behavior to always display command output with details:

```
set SYMCLI_VERBOSE=1
```

Disable environment variables

Syntax
From UNIX host, turn off an environment variable, use the following syntax:

`unsetenv variable_name`
From Windows host, turn off an environment variable, use the following syntax:

```bash
unset <environment variable>
```

**Examples**

From UNIX host, to turn off the verbose mode, enter:

```bash
unsetenv SYMCLI_VERBOSE
```

From Windows host, to turn off the verbose mode, enter:

```bash
unset SYMCLI_VERBOSE=
```

### Display full group names

**Description**

By default, if group names are longer than the allowed space allotment, the name truncates in the output for the `symcg`, `symdg`, and `symsg` list commands.

**Syntax**

To display the full group name in the list command output, use the following syntax:

```bash
setenv SYMCLI_FULL_NAME sid
```

**Example**

To display full group name for array 567, enter:

```bash
setenv SYMCLI_FULL_NAME 100200000567
```

### Preset names and IDs

**Description**

To reduce repeated key strokes for a group of commands that require the same argument, set the `SYMCLI_DG` and `SYMCLI_SID` to a preset value.

**Syntax**

To preset the device group name, use the following syntax:

```bash
setenv SYMCLI_DG dgName
```

To preset the array ID, use the following syntax:

```bash
setenv SYMCLI_SID array_id
```

**Examples**

To preset the array ID `100200000567` for a series of consecutive commands, enter:

```bash
setenv SYMCLI_SID 100200000567
```
To preset the device name for all \(-g\) arguments, enter:

```bash
setenc SYMCLI_DG MyDG
```

## Command input and output tips

There are a number of different terms and abbreviations used with SYMCLI commands to identify and specify a VMAX array device:

### Command line time-saving tips

Actions can be abbreviated, as follows:

**Table 3 Abbreviated command line actions**

<table>
<thead>
<tr>
<th>Command</th>
<th>Abbreviated command</th>
</tr>
</thead>
<tbody>
<tr>
<td>symcfg discover</td>
<td>symcfg dis</td>
</tr>
<tr>
<td>symcfg -sid 000002304324 sync</td>
<td>symcfg -sid 24 sync</td>
</tr>
<tr>
<td>symcfg LIST</td>
<td>symcfg list</td>
</tr>
<tr>
<td>sympd show /dev/rdsk/c2t1d1s2</td>
<td>sympd show c2t1d1s2</td>
</tr>
</tbody>
</table>

### Truncated output display

In some cases, the output data from SYMCLI list commands exceeds the available column width, and returned data is truncated and appended with an asterisk (*). To view the full data, use the `show` command or verbose option (`-v`), when available.

## Version compatibility information and restrictions

Compatibility between Solutions Enabler versions, can be set for output displays, running older version scripts, and client/server interoperability.

### Set compatibility mode for older Solutions Enabler versions

**Description**

Compatibility mode is set globally using the `setenv SYMCLI_MODE` environment variable, or at the command line using the `-mode` option on any command. This specifies the command output reporting style to be compatible with prior SYMCLI versions. Possible values are from V80, V81, V82, V83, and V84.

**Examples**

For example, to set the compatibility mode to Solutions Enabler V8.0, enter:

```bash
symcfg list -mode V80
```

Attempts to specify a compatibility mode earlier than V8.0 fails with an Invalid mode error.

```bash
symcfg list -mode V76
'V76': Invalid mode specified.
```
Prior version Solutions Enabler scripts

Specialized scripts developed using a prior version of Solutions Enabler can be run in compatibility mode. Compatibility mode specifies the command output reporting style to be compatible with prior SYMCLI versions.

Note

While running older scripts in compatibility mode, output that is only available in later releases may not be returned.

Client/server version compatibility

The latest Solutions Enabler version has additional restrictions limiting the interoperability between client and server with different versions of Solutions Enabler. The following restrictions are enforced in this release:

- SYMAPI client connections to servers running Solutions Enabler versions lower than V8.4 are rejected.
- SYMAPI server connections from clients running Solutions Enabler earlier than V8.0 are rejected with the error code:

  SYMAPI_C_NET_VERSION_TOO_OLD

  The remote connection is refused, as the client SYMAPI version is not supported by the server.

- SYMAPI server connections from clients with a Solutions Enabler version later than server are rejected with error code:

  SYMAPI_C_NET_VERSION_TOO_NEW

  The remote connection is refused, as the client cannot have a newer SYMAPI version than the server.

- Attempts to open a database file written by a version prior to V8.0 fail with the following error code:

  SYMAPI_C_DB_VERSION_TOO_OLD

  The SYMAPI database file cannot be used because it was written by a version of SYMAPI that is no longer supported.

- When comparing client and server versions, only the major and minor versions are compared (for example: 8.0, 8.1). The edit and patch levels are ignored.

Capacity information

Storage capacity can be measured using two different systems – base 2 (binary) and base 10 (decimal). Organizations such as the International System of Units (SI) recommend using the base 10 measurement to describe storage capacity. In base 10 notation, one megabyte (MB) is equal to 1 million bytes, and one gigabyte (GB) is equal to 1 billion bytes.

Operating systems generally measure storage capacity using the base 2 measurement system. Unisphere and Solutions Enabler use the base 2 measurement system to
display storage capacity along with the TB notation as it is more universally understood. In base 2 notation, one megabyte (MB) is equal to 1,048,576 bytes and one gigabyte (GB) is equal to 1,073,741,824 bytes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Binary Power</th>
<th>Binary Value (in Decimal)</th>
<th>Decimal Power</th>
<th>Decimal (Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilobyte</td>
<td>KB</td>
<td>$2^{10}$</td>
<td>1,024</td>
<td>$10^3$</td>
<td>1,000</td>
</tr>
<tr>
<td>megabyte</td>
<td>MB</td>
<td>$2^{20}$</td>
<td>1,048,576</td>
<td>$10^6$</td>
<td>1,000,000</td>
</tr>
<tr>
<td>gigabyte</td>
<td>GB</td>
<td>$2^{30}$</td>
<td>1,073,741,824</td>
<td>$10^9$</td>
<td>1,000,000,000</td>
</tr>
<tr>
<td>terabyte</td>
<td>TB</td>
<td>$2^{40}$</td>
<td>1,099,511,627,776</td>
<td>$10^{12}$</td>
<td>1,000,000,000,000</td>
</tr>
</tbody>
</table>
CHAPTER 2
Discovery

This chapter describes the SYMCLI discovery process.

- Discovery overview ........................................................................................................ 36
- Discovery syntax options .................................................................................................. 36
- Verify host configuration database is synchronized ......................................................... 36
- Scan for new devices ......................................................................................................... 37
- Connectivity authorization ................................................................................................. 38
- Configuring virtual disk mapping ...................................................................................... 38
- Display virtual disks as array devices ................................................................................. 39
- Host configuration database file ......................................................................................... 39
- Configuration data synchronization .................................................................................... 42
Discovery overview

The discovery process retrieves array, volume-level configuration, and status information. Discovery refers to the process where array, volume-level configuration, and status information is retrieved. Discovered configuration and status data for all arrays, as well as their directors and volumes, is maintained in a configuration database file on each host. Once the environment is discovered, information requests are made to retrieve array-level (high-level) data or device-level (low-level) information from it using SYMCLI commands.

Before using the SYMCLI commands, run the symcfg discover command to build the configuration (SYMAPI) database. Do after each Solutions Enabler or array operating system upgrade, and when presenting new devices to or removing old devices from the host.

Discovery syntax options

Description
During the first command line session, or if a configuration change has occurred, the configuration database must be built or rebuilt with the most complete and current information for all physical devices connected to the host. The discover command scans all SCSI buses, collects information about all the arrays and devices found, and rebuilds the database with the collected device information and parameters from all local and remotely attached devices. For more information about the configuration database, refer to Host configuration database file on page 39.

Syntax
To run a discovery operation, use the following syntax:

```
symcfg discover [-all | -pdev [-sid SymmID] | -sid SymmID] [-cache | -nocache]
```

Options
- **-pdev**
  Limits the discovery operation to only physical device information.
- **-sid**
  Limits the discovery operation to a specific array.

Examples
To scan the hardware and rebuild the database, enter:

```
symcfg discover
```

Verify host configuration database is synchronized

Description
The `symcfg verify` command verifies if the host configuration database file is synchronized with the configuration of an array. If they are in sync, the verify action
returns code 0 (the CLI_C_SUCCESS value). If they are out of sync, the verify action returns code 24 (CLI_C_NOT_IN_SYNC value).

The symcfg list -status command lists all arrays connected to the host, and shows whether the configuration has changed.

**Examples**

To run the verify action for a specific array, enter:

```
symcfg verify -sid 814
```

To run the list action, enter:

```
symcfg list -status
```

**Sample output**

For the `symcfg verify` command:

```
The Symmetrix configuration and the database file are in sync.
echo $status 0
```

For the `symcfg list -status` command:

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Attachment</th>
<th>Model</th>
<th>Version</th>
<th>Config Changed</th>
<th>Discovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>000192600305</td>
<td>Local</td>
<td>VMAX</td>
<td>5977</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>000192600321</td>
<td>Local</td>
<td>VMAX</td>
<td>5977</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>000192600198</td>
<td>Remote</td>
<td>VMAX</td>
<td>5977</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>000192600256</td>
<td>Remote</td>
<td>VMAX</td>
<td>5977</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>000192600282</td>
<td>Remote</td>
<td>VMAX</td>
<td>5977</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>000192600284</td>
<td>Remote</td>
<td>VMAX</td>
<td>5977</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Scan for new devices**

**Description**

When new devices are mapped to a host on nodes that have not yet been created, those nodes must exist before the discovery operation can find the devices along their path. The scan operation does the following:

- Searches the environment for devices accessible to a given host.
- Creates the nodes for the new or changed devices.
- Activates the necessary processing on the host system to recreate a list of accessible devices.

**Note**

The `symcfg scan` command is only supported on UNIX platforms.

If changes are associated with array devices, follow the `scan` operation with the `discover` operation.

The `discover` operation scans all devices on the host looking for array devices and builds or rebuilds the array host database.
Examples
To scan for new devices, enter:

```
symcfg scan
```

To discover changes associated with array devices, enter:

```
symcfg discover
```

Connectivity authorization

Description
Some arrays may require authorization information to provide access to the array. Use the `symcfg authorization` command to supply this information for use in subsequent discovery operations. The `symcfg authorization` command lists, adds, updates, or deletes this connectivity information. The `update` action updates the password of an existing entry.

Syntax
To authorize connectivity, use the following syntax:

```
symcfg
authorization list [-hyperv] [-v]
authorization add | update -host HostName
   -username UserName -password PassWord
   [-namespace NameSpace]
[-ahost HostName]
[<-vmport | -port> port] [-vmware]
authorization add | update -host HostName
   -username UserName -password PassWord [-hyperv]
authorization delete -host HostName
   -username UserName [-namespace NameSpace] [-vmware]
```

Configuring virtual disk mapping

Solutions Enabler can resolve all virtual disks that have only one array device in the VMware datastore (supported with ESX 3.5 and higher). To use VMware virtual disk mapping, configure the host access credentials and copy the SSL certificate from the server to the VM OS.

Procedure

1. Configure host credential using the following syntax:

```
symcfg auth add -host HostName -username root -password PassWord -namespace -vmware
```

2. Copy the SSL certificate. For example from the server: `/etc/vmware/ssl/rui.crt`) to the VM OS as: `/var/symapi/config/viclient_cert.pem`

3. When virtual disk mapping is configured, use following syntax to return the virtual disk information:

```
./syminq
```
Results

<table>
<thead>
<tr>
<th>Device</th>
<th>Product</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Type</td>
<td>Vendor</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>--------</td>
</tr>
<tr>
<td>/dev/sda</td>
<td>VMware Virtual disk 1.0</td>
<td>N/A</td>
</tr>
<tr>
<td>/dev/sdc</td>
<td>VMware Virtual disk 1.0</td>
<td>N/A</td>
</tr>
<tr>
<td>/dev/sdd</td>
<td>EMC SYMMETRIX</td>
<td>5773</td>
</tr>
<tr>
<td>/dev/sde</td>
<td>VMware Virtual disk 1.0</td>
<td>N/A</td>
</tr>
<tr>
<td>/dev/dm-0</td>
<td>VMware Virtual disk 1.0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note

An expected capacity difference is visible between the output of `syminq` and `sympd list` commands. When creating the virtual disk, it can use all the space or less space than the array device; so the `syminq` output may show smaller capacity than what `sympd list` output shows. In some cases, `syminq` shows larger capacity than `sympd list`, because the VMware datastore (or virtual disk) can have multiple array devices.

Display virtual disks as array devices.

Example

To display virtual disks as array devices for array 266, enter:

```
sympd list -sid 266
```

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000194900266</th>
<th>Device Name</th>
<th>Dir</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Syms SA :P Config</td>
<td>Attribute</td>
<td>Sts</td>
</tr>
<tr>
<td>/dev/sdl</td>
<td>00044 01E:0 TDEV</td>
<td>N/Grp'd ACLX RW</td>
<td>16</td>
</tr>
<tr>
<td>/dev/sdas</td>
<td>00168 07E:0 TDEV</td>
<td>N/Grp'd RW</td>
<td>28</td>
</tr>
<tr>
<td>/dev/sds</td>
<td>006DC 07E:0 TDEV</td>
<td>N/Grp'd NR</td>
<td>1934</td>
</tr>
</tbody>
</table>

Host configuration database file

The host configuration database (.bin) file, which is stored on the server host system, contains the physical configuration information of SCSI devices and array parameters that define your entire storage complex. More than one configuration database file may be required to support your operational needs.

The host configuration database is sometimes referred to SYMAPi database (because of how the file is named), or the Symmetrix database file. All of these names are referring to the same configuration database file, `symapi_db.bin`, described next.
Database file location

- On UNIX, the default pathname for the configuration database file is: /var/symapi/db/symapi_db.bin
- On Windows, the default configuration database path is: C:\Program Files\EMC\SYMAPI\db\symapi_db.bin
- On OpenVMS, the default configuration database path is: SYMAPI$DB:symapi_db.bin

An additional configuration database (.bin) file can be created to meet specific requirements.

Note

In a multi-database environment, verify that the correct database is being used. Always confirm the current database before applying a command. For safe command line environments, it is recommended to use the common (default) database.

Database file lock

Solutions Enabler utilizes a configuration database locking file. The lock file is created automatically and is given the same name as the configuration database file, but it is appended with an _xlock suffix. For example, symapi_db.bin_xlock.

Solutions Enabler uses this lock file to serialize access to the configuration database file. It contains no data and is only used as a lock.

If you protect the symapi_db.bin file to restrict the users permitted to perform Solutions Enabler management operations, this lock file should be protected as well. Both symapi_db.bin and symapi_db.bin_xlock should be given the same level of protection.

Changing the current database file name

Procedure

1. Check which host configuration database file is being used:

   ```
symcli -def
   ```

2. Modify the environment variable SYMCLI_DB_FILE.

   For example, to change the database file to symbackup_db.bin from a UNIX host in C shell (csh), enter:

   ```
   setenv SYMCLI_DB_FILE /var/symapi/db/symbackup_db.bin
   ```

   To perform the same operation on Windows, enter:

   ```
   set SYMCLI_DB_FILE=C:\Program Files\EMC\Symapi\db\symbackup_db.bin
   ```
Database location in client/server mode

For security reasons, in client/server mode the configuration database file must be located within the default database directory on the server host:

- On UNIX, the default pathname for the configuration database file is: `/var/symapi/db`
- On Windows, the default configuration database path is: `C:\Program Files\EMC\Symapi\db`

Database access modes

The SYMCLI commands utilize different modes to access the host configuration database file:

**read/write** — Commands that control and/or modify database parameters, read the database file into memory, and provide simultaneous modification of both the in-memory database and the database file. During this access cycle, the database file is locked.

**read/no write** — Commands that list or show database parameters, read the database file into memory and allow modifications to the in-memory database. No modifications to the database file occur. During the access cycle, the database file is not locked.

Command modes: Online and offline

SYMCLI commands are run in online or offline mode. Commands that execute in online mode, such as configuration control operations, automatically attempt to gather the latest state and mode information from the arrays, and update the in-memory database and configuration database file on the host. If a configuration change has occurred, commands that execute in online mode will attempt to discover the changed entity to retrieve and load any updated configuration information.

Commands that can execute in offline mode, such as `symcfg list`, retrieve data exclusively from the configuration database.

Database configuration information

**Example**

To view basic configuration information about the current database in use, enter:

```
symcfg -db
```

**Sample output**

```
symcfg list -db
Type of SYMAPI Database : Full
Host Node Name which discovered the DB : api33
Host OS Type which discovered the DB : LINUX
Version of SYMAPI Library which discovered the DB : 9.0.X.X (Edit Level: 2001)
Version of SYMAPI Library which wrote the DB : 9.0.X.X (Edit Level: 2001)
Min Edit Level of SYMAPI Lib Reqd to Read the DB : 2500
```
The above output includes the minimum edit level of the SYMAPI library required to read the database. Any SYMAPI library with this version or higher and edit level or higher can read the current database.

Configuration data synchronization

A sync operation of the host configuration database with the storage environment configuration, performed once a discovery operation has occurred, is less performance-intensive than a full discover operation.

A sync operation interrogates just the known arrays (previously discovered) that are accessible from the host, and updates the configuration and status information in the configuration database file. In addition, this synchronization can be limited to a specific array, where a configuration change may have occurred.

Update configuration information (sync operation)

Description
The sync operation refreshes the array configuration database file with data from the arrays. It does not update statistical information. #unique_44 provides information about obtaining array performance statistics. The symcfg sync command updates data for all known entities in the configuration database file, but does not scan for SCSI devices on the host. That means that any newly configured physical devices are not added to the database during the synchronization. Synchronizing data is an array-specific operation.

Note
If presenting new devices to a host or removing devices that a host sees, use the discover command before running the sync command.

Syntax
To perform a sync operation, use the following syntax:

```bash
symcfg sync
```

Options
- **-sid SymmID**
  - A specific array
- **-rdf**
  - SRDF information
- **-bcv**
  - BCV information
Inhibit Database synchronization

Description
To force some commands to operate in offline mode, use the environment variable SYMCLI_OFFLINE, which inhibits accessing the array to update the database.

Examples
For example, to globally force these commands to their offline mode (-offline option) from a UNIX host in C shell (csh), enter:

```
setenv SYMCLI_OFFLINE 1
```

It may be necessary to refresh the database if executing commands while offline mode is enabled or execute commands that normally run in the offline mode, such as the symcfg list. Most display commands can be run in the offline mode, which provides the fastest response, and does not require access to the array.
CHAPTER 3

User and Group Authorization

This chapter describes how to set up user and group authorization using the SYMCLI symauth command.

- User and group authorization overview .......................................................... 46
- Authorization settings management ................................................................. 49
- Monitor authorization ...................................................................................... 55
User and group authorization overview

User authorization restricts the management operations individual users or groups can perform on an array. User authorization and the host-based Access Control database are independent utilities, but can be used together for maximum security. Refer to Host-based Access Control on page 59 for more information on the Access Control database.

The symauth command maps a user or group to a specific role, and allows the user or group access to specific operations on either an entire array or on individual components within an array. Authorization is configured independently for each array.

For more information about the symauth command syntax, refer to the Dell EMC Solutions Enabler SYMCLI Command Reference Guide.

User roles

A role determines the operations a user can perform. Unlike host-based access control, a user is assigned a particular role for the entire array or specified components within the array. For each array, a user or group can be assigned up to four roles. Roles are predefined and cannot be changed.

The following roles are defined in Solutions Enabler:

- **None** — Has no rights.
- **Monitor** — Performs read-only operations on an array excluding the ability to read the audit log or Access Control definitions.
- **PerfMonitor** — Includes Monitor role permissions and grants additional privileges within the performance component of Unisphere for VMAX application to set up various alerts and update thresholds to monitor array performance.
- **StorageAdmin** has the following rights:
  - Can perform all management operations on an array or on individual components within an array in addition to all monitor operations. This is the only role that can be given access rights to specific components within an array and is limited to virtualization domain users. Refer to User ID formats on page 48 for user ID format to assign Storage Admin role for virtualization domain user.
  - Can modify the GNS group definitions and monitor all operations (even if only granted rights to one component), and also has application performance monitor privileges.
  - Can modify storage groups (add and delete devices in storage group).
- **SecurityAdmin** — Performs security operations (symaudit, symacl, symauth) on an array in addition to all monitor operations. Users or groups assigned the SecurityAdmin or Admin roles can create or delete component-specific authorization rules. The SecurityAdmin also has all Auditor rights.
- **LocalRep** — Performs local replication operations such as SnapVX on an array.
- **RemoteRep** — Performs remote replication operations such as SRDF on an array.
- **DeviceManage** — Performs control or configuration operations on devices.
- **Admin** — Performs all operations on an array, including security operations and monitor operations. The Admin also has StorageAdmin rights, SecurityAdmin rights, and application performance monitoring privileges.
Auditor — Grants the ability to view, but not modify, security settings for an array (including reading the audit log, symacl list, and symauth) in addition to all monitor operations. This is the minimum role required to view the array audit log.

List roles supported by the array

Syntax
To list the roles supported by an array, enter:

```
symauth list -roles
```

Assign multiple user roles

Examples
The `symauth` command is enhanced to assign multiple roles (up to four) separated with a '+' character.

```
StorageAdmin+Auditor+Monitor
```

Note
If any other role is combined with a role of None, the None role is ignored.

The `remove` command removes roles only for users assigned multiple roles, as shown in this example:

```
symauth -sid <SymmID> commit <<!
symauth -sid <SymmID> commit <<!
assign user H:mars\smith to role StorageAdmin+Auditor;
assign group D:Eng\Sup to role SecurityAdmin+PerfMonitor;
assign user H:mars\smith to role Monitor;
remove group D:Eng\Sup from role PerfMonitor;
remove user H:mars\smith from role Auditor;
```

User authorization rules

When a user or group attempts access to an array or one of its components, Solutions Enabler performs the following authorization checks:

1. Verifies if user has access to the entire array.
2. Checks if group has access to the entire array.
3. Verifies if user has access to the StorageGroup component within the array.
4. Checks if group has access to the StorageGroup component within the array.

The StorageGroup component allows an Role Based Authentication Control rule to apply to a specific Storage Group or set of Storage Groups, without providing access to all SGs. A simple wildcard syntax can be used with the component name to allow a single rule to apply to multiple SGs as follows:

- `abc` — Exactly these characters
- `?` — Any 1 character
- `*` — Any zero or more characters
- `+` — Zero or more additional occurrences of the previous match
The rights granted by each check are combined together to form an overall set of rights for the user or group. For example, if a user is assigned to the SecurityAdmin role and also belongs to finance group, that is assigned the Monitor role, then the user is granted both SecurityAdmin and Monitor rights.

**User ID formats**

Users are identified by the user ID format, `Type:Qualifier\UserName or GroupName`. Where:

- **Type** — Specifies the type of security authority used to authenticate the user. Authentication types are listed below.
- **Qualifier** — Specifies the domain or host that the user is logged into.
- **Name** — Specifies the username or groupname relative to that authority. It cannot be greater than 32 characters, and spaces are allowed if delimited with quotes.

**User authentication types**

**Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Indicates a user or group authenticated by LDAP. Domain specifies the domain controller on the LDAP server. For example: L:danube.com\Finance — Indicates that user group Finance logged in through the domain controller danube.com.</td>
</tr>
<tr>
<td>C</td>
<td>Indicates a user or group authenticated by the SMC server. For example: C:Boston\Legal— Indicates that user group Legal logged in through SMC server Boston.</td>
</tr>
<tr>
<td>D</td>
<td>Indicates a user authenticated by a Windows domain. The qualifier specifies the domain or realm name. For example: D:sales\putman — User putman logged in through the Windows domain sales. D:jupiter\Sales — Group Sales logged in through the Windows domain jupiter.</td>
</tr>
<tr>
<td>H</td>
<td>Indicates a user authenticated (by logging in) to some host. On Windows, this corresponds to logging into a local account on the host. The qualifier specifies the hostname. For example: H:jupiter\mason — User mason logged in on host jupiter. H:jupiter\Sales — Group Sales logged in on host jupiter.</td>
</tr>
<tr>
<td>V</td>
<td>Indicates a user or group authenticated by the SMC server. For example: C:Boston\Legal— Indicates that user group Legal logged in through SMC server Boston.</td>
</tr>
</tbody>
</table>
Examples

Only Virtualization domain users or groups are allowed the role of StorageAdmin, with access to specific array components such storage groups or thin data pools. To assign thin pool access to a Virtualization domain use, enter:

```bash
symauth -sid 1234 commit <<!
assign group V:Host932jx\joe to role StorageAdmin for component ThinPool ThinPool:Sales-2;!
```

**Username and groupname formats**

### Description

Within role definitions, user IDs or group IDs are either fully qualified (as shown previously), partially qualified, or unqualified. When the hostname or domain portion of the `UserName` parameter or `GroupName` parameter is an asterisk, the asterisk is treated as a wildcard meaning any host or domain. Examples of this include: `H:*\user, D:*\user, and *\user`. In all other cases, the asterisk is treated as a regular character.

### Examples

- **D:ENG\Sales** — Fully qualified name with a domain and groupname.
- **D:*\jones** — Partially qualified name that matches username `jones` within any domain.
- **H:HOST\Eng** — Fully qualified name with a hostname and groupname.
- **H:*\jones** — Partially qualified name that matches username `jones` within any host.
- **jones** — Unqualified username that matches any `jones` in any domain on any host.

### Wildcards

When using a wildcard (such as the asterisk), a given user or group may be matched by more than one mapping in the database. When searching for a role, the authorization mechanism uses the closest ID match that it can find.

- If an exact match (for example, `D:sales\putman`) is found, it is used.
- If a partial match (for example, `D:*\putman`) is found, it is used.
- If an unqualified match (for example, `putman`) is found, it is used; otherwise the user role is None.

When using the asterisk to allow wildcarding of user or group names, the `symauth` command may fail with an invalid argument error if it is used to establish a rule (assign or reassign) with a user or group that is deemed invalid through API validity checks.

**Authorization settings management**

The `symauth` command manages user and group authorization. This command enables and disables user and group authorization, sets enforcement mode, lists defined users and groups with their roles, and assigns roles to users and groups.
Current username identification

Options

-username
   Displays the current username.

Examples

To display all groups to which the user belongs, enter:

```bash
symauth show -username
```

Sample output

This output displays all groups to which the user belongs.

<table>
<thead>
<tr>
<th>Your current username:</th>
<th>D:Corp\Joe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your current groupname:</td>
<td>D:Corp\Finance D:Corp\Sales H:HostName\PowerUsers</td>
</tr>
</tbody>
</table>

Group names are sorted alphabetically.

User authorization

User and group role mappings should be defined before enabling authorization. At a minimum, there must be one mapping for an individual to the Admin or Security Admin, as user authorization can only be enabled if there is an individual (as shown by `symauth show -username` command) mapped to a role of either Admin or SecurityAdmin roles. These roles provide the ability to perform authorization control operations. Up to four roles can be assigned to a user group.

Set user authorization

Description

Assign user or group roles using the `symauth` command with role mappings supplied through a command file, or, on a UNIX host, supplied by a redirection of STDIN. Each line of the command file must contain a valid username or groupname with supported roles (refer to User roles on page 46 for supported roles), and end with a semicolon. For further details on using the command file, refer to User authorization command file usage on page 53.

Syntax

To create role mappings using a command file, use the following command syntax:

```bash
symauth -sid SymmID commit -file PathName
```
Examples

To create the user-to-role and group-to-role mappings, by supplying a redirection of
STDIN (on UNIX host):

```
symauth -sid 1234 commit <<!
assign user H:jupiter\laura to role SecurityAdmin+PerfMonitor;
assign user D:Eng\neil to role Monitor;
assign user D:Eng\dave to role StorageAdmin+Auditor;
assign user D:Eng\steve to role Admin;
assign user D:Eng\paul to role PerfMonitor;
assign group V:Host932jx\joe to role StorageAdmin for component
ThinPool ThinPool:Sales-2;
assign group D:Finance to role Monitor;!
```

Note

When using the asterisk (*) to allow wildcarding of user or group names, the *symauth*
command may fail with an invalid augument error, if it is used to establish a rule
(assign or reassign) with a user or group that is deemed to be invalid through API
validity checks.

Enable user authorization

Description

User and group authorization is disabled by default. Any user can make changes to the
authorization control data, including creating and removing user and group role
mappings. Once authorization is enabled for an array, only users or groups with the
Admin and SecurityAdmin role can change authorization control data. In addition, only
a Virtualization Domain user assigned the role of StorageAdmin of an entire array can
create or delete component-specific authorization rules. Refer to User ID formats on
page 48 for assigning component specific authorization.

Only a user or group granted the role of Admin or SecurityAdmin can enable or disable
authorization for an entire array.

Examples

To enable user authorization on array 097, enter:

```
symauth -sid 097 enable
```

Note

Specifying an array ID is optional for enable action.

User authorization enforcement

Description

Once user authorization is enabled, failed access attempts are enforced in one of two
ways. An authorization failure can either result in operation failure or simply log a
warning. The level of security enforced, is be set using the *symauth set
enforcement* command.
Syntax
To set the security enforcement level, use the following syntax:

```
symauth -sid <SymmID> set enforcement <advise | enforce>
```

Options

**advise**
This parameter allows the operation to proceed when user or group authorization is denied, but generates a warning message (less secure) to the Solutions Enabler log file. This is an effective mode for validating your user and group role mapping without preventing access to array functionality.

**enforce**
This parameter, which is the default setting, causes the operation to fail when user or group authorization is denied (more secure), and logs the authorization attempt with its associated User or Group ID to the common audit log, symaudit log, and the Solutions Enabler log file.

---

**Note**
Enforcement can also be set using a command file as described in User authorization command file usage on page 53.

---

**Set Secure Reads**

**Description**
The secure reads policy allows users with SECURITY_VIEW permissions to view the full set of authorization rules. All other users can only view rules affecting them. Enabling/disabling secure reads can be set using the `symauth set secure_reads <enable | disable>` command.

**Syntax**
To set the secure reads policy, use the following syntax:

```
symauth -sid <SymmID> set secure_reads <enable | disable>
```

**Modify user authorization role mappings**

**Description**
Modify user or group roles using the `symauth` command with role mappings supplied through a command file, or, on a UNIX host, supplied by a redirection of stdin. Each line of the command file must contain a valid username or groupname with supported roles (refer to User roles on page 46 for supported roles), and end with a semicolon. For further details on using the command file, refer to User authorization command file usage on page 53.

**Syntax**
To modify role mappings using a command file, use the following command syntax:

```
symauth -sid SymmID commit -file PathName
```
Options
-file
This is the fully qualified path of the file containing the user-to-role mappings.

Examples
To modify user or group role mappings supplying a redirection of STDIN (on Unix host), enter:

```bash
symauth -sid 1234 commit <<!
assign user H:jupiter\laura to role Monitor;
assign user D:Eng\neil to role Admin;
assign user lauren to role StorageAdmin for StorGrp SG10;
reassign group Sales to role Auditor;
delete group Marketing for ThinPool ThinPool:Sales-1;
reassign user D:Eng\bob to role Monitor;
reassign user V:Host932jx\joe to role StorageAdmin for ThinPool ThinPool:Sales-4;
!
```

Note
When using the asterisk to allow wildcarding of user or group names, the `symauth` command may fail with an invalid argument error, if it is used to establish a rule (assign or reassign) with a user or group that is deemed to be invalid through API validity checks.

User authorization command file usage
A command file can be used to set user authorization, so a sequence of operations are previewed and committed at once. A command file is a simple text file formatted as follows:

### Table 4 User authorization command file format

<table>
<thead>
<tr>
<th>Action</th>
<th>format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add a user to roles</td>
<td>assign user UserName to role RoleNames;</td>
</tr>
<tr>
<td>Remove roles from user</td>
<td>remove user UserName from role RoleNames;</td>
</tr>
<tr>
<td>Reassign an existing group</td>
<td>reassign group GroupName to role RoleNames;</td>
</tr>
<tr>
<td>to roles:</td>
<td></td>
</tr>
<tr>
<td>Delete a user</td>
<td>delete user UserName;</td>
</tr>
<tr>
<td>Set enforcement</td>
<td>set enforcement [advise</td>
</tr>
</tbody>
</table>

Note
Assign operation is additive and does not replace an existing role. A user or group is allowed up to four authorization roles. Remove operation will remove individual roles for users with multiple roles.
Naming rules

- The following naming rules apply to user names and group names:
  - *UserName or GroupName* is the name of a user or a group (32-character maximum).
  - Spaces are allowed if the name is quote delimited.
  - Examples of a valid *Username* include: "D:domain\joe", "H:host\joe", "domain\joe", and "joe". For "domain\joe" it is interpreted as "D:domain\joe". For "joe", this *Username* is allowed regardless of domain or host.

- The following rules apply to *RoleNames*:
  - *RoleNames* are the roles assigned to or removed from a user or group.
  - Current valid roles include: Admin, SecurityAdmin, StorageAdmin, Auditor, PerfMonitor, Monitor, and None.
  - *RoleNames* are case insensitive.
  - To assign multiple roles to a user or group, place a plus sign "+" between roles (for example, assign user User1 to role StorageAdmin+Auditor).

Preview and commit user authorization actions

**Description**
To apply authorization actions (command file entries) to the array perform these operations on the command file:

1. Preview — This verifies the syntax and contents of the file.
2. Commit - This verifies and commits the contents of the command file to the array.

**Syntax**
To preview the command file entries, use the following syntax:

```
 symauth -sid SymmID preview -file PathName
```

To commit the command file entries, use the following syntax:

```
 symauth -sid SymmID commit -file PathName
```

Backup the authorization database

**Description**
The backup operation saves the contents of the user and group authorization database from the array to the specified file. Use the following command syntax to back up your user authorization database, where *SymmID* is the 12-character ID that specifies the array and *BackupFile* is the fully qualified path and filename of the backup that will be created:
Syntax
To backup the database with a fully qualified path and filename for the backup file, use the following syntax:

```
symauth -sid SymmID backup -f BackupFile
```

**Restore the authorization database**

**Description**
The restore operation re-initializes the user and group authorization database on an array, from a previously generated backup file, and re-enables user authorization. The specified file must be created by an earlier backup operation and can be from the same or a different array. Use the following command syntax to restore a previously created backup file, where SymmID is the 12-character ID that specifies the array to restore the file and BackupFile is the fully qualified path and filename of an existing backup file:

**Syntax**
To restore the database with the fully qualified path and filename for an existing backup file, use the following syntax and specify:

```
symauth -sid SymmID commit -restore -f BackupFile [-noprompt]
```

The restored file must assign the current user a role of Admin or SecurityAdmin; if it does not, the final restore step, which re-enables user authorization will fail. If this occurs, assign a role of Admin or SecurityAdmin to the current user and manually enable user authorization. Otherwise, have a user with Admin or SecurityAdmin privileges re-enable user authorization on the array.

**Monitor authorization**

**Description**
Use the monitoring operations to view the current user authorization settings on a specific array.

**Examples**
To list the user authorization policies in effect on an array, enter:

```
symauth -sid 025 list
```

To list the supported roles, enter:

```
symauth list -roles
```

To list the component types, enter:

```
symauth list -components
```
List user roles, names, and components

Description
The list operation retrieves current user authorization information from the array. If current information cannot be retrieved, the operation fails.

Syntax
To list user authorization information, use the following syntax:

```
symauth [-sid SymmID] [-offline]
    list -users [-by_domain | -by_role | -by_user][--current_user]
```

Options

- **-offline**
  Retrieves cached authorization data on disk and does not communicate with the specified array. If there is no cached data on disk, no data displays (appearing as if there is no authorization data on the array.

- **-v**
  Use this option to request a multi-line display or when the length of names or components exceeds the 79-character limit.

Examples
To list the mappings of roles to all user and group names and their applicable components for array 1234, enter:

```
symauth -sid 1234 list -users
```

Sample output
The output shows the list the mappings of roles to user and group names and their applicable components for array 1234.

<table>
<thead>
<tr>
<th>Role</th>
<th>User/Group Name</th>
<th>Component</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>User Mike</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>SecurityAdmin</td>
<td>User Smith</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>StorageAdmin</td>
<td>User H:mars\Jones</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User H:saturn\Sally</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group D:Eng\QA</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>DeviceManage</td>
<td>User Jack</td>
<td>StorGrp:test2SG</td>
<td>.</td>
</tr>
<tr>
<td>Auditor</td>
<td>User H:mars\Jones</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group D:Eng\QA</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>PerfMonitor</td>
<td>User D:Eng\Joe</td>
<td>N/A</td>
<td>N</td>
</tr>
</tbody>
</table>
Legend for Flags:

(E) : N = Rule has no effect since a different rule grants greater rights.
       : . = Rule is active.

Note

- User H:mars\Jones has StorageAdmin role and which grants access to array 1234. This authorization rule is active as noted by the period (.) in the Flags column.

- User D:Eng\Joe is granted authorization to performance monitoring on the array, but the flag displays N (NoEffect) because another rule supersedes this one. User D:Eng\Joe also belongs to Group D:Eng\QA which is assigned the StorageAdmin role for the array and already grants performance monitoring rights to its group members.
User and Group Authorization
CHAPTER 4
Host-based Access Control

This chapter describes how to set up and perform Access Control actions using the symacl command.

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- Create or modify access control data .............................................................. 65
- Create and manage access groups ................................................................. 68
- Create and manage limited access to access pools ........................................ 72
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- Verify a locked access control session .......................................................... 82
- Release locked access control sessions ......................................................... 82
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Host-based access control overview

The `symacl` access control command sets up and limits access to array resources (access pools). The command sets up access control mechanisms and changes access control entries through the Access Control database.

For more information about the `symacl` command syntax, refer to the *Dell EMC Solutions Enabler CLI Command Reference*.

Access Control database

An array-based access control database contains all the mechanisms or information to limit access to array access pools.

**Figure 1 Access Control Lists and Entries in the Access Control database**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pools</th>
<th>ACLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdminGrp</td>
<td>PRODdevs</td>
<td>accgroup=UnknwGrp</td>
</tr>
<tr>
<td>access ID</td>
<td>006 - 011</td>
<td>rights=ALL</td>
</tr>
<tr>
<td>UNIXHost</td>
<td>01C - 01F</td>
<td>devices=ALL_DEVS</td>
</tr>
<tr>
<td>ProB</td>
<td>poolA</td>
<td>accgroup=AdminGrp</td>
</tr>
<tr>
<td>access ID</td>
<td>012 - 019</td>
<td>rights=BCV</td>
</tr>
<tr>
<td>WinHost</td>
<td>022 - 02A</td>
<td>accpool=poolA</td>
</tr>
<tr>
<td>HR</td>
<td>poolHR</td>
<td>accgroup=AdminGrp</td>
</tr>
<tr>
<td>access ID</td>
<td>081 - 0AA</td>
<td>rights=BASE</td>
</tr>
<tr>
<td>WinHR1</td>
<td></td>
<td>accpool=poolHR</td>
</tr>
<tr>
<td>Sales</td>
<td>Salepool</td>
<td>accgroup=AdminGrp</td>
</tr>
<tr>
<td>access ID</td>
<td>014 - 022</td>
<td>rights=BASE</td>
</tr>
<tr>
<td>WinSale2</td>
<td>042 - 03A</td>
<td>accpool=PRODdevs</td>
</tr>
<tr>
<td>GroupA</td>
<td></td>
<td>accgroup=ProB</td>
</tr>
<tr>
<td>access ID</td>
<td></td>
<td>rights=RDF</td>
</tr>
<tr>
<td>NodeB</td>
<td></td>
<td>accpool=PRODdevs</td>
</tr>
<tr>
<td>UnknwGrp</td>
<td></td>
<td>accgroup=UnknwGrp</td>
</tr>
<tr>
<td>Default</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The access control database contains the following access control components:

- **Access Control groups** — Unique access IDs and names are assigned (together) to hosts and then sorted into access control groups according to similar needs (determined by an Administrator). Access groups are allowed to act on access pools based on permissions (access types) granted by the Administrator. The unique host ID for open systems can be viewed by running the `symacl -unique` command.

- **Access pools** — Permissions (or access types), such as BCV, SRDF, ADMIN, are assigned to a host to perform certain Solutions Enabler functionality on a specified set of devices. These sets of devices are referred to as access pools or `accpool`. Refer to #unique_72/
  `unique_72_Connect_42_SECTION_1920D6264A324C81AAED962AD74E227E` on page 75 for details on access types.

- **Access Control Entry (ACE)** — Once the group and access pool mechanisms are established, the ACEs are created, which grant permissions to these pools. The
ACEs of the various access groups (along with groups and pools) are managed and stored in the Access Control database.

- **Access Control List (ACL)** — A group of ACEs that are associated with the same Access Control group.

## Host access IDs

Symmetrix Access Control identifies individual management hosts using access IDs which are stored in a Lockbox. The Lockbox is associated with a particular host which prevents copying the Lockbox from one host to another. There are two different methods to generate the access IDs:

- **Alternate access ID**: The host's access ID can be generated at random or from a user-defined passphrase, then stored in a secure location on the local disk. Alternate access IDs are supported for all platforms. See Alternate access IDs on page 61 for more information on alternate access IDs.

### NOTICE

It is strongly recommended that you use alternate access IDs on platforms where the hardware-based access ID is derived from a network interface MAC address.

- **Hardware-based access ID** (default): The host's access ID is derived from hardware characteristics of that host:
  - On x86_64 (64-bit Intel/AMD), and IA 64 platforms, a network interface MAC address is used.
  - On other platforms, characteristics of the host, such as a processor identifier, are used.

### NOTICE

When MAC addresses generate access IDs, the IDs may be unreliable or ineffective under some circumstances, including clustering environments, virtual environments, or following a hardware change. For added security on x86_64 (64-bit), IA64, and BS2000 hardware platforms, it is strongly recommended that you use alternate access IDs instead of hardware-based access IDs.

## Alternate access IDs

Alternate access IDs are available for all platforms. When alternate access IDs are enabled, Solutions Enabler can:

- Randomly generate an access ID.
- Generate an access ID based on a user-chosen passphrase, where the passphrase is either:
  - Entered on the command line in an option.
  - Entered in a file, whose name is specified in the command line.

You enable alternate access IDs with the SYMAPI_ALTERNATE_ACCESS_ID option in the `<SYMAPI_HOME>/config/options` file.

Solutions Enabler securely stores the alternate access ID on the local disk in the Lockbox file. The `symacl` man page provides more information on the `symacl --unique` command.
Note
Solutions Enabler access control changes must be made from an administrative host with ADMIN rights to the array and rights to make symacl changes.
If you only have one such administrative host, and you change its alternate access ID, once that change is made, the host can no longer make access control changes because the new access ID is not yet in an access group.
It is recommended that you enable a second administrative host prior to attempting to change a host’s alternate access ID.

Enabling alternate access IDs

Procedure
1. Add the following option to the `<SYMAPI_HOME>/config/options` file:
   ```
   SYMAPI_ALTERNATE_ACCESS_ID = ENABLE
   ```
2. Run the `symacl -unique` command.
   Solutions Enabler:
   - Recognizes that the above option is set
   - Generates an access ID if one does not already exist for the host
   - Securely stores the access ID in the lockbox
   - Displays the access ID

Note
If you run the `symacl -unique` command after enabling the options file setting, the new alternate access ID is different from the hardware-based access ID generated prior to enabling this option. Any hardware-based access ID previously used to identify this host in an access group must be updated with the new alternate access ID using Solutions Enabler.

3. Use the `symacl` command to add the access ID to the appropriate access groups.
   When an access ID is required on this host, the alternate access ID that was stored to disk is used.

Enabling alternate access IDs using a passphrase

Procedure
1. Add the following option in the `<SYMAPI_HOME>/config/options` file:
   ```
   SYMAPI_ALTERNATE_ACCESS_ID = ENABLE
   ```
2. Run the `symacl -unique` command using the `-passphrase` option.
   The syntax when using the `-passphrase` option is as follows:
   ```
   symacl -unique [-passphrase [Passphrase|-file PassFile]]
   ```

Note
Passphrases can be 4 to 1000 characters long.
The following example shows how to activate an alternate access ID using a passphrase:
```
symacl -unique -passphrase Passphrase
```

The next example shows how to activate an alternate access ID using a passphrase stored in a file on the local disk:
```
symacl -unique -passphrase -file pathname
```

---

**Note**

In client/server mode, `pathname` names the file on the client host.

If no access ID already exists for the host, Solutions Enabler generates an access ID using the passphrase, securely stores it on the local disk, and displays it.

3. Use the `symacl` command to add the access ID to the appropriate access group.

When the access ID is required on this host, the alternate access ID that was stored to the disk is used.

### Forcible generation of alternate access ID

#### Description

If the SYMAPI_CLIENT_SIDE_ACCESS_ID is enabled, then the SYMAPI_ALTERNATE_ACCESS_ID must be enabled. However, if the Alternate Access ID option is enabled on a host for the first time, along with the SYMAPI_CLIENT_SIDE_ACCESS_ID option and the client/server is set up, any command executed displays the error **(Unable to obtain unique ID for host)** because the client is attempting to send the client access ID to the server, but there is no client access ID to send.

Using the `symacl -unique -force` command in client/server mode to generate a client access ID is not permitted. To work around this, exit client/server mode on the client and execute the commands to generate a new access ID for the client.

#### Syntax

To forcibly generate a new alternate access ID using a supplied passphrase, use the following syntax:
```
symacl -unique -passphrase passphrase -force
```

To forcibly generate a new alternate access ID using a file that contains the passphrase, use the following syntax:
```
symacl -unique -passphrase -file PathnameToFile -force
```

---

**Note**

In the client/server mode, the `PathnameToFile` is on the client host, although the alternate access ID is activated on the server.

### Disabling an alternate access ID

There are two methods to disable SYMAPI_ALTERNATE_ACCESS_ID option in the options file:
Procedure

1. Change the following setting in the options file
to: SYMAPI_ALTERNATE_ACCESS_ID = DISABLE or remove the line from the
options file.
2. Run the symacl -unique command.

Results

This command recognizes that the option was reset, and disables the alternate access
ID stored in the lockbox. The alternate access ID is retained in the lockbox in case you
want to re-enable its use in the future.

Changing a host's alternate access ID

Note

Solution Enabler access control changes must be made from an administrative host
with ADMIN rights to the array and rights to make symacl changes.
If you only have one such administrative host, and you change its alternate access ID,
once that change is made, the host can no longer make access control changes
because the new access ID is not yet in an access group.
Dell EMC recommends that you enable a second administrative host prior to
attempting to change a host’s alternate access ID.

For example, to change the access ID for Host-1:

Procedure

1. Log in to another administrative host, such as Host-2.
2. Remove any existing Host-1 definitions from the access group for all arrays to
which Host-1 has access.
3. From Host-1, follow the steps outlined in Enabling alternate access IDs on page
62 or Disabling an alternate access ID on page 63 to enable or disable the
alternate access ID mechanism and obtain a new access ID.
4. From Host-2, add Host-1 back into its access group using its new access ID to
any arrays to which it requires access.

Enabling hardware-based access IDs

Note

On IBM z/OS platforms, you must use job #14MSACL in the RIMLIB to generate and
display the unique ID. #14MSACL takes the place of the symacl -unique command
on this platform.

Procedure

1. Confirm that the SYMAPI_ALTERNATE_ACCESS_ID option is disabled.

   In the <SYMAPI_HOME>/config/options file, verify that the option is set to
   DISABLE, as shown below:

   SYMAPI_ALTERNATE_ACCESS_ID = DISABLE

2. If the option is not set to DISABLE, do one of the following:
   • Edit the entry to set it to DISABLE.
Remove or comment out the statement.

3. Run the `symacl -unique` command to generate and display an access ID.
4. Use the `symacl` command to add the access ID to the appropriate access groups.

**Setting host access ID option**

On the server host, the `SYMAPI_USE_ACCESS_ID` option controls the source of the access ID used for the client/server sessions:

```
SYMAPI_USE_ACCESS_ID = CLIENT | SERVER | ANY
```

The behavior of this option is as follows:

- **CLIENT** - The access ID supplied by the client host is used. If the client did not provide an access ID, operations fail. This can occur if the client is not configured to send its access ID.
- **SERVER** (default) - The server always uses its own access ID and ignores the access ID, if any, provided by the clients.
- **ANY** - The server uses an access ID provided by a singular client. If one is not provided, the server uses its own access ID.

**Enabling or disabling client host access ID option**

On the client host, the `SYMAPI_ALTERNATE_ACCESS_ID` option must be enabled to use this alternate access IDs:

```
SYMAPI_ALTERNATE_ACCESS_ID = ENABLE
```

Additionally, you must set the following option to control whether the client can send its own access ID to the server:

```
SYMAPI_CLIENT_SIDE_ACCESS_ID = ENABLE | DISABLE
```

The behavior of this option is as follows:

- **ENABLE** - The client sends its access ID to the server in client/server mode.
- **DISABLE** (default) - The client does not send its access ID to the server in client/server mode.

**NOTICE**

After you enable the `SYMAPI_ALTERNATE_ACCESS_ID` and `SYMAPI_CLIENT_SIDE_ACCESS_ID` options, you must run the `symacl -unique` command on the client host to generate the access ID and store it in the lockbox on the client host. Client/server mode MUST be enabled to perform this task.

**Create or modify access control data**

The `symacl` command creates or changes the access information in the Access Control database by committing a command file to the database.

The command file format contains various command entries terminated with a semicolon (;). The command syntax is case insensitive, but any variable parameter entered must be case sensitive.

The `symacl` command performs the following operations (specified in the command file):
Host-based Access Control

- Creates new access groups
- Adds and removes access IDs to access groups
- Moves an access ID from one group to another
- Creates new access pools
- Adds and removes devices to access pools
- Deletes access pools and access groups
- Adds ACEs to grant access
- Removes ACEs to deny access

**Note**

After Access Control changes are made, a discover operation is required (`symcfg discover`).

### Applying access control operations

To safely apply any Access Control operations (command file entries) to the access control database, perform the following `symacl` operations on the command file:

**Procedure**

1. **Preview**
   - Verifies the syntax and accuracy of the contents of the entries in the command file.
2. **Prepare**
   - Performs the preview checks, but also verifies the validity of the requested access control modifications against the current state of the access control database in the array.
3. **Commit**
   - Performs both the **Preview** and **Prepare** checks and then commits the contents of the command file to the Access Control database.

**Note**

It is not mandatory to execute a **Preview** or **Prepare** action prior to a **commit**. However, these operations can ensure that the **commit** action is not rejected, or they can be used to debug the command file entries.

### Minimum access control configuration

To initialize the Access Control Database for a new array installation, create a host-based administrator and an access pin. This is usually performed by a Dell EMC Engineer and is described in the following example:

**Table 5** Initial access groups set

<table>
<thead>
<tr>
<th>Access groups</th>
<th>ID names</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdminGrp</td>
<td>SunHost1 ACCPIN</td>
</tr>
</tbody>
</table>
Table 5 Initial access groups set (continued)

<table>
<thead>
<tr>
<th>Access groups</th>
<th>ID names</th>
</tr>
</thead>
<tbody>
<tr>
<td>UnknwGrp</td>
<td>unknown</td>
</tr>
</tbody>
</table>

The name SunHost1 shown in the table (associated with AdminGrp) is the ID name that designates the machine where access controls are administered. To perform prepare, commit, and release actions, an access ID (PIN) with the name ACCPIN is created in the delivered setup. This ID name is also used for the value setting of SYMCLI_ACCESS_PIN. For more information, see Create and manage access groups on page 68.

Initial ACL setup

As shown in the following table for the delivered setup described in Minimum access control configuration on page 66, access group AdminGrp has access to all devices (ALL_DEVS) and this group is granted both ADMIN and ALL permissions. Also in the initial setup, a group called UnknwGrp is established with permissions to all devices in the array. For initial system usage, this gives all unknown hosts BASE permissions to all devices (ALL_DEVS), until it becomes clear what restrictions should be established.

The initial UnknwGrp setup also grants ALL permissions to any devices not already assigned to an access pool (i.e. !INPOOLS).

Table 6 ACL setup for new array installation

<table>
<thead>
<tr>
<th>Access groups</th>
<th>permissions (access types)</th>
<th>Access pools</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdminGrp</td>
<td>ADMIN, ALL</td>
<td>ALL_DEVS</td>
</tr>
<tr>
<td>UnknwGrp</td>
<td>BASE</td>
<td>ALL_DEVS</td>
</tr>
<tr>
<td>UnknwGrp</td>
<td>ALL</td>
<td>!INPOOLS</td>
</tr>
<tr>
<td>EmcIntrnlGrp -</td>
<td>ALL</td>
<td>ALL_DEVS</td>
</tr>
<tr>
<td>used for internal array operations only</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note

The access type ALL excludes ADMIN privileges.

VLOGIX permission behavior

During initial setup of the system, the access group UnknwGrp (with Access Type ALL for NON-POOLED Devices) is present, as shown in Table 6 on page 67. The VLOGIX privilege returns as true since access is granted access to all devices in the array. Initially, because no pools are present, the VLOGIX privilege is associated implicitly with all devices by this ACL.

Once you create an access pool and add a device to it, the VLOGIX privilege is no longer implicitly associated with all devices and a check for the VLOGIX privilege will
Create and manage access groups

Various sets of users tend to use the same applications that utilize common Solutions Enabler features from a given host. System users typically share the same device resources and require access permissions to these shared devices. For shared devices, hosts are registered in groups identified with a group name, which serves as a root for all ACEs in the group (see Figure 1 on page 60).

Access groups contain groups of access IDs and their ID names. Any access ID and name can only belong to one group and are paired together into the database. For ease of management, it is highly recommended to use an access ID name that best associates with the particular host in use. For example, SunHost1 is more appropriate than a name such as JRSMITH. Once the group is created, the group name is used to create access control entries (ACEs).

Verify administrative authority

Syntax
Prior to making any access control changes, verify the host used for ACL setup has the administrative authority. To verify the host, use the following syntax:

```
symacl list -v [-sid SymmID|ALL]
```

Create an access group

Examples
To add access groups named HR and Sales in array 12345, enter in the command file:

```
create accgroup HR;
create accgroup Sales;
```

To commit access groups to the database using the file `addnewgroups.cmd`, enter:

```
symacl -sid 12345 commit -file addnewgroups.cmd
```

At this point, a prompt may display for a 4 - 12 character access PIN (if environment variable SYMCLI_ACCESS_PIN is not already set to this PIN value).

Add host access IDs to a group

Description
The host access ID is case sensitive, allows alphanumeric characters, underscores, dashes and no spaces. The ID name length allows 1 - 31 characters.
Syntax
To add a host access ID to an access group, use the following syntax in the command file:

```
add host accid Id name IdName to accgroup GroupName
```

**Note**
The host access ID is encrypted; so choose an *IdNamethat is easy to remember.

**Examples**
To add *WinHost* with an access ID *73900158-06174491-16225515* to the *ProdB* group, enter in the command file:

```
add host accid 73900158-06174491-16225515 name WinHost to accgroup ProdB;
```

**Note**
To preserve access ID security for any host, IDs are encrypted. Use the *symacl - unique* command to get the encrypted value.

To commit the file (*addnewgroups.cmd*) and add the host access IDs to the specified groups, enter:

```
symacl -sid 12345 commit -file addnewgroups.cmd
```

**Note**
To update the array configuration after Access Control changes are complete, run the *symcfg discover command. *

**User access IDs (PINs) for AdminGrp**

**Description**
A user access ID is a PIN that allows a host to perform commit, prepare, or release operations to an array as the *AdminGrp*. When a host attempts a commit, prepare, or release operation as the *AdminGrp*, the *symacl* command prompts for this PIN.

The user access *Id* is case sensitive, allows alphanumeric characters, underscores, dashes and no spaces. The ID name length allows 1 - 31 characters.

**Syntax**
To add the user access ID for the *AdminGrp* access group, use the following command syntax in the command file:

```
add user accid Id name IdName to accgroup AdminGrp
```

**Note**
The host access ID is encrypted; so choose an *IdNamethat is easy to remember.*
Examples
To add the administrative user access ID (1234PIN) for JOEPIN, enter in the command file:

```
add user accid 1234PIN name JOEPIN to accgroup AdminGrp;
```

Note
User access IDs are set only for the AdminGrp access group. Setting an ID for other groups will not return an error and may not prompt for a PIN.

To commit the file `addnewgroups.cmd` and add the user access IDs to the specified groups, enter:

```
symacl -sid 12345 commit -file addnewgroups.cmd
```

Edit and manage an access group

Once access groups are established, access IDs or ACEs can be removed from a group, IDs can be moved between groups, or groups can be deleted.

Note
To update the array configuration after Access Control changes are complete, run the `symcfg discover` command.

Remove an access ID from a group

Syntax
To remove an access ID from an access group, use the following syntax in the command file:

```
remove accid name IdName from accgroup GroupName
```

Examples
To remove user HRUser2 from the HR group, enter in the command file:

```
remove accid name HRUser2 from accgroup HR;
```

To commit the file (`removeaces.cmd`) and remove the specified user, enter:

```
symacl -sid 12345 commit -file removeaces.cmd
```

Move an access ID to another group

Syntax
To move an access ID from one access group to another, use the following command syntax in the command file:

```
move accid name IdName to accgroup GroupName
```
Examples
To move user HRUser1 to GroupA, enter in the command file:

```
move accid name HRUser2 to accgroup GroupA;
```

To commit the file (moveaces.cmd) and move the specified user, enter:

```
symacl -sid 12345 commit -file moveaces.cmd
```

Remove all ACEs from a access group

Syntax
To remove all ACEs from an access group, use the following syntax in the command file:

```
remove aces from accgroup GroupName
```

Examples
To remove all ACEs from the HR group, enter in the command file:

```
remove aces from accgroup HR;
```

To commit the file (moveallaces.cmd) and remove all ACEs from the specified group, enter:

```
symacl -sid 12345 commit -file moveallaces.cmd
```

Delete a access group

Syntax
To delete an access group from the database, use the following syntax in the command file syntax:

```
delete accgroup GroupName;
```

Options

```
remove_aces=true
```

If ACEs have not been removed from the group, this option removes all the ACEs as part of the delete operation.

Examples
To delete access group HR and any ACEs in the group, enter in the command file:

```
delete accgroup HR remove_aces=true;
```
To commit the file (deletegroup.cmd) and remove the specified user, enter:

```
symacl -sid 12345 commit -file deletegroup.cmd
```

## Create and manage limited access to access pools

Access pools are groups of devices controlled by access groups. When the various devices used by a host application must function as non-shareable resources, the target devices must be identified and assigned into an access pool for protection. Once an access pool is created, the pool can be a target to create access control entries (ACEs). More than one access group can access a pool with different permissions. For example, group AdminGrp might access PoolA with ALL permissions, while group HR could access the same PoolA with just BASE permissions.

**Note**

Once an access pool is created, any host in the access group UnknwGrp is denied access to the symmask and symaccess commands. In addition, when a host in UnknwGrp calls the symmaskdb list database or symaccess list view -detail commands, only its own devices will be returned in the list. To provide hosts in access group UnknwGrp with full access to the symmask command, grant the access type VLOGIX (for ALL DEVS) to access group UnknwGrp. For more information on granting access types with full access to the symmask and symaccess commands, refer to Create and manage access control entries on page 74.

## Verify administrative authority

**Syntax**

Prior to making any access control changes, verify the host used for ACL setup has the administrative authority. To verify the host, use the following syntax:

```
symacl list -v [-sid SymmID|ALL]
```

## Create an access pool

**Examples**

To create an access pool named PoolB in array 12345, enter in the command file:

```
create accpool PoolB;
```

To commit the file addnewpool.cmd and add a new pool, enter:

```
symacl -sid 12345 commit -file addnewpool.cmd
```
Add devices to access pool

Syntax
To add the specific devices to a pool, use the following command syntax in the command file:

```
add dev StartDevName[:EndDevName] to accpool PoolName
```

Examples
To assign devices 0A through 19 to PoolB, enter in the command file:

```
add dev 00A:019 to accpool PoolB;
```

To commit the file addnewdevices.cmd and devices to the pool, enter:

```
symacl -sid 12345 commit -file addnewdevs.cmd
```

Note
To update the array configuration after Access Control changes are complete, run the symcfg discover command.

Edit and manage access pools

Once access pools are created, devices can be removed from a pool, or pools can be deleted.

Note
To update the array configuration after Access Control changes are complete, run the symcfg discover command.

Remove devices from access pool

Syntax
To remove specific devices from a pool, use the following command syntax in the command file:

```
remove dev StartDevName[:EndDevName] from accpool PoolName
```

Examples
To remove devices 16 through 19 from PoolB, enter in the command file:

```
remove dev 016:019 from accpool PoolB;
```
To commit the file `removedevs.cmd` and remove the specified devices from the pool, enter:

```
symacl -sid 12345 commit -file removedevs.cmd
```

Delete access pool

**Syntax**
To delete an access pool from the database, use the following syntax in the command file syntax:

```
delete accpool PoolName;
```

**Options**

- `remove_aces=true`
  
  Removes any ACEs associated with the pool.

**Examples**

To delete access pool `PoolB` and any associated ACEs, enter in the command file:

```
delete accgroup PoolB remove_aces=true;
```

To commit the file `deletepool.cmd` and remove the specified user, enter:

```
symacl -sid 12345 commit -file deletepool.cmd
```

Create and manage access control entries

**Syntax**
Access Control Entries (ACEs) grant permissions to groups and pools. Once access groups and pools are created, ACEs are created. A group can have multiple permissions and pools, which requires an ACE for each permission. ACEs determine and grant, to the access group, the permissions (AccessType) for access to a specified pool or all devices not in a pool.

Verify administrative authority

**Syntax**
Prior to making any access control changes, verify the host used for ACL setup has the administrative authority. To verify the host, use the following syntax:

```
symacl list -v [-sid SymmID|ALL]
```
Grant permissions to access group

Syntax
For command the file, use the following syntax:

```
grant access=AccessType to accgroup GroupName for accpool PoolName | ALL | NON-POOLED devs
```

To commit permissions granting, use the following syntax:

```
symacl -sid SymID commit -file FileName
```

Options

**AccessType**

Specifies permissions to the SYMCLI or SYMAPI features, or functionality granted to selected devices

**Available access control permissions**

<table>
<thead>
<tr>
<th>Permissions (AccessType)</th>
<th>Description</th>
<th>SYMCLI commands affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMIN²</td>
<td>Grants administrator privilege to grant/deny access control entries to hosts and users.</td>
<td>symacl &lt;prepare, commit, release, list, show&gt;</td>
</tr>
<tr>
<td>ADMINRD²</td>
<td>Grants read-only access to all access control information.</td>
<td>symacl &lt;list, show&gt;</td>
</tr>
<tr>
<td>ALL²</td>
<td>All possible access types granted except ADMIN and ADMINRD. Must be directed to ALL devices.</td>
<td>All</td>
</tr>
</tbody>
</table>
| BASE⁴                    | Allows the discovery of devices and to obtain states and statistics from the array (directors and devices). | Base component commands
  - symevent, symcfg, symaudit, symdg, symdev, symcg <list, show>, symdisk, symipsec (Policy priority list, Policy get, and IPSec statistics get operations)
  - symmigrate query and list
  - symlmf query, list, and show |
<p>| BASECTRL                 | Allows base control operations on devices and device groups. | symdg &lt;controls&gt;, symcg &lt;controls&gt;, symdev &lt;controls&gt;, symmsg &lt;controls&gt; |</p>
<table>
<thead>
<tr>
<th>Permissions (AccessType)</th>
<th>Description</th>
<th>SYMCLI commands affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCV</td>
<td>Allows TimeFinder BCV and TF/Clone control and status operations.</td>
<td>symbcv, symmir &lt;controls&gt;, symclone &lt;controls&gt;</td>
</tr>
<tr>
<td>CACHCTRL</td>
<td>Allows Cache control operations concerning LRU partition management.</td>
<td>symqos &lt;set LRU &gt;</td>
</tr>
<tr>
<td>CFGDEV</td>
<td>Allows powerful configuration control operations that manage various types of configuration changes on devices in the array.</td>
<td>symconfigure</td>
</tr>
<tr>
<td></td>
<td>Allows the following types of operations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Convert device configurations (BCV, SRDF, DRV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Convert device configuration (changing mirroring)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Set device attributes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Set device emulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Metadevice management</td>
<td></td>
</tr>
<tr>
<td>CFGSYM^2</td>
<td>Allows access to set array attributes, set port flags, and swap RA groups with symconfigure command. It also affects the symmaskdb, symaccess, and symrdf commands as specified in the next column. Must be directed to ALL devices.</td>
<td>symconfigure, symmaskdb, symrdf, symaccess</td>
</tr>
<tr>
<td></td>
<td>Allows the following types of operations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Spare management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• SAVE device pool create/delete</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• SAVE device pool member management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Enable/disable SRDFA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Set matrix across the array</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Add/remove dynamic SRDF groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Change director supporting a dynamic SRDF group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Set the link limbo value for a dynamic SRDF group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Modify User Authorization settings via symauth</td>
<td></td>
</tr>
</tbody>
</table>
Table 7 Access Control Permissions: AccessType (continued)

<table>
<thead>
<tr>
<th>Permissions (AccessType)</th>
<th>Description</th>
<th>SYMCLI commands affected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHECKSUM</td>
<td>Allows array device Double Checksum operations.</td>
<td>symchksum &lt;controls&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CREATEDV²</td>
<td>Allows the creation and deletion of array devices (part of symconfigure).</td>
<td>symconfigure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Converting thin device (adding SRDF)
- Setting thin dev attributes
- Bind/unbind thin device (not supported by symconfigure)
- Configuring thin metadevices
- Allocate/free thin device
- Creating thin device pools
- Adding devices to thin pools
- Enabling/disabling devices in thin pools
- Removing devices from thin pools
- Deleting thin pools
- symipsec policy add, replace/modify, and delete
- Initialize the VCMDB
- Convert the database type
- Restore the database
- Manage storage groups
- Manage port groups
- Manage initiator groups
- Manage masking views
<table>
<thead>
<tr>
<th>Permissions (AccessType)</th>
<th>Description</th>
<th>SYMCLI commands affected</th>
</tr>
</thead>
</table>
| **DIRCTRL**² | Allows you to take directors and their ports offline and online. Must be directed to ALL devices. Also allows you to set CHAP authentication. | symcfg <online/offline>  
  - Online/offline RA directors  
  - Online/offline front-end ports symconfigure  
  - Set port flags and attributes symconnect, symaccess  
  - CHAP authentication |
| **ECC**¹ - ² | Allows the ECC Symmetrix agent to run on the requested host. | Not applicable |
| **OPTMZR** | Allows user-configurable attributes that may affect the Optimizer and Symmetrix Migration behavior. | symoptmz <controls>  
 symmigrate <controls>  
 symfast <controls> |
| **POWRPATH**¹ - ² | Access to PowerPath-directed devices in an SRDF consistency group. Must be directed to ALL devices. | Not applicable |
| **QOS** | Allows the execution of Quality of Service (QOS) performance control operations to manage copy priorities. Excludes LRU cache control functionality. | symqos <set pace> |
| **RCOPY** | Manage Open Replicator sessions. | symrcopy |
| **RDF** | Allows SRDF control and set operations. | symrdf <control> |
| **RPA** | For RecoverPoint splitter to operate correctly, you are required to grant BASE, BASECTRL, RPA, and CFGDEV access types. | Not applicable |
| **SDDF** | Allows the DeltaMark (Change Tracker) functionality that monitors track changes. | symchg |
Table 7 Access Control Permissions: AccessType (continued)

<table>
<thead>
<tr>
<th>Permissions (AccessType)</th>
<th>Description</th>
<th>SYMCLI commands affected</th>
</tr>
</thead>
</table>
| SDR                      | Allows mapping/unmapping of devices to directors/ports for the Symmetrix Disk Reallocation (SDR) feature, Device Masking, and Auto-provisioning Groups. | symconfigure  
  - Manage CKD aliases  
  - Map/unmap devices  
  - Map/unmap thin device  
  symmask, symmaskdb, symaccess  
  - mapping and unmapping |
| SNAP                     | TF/Snapshot allows the creation and management of virtual copy sessions between a source device and multiple virtual (VDEV) target devices. Allows for creation of snapvx sessions | symsnap  
 symsnapvx |
| VLOGIX$^{1-4}$           | Enables access to Device Masking devices and Auto-provisioning Groups. | symmask, symmaskdb, symaccess |

1. See the appropriate product documentation for use of these access types.
2. These access types must be granted to either ALL devices or all NON-POOLED devices in an array.
3. This access type must be granted to ALL devices in an array.
4. BASE access allows the creation/modification of symaccess group types, which are not part of a view. VLOGIX access is required to create or manipulate items within a view

Grant BASE permissions to a group

**Examples**

Grant BASE permissions to a group before granting permissions to any value-added, non-base feature. To grant BASE permissions to access group ProdB for all devices, enter in the command file:

```
grant access=BASE to accgroup ProdB for ALL devs
```

To grant BASE permissions to access group ProdB for poolPRODdevs, enter in the command file:

```
grant access=BASE to accgroup ProdB for accpool PRODdevs
```
To commit the file `grantbaserights.cmd` and grant BASE permissions, enter:

```
 symacl -sid 12345 commit -file grantbaserights.cmd
```

**Note**

When restricting a host to BASE access to a pool of devices, all devices mapped to the host are visible along with any devices that are not mapped to the host, but are in the pool. To configure a host to see only devices that are in the pool, map only those devices to the host. In addition, remote (SRDF) arrays and their devices are discovered, and the application registration database and the audit logs cannot be accessed since these may contain data relevant to other hosts.

**Grant SRDF permissions to a group**

**Examples**

To grant SRDF permissions to access group `ProdB` for pool `PRODdevs`, enter in the command file:

```
grant access=RDF to accgroup ProdB for accpool PRODdevs
```

To commit the file (`grantsrdfrights.cmd`) and grant SRDF permissions, enter:

```
 symacl -sid 12345 commit -file grantsrdfrights.cmd
```

**Grant BCV and SDR permissions to a group**

**Examples**

To grant BCV and SDR permissions to access group `HR` for pool `poolHR`, enter in the command file:

```
grant access=BCV, SDR to accgroup HR for accpool poolHR;
```

To commit the file (`grantbcvsdrrights.cmd`) and grant BCV, and SDR permissions, enter:

```
 symacl -sid 12345 commit -file grantbcvsdrrights.cmd
```

**Grant BASE permissions to a non-registered host**

**Examples**

To make any non-registered (`unknown`) host have BASE permissions to access group `UnknwGrp` for all devices in the array environment, enter in the command file:

```
grant access=BASE to accgroup UnknwGrp for ALL devs
```
To commit the file (grantbaserights.cmd) BASE permissions to a non-registered user, enter:

```
symacl -sid 12345 commit -file grantbaserights.cmd
```

### Remove permissions from access group

**Syntax**

In the command file, use the following syntax:

```
remove access=AccessType from accgroup GroupName  for accpool PoolName| ALL|NON-POOLED devs;
```

To commit removing permissions, use the following syntax:

```
symacl -sid SymID commit -file FileName
```

### Obtain access control information

Only ADMIN or ADMINRD permissions allow viewing the access objects (groups, pools, ACLs). Using the list action without administrative positions, display only the access objects associated with the access group for the host executing the `symacl list` command.

### List access control information

**Syntax**

To list information about groups, pools, and ACLs, use the following syntax:

```
symacl [-sid SymmID|ALL] [-h]
list [-v]
list [-accpool | -accgroup | -acl]
```

**Examples**

To list the access groups on array 0133, enter:

```
symacl -sid 0133 list -accgroup
```

### Show access control information

**Syntax**

To show detailed information about a specified group or pool, use the following syntax:

```
symacl [-sid SymmID | ALL]
    show accpool PoolName [-acl]
    show accgroup GroupName [-acl]
```
Note
When using the show actions without administrative permissions, you only see access objects that are associated with the access group to which your host belongs.

Examples
To show the details for access group ProdB on array 0133:

```
symacl -sid 0133 show accgroup ProdB
```

Obtain host access ID

Options
-unique
  Returns the access ID in a segmented, 24-digit numeric form (xxxxxxxx-yyyyyyy-zzzzzzzz).
  For example: 12301558-94200021-00347892

Examples
To return the access ID for the controlling host, enter:

```
symacl -unique
```

Verify a locked access control session

Examples
To verify an access control session is locked on any array, enter:

```
symacl list -v
```

Reports the session owner and length of time the session has been locked.

Release locked access control sessions

Description
During the processing of the access control command file, the prepare and commit actions are critical SYMCLI or SYMAPI operations that are considered access control sessions. In the event a host machine or application should abnormally fail and stop processing any prepare or commit access operation, the locked session can be aborted.

Syntax
To release the session lock, use the following syntax:

```
symacl release -sid SymmID
```
If as a security administrator, you intend to release a lock on a command file session, you must either set the environment variable `SYMCLI_ACCESS_PIN` to your access ID, or enter your PIN every time `symacl` prompts for this.

**Access control strategies**

This section describes the access control strategies that can be applied in an access-controlled array environment. Several strategies can be considered for establishing or restricting access for a node or group of users or hosts to your environment. These strategies should be considered when setting up an access control environment for the first time.

**Note**

The `discover` command (`symcfg discover`) must be run after making access control changes.

**Default configuration: all permissions to users and hosts**

The initial (delivered) strategy is to employ a default ID that controls all nodes not yet registered. This default ID can be used to grant a certain level or a minimal level of access for all unregistered nodes.

When an array is delivered it is configured with a group named `UnknwGrp` created for nonregistered hosts (with no ID), as shown in the figure below.

Figure 2 Example default configuration

<table>
<thead>
<tr>
<th>Group</th>
<th>ACE</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>UnknwGrp</code></td>
<td><code>accgroup=UnknwGrp</code></td>
</tr>
<tr>
<td><code>unknown</code></td>
<td><code>ALL</code></td>
</tr>
<tr>
<td></td>
<td><code>devices=ALL_DEVS</code></td>
</tr>
</tbody>
</table>

A special default access ID named `unknown` is added to the group granting all unknown hosts and users ALL permissions. Next, an ACE is created for group `UnknwGrp` granting them ALL permissions to all the array devices. In this scenario, all users and hosts can perform any of the SYMCLI command set operations.

**Manage default access**

During Access Control implementation, the access IDs of all hosts that need to communicate to the array (for performing array operations using applications such as Solutions Enabler) are registered in the database and granted sufficient permissions to accomplish the functions they need to perform. Once the setup of Access Control is complete, one strategy could be to block or severely limit access for any other host not specifically defined. This is accomplished by adjusting the permissions of the default accgroup `UnknwGrp`.

The default access id `UNKNOWN`, affiliated with the accgroup `UnknwGrp`, is provided at array setup, to allow any host not specifically defined, to have a specific access. The accgroup `UnknwGrp` access rights can be tailored to provide certain hosts a specific access.

The default access id `UNKNOWN` and the accgroup `UnknwGrp` can be removed which will prevent any access by a host, unless it is specifically defined with its own entries.
This means that a host, unless specifically defined and associated with a group, will be denied access.

Remove UnknwGrp

**Examples**
To remove the *UnknwGrp*, enter from the administrative host, enter:

```
delete accgroup UnknwGrp remove_aces=true;
```

Revert UnknwGrp to default

**Examples**
To revert access control settings back to the default UnknwGrp, enter from the administrative host:

```
create accgroup UnknwGrp;
grant access=ALL to accgroup UnknwGrp for NON-POOLED devs;
grant access=BASE to accgroup UnknwGrp for ALL devs;
add default accid name UNKNOWN to accgroup UnknwGrp;
```

Limit access to UnknwGrp group

**Examples**
To limit access to the *UnknwGrp* with limited access (for example BASE permission only to all undefined hosts), enter:

```
create accgroup UnknwGrp;
grant access=BASE to accgroup UnknwGrp for ALL devs;
add default accid name UNKNOWN to accgroup UnknwGrp;
```

Create alternate default ACCID

**Description**
After removing the default accid *UNKNOWN*, an alternative default accid can be created. A new accgroup is created with permissions that will be the access limitations for all undefined hosts.

**Syntax**
The default accid provided during setup is called *UNKNOWN*. To create an alternate default accid, use the following syntax:

```
add default accid name IdName to accgroup GroupName
```

**Examples**
To create an alternate default accid *Others*, enter:

```
create accgroup OtherGrp;
grant access=BASE to accgroup OtherGrp for ALL devs;
add default accid name Others to accgroup OtherGrp;
```

These hosts can discover devices, obtain states and statistics from the array, with BASE permission granted to a default accid *Others*. 
Establish an administrator

A newly delivered array allows at least one host assigned with administrative (ADMIN) privileges to the access control database.

In this example, to establish an administrator, an access group named AdminGrp is created. Then a UNIX workstation named SunHost1 with an encrypted access ID (of the form xxxxxxxx-yyyyyyyy-zzzzzzzz) is added to the AdminGrp group. (Obtain an access ID by running the symacl -unique command.) Then two ACEs are created: one granting ADMIN permissions and one granting ALL permissions to group AdminGrp for all devices in the array.

**Figure 3 Establish Administrator**

<table>
<thead>
<tr>
<th>Group</th>
<th>ACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdminGrp</td>
<td>accgroup=AdminGrp</td>
</tr>
<tr>
<td></td>
<td>ADMIN</td>
</tr>
<tr>
<td></td>
<td>devices=ALL_DEVS</td>
</tr>
<tr>
<td>SunHost1</td>
<td>ACE</td>
</tr>
<tr>
<td></td>
<td>accgroup=AdminGrp</td>
</tr>
<tr>
<td></td>
<td>ALL</td>
</tr>
<tr>
<td></td>
<td>devices=ALL_DEVS</td>
</tr>
</tbody>
</table>

Grant all permissions to the nonpooled devices

Once access controlled access pools have been established, access to all the array devices that are not otherwise registered (Nonpooled) in any access pool can be set.

In this example, the ACE for the access group named UnknwGrp is modified to restrict access to only those devices not registered in an access control pool.

**Figure 4 Grant all permissions to non-pooled devices**

<table>
<thead>
<tr>
<th>Group</th>
<th>ACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UnknwGrp</td>
<td>accgroup=UnknwGrp</td>
</tr>
<tr>
<td></td>
<td>ALL</td>
</tr>
<tr>
<td></td>
<td>devices=non-pooled</td>
</tr>
</tbody>
</table>

General absolute access control

General absolute access control registers access only to certain devices on an as-needed basis. In this configuration, the UnknwGrp group is removed. Therefore, a node must be known to the array, and only specific users/hosts in defined groups with limited or unlimited permissions have access to certain devices defined in their working pools.

Initial setup summary

Once user needs and limitations are determined, it is highly recommended to use the preview and prepare actions on the first major command file before you committing it;
particularly if it is an extensive list. The preview and prepare will identify any coding errors or mistakes in the logic.

Setting up access control for TimeFinder devices

To set up an access controlled environment for TimeFinder operations, set up both the standard and BCV devices as follows:

Procedure
1. Define your working access pool to contain both the standard and BCV SymDevNames.
2. For the group name, grant BASE permissions to access all devices.
3. For the group name, grant BCV permissions to the access pool holding the pairs.

Setting access control for SRDF devices

To set up an access controlled environment for SRDF operations, set up both the local array and remote array. Because both arrays have their own access controlled database, this requires the following configuration:

Procedure
1. With the ADMIN host, create an access control group for the local array. Then with an ADMIN local or remote host, define the same access control group name for the remote array.
2. With an ADMIN host, create an access pool defined with the R1 SymDevNames. Then with the ADMIN local or remote host, define an access pool with the R2 SymDevNames.
3. Grant BASE permissions for the group to access all devices on the R1 array. Then with an ADMIN host, grant BASE permissions for the group to access all devices on R2.
4. Grant SRDF permissions for the group to access the R1 access pool. Then with an ADMIN host, grant SRDF permissions for the group to access the R2 access pool.

Unisphere for VMAX setup strategy

Unisphere software provides a GUI interface to query and manage an array. The GUI is allowed to perform any operations to which the host has been granted rights.

Setup access control for Symaccess

To enable symaccess control for a host, use the permission VLOGIX. This permission must be granted to ALL devices in the array. Note that the behavior of symaccess changes once access pools are created. Once access pools containing devices are created, VLOGIX type privileges are denied to groups unless the privilege is explicitly granted to any group needing access. This includes the default UnknwGrp.

Backup and restore the access control database

It is a good practice to create a backup file of the current access control database prior to making changes.
Create an access control database backup file

**Syntax**
To create a backup of the current access control database, using the following syntax:

```
symacl -sid SymmID backup -file CommandFile
```

The backup operation saves the contents of the access control database in the file specified by the file option. The file must not previously exist. The backup file is compatible for use with the `symacl` command.

**Note**
The backup file contains encrypted versions of the unique IDs. Therefore if comparing the values in the backup file to the original file used to create the database, they will be different.

Restore access control database with backup file

**Syntax**
To restore the previous configuration data to access control database, use the following syntax:

```
symacl -sid SymmID commit [-v|-noecho] -restore -file CommandFile
```

The restore operation replaces the contents of the access control database with the contents of the file specified by the file option.

**Note**
The backup file contains encrypted versions of the unique IDs, therefore if comparing the values in the backup file to the original file used to create the database, they will be different.
Host-based Access Control
This chapter describes thin device management and reporting.

- Thin device management and reporting overview .............................................. 90
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- Rename thin pools .............................................................................................. 93
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Thin device management and reporting overview

VMAX3 and VMAX All Flash arrays are pre-configured at the factory with virtually provisioned devices. Thin Provisioning helps reduce cost, improve capacity utilization, and simplify storage management. Thin Provisioning presents a large amount of capacity to a host and then consumes space only as needed from a shared pool. Thin Provisioning ensures that thin pools can expand in small increments while protecting performance, as well as non-disruptive shrinking of thin pools to help reuse space and improve capacity utilization.

Refer to **EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS** and **EMC VMAX All Flash Product Guide for VMAX 250F, 450F, 850F, 950F with HYPERMAX OS** for more information on Thin Provisioning.

Use the **symdev, symsg (storage groups), symcg (composite groups), and symdg (device groups)** commands to perform the following supported operations for thin devices:

- Create thin devices (refer to **Create devices (HYPERMAX OS 5977 Q12016SR or higher)** on page 227 or **Create devices (HYPERMAX OS 5977 lower than 5977 Q12016SR)** on page 229 for creating devices).
- Allocate space on thin devices
- Reclaim space on thin devices
- Free device allocations
- Stop background operations on thin devices
- Rename a thin pool
- Verify pool and device states
- Monitor a thin pool
- View thin devices
- View a thin pool

### Allocate space on thin devices

**Description**
The **allocate** action allocates storage for specified devices. The **-persistent** option specifies that allocated storage cannot be reclaimed or freed. If any of the tracks specified for persistent allocation are already allocated, the already allocated tracks are marked as persistent.

**Examples**
To start allocation on the thin devices in the device group **myDg**, enter:

```
symdg -sid 234 -nop -v allocate -dg myDg -persistent
```

The **symsg** and **symcg** commands are the same as **symdg** command using **-sg SgName** and the **-cg CgName**.

To start allocation on thin devices 1078 - 1081, enter:

```
symdev -sid 234 -nop -v allocate -devs 1078:1081 -persistent
```
Restrictions for allocating space on thin devices

The following restrictions apply to the allocate action:

- If any of the devices in the device group or storage group are in a state other than allocating or bound, the command will fail.
- If a device group is specified, the action of the command is limited to the standard devices in the device group only.
- Unwritten storage can be recovered with either a free or a reclaim action. Allocations that were written as zeros can only be recovered by using the reclaim action. Written tracks are freed with the free action. Additionally, storage that was allocated with the persistent attribute can only be recovered by using the -persistent option with the reclaim action.

Reclaim allocations on thin devices

Description

Reclaiming persistent allocations frees up tracks that are unwritten or zero-based, even if they are marked as persistent. The reclaim - persistent command is the only action that frees up persistent tracks and returns a success status if there are no allocations on the specified thin device. If -persistent is not specified, this command frees up both unwritten tracks and tracks written with zeros. It will not free up tracks that are marked persistent.

Examples

To start reclaiming space on thin devices in the device group myDg, enter:

```
symdg -sid 234 -nop -v reclaim -dg myDg -persistent
```

The symsg and symcg commands are the same as symdg command using -sg SgName and the -cg CgName.

To start reclaiming space on thin devices 1078 - 1081, enter:

```
symdev -sid 234 -nop -v reclaim -devs 1078:1081 -persistent
```

Restrictions for using reclaim

- If a device group is specified, the action of the command is limited to the standard devices in the device group only.
- The reclaim operation is ignored for any non-thin devices in a range, device group, or storage group.
- If the devices in a device group or storage group are bound to different pools, the reclaim operation is allowed on the device group or storage group.
- Space reclamation cannot be performed while a DATA device in the pool is draining.

Free allocations or free allocations with written tracks

Description

To free allocations on thin devices without written tracks, use the free command.

To free allocations on thin devices with written tracks, use the free -all command. The device must be not mapped or Not Ready.
Use of `free -all` command can result in lost data. Please use this command carefully.

Examples
To free allocations on thin devices in device group `myDg`, enter:

```
symdg -sid 234 -nop -v free -g myDg
```

To free all allocations on thin devices in device group `myDg`, enter:

```
symdg -sid 234 -nop -v free -g myDg -all
```

The `symcg` and `symcg` commands are the same as `symdg` command using `-sg SgName` and the `-cg CgName`.

To free up all allocations on thin devices `1078 - 1081`, enter:

```
symdev -sid 234 -nop -v free -devs 1078:1081 -all
```

Restrictions for freeing all allocations
The `free -all` command is blocked on any device participating in replication operations.

If the `free -all` operation is running in the background on a device and it is in a `Ready` state, the following operations are not allowed on that device:

- RDF create pair
- map dev
- convert dev
- All TimeFinder commands

Background operations on thin devices

Description
Actions to allocate, free, or reclaim space on thin devices are performed asynchronously in the background and are started with an explicit start action. Solutions Enabler displays these background tasks as the thin device status, such as `allocating`, `reclaiming`, and so on.

Stop background operations on thin devices

Description
To stop background operations, use the `-stop` option.

Examples
To stop allocation on thin devices in the device group `myDg`, enter:

```
symdg -sid 234 -nop -v allocate -g myDg -stop
```
The `symsg` and `symcg` commands are the same as `symdg` command using `-sg SgName` and the `-cg CgName`.

To stop allocation on thin device 1078, enter:

```
symdev -sid 234 -nop -v allocate -devs 1078 -stop
```

**Restrictions**

- If a device group is specified, the action of the command is limited to the standard devices in the device group.
- Devices must be in the `allocating`, `reclaiming`, or `freeing` state, otherwise the command fails.

### Rename thin pools

**Syntax**

To rename a thin pool, use the following syntax:

```
rename pool PoolName to NewPoolName
```

### Verify pool and device states

**Description**

The `symcfg verify` command verifies the states of DATA devices and thin devices, and also determines if the pool is in a valid pool state.

To verify if a pool is enabled or disabled, the standard verification options are provided, such as blocking until the pool is in the desired state, and polling at a given rate.

**Syntax**

To verify a pool state, use the following syntax:

```
symcfg -sid SymmID [-i Interval] [-c Count] <-pool PoolName | -devs <SymDevStart:SymDevEnd | SymDevName [,<SymDevStart:SymDevEnd | SymDevName>...]>>
verify -datadev <-draining | -drainwait | -disabled | -enabled | -deactivated | -nonpooled | -balancing>
symcfg -sid SymmID [-i Interval] [-c Count] -pool PoolName verify -poolstate <-enabled | -disabled | -balancing>
```

### Monitor thin pools

The `symcfg monitor` monitors the thin pools and displays the `-percent usage`.

**Syntax**

To monitor usage of a thin pool, use the `symcfg monitor` command:

```
symcfg [-sid SymmID] [-i Interval] [-c Count] [-offline] [-percent 1-100] -action ScriptFile [-norepeat]]
```
Options

-action
Selects a script that should be run when the specified percent value is encountered. The full pathname to the action script must be specified. The first argument passed to the script is automatically set to the percent value.

-c
Indicates the number (count) of times to display or to acquire an exclusive lock on the array host database, the local array, and the remote arrays.

-i
Specifies the repeat interval in seconds to display or to acquire an exclusive lock on the array host database, the local, and the remote arrays. The default interval is 10 seconds. The minimum interval is 5 seconds.

monitor
Checks the total percent full of the devices currently configured in the pool and can optionally execute a script file if a specified percentage is encountered.

-norepeat
Specifies that the action script should only be run once if the threshold has been met. Used with the action script option on the monitor command.

-percent
Causes the action script to be executed when the percent full argument is encountered.

-pool
Specifies a thin pool.

-thin
Specifies that the pool type is a thin pool.

View all thin device pools

Examples
To view all thin device pools for array 087, enter:

```
symcfg list -pool -all -sid 087
```

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197800087</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Y M M E T R I X   P O O L S</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Pool</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>DG1_FBA_F</td>
</tr>
</tbody>
</table>
### View thin device pool details

**Examples**

To view all thin device pool details for pool `DG1_FBA_F_8` for array `087`, enter:

```bash
grep 'DG1_FBA_F_8' /etc/arrays
```

**Sample output**

```bash
Symmetrix ID: 000197800087
Symmetrix ID: 000197800087
Pool Name: DG1_FBA_F_8
Pool Type: Thin
Disk Location: Internal
Technology: EFD
Dev Emulation: FBA
Dev Configuration: RAID-5(3+1)
Pool State: Enabled
Compression State: Enabled
Compression Ratio: 2.0:1
# of Devices in Pool: 13
# of Enabled Devices in Pool: 13
# of Usable Tracks in Pool: 3570840
# of Used Tracks in Pool: 538200
# of Thin Device Tracks: 538200
# of DSE Tracks: 0
# of Local Replication Tracks: 0
# of Tracks saved by compression: 0
# of Shared Tracks in Pool: N/A
Pool Utilization (%): 15
Max. Subscription Percent: N/A
Rebalance Variance: N/A
Max devs per rebalance scan: N/A
Pool Reserved Capacity: N/A

Enabled Devices(13):

<table>
<thead>
<tr>
<th>Sym</th>
<th>Usable Tracks</th>
<th>Free Tracks</th>
<th>Used Full FLG Device Tracks (%)</th>
<th>S State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Legend:
- **Pool Type:**
  - S = Snap, R = Rdfa DSE, T = Thin
- **Technology:**
  - S = SATA, F = Fibre Channel, E = Enterprise Flash Drive, M = Mixed, - = N/A
- **Dev Emulation:**
  - F = FBA, A = AS400, 8 = CKD3380, 9 or C = CKD3390, - = N/A
- **Compression:**
  - E = Enabled, D = Disabled, N = Enabling, S = Disabling, - = N/A
- **State:**
  - E = Enabled, D = Disabled, B = Balancing
- **Disk Location:**
  - I = Internal, X = External, M = Mixed, - = N/A
View thin devices

Examples
To list thin devices for array 087, enter:

```
symcfg list -tdev -sid 087
```

Sample output

Symmetrix ID: 000197800087

Enabled Capacity (Tracks) : 162267840
Bound Capacity (Tracks) : 396948045

<table>
<thead>
<tr>
<th>Sym</th>
<th>Pool Name</th>
<th>Bound</th>
<th>Total</th>
<th>Allocated</th>
<th>Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tracks</td>
<td>Tracks (%)</td>
<td>Tracks</td>
<td></td>
</tr>
<tr>
<td>00143</td>
<td>-</td>
<td>46480</td>
<td>23240</td>
<td>50</td>
<td>23240</td>
</tr>
<tr>
<td>0014E</td>
<td>-</td>
<td>46780</td>
<td>25779</td>
<td>55</td>
<td>25779</td>
</tr>
<tr>
<td>0014F</td>
<td>-</td>
<td>46780</td>
<td>25779</td>
<td>55</td>
<td>25779</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>26005</td>
<td>16970</td>
<td>65</td>
<td>16970</td>
</tr>
<tr>
<td></td>
<td></td>
<td>416455</td>
<td>538200</td>
<td>77</td>
<td>538200</td>
</tr>
</tbody>
</table>

Legend:
- Enabled devices FLG:
  - (S)hared Tracks : X = Shared Tracks , . = No Shared Tracks
- Bound Devices FLG:
  - S(T)atus : B = Bound, I = Binding, U = Unbinding, A = Allocating,
    D = Deallocating, R = Reclaiming, C = Compressing,
    N = Uncompressing, F = FreeingAll, . = Unbound
<table>
<thead>
<tr>
<th>Sym</th>
<th>Pool Name</th>
<th>EMPT</th>
<th>Total</th>
<th>Allocated</th>
<th>Comp</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>00001</td>
<td>-</td>
<td>F..B</td>
<td>26220</td>
<td>10400</td>
<td>40</td>
<td>2.2:1</td>
</tr>
<tr>
<td>00002</td>
<td>-</td>
<td>F..B</td>
<td>26220</td>
<td>1333</td>
<td>5</td>
<td>1.0:1</td>
</tr>
<tr>
<td>00003</td>
<td>-</td>
<td>F..B</td>
<td>26220</td>
<td>20000</td>
<td>75</td>
<td>1.8:1</td>
</tr>
<tr>
<td>00004</td>
<td>-</td>
<td>F..B</td>
<td>26220</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>00005</td>
<td>-</td>
<td>F..B</td>
<td>26220</td>
<td>3232</td>
<td>12</td>
<td>4.0:1</td>
</tr>
</tbody>
</table>

Total

| Tracks | 396948045 | 60065803 | 15 | 2.0:1 |

Legend:

Flags:  (E)mulation : A = AS400, F = FBA, 8 = CKD3380, 9 = CKD3390
(M)ultipool : X = multi-pool allocations, . = single pool allocation
(P)ersistent Allocs : A = All, S = Some, . = None
S(T)atus : B = Bound, I = Binding, U = Unbinding, A = Allocating,
D = Deallocating, R = Reclaiming, C = Compressing,
N = Uncompressing, F = FreeingAll, . = Unbound

A dash (-) displays in the Bound Pool Name column for all TDEV devices, but only for
the first (summary) line for each TDEV.

**View thin device details**

**Examples**

To list thin device details for -devs 140:143 on array 087, enter:

```
symcfg list -tdev -sid 087 -devs 140:143
```

**Sample output**

Symmetrix ID: 000197800087

Enabled Capacity (Tracks) : 162267840
Bound Capacity (Tracks) : 2845170

```
SYMMETRIX THIN DEVICES

<table>
<thead>
<tr>
<th>Sym</th>
<th>Pool Name</th>
<th>ESPT</th>
<th>Total</th>
<th>Subs</th>
<th>Allocated</th>
<th>Allocated</th>
<th>Comp</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>00140</td>
<td>-</td>
<td>F..B</td>
<td>21000</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00141</td>
<td>-</td>
<td>F..B</td>
<td>21000</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>8000</td>
<td>1.6:1</td>
</tr>
<tr>
<td></td>
<td>DG1_FBA_F</td>
<td>--</td>
<td>21000</td>
<td>-</td>
<td>5000</td>
<td>24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>DG3_FBA_F</td>
<td>--</td>
<td>21000</td>
<td>-</td>
<td>16000</td>
<td>76</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00142</td>
<td>-</td>
<td>F..B</td>
<td>21000</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>00143</td>
<td>-</td>
<td>F..B</td>
<td>30000</td>
<td>-</td>
<td>0</td>
<td>12333</td>
<td>1.8:1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DG1_FBA_F</td>
<td>--</td>
<td>30000</td>
<td>-</td>
<td>5000</td>
<td>17</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>DG1_FBA_F</td>
<td>--</td>
<td>30000</td>
<td>-</td>
<td>6000</td>
<td>20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>DG1_FBA_F</td>
<td>--</td>
<td>30000</td>
<td>-</td>
<td>4000</td>
<td>13</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Total

| Tracks | 93000 | 36000 | 20 | 20333 | 1.7:1 |

Legend:

Flags:  (E)mulation : A = AS400, F = FBA, 8 = CKD3380, 9 = CKD3390
(S)hared Tracks : S = Shared Tracks Present, . = No Shared Tracks
(P)ersistent Allocs : A = All, S = Some, . = None
For arrays running HYPERMAX OS 5977, a dash (-) displays in the Bound Pool Name column for all TDEV devices, but only for the first (summary) line for each TDEV. If the TDEV has allocations in other VP Pools, the pool names and allocation details for those pools are displayed on subsequent lines.

**View thin device allocations bound to a different pool**

**Examples**
To show all allocations for pool DG1_FBA_F_8 on array 432, enter:

```
symcfg show -pool DG1_FBA_F_8 -thin -sid 432 -all -detail
```

**Sample output**
When the pool contains allocations from devices that are bound to a different pool:

```
Symmetrix ID: 000197800087

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197800087</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool Name</td>
<td>DG1_FBA_F_8</td>
</tr>
<tr>
<td>Pool Type</td>
<td>Thin</td>
</tr>
<tr>
<td>Disk Location</td>
<td>Internal</td>
</tr>
<tr>
<td>Technology</td>
<td>EFD</td>
</tr>
<tr>
<td>Dev Emulation</td>
<td>FBA</td>
</tr>
<tr>
<td>Dev Configuration</td>
<td>RAID-5(3+1)</td>
</tr>
<tr>
<td>Pool State</td>
<td>Enabled</td>
</tr>
<tr>
<td>Compression State</td>
<td>Enabled</td>
</tr>
<tr>
<td>Compression Ratio</td>
<td>2.0:1</td>
</tr>
<tr>
<td># of Devices in Pool</td>
<td>13</td>
</tr>
<tr>
<td># of Enabled Devices in Pool</td>
<td>13</td>
</tr>
<tr>
<td># of Usable Tracks in Pool</td>
<td>3570840</td>
</tr>
<tr>
<td># of Used Tracks in Pool</td>
<td>538200</td>
</tr>
<tr>
<td># of Thin Device Tracks</td>
<td>538200</td>
</tr>
<tr>
<td># of DSE Tracks</td>
<td>0</td>
</tr>
<tr>
<td># of Local Replication Tracks</td>
<td>0</td>
</tr>
<tr>
<td># of Tracks saved by compression</td>
<td>N/A</td>
</tr>
<tr>
<td># of Shared Tracks in Pool</td>
<td>N/A</td>
</tr>
<tr>
<td>Pool Utilization (%)</td>
<td>15</td>
</tr>
<tr>
<td>Max. Subscription Percent</td>
<td>N/A</td>
</tr>
<tr>
<td>Rebalance Variance</td>
<td>N/A</td>
</tr>
<tr>
<td>Max devs per rebalance scan</td>
<td>N/A</td>
</tr>
<tr>
<td>Pool Reserved Capacity</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Enabled Devices(13):**

```
FEEF0 274680 233364 41316 15  .  Enabled
FEEF1 274680 233280 41400 15  .  Enabled
FEEF2 274680 233364 41316 15  .  Enabled
FEEF3 274680 233314 41366 15  .  Enabled
... FEEFC 274680 232910 41770 15  .  Enabled
-------- -------- -------- ----
Tracks 3570840 3032640 538200 15
```
No Thin Devices Bound to Device Pool DGl_FBA_F_8

Other Thin Devices with Allocations in this Pool (18):

<table>
<thead>
<tr>
<th>Bound</th>
<th>Total Tracks</th>
<th>Allocated Tracks (%)</th>
<th>Used Tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sym</td>
<td>Pool Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>00143 -</td>
<td>46480</td>
<td>23240</td>
<td>50</td>
</tr>
<tr>
<td>0014E -</td>
<td>46780</td>
<td>25779</td>
<td>55</td>
</tr>
<tr>
<td>0014F -</td>
<td>46780</td>
<td>25779</td>
<td>55</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00500 -</td>
<td>26005</td>
<td>16970</td>
<td>65</td>
</tr>
</tbody>
</table>

Legend:

- Enabled devices FLG:
  - (S)hared Tracks: X = Shared Tracks, . = No Shared Tracks
- Bound Devices FLG:
  - S(T)atus: B = Bound, I = Binding, U = Unbinding, A = Allocating,
  - D = Deallocating, R = Reclaiming, C = Compressing,
  - N = Uncompressing, F = FreeingAll, . = Unbound
CHAPTER 6

Grouping Devices

This chapter describes the benefits of grouping storage array devices, the types of groups, and how to create and modify them.

- Overview of groups ................................................................. 102
- Device groups ........................................................................ 102
- Storage groups ........................................................................ 119
- Composite groups ................................................................. 154
- GNS repository ......................................................................... 169
Overview of groups

Solutions Enabler uses several types of groups to monitor and control storage arrays. The type of group depends on your storage, host, and application environment. Grouping devices allows for:

- Performing control operations on all devices in a group or on device pairs within a group. Refer to Device groups on page 102.
- Managing groups of storage volumes that belong to a single array for mapping/masking, virtual LUN technology, FAST, and other base control operations. Refer to Storage groups on page 119.
- Managing groups of devices spread across multiple local arrays. Refer to Composite groups on page 154.
- Ensuring remote data consistency. Refer to SRDF consistency groups on page 156.

Device groups

A device group is a user-defined group comprised of devices that belong to a locally attached array. Control operations can be performed on the group as a whole, or on the individual device pairs in the group. By default, a device can belong to more than one device group.

Use device groups to identify and work with a subset of available devices; obtain configuration, status, and performance statistics on a collection of related devices; or issue control operations that apply to all devices in the specified device group.

A device group can belong to one or more composite groups. For more information, see Composite groups.

Group name services

In a default array environment, device group and composite group definitions are created through a locally-attached host. Upon creation, the group definition is stored in the host configuration database file. Therefore, only the host that created the group can see the group and control it. To perform control operations from another locally-attached host, the group definition must be manually copied to other hosts.

Group Name Services (GNS) can be enabled to store device and composite group definitions in a shared repository located on each array, which then becomes automatically visible to all locally-attached hosts. This allows all GNS-enabled hosts to see the same group definitions across your environment, while sharing real-time updates to group definitions and configurations made by other hosts. For more information on GNS operations, refer to GNS repository.

Names of device groups and devices

Device groups, as well as the devices in a device group, are assigned names that facilitate reference in a session. Assign a device group name when you create it. The name can have up to 31 characters and must be unique for a given configuration database.

When adding a device to a device group, it is given a logical name. This name allows you to refer to the device independently of its physical device name or array device name. The name can have up to 31 characters and must be unique within the device group. It is known only within the context of the device group to which the device
belongs. This logical name must be used with the \texttt{LdevName} or \texttt{ld} argument in any SYMCLI command.

**Device group types**

When creating a device group, define it as one of the following types:

- **REGULAR**
- RDF1 (R1 and concurrent R11 devices)
- RDF2 (R2 and concurrent R22 devices)
- RDF21 (cascaded R21 devices)
- ANY (can contain a device mix of REGULAR, RDF1, RDF21 for an R1 site or RDF2, RDF21, RDF22 for an R2/R22 site)

**Device lists**

A device group must be defined as type REGULAR, RDF1, RDF2, RDF21, or ANY, and may contain various device lists for standard, BCV, virtual (VDEV), and remote devices. A device is placed into a logical list when added to a device group. The following explains the device list types:

- **Standard device list** — Standard device lists provide a mechanism for grouping standard devices in a device group subject to the following restrictions:
  - SRDF and non-SRDF devices cannot be in the same device group unless you specify ANY for the type when creating the device group.
  - All SRDF devices in a given device group must belong to the same SRDF group or if concurrent SRDF, belong to two SRDF groups.
- **TimeFinder BCV device list** — TimeFinder BCV device lists provide a mechanism for associating Business Continuance Volume (BCV) regular devices and RDF1 BCV devices with a device group. BCV control operations can be performed on any BCV pair in the device group. Also, you can perform SRDF operations on just the associated RDF1 BCV devices. Refer to \textit{Dell EMC Solutions Enabler TimeFinder SnapVX CLI User Guide} for more information on adding BCV devices to a device group.
- **TF/Snap virtual device list** — A virtual device is a host-accessible device containing address pointers to the data stored on the source device or a pool of SAVE devices, which indicate where the copy session data is located in the physical storage. Virtual devices (VDEV) paired with standard and BCV devices can be associated with any device group. In addition, TF/Snap control operations can be performed on any virtual device in a device group.
- **TF/Clone target list** — Target lists provide a mechanism for establishing source (SRC) and target (TGT) devices for TF/Clone operations. They can be created for both device groups and composite groups. A target list can contain various types of devices, including STDs, VDEVs, or BCV devices (based on a set of rules discussed in \textit{Device restrictions}) and can use those devices as targets in clone operations. Remote target lists can also be created for remote operations.

\textbf{Note}

VDEVs cannot be mixed with other types of devices in any target list. In other words, a target list cannot contain both VDEVs and STDs.

- **Gatekeeper device list** — One or more gatekeeper devices can be associated with a device group. SYMCLI uses the associated gatekeeper to issue requests to
the array for control operations on the devices within the specified device group. A
standard device can be added to a device group. However, the gatekeeper cannot
be added to the device group, only associated with a device group. For more
information about associating a gatekeeper device with a group, refer to the Dell
EMC Solutions Enabler Installation and Configuration Guide.

Note
A BCV device or a RDF2 device cannot be assigned as a gatekeeper, nor can a
device that is a member of a device group be defined as a gatekeeper.

Device restrictions

Restrictions on the devices you can add to a device group are based on the device
type.

RDF1 and RDF2 type device restrictions
The following restrictions apply when adding an SRDF device to a device group:

- All devices in the device group must be SRDF devices.
- All devices in the device group must be either all source (RDF1 type) or all target
  (RDF2 type) devices.
- All devices in the device group must have the same SRDF group number.
- When there is a combination of R1 and R11 devices in a device group, the R1 and
  one of its R11 mirrors must have the same SRDF group number. This also applies
  for R2 and R22 devices.

RDF21 type device restrictions
The following restrictions apply to all devices added to an RDF21 device group:

- All devices must be R21 STD devices. No mixture of STD device types is allowed.
- All R21 devices in a device group must maintain mirror consistency. All R1 mirrors
  must have the same SRDF group number and all R2 mirrors must have the same
  SRDF group number.
- Groups that have the same first SRDF group number must have the same
cascaded SRDF group number in a cascaded SRDF configuration.
- The existing rules for adding BCV, VDEV, and TGT devices to RDF21 groups apply.

Virtual device restrictions
To add a device as a VDEV, the device must be defined as a virtual device. Virtual
devices are VDEV, RVDEV and Hop-2 VDEV.

Clone target restrictions
STD, BCV and VDEV devices can be added to a target list. The following are the sets
device types allowed in a target list, although devices from only one set of devices
is allowed in a given device group’s target list at any given time:

- Non-SRDF STDs
- R1 STDs
- R2 STDs
- R1 + Non-SRDF Standards
- R2 + Non-SRDF Standards
- Non-SRDF BCVs
• R1-BCVs
• R2-BCVs
• R1-BCVs + Non-SRDF BCVs
• R2-BCVs + Non-SRDF BCVs
• VDEVs (cannot mix VDEVs with other device types in the list)

By default, the logical device name (LdevName) for devices in a target list is TGT.xxx. For devices in the remote target list, the default Ldevname is RTGT.xxx.

**ANY group type restrictions**
The ANY group type allows a mix of non-SRDF and SRDF (R1, R11, R2, R22, and R21) devices in a single device group. It lifts the restrictions pertaining to the type of devices added to the device group but still follows the previous restrictions for SRDF devices. For example, all SRDF mirrors in a SRDF list must be of the same device type.

When there is a combination of R1 and R21 devices in a device group, the R1 mirror of the R21 devices must have the same SRDF group number. This also applies to R2 and R21 devices in a device group.

The following devices are allowed in a device group of ANY:

• All REGULAR devices
• All R1 and R11 devices
• All R2 and R22 devices
• All R21 devices
• A combination of REGULAR, R1, R11 and R21 devices
• A combination of REGULAR, R2, R22 and R21 devices

**Note**
A device group of any SRDF type can change its type because of an `symrdf` control operation. For example, an RDF1 composite group can change to an RDF2 when the device personalities are swapped. The `symrdf swap` operation does not change the type of an ANY device group.

SYMCLI provides various commands to add standard devices, virtual devices, or TF/Clone target devices to a device group. Once a device group is created, SYMCLI commands can be used to add a single device, multiple or all devices on an array, or a list of devices from a file to that group. For more information on adding a list of devices from a file, refer to Export and import device lists.

### Create a device group

Create a device group by defining a named empty group of a specific type and then adding devices to the group. A newly-created device group is defined by the devices added to it. Each type of device list has its own set of restrictions.

### Create an empty device group

**Syntax**

To create a device group, use the following syntax:

```
(symdg -type GroupType create GroupName)
```
Options

- type
  Specifies the group type. Valid group types are: REGULAR, RDF1, RDF2, R21 or ANY. The default type is Regular.

name
  Specifies the group name. The name can have up to 31 characters and must be unique for a given configuration database.

Example
For example, to create a device group named prod whose members are operating as SRDF source devices, enter:

```shell
symdg -type RDF1 create prod
```

If a group type is not specified, the default group created is REGULAR.

Add devices to a device group

Description
Use the symdg command to add a single device to a device group. Devices can be added by specifying either the physical device name (add pd) or the array device name (add dev). A logical device name can also be assigned to a device. A valid logical device name cannot exceed 31 characters and must be unique within the device group. If a logical device name is not specified, one will be supplied automatically by SYMCLI.

Syntax
The following is the syntax for adding a device:

```shell
symdg -g DgName [-offline] [-i Interval] [-c Count][-v]
  add pd PdevName [LdevName]
add dev SymDevName [LdevName][-sid SymmID]
  [-rdf | -hop2 | -vdev | -tgt]
  [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]
```

Options

SymDevName
  Specifies the device name when adding virtual devices or target devices.

Interval
  The time to wait between attempts to acquire an exclusive lock on the host database.

Count
  The number of attempts.
Examples
To add a single device using the physical device name /dev/rhdisk32 to a device group named prod, enter:

```
symdg -g prod add pd /dev/rhdisk32
```

To add device 00005 to a device group named prod and assign the logical device name temp1, enter:

```
symdg -g prod add dev 00005 temp1
```

Add virtual devices to a device group

Syntax
The following is the syntax for adding a virtual device:

```
symdg add dev SymDevName [LdevName][-sid SymmID]
[-rdf | -hop2 | -vdev | -tgt]
[-rdfg GrpNum [-remote_rdfg RemoteGrpNum]
```

Options
- **-vdev**
  Specifies that the added device is a virtual device.

- **-rdf**
  When adding virtual devices from a remote array (RVDEV), targets the operation to the specified virtual device over SRDF links on the remote array.

- **-rdfg**
  With concurrent SRDF, specifies the SRDF group number (-rdfg GrpNum), with the -rdf option.

- **-remote_rdfg, -hop2**
  Targets the operation to the specified virtual device over SRDF links 2 hops away.

Example
For example, to add virtual device 00005 to a device group named prod1 and assign the logical device name vdev1, enter:

```
symdg -g prod1 add dev 00005 vdev1 -vdev
```

For example, to add virtual device 00005 to a device group named prod1 from a remote array 2 hops away, enter:

```
symdg -g prod1 add dev 00005 vdev1 -vdev -hop2 -remote_rdfg 10
```
Add devices to the target list

Description
For TimeFinder/Clone operations, devices can be added to the target device list (TGT) of a device group or the remote target device list (RTGT). STD, SRDF, BCV, and VDEV devices can be added to the TGT, RTGT, and Hop2 TGT target lists.

For details on the types of devices that can be added to a device group's target list, refer to Clone target restrictions on page 104.

Options
- `-vdev`
  Specifies that the added device is a virtual device.
- `-tgt`
  Specifies that added devices are from a local array.
- `-rdf`
  When adding virtual devices from a remote array (RVDEV), targets the operation to the specified virtual device over SRDF links on the remote array.
- `-rdfg`
  With concurrent SRDF, specifies the SRDF group number (-rdfg GrpNum), with the -rdf option.
- `-remote_rdfg, -hop2`
  Targets the operation to the specified virtual device over SRDF links 2 hops away.

Examples
To add target device 00023 to a device group named prod1 and assign the logical device name tgt23, enter:

```
 symdg -g prod1 add dev 00023 tgt23 -tgt
```

To add target device 00069 belonging to SRDF group 12 to a device group named mywork and assign the logical device name tgt2, enter:

```
 symdg -g mywork add dev 00069 tgt2 -vdev -rdf -rdfg 12
```

Logical device names for virtual devices
When a virtual device is added to a target list, its logical device name is assigned a VDEV default logical name according to these rules:

- VDEVs added to the target list are named TGT.xxx.
- VDEVs added to the remote target list are named RTGT.xxx.
- VDEVs added to the Hop-2 target list are named 2TGT.xxx.

Add ungrouped devices to a device group

Description
The symdg addall command assigns the following logical names to the devices it adds: DEV001, DEV002,..., DEVnnn. Use the symdg rename command to change these logical names after the devices have been added. Or, prior to calling this
command, change the default logical device naming conventions using the
SYMCLI_LDEV_NAMING environment variable. To not truncate logical names too long
to fit in the columns of the symdg show and symcg show output, set the
SYMCLI_FULL_LDEVNAME environment variable.

Syntax
By default, all standard devices (or local virtual devices) are added to a device group,
unless options are used to specify certain types of devices. To add multiple devices to
a device group, use the following syntax:

```
symdg -g DgName [-offline] [-i Interval] [-c Count][v]
    [-sid SymmID]
    [-vdev | -tgt -rdf | -hop2
    [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]]
    addall dev
    [-SA # | ALL] [-P #] [-N #]
    [-cap # [-captype mb | cyl]]
    [-sel_rdfg SelRdfgNum]
    [-devs SymDevStart:SymDevEnd | SymDevName
    ,SymDevStart:SymDevEnd | SymDevName . . .]
```

Options

-i
The time to wait between attempts to acquire an exclusive lock on the host
database.

-c
The number of attempts.

-sid
All ungrouped devices from a specific array ID.

-vdev -rdf -rdfg GrpNum
All virtual devices from a local or remote array.

-tgt -rdf -rdfg RemoteGrpNum
All devices are added to the target list of the device group for TF/Clone
operations on a remote array.

-vdev -hop2 -remote_rdfg RemoteGrpNum
All virtual devices from a remote array two hops away.

-tgt -rdf -hop2 -remote_rdfg RemoteGrpNum
All devices are added to the target list of the device group for TimeFinder/Clone
operations on an array two hops away.

-SA <#|ALL>
All devices visible to one or all front-end directors.

-P #
All devices visible to one or all front-end port number.

-N #
The number of devices to add to the device group.

-devs
Grouping Devices

Any combination of device ranges and single devices, such as 225:22a, 120,a5,7a0:7af

-CAP#
Any combination of device ranges and single devices that are of a specific capacity.

-sel_rdfg
Only SRDF devices belonging to that group number are added.

Note
When using concurrent SRDF where there are two arrays on the remote side, you must specify the SRDF group number (-rdf GrpNum) with -rdf option. When the -hop2 option is specified, you must specify a -remote_rdfg RemoteGrpNum.

Restrictions
The following are not allowed when using addall command:

- Mix devices from different arrays.
- Mix SRDF devices that have different SRDF group numbers.
- Add devices defined as a gatekeeper or BCVs.
- Add devices whose device type does not match the device group type.

Set controls on Celerra devices

Syntax
To set controls on Celerra FBA devices with the symdg -celerra command, use the following syntax:

```bash
symdg -g <DgName> [-noprompt] [-i <Interval>] [-c <Count>]
rw_enable [LdevName [LdevName...]] [-p <#>] [-SA <#|ALL>]
write_disable [LdevName [LdevName...]] [-p <#>][SA <#|ALL>]
symdg -g <DgName> [-noprompt] [-i <Interval>] [-c <Count>]
[-bcv [-hop2]] [-rbcv | -brbcv | -rrbcv | -vdev [-hop2] | -rvdev | -tgt [-hop2] |
-rtgt] [-rp] [-star] [-celerra]
not_ready [LdevName [LdevName...]]
```

List devices in a device group

Syntax
To list devices in a device group, use the following syntax:

```bash
symdg -g DgName list ld
```
List all device groups

Description
Use the `symdg list` command to list all device groups defined in the configuration database, including group names, group type, array ID, the number of standard, BCV, virtual devices, and TF/Clone target devices (TGTs). The output also indicates if the device group is valid and whether it is contained by a composite group.

Options

- `-novalid`
  Eliminates the validation of groups during the execution of the `list` command. The `V` column under the Flags field and the `V` description in the legend do not display in the output.

Example

```
symdg list
```

Note

Device groups with names longer than 17 characters display with their first 17 characters followed by an asterisk (*). Display composite group information on page 167 explains how to set the environmental variable to display longer group names.

Sample output

```
D E V I C E      G R O U P S
Flags                         Number of
Name    Type    VC    Symmetrix ID  Devs    BCVs  VDEVs  TGTs
-------    ------    --    -----------  -----    -----  -----  -----  
dgnocgs RDF1    YN    N/A              0      0      0     0
dgincg  REGULAR YY    000194900341  2154    128      0     0     0
Legend:
Flags:
  V(alid) DG    : Y = Valid, N = Invalid, - = N/A
  (In) C(g)     : Y = Contained by a CG, N = Not contained by
  a CG
```

Show device group details

Description
Use the `symdg show` command to display information about a specific device group.

Example

```
symdg show dgincg
```

Sample output

```
Group Name:  dgincg
  Group Type                                   : ANY
  Device Group in GNS                          : No
  Valid                                        : Yes
  Symmetrix ID                                 : 000194900341
```
<table>
<thead>
<tr>
<th><strong>Group Creation Time</strong></th>
<th>Tue Dec 1 8:6:9 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vendor ID</strong></td>
<td>EMC Corp</td>
</tr>
<tr>
<td><strong>Application ID</strong></td>
<td>SYMCLI</td>
</tr>
<tr>
<td><strong>Number of STD Devices in Group</strong></td>
<td>2154</td>
</tr>
<tr>
<td><strong>Number of Locally-associated BCV’s</strong></td>
<td>128</td>
</tr>
<tr>
<td><strong>Number of Locally-associated VDEV’s</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Locally-associated TGT’s</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-associated VDEV’s (STD RDF)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-associated BCV’s (STD RDF)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-associated TGT’s (TGT RDF)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-associated BCV’s (BCV RDF)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-assoc’ed BCV’s (Hop-2 BCV)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-assoc’ed VDEV’s (Hop-2 VDEV)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Remotely-assoc’ed TGT’s (Hop-2 TGT)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of Composite Groups</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Composite Group Names</strong></td>
<td>cg110 : cgregular</td>
</tr>
</tbody>
</table>

### Export and import device lists

The list of devices from an existing group can be saved to a file on the host system, and this file can later be imported to create a device group. Device list files are used to recreate a device group that was deleted, or for importing the group into another system.

#### Export a device list

**Syntax**

To remove all devices from a group but retain or export the list of devices in the group to a file on your host system, use the following syntax:

```bash
symdg
  export <DgName> [-delete] [-file <FileName>]
  [[-rdf [-rdfg <GrpNum>]] | [-sid <SymmID>]]
  [-grpfile <GrpDbFileName>]
exportall [-delete] [-file <FileName>]
  [[-rdf [-rdfg <GrpNum>]] | [-sid <SymmID>]]
  [-grpfile <GrpDbFileName>]
```

**Options**

- **-rdf**
  
  Exports an SRDF group. Uses the remote array ID and device names and changes the SRDF group type from R1 to R2 or R2 to R1.

- **-rdfg GrpNum**
  
  Specifies an SRDF group number.

- **-delete**
  
  Exports the device group membership to a file and deletes the existing device group in the same operation. To reinstate the same group again, import this list to the same or different device group. Refer to Import a device list on page 113.
Example
To create a text file that contains the details of all members of the existing device
groups, use the symdg -exportall operation. To later recreate the device groups
from this file, use the symdg importall command.

To export the device group membership from group prod2 to file prod2list, enter:

```
symdg export prod2 -f prod2list
```

To export the device group membership to file prod2list from group prod2 and
then delete the group, enter:

```
symdg export prod2 -f prod2list -delete
```

For information on deleting a device group, refer to Delete a device group on page
119.

Note
The -rdf option is not supported when exporting R21 device groups.

Import a device list

Description
Typically imported files were previously exported (refer to Export a device list on page
112).

The import action creates the device group if the group name specified in the
command does not already exist, devices can be imported to an existing group name
that is partially populated. If importing to an existing group, the devices in the
imported file are appended to the existing group membership.

To recreate all device groups, use the symdg importall command from data
contained in a text file that was previously created using the symdg exportall
command.

Note
Raid group members cannot be directly controlled, so exporting or importing details
about specific raid group members is not supported.

Syntax
To add multiple devices to a new or existing device group by importing an existing file,
use the following syntax:

```
symdg -sid SymmID [-i Interval] [-c Count][-v]
import DgName [-f FileName]
importall [-f FileName]
```

Example
For example, to create a device group named prod2 from the file prod2list, enter:

```
symdg import prod2 -f prod2list
```
Rename device groups

Description
Use the `symdg rename` command to rename a device group. The new name can contain up to 31 characters and must be unique for the configuration database on which the device group is defined.

Options
- `-v`
  For a device group that is a member of one or more composite groups, use the verbose option to view associated composite groups.

Examples
To rename the device group `prod` to `prod_B`, enter:

```
symdg rename prod prod_b
```

To rename a device group that is a member of one or more composite groups, enter:

```
symdg rename prod prod_b -v
```

Sample output
Using verbose option:
```
DG prod contained by CG cg1 was renamed
DG prod contained by CG cg14 was renamed
```

Rename logical device names

Description
Use the `symdg` command to change the logical name of a device in a device group. The name can have up to 31 characters and must be unique within its device group.

Note
This command fails if attempting to rename a logical device name of a device in a device group containing storage groups.

Example
To rename the logical name of device `DEV003` to `TEMP3` in device group named `prod`, enter:

```
symdg -g prod rename ld DEV003 TEMP3
```

Move a device between device groups

Description
Use the `symdg` command to move one device from one device group to another. The source and destination device groups must be compatible types.
This command cannot be used to move devices from a device group containing storage groups. Use the `symsg move` or `symsg moveall` commands to move devices in a storage group.

**Syntax**

To move an individual device, use the following syntax:

```
symdg -g DgName [-h] [-offline] [-i Interval] [-c Count move ld LdevName DestDgName [-force] [-rename]
```

**Options**

- `-i`
  
  Specifies the predetermined time (interval) to wait between attempts to acquire an exclusive lock on the array host database and, for SRDF control operations, on the local and/or remote arrays.

- `-c`
  
  Specifies the number of attempts (count).

- `-rename`
  
  If there is a device within the destination device group with the same logical device name as device you wish to move into the destination device group, use the `-rename` option to avoid encountering an error. When this option is used, SYMCLI renames the moved device to the next available logical device name as defined in the SYMCLI_LDEV_NAMING environment variable.

**Example**

To move logical device `DEV003` from device group `prod` to device group `test`, enter:

```
symdg -g prod move ld DEV003 test
```

**Move all devices between device groups**

**Description**

Use the `symdg moveall` command to move all standard devices from one device group to another. The source and destination device groups must have compatible device types.

**Syntax**

To move all devices, use the following syntax:

```
symdg -g DgName[-i Interval] [-c Count][-v] [-offline] moveall DestDgName [-force] [-rename] [-vdev | -tgt [-hop2] | -rvdev | -rtgt]
```

**Options**

- `-i`
Specifies the predetermined time (interval) to wait between attempts to acquire an exclusive lock on the array host database and, for SRDF control operations, on the local and/or remote arrays.

-c
Specifies the number of attempts (count).

-rename
If there is a device within the destination device group with the same logical device name as the device being moved, use the -rename option to avoid an error. When this option is used, SYMCLI renames the moved device to the next available logical device name as defined in the SYMCLI_LDEV_NAMING environment variable.

-vdev
Moves only the virtual devices to the destination device group.

-hop2
Indicates that the specified device is two hops away.

-tgt
Moves only the TGT devices to the destination device group.

-rdev
Moves only remote virtual devices to the destination device group.

-rtgt
Moves only RTGT devices to the destination device group.

Example
To move all virtual devices from device group prod to group test, enter:

```
symdg -g prod moveall -vdev test
```
Copy devices from device group to storage group

Description
Devices from a device group can be copied (or added) to a storage group. The copied devices remain in the device group (DgName) and are added to the destination storage group (SgName).

If the storage group does not exist, it is created. If optional device types are not specified, only standard devices are added.

Note
The symdg dg2sg command is blocked for device groups containing storage groups.

Syntax
To add devices from a device group to a storage group, use the following syntax:

```
symdg dg2sg
  DgName
  SgName
  [-bcv] [-vdev] [-tgt]
```

Example
To add devices from a device group named prod to a storage group named prod_2, enter:

```
symdg dg2sg prod prod_2
```

Remove a device from a device group

Description
Use the symdg remove command to remove a device from a device group. By default, the remove argument affects standard devices only. However, the -vdev option can be specified to remove a virtual device.

Note
If you remove the only member of a device group, the device group is not automatically deleted. Use the symdg delete command to explicitly delete the device group, as described in the Delete a device group on page 119. If the device is contained in a storage group, the operation fails. Use the symsg remove dev command to remove a device in a storage group.
Example
To remove logical device DEV003 from a device group named prod, enter:

```
symdg -g prod -force remove ld DEV003
```

In this example, the `-force` option removes the device regardless of its BCV state.

Remove all devices from a device group

Description
Use the `symdg rmall` command to remove all devices from a device group. By default, the `rmall` argument affects standard devices only. However, the `-vdev` option can be specified to remove just the virtual devices.

Note
Removing all members of a device group, does not automatically delete the device group. Use the `symdg delete` command to explicitly delete the device group, as described in Delete a device group on page 119. If the devices are contained in a storage group, the operation fails. Use the `symsg rmall` command to remove devices in a storage group.

Syntax
To remove all devices from an existing device group, use the following syntax:

```
symdg -g DgName [-i Interval] [-c Count] [-v]
   [-offline] [-sid SymmID]
   [-SA # | ALL] [-P #] [-N #]
   [-cap # [-captype mb | cyl]]
   [-sel_rdfg SelRdfgNum]
   [-devs SymDevStart:SymDevEnd | SymDevName
       [,SymDevStart:SymDevEnd | SymDevName...]]
   [-R1 | -R2 | -R21 | -noRDF]
   rmall [-force] [-vdev | -tgt -rdf [-rdfg GrpNum] | -hop2]
```

Options

- **-SA #|ALL**
  Specifies devices mapped to a specific front-end (SCSI or Fibre) director number.

- **-P #**
  Specifies devices mapped to a specific (SCSI or Fibre) director port number.

- **-CAP #**
  Specifies devices of a specified capacity.

- **-devs**
  Specifies any combination of device ranges and single devices to remove.

- **-vdev | -tgt -rdf [-rdfg GrpNum]**
  Specifies local and remote virtual and target devices.
Delete a device group

Syntax
To delete a device group, use the following syntax:

```
symdg delete DgName [-force]
```

Examples
To delete a device group named `prod`, enter:

```
symdg delete prod
```

When deleting device groups that are associated with a composite group, enter the `verbose` (`-v`) option to view the composite groups:

```
symdg delete prod -force -v
DG prod was removed from CG cg1
DG prod was removed from CG cg14
```

Note
Deleting populated device groups or a device group of a composite group requires the use of the `-force` option.

Perform control operations on device group devices

Description
For additional control operations allowed on device groups refer to Dell EMC Solutions Enabler CLI Reference Guide. Operations can be directed at all devices in a device group. By default the actions only apply to the standard devices in the group. If a control operation is performed on devices in a specific list, the appropriate qualifier needs to be used (such as, `-bcv`, `-rbcv`, etc.).

Storage groups

Storage groups are a collection of devices stored on the array that are used by an application, a server, or a collection of servers. Storage groups are used to present storage to hosts in masking/mapping, Virtual LUN Technology, FAST, and various base operations. Use the SYMCLI `symsg` command to create and manage these storage groups.

Storage group restrictions
The following general restrictions apply to all storage groups containing only devices. This applies to storage groups containing child storage groups only, not cascaded storage groups containing both parent storage groups with child storage groups:

- Storage groups must contain only FBA devices, or only CKD devices. A mix of FBA and CKD devices is not allowed.
- Storage groups with CKD devices do not have a Workload.
- GNS does not support storage groups. Storage groups are saved in a special area on the array.
• the maximum number of storage groups for a single array is 16K storage groups.
• Each storage group can contain a maximum of 4096 devices.
• Storage group names can be up to 64 characters in length. Names must begin with an alphanumeric character and may contain embedded hyphens and underscore characters. Names are not case sensitive. Therefore, two storage groups named test and Test are not allowed.
• Diskless devices are not permitted in storage groups.
• Logical device names are not supported by storage groups.
Additional usage restrictions for storage groups are described in Add cascaded storage groups on page 132 and Restrictions for storage groups with defined Host I/O limits on page 136.

Create storage groups

Syntax
To create an empty storage group, use the following syntax:

```
symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] 
create <SgName> 
   [-bw_max <MBperSec>] 
   [-iops_max <IOperSec>] 
   [-dynamic <NEVER | ALWAYS | ONFAILURE>] 
   [-sl <SLName>] [-wl <WorkloadName>] 
   [-srp <SRPName>] [-nocompression]
```

Options

-bw_max
Specifies the front-end bandwidth of the devices in the storage group. The valid range for bandwidth is from 1 MB/Sec to 100,000 MBs/sec.

-iops_max
Specifies the I/Os per second of the devices over a set of director ports. The valid range for IOPs is from 100 IO/sec to 100,000 IOs/sec but must be specified in units of 100 IO/Sec.

-dynamic
Specifies the Host IO Limit dynamic distribution setting for the storage group as follows:

- NEVER – The Host IO Limits for a storage group are never dynamically redistributed (static).
- ALWAYS – The Host IO Limits for the storage group are always dynamically redistributed.
- ONFAILURE – The Host IO Limits for the storage group are dynamically redistributed only upon failure of a front-end port.

Note
Host I/O Limits for storage groups on page 135 describes how to use the bw_max, iops_max, and dynamic options to set Host I/O limits.

-sl
Specifies the Service Level for the storage group as follows in the order of the highest to lowest performance expectation:

- **Diamond** – emulates EFD performance. The only Service Level supported on All Flash Arrays (VMAX 450K, 850K, and 950K).
- **Platinum** – emulates between EFD and 15K drive performance.
- **Gold** – emulates 15K drive performance
- **Silver** – emulates 10K drive performance
- **Bronze** – emulates 7.2K drive performance
- **Optimized** – Balances performance across the whole SRP, based on I/O load, type of I/Os, data pool utilization, and available capacities in the pools. It places the most active data on higher performing storage and least active data on the most cost-effective storage. Optimized Service Level does not use a workload type. If no Service Level is specified then Optimized Service Level is the default for the storage group.

__Note__

CKD devices support only Diamond, Bronze, and Optimized Service Level.

**-srp**

Specifies a Storage Resource Pool on a storage group.

**-wl**

Specifies the workload type as follows:

- **OLTP** – Online Transaction Processing
- **DSS** – Decision Support System

__Note__

If Workload is not specified then a value of *none* is assigned.

**-nocompression** (-noc)

When creating a storage group the compression attribute is enabled by default on FAST managed storage groups if the associated SRP supports compression. The compression attribute is removed using this option. Compression is allowed only on VMAX All Flash Array and only FBA devices.

The Service Level and Storage Resource Pool name parameters behave as follows:

- If the **SL Name** and **SRP Name** are not specified, the storage group is created with no Service Level or SRP and it is not FAST-managed.
- If both **SL Name** and **SRP Name**, are specified, the storage group is FAST-managed.
- If only the **SL Name**, is specified, a default Storage Resource Pool for the emulation type of the devices in the storage group is used and the storage group is FAST-managed.
- If only the **SRP Name** is specified, an Optimized Service Level is used with the storage group and it is FAST-managed.
Restrictions

- Requires Storage Admin permission.
- Requires Base access type.
- The command fails if the specified Service Level, workload, or Storage Resource Pool does not exist.
- The command fails if the specified Service Level cannot be supported based on the Storage Resource Pool that is being used by the storage group.
- When setting a workload on an group, the command fails if a Service Level is not set.
- When setting an Service Level, Workload or SRP, the command fails if the device list contains both FBA and CKD devices.
- Workload is not supported for PowerMaxOS.

Create devices and add to storage groups

Note

If a storage group is not specified or if the specified storage group is not FAST-managed, the device is created using the default Storage Resource Pool for the device's emulation type and an Optimized Service Level.

Syntax

To add a device to a storage group, use the following syntax:

```
create dev count=<n>,
    size = <n> [MB | GB | CYL],
    emulation=<EmulationType>,
    config=<DevConfig>
    [, preallocate size = <ALL>
    [, allocate_type = PERSISTENT]]
    [, remote_config=<DevConfig>, ra_group=<n>]
    [, sg=<SgName> [, remote_sg=<SgName>]]
```

Example

To create a device and add it to a storage group named `SG_Finance`, enter:

```bash
symconfigure -sid 230 commit -cmd "create dev count = 2, size = 1000 cyl, emulation = fba, config = TDEV, SG = SG_Finance;"
```

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
   {create dev count = 2, size = 1000 cyl, emulation = fba,
   config = TDEV, SG = SG_Finance;
   }
   Performing Access checks.................................Allowed.
   Terminating the configuration change session...............Done.
The configuration change session has successfully completed.
Restrictions

- Storage Admin permission is required.
- The command fails if the specified storage group does not exist.
- The command fails if attempting to add an FBA device to a FAST-managed storage group that contains CKD devices or to add a CKD device to a group that contains FBA devices. This includes previous device create operations that add devices to the same storage group during one configuration change session.
- The command fails if attempting to add devices to a storage group that contains encapsulated devices. This includes previous device create operations that add devices to the same storage group during one configuration change session.

Add existing devices to storage groups

Syntax

To add a device, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] 
   add dev <SymDevName>
```

To add multiple devices, or devices in a range or a file, use the following syntax:

```
symsg -sg <SymDevName> -sid <SymmID> [-i <Interval>] 
   [-SA <# | ALL>] [-p <#>] [-N <#>] 
   [-cap <#] [-captype <mb> | <cyl>] ] 
   [-devs <<SymDevStart>:<SymDevEnd> | <SymDevName> 
    [,<<SymDevStart>:<SymDevEnd> | <SymDevName>...]> | 
    -file <DeviceFileName> [-tgt] ] 
   addall [pd | devs]
```

Options

- **-tgt**
  Specifies adding only target devices listed in a text file. Device text files are either a one or two column format; source devices listed in the first column and target devices listed in second column.

Examples

To add a single device to storage group `prod` on array 123, enter:

```
symsg -sid 123 -sg prod add dev 30
```

To add all devices that are primarily visible from the host (mapped) to storage group `prod` on array 123, enter:

```
symsg -sid 123 -sg prod addall pd
```

To add a range of physical devices to storage group `prod` on array 123, enter:

```
symsg -sid 123 -sg prod addall pd -devs 30:3F
```
To add a range or list of devices to storage group `prod` on array `123`:

```bash
symsg -sid 207 -sg sg1 addall -devs 64:105,22a,505,600:605,0700
```

To add all devices listed in text file `storgrp_a.txt` to storage group `prod` on array `123`, enter:

```bash
symsg -sid 123 -file storgrp_a.txt -sg prod addall
```

**Note**

Any device that belongs to storage group that is part of a masking view cannot be added to another storage group.

**Restrictions**

- Storage Admin permission is required.
- If the storage group is FAST-managed, the command fails if the device is already in another storage group that is FAST-managed.
- If the storage group is FAST-managed, the command fails if adding encapsulated devices.
- The command fails if adding FBA devices and the SG has CKD devices.
- The command fails if adding CKD devices and the SG has FBA devices.
- Workload cannot be specified for CKD devices. The command fails if adding CKD devices to an SG if that SG has Workload set.

### Add child storage groups to existing storage groups

**Syntax**

To add devices or storage groups, use the following syntax:

```bash
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] [-celerra] [-rp] [-ckd] add sg <SgName1>[,<SgName2>,<SgName3>,...,<SgNamen>]
```

**Restrictions**

- Storage Admin permission is required.
- The command fails when adding a child storage group to a FAST-managed storage group.
- The command fails if the list of child SGs contain both FBA and CKD devices.
- The command fails if adding child SGs with FBA devices and any current child SG contains CKD devices.
- The command fails if adding child SGs with CKD devices and any current child SG contains FBA devices.
- The command fails if adding CKD devices to an SG if that SG has the Workload set.
Storage group merge operation

Syntax
To merge storage groups, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> merge <SgName1>
```

Options

**SgName**
Specifies the source SG for the merge operation.

**SgName1**
Specifies the target SG. The target SG can be either a parent SG or a standalone SG. If the target SG is a parent SG the source SG will be added as a child SG. If the target SG is a standalone SG, the devices from the source SG will be merged to the target SG, the source SG and masking view will be deleted.

Restrictions

- The source SG cannot be empty.
- The source SG must be a standalone SG.
- Both source and target SG must be in a single masking view with the same IG and PG.

Storage group split operation

Syntax
To split storage groups, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> split <SgName1> -view_name <MvName> [-devs <<SymDevStart>:<SymDevEnd> | <SymDevName>,<SymDevStart>:<SymDevEnd> | <SymDevName>...]]
```

Options

**SgName**
Specifies the source SG for the split operation.

**view_name <MvName>**
Specifies the name of the masking view created as part the split operation.

**SgName1**
For a cascaded source SG, the <SgName1> option is used to specify the child SG to be split. For the standalone source SG, the <SgName1> option is used to specify the new SG to be created during the split operation.

**devs**
Specifies the device list to be split from the source SG to the new target SG

Restrictions

- The source SG must be in a single masking view.
Modify storage group properties

Syntax
To modify the storage group properties, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>]  
  [-c <Count>] 
  set [-bw_max <MBperSec> | NOLIMIT]  
    [-iops_max <IOperSec> | NOLIMIT]  
    [-dynamic <NEVER | ALWAYS | ONFAILURE>]>  
    [-sl <SL Name> [-wl <Workload Name>] [-nosl]  
    [-srp <SRP Name> | -nosrp]  
    [-compression | -nocompression]
```

Options

**bw_max**
Specifies the front-end bandwidth of the devices in the storage group. The valid range for bandwidth is from 1 MB/Sec to 100,000 MBs/sec.

**iops_max**
Specifies the I/Os per second of the devices over a set of director ports. The valid range for IOPs is from 100 IOs/sec to 100,000 IOs/sec but must be specified in units of 100 IO/Sec.

**dynamic**
Specifies the Host IO Limit dynamic distribution setting for the storage group as follows:

- NEVER – The Host IO Limits for a storage group are never dynamically redistributed (static).
- ALWAYS – The Host IO Limits for the storage group are always dynamically redistributed.
- ONFAILURE – The Host IO Limits for the storage group are dynamically redistributed only upon failure of a front-end port.

**Note**

*Host I/O Limits for storage groups* on page 135 describes how to use the `bw_max`, `iops_max`, and `dynamic` options to set Host I/O limits.

**-sl**
Specifies the Service Level for the storage group as follows in the order of the highest to lowest performance expectation:

- Diamond – emulates EFD performance. The only Service Level supported on All Flash Arrays (VMAX 450K, 850K, and 950K).
- Platinum – emulates between EFD and 15K drive performance.
- Gold – emulates 15K drive performance
- Silver – emulates 10K drive performance
- Bronze – emulates 7.2K drive performance
- Optimized – Balances performance across the whole SRP, based on I/O load, type of I/Os, data pool utilization, and available capacities in the pools. It places the most active data on higher performing storage and least active
data on the most cost-effective storage. Optimized Service Level does not use a workload type. If no Service Level is specified then Optimized Service Level is the default for the storage group.

Note

CKD devices support only Diamond, Bronze, and Optimized Service Level.

-nosl
Removes Service Level from a storage group.

-wl
Specifies the workload type as follows:
- OLTP – Online Transaction Processing
- DSS – Decision Support System

Note
If no workload is specified then default workload none is set for the storage group.

-srp
Specifies a Storage Resource Pool on a storage group.

-nosrp
Specifies a Storage Resource Pool to be removed from a storage group.

-compression (-com)
Sets compression on a storage group. Compression is allowed only on VMAX All Flash Array and only FBA devices.

-nocompression (-nco)
Removes compression on a storage group. Compression is allowed only on VMAX All Flash Array and only FBA devices.

Restrictions
- Requires Storage Admin permission.
- Requires Base access type.
- The command fails if the specified Service Level, workload, or Storage Resource Pool does not exist.
- The command fails if the specified Service Level cannot be supported based on the Storage Resource Pool that is being used by the storage group.
- When setting a workload on a group, the command fails if a Service Level is not set.
- When setting a Service Level, Workload or SRP, the command will fail if the device list contains both FBA and CKD devices
- When setting a SRP, the command fails if the SG contains FBA devices and SRP doesn't contain FBA Pools,
- When setting a SRP, the command fails if the SG contains CKD devices and SRP doesn't contain CKD pools.
When setting a Service Level, the command fails if the SG attached to an SRP contains CKD devices and Service Level is not compatible with CKD emulation.

When setting a Service Level, the command fails if the SG attached to an SRP contains FBA devices and Service Level is not compatible with FBA emulation.

Workload cannot be specified for CKD devices. When setting Workload, the command fails if the SG contains CKD devices.

Set Service Level for a storage group

Description
When setting a Service Level for a storage group, a workload can also be set for storage groups with FBA devices. If no workload is specified, then the workload *none* is assigned.

If the storage group does not have a SRP set, the system default SRP for the emulation type of the devices in the storage group (FBA or CKD) is used and the group becomes FAST-managed.

Syntax
To set a Service Level for a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-sl <SL Name>] [-wl <Workload Name>]
```

Options

**-sl**
Specifies the Service Level for the storage group as follows in the order of the highest to lowest performance expectation:

- Diamond – emulates EFD performance. The only Service Level supported on All Flash Arrays (VMAX 450K, 850K, and 950K).
- Platinum – emulates between EFD and 15K drive performance.
- Gold – emulates 15K drive performance
- Silver – emulates 10K drive performance
- Bronze – emulates 7.2K drive performance
- Optimized – Balances performance across the whole SRP, based on I/O load, type of I/Os, data pool utilization, and available capacities in the pools. It places the most active data on higher performing storage and least active data on the most cost-effective storage. Optimized Service Level does not use a workload type. If no Service Level is specified then Optimized Service Level is the default for the storage group.

**Note**
CKD devices support only Diamond, Bronze, and Optimized Service Level.

**-wl**
Specifies the workload type as follows:

- OLTP – Online Transaction Processing
- DSS – Decision Support System
Remove Service Level from a storage group

Description
When removing the Service Level from a storage group, any workload that was
assigned for the Service Level is removed. If the storage group has a SRP, the storage
group will be assigned an Optimized Service Level. Otherwise, there is no Service
Level or SRP for the storage group and the group will no longer be FAST-managed.

Syntax
To remove the Service Level from a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> -nosl
```

Set SRP for a storage group

Description
When setting a SRP for a storage group, if the storage group does not have an
assigned Service Level, an Optimized Service Level is assigned and the group becomes
FAST managed.

Syntax
To set the SRP for a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> -srp <SRP Name>
```

Remove SRP from a storage group

When removing an SRP from a storage group, if the storage group has an assigned
Service Level, the system default SRP for the emulation type of the devices in the
storage group is used. If there is no assigned Service Level, the storage group is no
longer FAST-managed.

Syntax
To remove the SRP from a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> -nosrp
```

Remove Service Level and SRP from a storage group

Syntax
To remove the Service Level and SRP from a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> -nosl -nosrp
```
Note
When the Service Level and SRP are removed from a storage group, it is no longer FAST-managed.

Change workload on a storage group

Description
To change the workload without changing the assigned Service Level, specify both the `-sl` option with the current Service Level name and the `-wl` option with the new workload name.

Syntax
To change the workload type for a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> -sl <SL Name> -wl <Workload Name>
```

Remove workload on a storage group

Description
To remove the workload on a storage group while retaining the current Service Level, specify the `-sl` option with current Service Level name and omit the `-wl` option. This causes the workload `<none>` to be assigned. The storage group will remain FAST-managed.

Syntax
Use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] set [-bw_max <MBperSec> | NOLIMIT] [-iops_max <IOPerSec> | NOLIMIT] [-dynamic <NEVER | ALWAYS | ONFAILURE>] [-sl <SL Name> [-wl <Workload Name>] | -noslo] [-srp <SRP Name> | -nosrp]
```

Restrictions for storage group modification

- Requires Storage Admin permission.
- Requires Base access type.
- The command fails if the user-supplied storage group, Service Level, workload, or Storage Resource Pool does not exist.
- The command fails if the user-supplied Service Level cannot be supported based on the Storage Resource Pool that is being used by the storage group.
- The command fails if setting a Service Level or a Storage Resource Pool to a parent storage group.
- When setting a Service Level or a Storage Resource Pool, the command fails if any device in the storage group is already in another storage group which is FAST-managed.
- When setting a Service Level or a Storage Resource Pool, the command fails if the storage group contains encapsulated devices.
When setting a workload on a storage group, the command fails if the storage group does not have a Service Level or a Service Level is not being set. It will also fail if a Service Level set on the storage group is being removed.

Standalone storage groups and cascaded groups

Solutions Enabler provides the capability for storage groups to contain other storage groups (cascaded storage groups). This cascading of storage groups allows for individual FAST policies for the storage groups containing devices and a masking view for the storage group containing other storage groups. The storage group, containing only devices, that is contained within a parent storage group is referred to as the child storage group.

Parent and child storage group restrictions

The following restrictions apply to cascaded storage groups. This applies to storage groups containing other storage groups (a parent storage group and children storage groups):

- Only a single level of cascading is permitted. A parent storage group may not be a child of another storage group.
- Storage groups can only contain devices or other storage groups. No mixing is permitted. This covers attempts to add devices to a parent storage group using add, copy, move, and dg2sg. This also covers attempts to add child storage groups to an storage group containing devices.
- A parent can have up to 64 child storage groups.
- Empty storage groups can be added to a parent storage group as long as the parent storage group inherits at least one device when the parent storage group is in a view.
- A parent storage group cannot inherit the same device from more than one child storage group.
- A child storage group may only be contained by a single parent storage group.
- No parent storage group can have a FAST association.
- A storage group already associated with a FAST policy is not allowed to be a parent storage group.
- Masking is not permitted for a child storage group which is contained by a parent storage group already part of a masking view.
- Masking is not permitted for the parent storage group which contains a child storage group that is already part of a masking view.
- A child storage group cannot be deleted until it is removed from its parent storage group.

Child storage group operation restrictions

The following restrictions exist for device operations involving child storage group device operations. This includes the symsg add and addall commands, as well as the copy, copyall, move and moveall commands because they involve adding devices to a storage group:

- A moveall operation is not permitted from a storage group that contains a masking view or is associated with a FAST policy.
- A copy or copyall operation is not permitted from a storage group that is associated with a FAST policy into a storage group that is associated with a FAST policy.
When in a view, the total number of devices inherited by a parent storage group cannot exceed 4096 devices.

- If adding Celerra devices into an storage group or a child storage group with Celerra devices to a parent storage group within a view, you must use the -celerra flag.
- If adding a CKD device or a child storage group with CKD devices to a parent storage group within a view, you must use the -ckd flag.
- If adding a RecoverPoint tagged device or a child storage group with RecoverPoint tagged devices to a parent storage group within a view, you must use the -rp flag.
- Adding a RecoverPoint tagged device to a storage group that is in a masking view containing FCoE directors is not allowed.
- Adding an AS400 device to a storage group that is in a masking view containing FCoE directors is not allowed.

The following restrictions exist for child storage group remove and removeall operations. This also includes move and moveall operations because they perform device removals:

- If the parent storage group has a masking view, any operations involving device removes from the child storage groups will not be permitted, if it causes the parent storage group to have no more devices. This includes removes and moves.

When they are performed on the parent storage group, the following `symsg` operations affect all of the devices in all of the child storage groups contained by that parent:

- ready / not_ready
- rw_enable / write_disable
- hold / unhold
- pin / unpin

Add cascaded storage groups

**Description**

Use the `symsg add sg` command to add child storage groups individually to a parent storage group.

**Note**

The `symsg add` command allows a storage group with Host I/O limits set to be added to a parent storage group that is in a provisioning view using a port group that has FCoE ports.

**Syntax**

To add child storage groups to a parent storage group, use the following syntax:

```
symsg -sg SgName -sid SymmID [-i Interval]
       add sg SgName1[,SgName2,SgName3,"]",SgName1
```

**Restrictions**

The following additional restrictions apply to `symsg add sg` operations:
- A device cannot be added to a storage group associated with a FAST policy if the device already exists in another storage group that is also associated with a FAST policy.
- Any attempt made to add a storage group that is part of a masking view to a second storage group fails.
- If the Host I/O limits (either `-bw_max` or `-iops_max`) on the child storage group that is being added is greater than what is configured on the parent storage group, the operation will fail.

### Convert standalone storage group to cascaded group

**Description**
Use the `symsg convert -cascaded` CLI command to non-disruptively convert from a standalone storage group to a cascaded storage group consisting of a parent storage group and a single child storage group. If the standalone storage group has a Host IO Limit it must be specified, if after the conversion the limit will be set on the parent or the child storage group. The standalone storage group has Host I/O Limits set if a limit to either `bw_max` or `iops_max` was configured on the group.

**Syntax**
To convert a storage group to a cascaded group, use the following syntax:

```bash
symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] convert -cascaded <SgName> <ChildSgName> [-host_IO <on_parent | on_child>]
```

**Restrictions**
- The following security privileges are required to execute this command:
  - Required Access type: BASE (if the storage group is not in a masking view)
  - Required Authorization Rights: VLOGIX (if the storage group is in a masking view)
- The user-supplied storage group must exist.
- The supplied child storage group must not already exist.
- The supplied storage group must be standalone.
- If the supplied storage group has a Host IO limit defined, the `host_IO` option must be specified.

### Convert cascaded group to standalone storage group

**Description**
Use the `symsg convert -standalone` CLI command to non-disruptively convert from a cascaded storage group consisting of a parent storage group and a single child storage group to a standalone storage group. If either the parent or the child storage group has a Host IO limit defined, it will be set on the standalone storage group. But if both parent and child storage groups have a Host IO limit, the `host_IO` option must be supplied. A storage group has Host I/O Limits set if a limit to either `bw_max` or `iops_max` was configured on the group.
Syntax
To convert a cascaded group to a standalone storage group, use the following syntax:

```
symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v]
    convert -standalone <SgName> [-host_IO <keep_parent | keep_child>]
```

Restrictions
- The following security privileges are required to execute this command:
  - Required Access type: BASE (if the SG is not in a Masking View)
  - Required Authorization Rights: VLOGIX (if the SG is in a masking View)
- The command will fail if the user-supplied storage group does not exist.
- The command will fail if the supplied storage group is either standalone or a child storage group is in a cascaded storage group configuration.
- The command will fail if the supplied storage group is a parent storage group that contains more than one child storage group.
- The command will fail if both the supplied storage group and its child storage group have a Host I/O Limit defined and the host_IO option was not given.

Remove devices from a storage group

Description
Devices can be removed from a storage group as a single device, using a combination of device ranges and single devices, or grouped in a text file.

Options
- `-tgt`
  Specifies adding only target devices listed in a text file. Device text files are either a one or two column format; source devices listed in the first column and target devices listed in second column.

Syntax
To remove a single device from a storage group, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] [-celerra] [-rp] [-ckd]
    remove dev <SymDevName> [-force]
```

To remove multiple devices, devices in a range, or a file, use the following syntax:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] [-celerra] [-rp] [-ckd]
    [-SA <# | ALL>] [-p <#>] [-N <#>]
    [-cap <#> [-captype <mb> | <cyl>]]
    [-devs <SymDevStart>:<SymDevEnd> | <SymDevName> [,<SymDevStart>:<SymDevEnd> | <SymDevName>>...]] | -file <DeviceFileName> [-tgt] ]
    rmail [-force]
```
Example
To remove all devices that are listed in text file `storgrp_a.txt` from storage group `prod` on array 123, enter:

```
symsg -sid 123 -file storgrp_a.txt -sg prod rmall
```

Note
Any attempt made to remove a device belonging to a storage group that is part of a masking view to a second storage group fails.

Remove child storage groups

Description
To remove child storage groups individually from a parent storage group, use the `symsg remove sg` command.

Syntax
Use the following syntax to remove child storage groups from a parent storage group:

```
symsg -sg SgName -sid SymmID [-i Interval] [-c Count] [-v] [-celerra] [-rp] [-ckd] remove sg SgName1[, SgName2, SgName3, SgNameN]
```

Restrictions
The following restrictions apply to `symsg remove sg` operations:

- If the parent storage group has a masking view, any operations involving device removes from the child storage groups will not be permitted, if it causes the parent storage group to have no more devices. This includes removes and moves.
- You cannot remove devices from a child storage group using the parent storage groups name.
- If you are removing Celerra devices from a storage group or a child storage group with Celerra devices from a parent storage group within a view, you must use the -celerra flag.
- If your are removing a CKD device or a child storage group with CKD devices from a parent storage group within a view, you must use the -ckd flag.
- If you are removing an RecoverPoint tagged device or a child storage group with RecoverPoint tagged devices from a parent storage group within a view, you must use the -rp flag.

Host I/O Limits for storage groups

The VMAX array Host I/O Limits feature allows you to define limits to enforce service levels and make application performance more predictable. The Host I/O Limits settings (`-bw_max MBperSec` and `-iops_max IOperSec`) allow you to limit front-end (FE) port performance by setting FE bandwidth limits on a storage group. This feature is used to limit the amount of FE bandwidth and I/Os per second (IOPs) that can be consumed by a set of devices over a set of director ports. The bandwidth and I/Os controls are then monitored by the VMAX array to ensure that they do not exceed the specified maximum bandwidth or maximum IOPs. This feature allows you to place limits on the FE bandwidth and IOPs consumed by applications on the array.
Host I/O Limits can be added, removed, or modified for a storage group. The Host I/O Limit for a cascaded storage group can be added for both the parent and the child storage group. If a parent storage group has a control set, the setting is shared among all its child storage groups when a provisioning view is created using the parent storage group. If a parent storage group has a control set, you cannot create provisioning views using the child storage groups.

If the Host I/O Limits (either \(-\text{bw\_max}\) or \(-\text{iops\_max}\)) being configured on a child storage group is greater than what is set on the parent storage group, then the operation will fail. If a Host I/O Limits (either \(-\text{bw\_max}\) or \(-\text{iops\_max}\)) being configured on a parent storage group is less than the what is set on any one of its child storage groups, then the operation will fail.

---

**Note**

For additional documentation on using this feature, refer to the *Host I/O Limits for Symmetrix Family Arrays Technical Notes*, which are available on Dell EMC Online support at: [https://support.EMC.com](https://support.EMC.com). The paper explains the benefits of implementing the Host I/O Limits feature and provides use case examples.

---

**Restrictions for storage groups with defined Host I/O limits**

The following restrictions apply to a storage group that has defined Host I/O Limits:

- At any given time, a storage group with defined Host I/O Limits can be associated with at most, one port group in any provisioning view. This means, that if the storage group with defined Host I/O Limits is in a provisioning view with a port group, the storage group and port group combination must be used when creating other provisioning views on this storage group. If you attempt to create the view using a different port group, the following error returns:

  ```
  The operation cannot be performed because the storage group with a Host I/O Limit can be associated with at most one port group in any masking view.
  ```

- Creating a provisioning view on child storage group is not allowed if the parent storage group has defined Host I/O Limits. If you attempt to create a view, the following error returns:

  ```
  The operation can not be performed because the child storage group or the parent storage group has a Host I/O Limit defined.
  ```

- Setting Host I/O Limits on a parent storage group is not allowed if any child storage group is already part of a provisioning view that was created using the child storage group. If you attempt to create a view, the following error returns:

  ```
  Cannot perform the requested operation because the group is currently within a masking view or a masking view through cascading.
  ```

- Any device can be in at most one storage group with Host I/O Limits. If you attempt to add the same device to another storage group with Host I/O Limits, the following error returns:

  ```
  The operation cannot be performed because the device already exists in a storage group with a Host I/O Limit.
  ```
If a device is in a masking view with Host I/O Limits, it cannot be in another masking view without Host I/O Limits. If you attempt to add a device in a masking view with Host I/O Limits to another masking view without Host I/O Limits, the following error returns:

```
The operation cannot be performed because the device already exists in a masking view with or without Host I/O Limit.
```

- If the Host I/O Limits (either `-bw_max` or `-iops_max`) being configured on a child storage group is greater than what is set on the parent storage group, then the operation will fail.
- If the Host I/O Limits (either `-bw_max` or `-iops_max`) on the child storage group that is being added is greater than what is configured on the parent storage group, then the operation will fail.
- If a Host I/O Limits (either `-bw_max` or `-iops_max`) being configured on a parent storage group is less than the what is set on any one of its child storage groups, then the operation will fail.
- The Host I/O Limits dynamic (`-dynamic`) setting for the parent and children must match. Child storage groups inherit the dynamic distribution setting from the parent storage group if set.

### Set the Host I/O Limit

**Description**
The `symsg create` command provides two options for setting the storage group Host I/O Limit (`-bw_max MBperSec` and `-iops_max IOperSec`). To configure Host I/O Limits on a set of devices, the front-end limits are added to a storage group. When you create a provisioning view using that storage group, the limits are applied to the devices in the storage group for the ports defined in the port group.

- The `-bw_max` option specifies the front-end maximum bandwidth in MBs/sec for the storage group. The valid range for bandwidth is from 1 MB/Sec to 100,000 MB/Sec.
- The `-iops_max` option specifies the front-end maximum IOPs/sec. The valid range for IOPs is from 100 IO/Sec to 2,000,000 IO/Sec and must be specified in units of 100 IO/Sec. An error returns if an invalid range is specified.

**Example**
To create an empty storage group named `prod` with a front-end bandwidth limit of 40,000 MB per second on array ID 123, enter:

```
symsg -sid 123 create prod -bw_max 40000
```

### Change the Host I/O Limits

**Description**
The same range limits described in **Set the Host I/O Limit** on page 137 apply, but if `NOLIMIT` is specified, then the maximum bandwidth or IOPs/Sec is set to unlimited. **List storage groups** on page 140 provides more information on listing storage group information including Host I/O Limits feature and demand reports.
The `symsg set` command allows Host I/O Limits to be set on a storage group that is in a provisioning view using a port group with FCoE ports.

**Syntax**

Use the following syntax to set or change performance limits for an existing storage group:

```bash
symsg -sg SgName -sid SymmID [-i Interval] [-c Count] set [-bw_max MBperSec | NOLIMIT] [-iops_max IOperSec | NOLIMIT]
```

**Example**

To set an IOPs limit of 50,000 I/Os per second for a storage group named `prod` on array ID 123, enter:

```bash
symsg -sg prod -sid 123 -sg prod set -iops_max 50000
```

Set dynamic distribution for FE Host I/O limits

**Description**

You can optionally configure a dynamic distribution of the FE Host I/O limits by using the `-dynamic` option with the `symsg set` and `symsg create` commands. If the option field is not specified, a default of NEVER is used.

Setting port failure capability causes the fraction of the configured Host I/O limits available to a configured port to be adjusted based on the number of ports that are currently online. Setting dynamic distribution causes the configured limits to be dynamically distributed across the configured ports, allowing the limits on each individual port to adjust to fluctuating demand. The dynamic distribution feature is supported on front-end ports from Fibre Channel, iSCSI and FCoE directors.

- If port failure capability is set on the FE Host I/O Limit and one of the directors is taken offline or fails, its percentage of the limit is then redistributed, and the two remaining ports can consume the remaining portion of the limit. Once the faulted director comes back online, the limit is again redistributed across all three ports.
- If dynamic distribution is set on the FE Host I/O Limit, then the maximum IOPs for the provisioned view are distributed dynamically across all three of the active ports within the view. The distribution fluctuates based on the current demand on each of the ports.

**Note**

Use the `symsg show` command to display the value of a storage group’s dynamic distribution setting. If a provisioning view has not been created on the parent storage group, the dynamic distribution displays as N/A.

**Syntax**

Use the following syntax to set or change dynamic distribution for an existing storage group:

```bash
symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] create <SgName> [-bw_max <MBperSec>] [-iops_max <IOperSec>]
```
Options

-dynamic

- ALWAYS: indicates that the Host IO Limits for the storage group should always be dynamically redistributed
- NEVER: indicates that the Host IO Limits for the storage group should never be dynamically redistributed
- ONFAILURE: indicates that the Host IO Limits for the storage group should dynamically redistributed only upon a failure of a Front-End Port

When the dynamic distribution attribute is set on a parent storage group, every child storage group inherits the same attribute value. The operation is blocked if you attempt to set the attribute on a child storage group.

Note

The parent and child storage groups must have the same dynamic distribution attribute value before they can be placed in a cascaded relationship.

Copy devices from a storage group to a device group

Description

Devices from an existing storage group can be copied (or added) to a device group. The copied devices remain in the storage group (SgName) and are added to the destination device group (DgName).

Syntax

Use the following syntax to add devices from an existing storage group to a device group:

```bash
```

This command adds RDF1 (-R1) devices, RDF2 (-R2) devices, RDF21 (-R21) devices, or non-SRDF devices (-noRDF) to the device group. This option must match the device type. If the device group does not exist, an error is returned.

Note

For cascaded storage groups, the sg2dg command behavior has been modified to create a device group from a parent storage group with the device group containing devices from all the child storage groups.
Example
To copy only R1 devices belonging to group number 008 from storage group prod to device group prod_2, enter:

```
symsg sg2dg prod prod_2 -R1 -sel_rdfg 008
```

List storage groups

Description
The symsg list command returns a list of all storage group names and the following details:

- Number of devices
- Number of gatekeepers
- Number of child storage groups — For parent storage groups, displays both the number of child storage groups it contains and the cumulative total of all devices contained in the child storage groups.
- FAST association
- Masking view status
- Cascade status
- Host I/O Limits status
- Compression status

Note
Storage groups with names longer than 21 characters display with their first 21 characters followed by an asterisk (*). Display full group names on page 31 explains how to set the environmental variable to display full group names.

Syntax
To retrieve a list of all storage groups for a specified array, use the following syntax:

```
symsg list -sid SymmID
```

Example
To display all storage groups for array 230, enter:

```
symsg -sid 230 list
```

Note
For the (M)asking View flag, if a parent storage group contains a masking view, all its child storage groups display that they are contained within the same masking view.

Sample output

```
STORAGE GROUPS
Symmetrix ID: 000197100230
Flags Number Number Child
Storage Group Name EFMSLC Devices GKS SGs
```
Report Host I/O Limit demands

Description
Use the `symsg list` command to report the Host I/O Limit demand on each individual director port (`-by_port -demand`) or port group (`-by_pg -demand`). The demand reports show that the Host I/O Limit is divided equally among all of the directors in the port group, independent of the number of ports on each director. This means that the demand reports show the same Host I/O Limit on both ports even though the Host I/O Limit is shared by the ports. Because of this, it is recommended that you configure only one of the ports of a director in the same port group.

Only a single front-end emulation of each type (FA, EF, etc.) can be assigned to each director, however each of these emulations can be assigned a variable number of physical ports (up to 32, numbered from 0 - 31). In addition, directors containing a Fibre Channel emulation have 32 virtual ports (numbered 32 - 63), that are reserved for use by internal guests.

Syntax
To list Host I/O Limit demands, use the following syntax:

```
symsg -sid SymmID [-i Interval] [-c Count] [-V]
    list -by_port -demand [-pg PgName | -dir <# | ALL | ALL>]
    list -by_pg -demand [-pg PgName]
```

Examples
To list a demand report for all director ports, enter:

```
symsg list -by_port -demand
Symmetrix ID : 000197100001
Director     IO Limit            Bandwidth Limit
-------------- ---------------- --------------------------------------
Maximum Number     Port    Maximum    Number
Flags   Demand Nolimit    Speed     Demand   NoLimit   Excess
-------- ----- -------- ------- -------- -------- --- ------- --------
DIR:Port  HD   (IO/Sec)     SGs (MB/Sec) (MB/Sec) (%)     SGs (MB/Sec)
-------- ----- -------- ------- -------- -------- --- ------- --------
01A:001   NN          0       0     1000        0   0       0    +1000
01A:010   YN       2000       0     1000     1000 100       0       +0
...
Legend:
  Flags:
The **Flags H** (Host I/O Limit Exist) column indicates whether a limit demand has been configured on a port, and if storage groups with no limits configured are sharing the port. The **Flags D** (Dynamic Distribution) column indicates if the dynamic option is set.

The **Maximum Demand** columns indicate the total Host I/O Limit demand on the specified director port in MB/Sec or IO/Sec.

The **Port Speed** column indicates the bandwidth in MB/Sec for that port (the port negotiated speed).

The **Number NoLimit SGs** columns indicate the number of storage groups with no limits configured that are sharing the port.

The **Excess** column indicates the amount of bandwidth in MB/sec that is available on the director port after accounting for the demands on the port.

---

**Note**

Only storage groups that have a provisioning view created on them are shown as placing a Host I/O Limit demand on the director port. If both the parent and child storage group has a Host I/O defined, the maximum demand is calculated based on the parent Host I/O settings.

To list a demand report for all port groups, enter:

```
symsg list -by_pg -demand
```

<table>
<thead>
<tr>
<th>Port Group</th>
<th>IO Limit</th>
<th>Bandwidth Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Host Limit</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>Exist (IO/Sec)</td>
<td>NoLimit SGs (MB/Sec)</td>
</tr>
<tr>
<td>PG_Eng1</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>PG_Eng2</td>
<td>Yes</td>
<td>1500</td>
</tr>
<tr>
<td>PG_Eng3</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>PG_Eng4</td>
<td>No</td>
<td>2000</td>
</tr>
</tbody>
</table>

---

**Note**

Only storage groups that have a provisioning view created on them will be shown as placing a Host I/O Limit demand on the port group.

- The Host Limit Exist column indicates whether a limit demand has been placed on a port group, and if storage groups with no limits configured are sharing the port group.
- The Maximum Demand columns indicate the total Host I/O Limit demand on the specified port group in MB/Sec or IO/Sec.
- The Port Grp Speed column indicates the bandwidth in MB/Sec for that port group (the aggregated port negotiated speed for the ports in the group).
- The **Number NoLimit SGs** columns indicate the number of storage groups with no limits configured that are sharing the port group.

- The **Excess** column indicates the amount of bandwidth in MB/sec that is left available on the port group after the demands have been accounted for.

**View storage group details**

**Examples**

To view information about storage group **sg1** on array **087**, enter:

```
symsg show -sid 087 sg1
```

**Sample output**

This output shows a storage group without a defined Host I/O Limit.

**Name:** sg1

- **Symmetrix ID:** 000197800087
- **Last updated at:** Fri Mar 04 10:19:41 2016
- **Masking Views:** No
- **FAST Managed:** Yes
- **Service Level Name:** Diamond
- **Workload:** <none>
- **SRP Name:** <none>
- **VP Saved (%):** 25.1
- **Compression Enabled:** Yes (1.8:1)
- **Compression Ratio:** 1.8:1
- **Host I/O Limit:** None
- **Host I/O Limit MB/Sec:** N/A
- **Host I/O Limit IO/Sec:** N/A
- **Dynamic Distribution:** N/A
- **Number of Storage Groups:** 0
- **Storage Group Names:** N/A
- **Number of Gatekeepers:** 0

**Devices (4):**

- 000DD N/A TDEV RW 23016
- 000DE N/A TDEV RW 23016
- 000DF N/A TDEV RW 23016
- 000E1 N/A TDEV RW 23016

**Show cascaded storage group details**

**Examples**

To show information for parent storage group **SG_Eng1** for array **601**, enter:

```
symsg show SG_Eng1 -sid 601
```

To show information for child storage group **Eng1_Data** for array **601**, enter:

```
symsg show Eng1_Data -sid 601
```
Sample output
For parent storage group:

Note
The Number of Composite Groups and Number of Groups fields display as 0 for a child storage group whose parent belongs to a composite group or device group. Only a storage group that is directly contained by the composite group or device group displays a value.

Name: SG_Eng1
Symmetrix ID : 000195700601
Last updated at : Wed Apr 11 00:28:16 2017
Masking Views : Yes
FAST Policy : No
Host I/O Limit : Defined
Host I/O Limit MB/Sec : 1000
Host I/O Limit IO/Sec : NoLimit
Dynamic Distribution : N/A
Number of Storage Groups : 2
Storage Group Names : Eng1_Data (IsChild) Eng2_Data (IsChild)
Number of Composite Groups : 0
Composite Group Names : N/A
Number of Groups : 2
Group Names : DG1 : DG2
Devices (20):
{  
  Sym Dev Pdev Name Device Config Sts Cap  
  ----------- ----------- -------------  
  1A41 N/A N/A TDEV RW 2000  
  1A42 N/A N/A TDEV RW 2000  
  1A43 N/A N/A TDEV RW 2000  
  1A44 N/A N/A TDEV RW 2000  
  1A45 N/A N/A TDEV RW 2000  
  . .  
}

For child storage group:

Note
This example shows a child storage group sharing the Host I/O Limit defined in the parent storage group. This is only shown when a provisioning view is created using the parent storage group. If a provisioning view was not created on the parent storage group, the limit is not reported as being shared.

Name: Eng1_Data
Symmetrix ID : 000195700601
Last updated at : Wed Apr 11 00:28:16 2017
Masking Views : Yes
FAST Policy : No
Host I/O Limit : Shared
Host I/O Limit MB/Sec : 1000
Host I/O Limit IO/Sec : NoLimit
Dynamic Distribution : N/A
Number of Storage Groups : 1
Storage Group Names : SG_Eng1 (IsParent)
Devices (10):
For a storage group that is not part of a cascaded relationship, the following fields display:

```
Number of Storage Groups : 0
Storage Group Names      : N/A
```

### Export and import device lists

You can export the list of devices from an existing storage group to a text file on your host system, and this file can later be imported to create a storage group. This can be useful if you then delete the group and later wish to recreate it. The device list file contains a device description line for as many devices as there are listed in the storage group. Lines that are blank or include a pound (#) sign in the first column are ignored.

Group files for the `import` and `export` commands contain device parameters in the following format:

```
SymmIDSymDevNameSymDevName. . .
```

Group files for the `importall` and `exportall` commands contain device parameters in the following format:

```
SgNameSymmIDSymDevNameSymDevName. . .
```

Repeat this format in the file for multiple storage groups.

---

**Note**

If a filename is not specified with the `symsg import` or `export` command, a default file named `symsg.txt` is created in the directory where the `symsg` command is executed. If a filename is not specified with the `symsg importall` or `exportall` command, a default file named `symsgall.txt` is created in the directory where the command is executed.

---

### Export a device list

**Description**

Use the `symsg export` or `exportall` to export a list of devices from one or all storage groups to a text file to the host system.

The `symsg export` and `exportall` commands support exporting the Service Level, the workload, and the Storage Resource Pool, set on the storage group. If a storage
group has a Service Level or a Storage Resource Pool name set on the storage group, the
name is copied to the export file. If an implicitly set Optimized Service Level or the
system default Storage Resource Pool for the emulation type is set on the storage
group, the string DEFAULT is written in place of the name.

Note
If the storage group configuration, as specified in the export file, has a Storage
Resource Pool set and if the Storage Resource Pool has been renamed between the
export and import operations, the storage group will not be imported.

Syntax
To export a storage group device list, use the following syntax:

```
symsg -sid SymmID [-i Interval] [-c Count][-v]
export <SgName> [-file <FileName>] [-offline
eportall [-file <FileName>] [-offline]
```

Examples
To export the storage group membership from group prod2 to device file named
prod2list.txt, enter:

```
symsg -sid 123 export prod2 -f prod2list.txt
```

Sample output
The output of the text file with the exported data displays as follows:

```
000194900341
S sgchild1
S sgchild2
```

The output of a text file generated from `symsg exportall` displays as follows:

```
<sgparent>
000194900341
S sgchild1
S sgchild2
<sgchild1>
000194900341
00201
00206
<sgchild2>
000194900341
00404
00405
00406
```

Import a device list

Description
You can add multiple devices to a new or existing storage group by importing an
existing file that contains a list of devices created by the export action. The import
action will create the storage group if the group name specified in the command does not already exist, or you can import to an existing group name that is partially populated. If you import to an existing group, the devices in the imported file will be appended to the existing group membership.

In addition, you can recreate all storage groups, using the `symsg importall` command, that were from data contained in a text file previously created using the `symsg exportall` command.

**Note**

For `importall`, if any of the storage groups that you are attempting to create already exist, Solutions Enabler displays a message indicating it exists, and the operation will continue to create the next storage group in the list.

The following security privileges are required to execute this command:

- Required Access type: BASE

The `symsg import` and `importall` commands support importing devices from the FAST-managed storage group in the import file to a target storage group as follows:

- If the imported storage group exists in the array, the target storage group will have its Service Level, workload, and Storage Resource Pool overwritten with those from the imported storage group. If the imported storage group was FAST-managed, the resulting target storage group will become FAST-managed. If the imported storage group was not FAST-managed, the resulting target storage group will become non FAST-managed.
- If the Service Level set on the storage group does not exist on the target array, the storage group will be imported and set to use an Optimized Service Level with no workload.
- If the workload set on the storage group does not exist on the target array, the storage group will be imported without a workload.
- If the Storage Resource Pool set on the storage group does not exist on the target array, the storage group will be imported and set to the default Storage Resource Pool for the emulation type.
- If the both Service Level and the Storage Resource Pool set on the storage group do not exist on the target array, the storage group will be restored with no Service Level and no Storage Resource Pool and will not be FAST-managed.
- If the resulting target storage group is FAST-managed, the command will fail if any device in the storage group is already in another FAST-managed storage group on the array or if any device in the storage group is an encapsulated device.
- The command will fail if the Service Level used by the storage group cannot be supported based on the Storage Resource Pool that is being used by the storage group.
- The `import` fails if the storage group is configured with a Service Level other than "Optimized" and the SRP set for the storage group is configured for FTS external provisioning. With a Service Level other than "Optimized" and an SRP that is configured for FTS external provisioning `importall` skips the import of these storage groups.

**Syntax**

Use the following syntax:

```
symsg -sid SymmID [-i Interval] [-c Count][-v]
```
import SgName [-f FileName]
importall [-f FileName]

Example
To create a storage group named prod2 from the device file prod2list.txt, enter:

```bash
symsg -sid 123 import prod2 -f prod2list.txt
```

Rename a storage group

Syntax
To rename a storage group, use the following syntax:

```bash
symsg -sid SymmID [-i Interval] [-c Count] rename OldSgName NewSgName-v
```

Note
If the storage group is contained by a composite group or device group, all local device groups containing the storage group update with the new name of the storage group. The update is then propagated to the GNS or RDF daemons and the SYMAPI database.

Example
To rename a storage group named prod on array 123 to prod_B, enter:

```bash
symsg rename -sid 123 prod prod_B
```

Move devices between storage groups

Use the `symsg move dev` or `symdev moveall` command to move one or all devices from one existing storage group to another existing storage group.

Conditions
Moving a device to another storage group will not disrupt the host visibility for the device if any of the following conditions is met:

- Moving devices between child storage groups of a parent storage group when the view is on the parent storage group.
- Moving devices between storage groups when a view is on each storage group and both the initiator group and the port group are common to the views.
- Moving devices between storage groups when a view is on each storage group and they have a common initiator group. They have different port groups but the same set of ports.
- Moving devices between storage groups when a view is on each storage group and they have a common initiator group. They have different port groups but the target port group is a superset of the source port group (additional ports).
Move a single device between storage groups

Description
Use the `symsg move dev` command to move one device, specifying the device name, from one storage group to another storage group. The moved device is deleted from the current storage group (`SgName`) and added to the destination storage group (`DestSgName`). You can specify the interval and count options (`-i` and `-c`) to wait a predetermined time (interval) between attempts (count) to acquire an exclusive lock on the host database.

Syntax
Use the following syntax to move an individual device:

```
symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] [-celerra] [-rp] [-ckd] . . . move dev <SymDevName> <DestSgName> [-force]
```

Example
For example, to move device 30 on array ID#59866000123 from storage group `prod` to storage group `test`, enter:

```
symsg -sid 123 -sg prod move dev 30 test
```

Restrictions
- The selected or all the devices in a source storage group can be moved to a standalone or child destination storage group that is FAST-managed. The operation will fail if after the move the device is in more than one FAST-managed storage group or if moving encapsulated devices to the storage group.
- If the target SG is FAST Managed, the command fails if moving FBA devices to an SG with CKD devices.
- If the target SG is FAST Managed, the command fails if moving CKD devices to an SG with FBA devices.
Move all devices between storage groups

Description
Use the `symsg moveall` command to move multiple devices from a storage group in a list, using a combination of device ranges and single devices, or from a text file. The moved devices are deleted from the current storage group \((\text{SgName})\) and added to the destination storage group \((\text{DestSgName})\).

When moving all devices from one existing storage group to another, you can move all devices, or use the additional options to select specific devices. Specify the interval and count options \((-i\) and \(-c\)) to wait a predetermined time (interval) between attempts (count) to acquire an exclusive lock on the host database.

The `symsg moveall` command requires the `-force` option under the following conditions:

- Moving devices from a source storage group contained in a masking view, either directly or indirectly (inherited from a parent storage group contained in a masking view) to a destination storage group that is also contained in a masking view, either directly or indirectly.
- Moving devices between two storage groups, both associated with a FAST policy.

Syntax
To move multiple devices, devices in a range, or listed in a file, use the following syntax:

```
symsg -sg <\text{SgName}> -sid <\text{SymmID}> [-i <\text{Interval}>] 
     [-c <\text{Count}>] [-v] [-celerra] [-rp] [-ckd] 
     [-SA [\text{#} | \text{ALL}] [-p <\#>] [-N <\#>]] 
     [-cap <\#> [-captype <\text{mb} | <\text{cyl}>]] 
     [-devs <<\text{SymDevStart}:\text{SymDevEnd}> | <\text{SymDevName}> 
       \[,<<\text{SymDevStart>:\text{SymDevEnd}> | <\text{SymDevName}>\...,] > ] 
     -file <\text{DeviceFileName}> [-tgt] ]
moveall Dest\text{SgName}
```

Examples
To move all devices from a storage group named `prod` to a storage group named `test` on array 123, enter:

```
symsg -sid 123 -sg prod moveall test
```

To move multiple devices from a storage group named `prod` to a storage group named `test` on array 123, enter:

```
symsg -sid 123 -sg prod moveall -devs 31:35,37,40:43 test
```

Restrictions
- The selected or all the devices in a source storage group can be moved to a standalone or child destination storage group that is FAST-managed. However, the operation fails if after the move the device is in more than one FAST-managed storage group, or if moving encapsulated devices to the storage group.
- If the target SG is FAST Managed, the command fails if moving FBA devices to an SG with CKD devices.
Copy a device between storage groups

Move all devices between storage groups

Description
Use the symsg copy dev command to copy one device, specifying the array device name, from one storage group to another storage group. The copied device remains in the current storage group (SgName) and is added to the destination storage group (DestSgName). Specify the interval and count options (-i and -c) to wait a predetermined time (interval) between attempts (count) to acquire an exclusive lock on the host database.

Syntax
To copy an individual device, use the following syntax:

```
    symsg -sg <SgName> -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] [-celerra] [-rp] [-ckd]
    copy dev <SymdevName> <DestSgName>
```

Example
To copy device 30 on array 123 in storage group prod to storage group test, enter:

```
symsg -sid 123 -sg prod copy dev 30 test
```

Restrictions
- A device in a source storage group can be copied to a standalone or child destination storage group that is FAST-managed. However, the operation fails if the device is already in another storage group that is FAST-managed or if copying encapsulated devices to the storage group.
- If the target SG is FAST Managed, the command fails if moving FBA devices to an SG with CKD devices.
- If the target SG has is FAST Managed, the command fails if moving CKD devices to an SG with FBA devices.

Copy all devices between storage groups

Description
Use the symsg copyall command to copy multiple devices, from one storage group to another storage group. Multiple devices are copied from a storage group in a list, range, or grouped in a text file. The copied devices remain in the current storage group (SgName) and is added to the destination storage group (DestSgName). When choosing to copy all devices from one existing storage group to another, you can copy all devices, or use the additional options to select specific devices. Specify the interval and count options (-i and -c) to wait a predetermined time (interval) between attempts (count) to acquire an exclusive lock on the host database.
Syntax
To copy multiple devices from a storage group, use the following syntax:

```
symsg -sg SgName -sid SymmID [-i Interval] [-c Count][-v]
[-celerra] [-rp] [-ckd][-sa <# | ALL>] [-p <#>] [-n <#>]
[-cap <#> [-captype <mb> | <cyl>]]
[-devs <SymDevStart:SymDevEnd | SymDevName >
[<,SymDevStart:SymDevEnd | SymDevName...]> |
-file DeviceFileName [-tgt]]
copyall DestSgName
```

Examples
To copy all devices from a storage group named prod to a storage group named test on array 123, enter:

```
symsg -sid 123 -sg prod copyall test
```

To copy multiple devices from a storage group named prod to a storage group named test on array 123, enter:

```
symsg -sid 123 -sg prod copyall -devs 31:35,37,40:43 test
```

To copy multiple devices from device file test_2.txt to storage group test and destination storage group test_2 on array 123, enter:

```
symsg -sid 123 -sg test copyall -file test_2.txt test_2
```

Restrictions
- All the devices in a source storage group can be copied to a standalone or child destination storage group that is FAST-managed. However, the command fails if the device is already in another storage group that is FAST-managed or if copying encapsulated devices.
- If the target SG is FAST Managed, the command fails if moving FBA devices to an SG with CKD devices.
- If the target SG has is FAST Managed, the command fails if moving CKD devices to an SG with FBA devices.

Copy devices from a storage group to a device group

Description
Devices from an existing storage group can be copied (or added) to a device group. The copied devices remain in the storage group (SgName) and are added to the destination device group (DgName).

If the device group does not exist, it will be created. If optional device types are not specified, only standard devices will be added.
Syntax
Use the following syntax to add devices from an existing storage group to a device group:

```
symsg -sid SymmID [-i Interval] [-c Count][-v]
  sg2dg SgName DgName [-bcv | -vdev | -tgt]
```

Examples
To add devices from a storage group named prod on array 123 to a device group named prod_2, enter:

```
symsg -sid 123 sg2dg prod prod_2
```

To add only the target devices from a storage group named prod on array 123 to a device group named prod_2, enter:

```
symsg -sid 123 sg2dg prod prod_2 -tgt
```

Note
An error will be returned if the -tgt option is specified and the storage group contains both standard and BCV devices.

Delete a storage group

Syntax
Use the following syntax:

```
symsg -sid SymmID [-i Interval] [-c Count] delete SgName [-force] -v
```

Note
Use the -force option to force the deletion of a storage group that is contained by a device group or composite group. On the host performing the delete, all device groups or composite groups containing the deleted storage group are updated. The update is then propagated to the GNS daemon and the database. Deleting a storage group contained by a composite group causes the RDF daemon to stop monitor the composite group.

Example
To delete an empty storage group named prod on array 123, enter:

```
symsg delete -sid 123 prod
```
Restrictions

- Deleting a storage group that is part of a masking view or associated with a FAST policy is not allowed.
- The following restrictions apply to the `symsg delete` command for cascaded storage groups:
  - A parent storage group cannot be deleted unless the `-force` flag is used.
  - A parent storage group cannot be deleted if it has a masking view
  - A child storage group must be removed from its parent storage group before it can be deleted.

Perform control operations on storage group devices

Description

Use the `symsg -sg` command to perform the following operations on devices within a storage group.

Syntax

Refer to the Dell EMC Solutions Enabler CLI Reference Guide for the `symsg` command syntax and allowable control operations.

Composite groups

A composite group (CG) is a user-defined group comprised of devices or device groups, that can belong to one or more locally-attached arrays and one or more SRDF groups within a array. Members can be individual devices or device groups spanning multiple arrays and SRDF groups.

For example, with a composite group you can make a consistent, restartable local copy of a database that is using volumes spanning two local arrays. Without composite groups, it would be impossible to guarantee that all of the BCVs would be split at the same point in time.

Composite groups are created and managed by using the `symcg` command.

Composite group device members

A single composite group can contain devices from the following different device lists:

- Standard device list (STD) — Non-BCV devices that are local to the host.
- Local Business Continuance Volume (BCV) list — BCV devices local to the host.
- Local VDEV list (VDEV) — Virtual devices that are local to the host.
- Remote VDEV list (RVDEV) — Virtual devices that are remote.
- Remote BCV list (RBCV) — BCV devices that are to be associated with the remote mirrors of the STD devices.
- BCV-Remote BCV list (BRBCV) — BCV devices that are to be associated with the remote mirrors of the local BCV devices.
- Remote-Remote BCV List (RRBCV) — Remote BCV devices that are to be associated with the remote mirrors of the RBCV devices.
- Local TGT list (TGT) — TF/Clone target devices that are local to the host.
- Remote TGT list (RTGT) — TF/Clone target devices that are remote.
R21 STD devices — R21 devices utilize two mirrors and are considered to be concurrent SRDF devices.

Logical device name support

A composite group can contain logical device names (aliases) for devices. All new composite groups, and any devices added to them, will automatically be assigned an LdevName if you do not specify one.

The devices added to device groups and composite groups are assigned a default logical names at add time. The name is unique within the group to which it was added.

Device group members within composite groups

A device group can be a member of more than one composite group.

The integrity of control operations is maintained separately at the device group and composite group level. For example, pairing STD devices with BCV devices is only allowed if both devices are contained within the same device group.

Device group membership of composite groups provides the following:

- Building blocks to creating composite groups.
- Support for auto-correct of the composite group.
- SRDF consistency at the composite group and SRDF group name levels.
- GNS support of the composite group.

Restrictions

Before you create a composite group containing device groups, review the following restrictions:

- GNS does not remotely mirror composite groups containing device groups.
- Composite groups can contain either individual devices or device groups, but not both.
- If any of the device groups contained by a composite group become invalid, the composite group also becomes invalid.
- Cannot add a device group to an enabled composite group.
- A composite group cannot contain multiple device groups that contain the same devices.
- Control operations are only allowed at the device group or composite group level if currently supported at that level. For example, control operations such as symdg and symqos are allowed at the device group level.
- A device group must exist before it can be added to the composite group.
- The device groups in a composite group must follow the guidelines and restrictions outlined in Device lists on page 103 and Create a device group on page 105.

Logical names of devices within a composite group

When adding more than one device group to a composite group, a device group may contain devices with the same logical names, resulting in a composite group having more than one device with the same logical name. To prevent this, the logical name of a device in a device group is not carried over into the composite group. A new logical name is created for each device using the following format:

```
xxxxxsseeeee_dddttt
```

Where:
• **xxxxx** is the one of the following reserved words representing the device type:

<table>
<thead>
<tr>
<th>Table 8 Logical name formats</th>
</tr>
</thead>
<tbody>
<tr>
<td>2BCV</td>
</tr>
<tr>
<td>2TGT</td>
</tr>
<tr>
<td>2VDEV</td>
</tr>
<tr>
<td>BCV</td>
</tr>
</tbody>
</table>

• **ssss** is the last five characters of the array ID containing the device.

• **ddd** is the device number, in hexadecimal, which is guaranteed to be unique within the array.

These naming conventions guarantee that all devices have unique logical names from the composite group point of view. Devices in the device groups maintain the logical names that were assigned at the time when the devices were added to the composite group.

**Composite group types**

Use one of the following types to create a composite group:

• REGULAR (Solutions Enabler V7.4 and higher allows the inclusion of SRDF devices)

• RDF1 (R1 and concurrent R11 devices)

• RDF2 (R2 and concurrent R22 devices)

• RDF21 (cascaded R21 devices)

• ANY (can contain as device mix of the above types)

**Note**

A composite group of any SRDF type can change its type because of a **symrdf** control operation. For example, an RDF1 composite group can change to an RDF2 when the device personalities are swapped. SRDF control operations (such as the **suspend**, **establish**, and **swap**) cannot change the type of an ANY composite group but can affect the devices in that composite group.

**SRDF consistency groups**

An SRDF consistency group is a composite group comprised of SRDF devices (RDF1, RDF2, or RDF21) acting in unison to preserve dependent write consistency of a database distributed across multiple SRDF systems. If a source R1 device in the consistency group cannot propagate data to its corresponding target R2 device, data propagation from all R1 devices in the consistency group is suspended, halting all data flow to the R2 targets.

Consistency is maintained by using either Multi-Session Consistency (MSC) for SRDF/A or SRDF Enginuity Consistency Assist (RDF-ECA) for SRDF/S. For detailed information about SRDF consistency groups, refer to the Dell EMC Solutions Enabler SRDF Family CLI User Guide.

A group is considered an SRDF consistency group if it is a composite group meeting all of the following criteria:

• Created as type RDF1, RDF2, RDF21, or ANY.
Contains STD devices.

Set for consistency using the \texttt{-rdf\_consistency} option, which registers it with the SRDF daemon, and then enabled using the \texttt{symcg enable} command.

\begin{quote}
\textbf{Note}

Deleting a device group from a composite group enabled for SRDF consistency causes the SRDF daemon to stop monitoring this composite group.
\end{quote}

\begin{quote}
\textbf{Note}

For detailed interoperability information, please refer to E-Lab\textsuperscript{TM} Interoperability Navigator (ELN) which can be reached at \url{http://elabnavigator.EMC.com}.
\end{quote}

\section*{Create a composite group}

To create a composite group:

1. Define a named empty group of a specific type explained in \textit{Composite group types} on page 156.
2. Add devices OR device groups to the composite group.

\section*{Create an empty composite group}

\textbf{Description}

Use the \texttt{symcg} command to create a composite group. When you create a composite group, you assign it a name and a group type.

\textbf{Syntax}

Use the following command syntax to create a composite group:

\begin{verbatim}
symcg [-i \texttt{Interval}] [-c \texttt{Count}][-v]
create \texttt{CgName} [-t \texttt{type} \texttt{REGULAR} | RDF1 | RDF2 | RDF21 | ANY ] [-apidb | \texttt{-rdf\_consistency}]
\end{verbatim}

\textbf{Options}

\texttt{-i}

Specifies the interval to wait between attempts to acquire an exclusive lock on the host database and, for SRDF control operations, on the local and/or remote arrays.

\texttt{-c}

Specifies the number of attempts to acquire an exclusive lock on the host database and, for SRDF control operations, on the local and/or remote arrays.

\texttt{type}

Specifies the group type. If a group type is not specified, the default group created is \texttt{REGULAR}.

\section*{Create a composite group from devices in a storage group}

\textbf{Description}

Starting with Solutions Enabler V8.0.1, you can add selected members of a storage group to a target composite group. If the composite group does not exist, it is created.
If none of the optional device types are specified, the default is to add standard devices.

**Syntax**

Use the following syntax to create a composite group from specified storage group devices:

```
  symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v] 
    ... 
  sg2cg <SgName> <CgName> [-bcv | -vdev | -tgt] 
    [-R1 | -R2 | -R21 | -noRDF] [-apidb | -rdf_consistency]
```

**Options**

**sg2cg**

If the storage group is a cascaded storage group, `sg2cg` creates a composite group for the parent storage group with devices from each of the child storage groups.

**Create composite groups with SRDF consistency**

**Description**

Specify the `-rdf_consistency` option parameter with `symcg create` to register a composite group of type RDF1, RDF2, or RDF21 with the SRDF daemon.

**Note**

Before the SRDF daemon can begin monitoring and managing a composite group created with SRDF consistency, enable it using the `symcg enable` command. Note that the `symcg enable` command will be blocked if the type of the enable being performed is MSC or SRDF-ECA and the scope of the enable contains multiple SRDF groups.

When creating a composite group with SRDF consistency, the composite group name is compared against all existing composite group names for uniqueness. This comparison is not case sensitive, ensuring there are no composite group naming collisions in the Symmetrix File System (SFS).

**Note**

If devices set for consistency protection are in an existing composite group, you cannot add them to another composite group enabled for consistency protection. However, you can add these devices to a composite group not enabled for consistency protection.

**Examples**

To create a composite group named `mycg1` of type RDF1 with consistency enabled, enter:

```
symcg create mycg1 -rdf_consistency -type rdf1
```
In the options file, you must set the following option to **ENABLE** to create composite groups with SRDF consistency:

```
SYMAPI_USE_RDFD=ENABLE
```

### Set controls on Celerra devices

**Syntax**

Use the following `-celerra` option to set the `rw_enble`, `write_disable`, `ready`, and `non_ready` controls on Celerra FBA devices in a composite group:

```
```

### Export a composite group to file

**Syntax**

Use the following syntax to export a composite group to file:

```
symcg [-i Interval] [-c Count] [-v] export <CgName> [-file <FileName>] [-rdf] [-grpfile <GrpDbFileName>]
symcg exportall [-file <FileName>] [-rdf] [-grpfile <GrpDbFileName>]
```

**Options**

- **-i**
  - Specifies an interval to wait between attempts to acquire an exclusive lock on the host database and, for SRDF control operations, on the local and/or remote arrays.

- **-c**
  - Specifies the number of attempts to acquire an exclusive lock on the host database and, for SRDF control operations, on the local and/or remote arrays.

- **-rdf**
  - If `-rdf` is specified, the remote partners of the STD devices and BCV devices are added to the file instead of those devices that exist in the current local composite group. The RBCV devices will become local BCVs. Non-SRDF BCVs, VDEVs, BRBCVs, and RRBCVs will be ignored in this case. The resulting file will have as many device description lines as the composite group has members.

**Note**

The `-rdf` option cannot be used on REGULAR or cascaded SRDF composite groups or when the composite group is of type ANY. Specifying the `-rdf` option produces an error if any Hop-2 devices are detected in the composite group.
Delete a composite group

Syntax
Use the following syntax to delete an existing composite group:

```
symcg [-i Interval] [-c Count][-v]
    delete CgName [-force] [-symforce]
```

Options
- **-force**
    If the composite group has members, the command fails unless **-force** is used. If **-force** is specified, the device members of the group are removed, and the group is deleted. If the composite group is enabled for SRDF consistency, you must use **-force** to delete it.

Import a composite group

Syntax
Use the following syntax to import a composite group from a previously generated file:

```
symcg [-i Interval] [-c Count][-v]
    import CgName [-f FileName]
    [-apidb | -rdf_consistency] [-rename]
    importall [-f FileName] [-rdf_consistency]
```

Options
- **-rdf_consistency**
    When the **-rdf_consistency** parameter is specified, the composite group is registered with the SRDF daemon.

- **-rename**
    If **-rename** is specified, the devices are given the next available default device name when added to the group. If **-rename** is not used, the devices are added with the name specified in the import file. This may result in a failure if a device already has that name in the composite group.

Add standard devices to a composite group

Syntax
Use the following syntax to add a standard device to a composite group:

```
symcg [-i Interval] [-c Count][-v]
    add pd PdevName [LdevName] -cg CgName
```
or

```
syencg -cg CgName -sid SymmID [-i Interval] [-c Count] [-v]
   [-rdf | -hop2]
   [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]]
add dev SymDevName [LdevName] [-vdev | -tgt]
```

**Note**

If the composite group already contains one or more storage groups, the command to add devices will fail as this action violates the restrictions for device groups containing storage groups.

**Options**

- `-i`
  Specifies an interval to wait between attempts to acquire an exclusive lock on the host database on the local and/or remote arrays.

- `-c`
  Specifies the number of attempts to acquire an exclusive lock on the host database on the local and/or remote arrays.

- `-sid`
  Specifies the array ID when adding devices by specifying a device name.

- `-rdf`
  When specified with the `-vdev` option, adds the devices to the remote virtual device list. When specified with the `-tgt` option, adds the target devices to the remote target device list.

- `-hop2`
  Same as `-rdf`, but when the device is two hops away.

- `-rdfg`
  Specifies the SRDF group number.
  Composite groups allow remote BCV devices (RBCVs) on both links to be associated with the SRDF group. These RBCVs may be R1 or R2 type BCVs and may also have a remote BCV (RRBCV) associated behind each.

- `-vdev`
  When the `-vdev` option is specified, the devices are added to the virtual device list.

**Note**

In addition, to add a VDEV to the remote virtual device list, specify the `-rdf` option with the `-vdev` options. If the device is two hops away, specify the `-hop2` option instead.

- `-tgt`
  When the `-tgt` option is specified, the devices are added to the target device list.
Move and copy devices in composite groups

Devices from an existing composite group can be moved or copied into another existing composite group of compatible type.

- When the move ld or moveall action is used, the devices are removed from the source composite group and added to the destination composite group.

Note

The move and moveall commands fail if you attempt to move devices from a composite group containing storage groups. You must use the symsg move or symsg moveall commands to move devices in a storage group.

- When the copy ld or copyall action is used, copies of the devices are added to the destination composite group, and the source composite group remains unchanged.

Note

The symcg copy and symcg copyall commands do not allow you to copy any devices from a composite group containing device groups. In this case, use the symdg copy or symdg copyall command to copy devices from a device group.

You can assign a new name to a device being copied or moved.

Syntax

Use the following syntax to move or copy devices from one composite group to another.

```
symcg -cg CgName [-i Interval] [-c Count][-v]
move ld LdevName DestCgName [-force] [-rename]
copy ld LdevName DestCgName [-force] [-rename]
symcg -cg CgName [-i Interval] [-c Count] [-v]
[-sid SymmID]
[-SA # | ALL] [-P #] [-N #]
[-cap # [-captype mb | cyl]]
[-vdev | -tgt [-hop2] | -rvdev | -rtgt]
[-rdfg GrpNum [-remote.rdfg RemoteGrpNum]]
[-sel rdfg SelRdfGrpNum]
[-devs SymDevStart:SymDevEnd | SymDevName
[,SymDevStart:SymDevEnd | SymDevName...]]
moveall DestCgName [-force] [-symforce] [-rename]
[-R1 | -R2 | -R21 | -noRDF]
copyall DestCgName [-force] [-symforce]
[-R1 | -R2 | -R21 | -noRDF]
```

Options

- sel rdfg
When the `-sel_rdfg` option is specified, only SRDF devices belonging to that group number are moved or copied.

- `r1`
  Limits the number of SRDF devices added to a composite group to R1s.

- `r2`
  Limits the number of SRDF devices added to a composite group to R2s.

- `r21`
  Limits the number of SRDF devices added to a composite group to R21s.

- `noRDF`
  By specifying `-noRDF`, you can prohibit any SRDF devices from becoming members of the composite group.

Copy devices from a device group to a composite group

**Description**
Use the `symcg dg2cg` command to copy or add devices from an existing device group to a composite group. If the composite group does not exist, it is created. By default, all device lists from the device group are added to the composite group.

**Note**
During a device add operation, the command fails if the composite group already contains storage groups.

**Syntax**
Use the following syntax to add devices from an existing device group to an existing composite group:

```
dg2cg DgName CgName [-rename] [-force]
  [-apidb | -rdf_consistency]
```

**Options**

- `bcv`
  Adds only the BCVs to the composite group.

- `vdev`
  Adds only the virtual devices to the composite group.

- `hop2`
  Indicates the specified device is two hops away.

- `rcv`
  Adds only the RBCVs to the composite group.

- `rrbcv`
  Adds only the RRBCVs to the composite group.

- `brbcv`
Adds only the BRBCVs to the composite group.

-nobcv
   Adds only the STDs to the composite group.

-rvdev
   Adds only the remote virtual devices to the composite group.

-tgt
   Adds only the TGTs to the composite group.

-rtgt
   Adds only the RTGTs to the composite group.

Remove a standard device from a composite group

Description
Use the `symcg remove` command to remove devices from an existing composite group. You can either remove devices individually, remove all devices, or remove all devices meeting the specified criteria.

Removing an consistency-enabled device does not disable the device. Use `symcg disable` to disable the composite group. If SRDF consistency is enabled and cannot be disabled, use `-symforce`.

Note
If the device is contained in a storage group, the operation will fail. Use the `symmsg remove dev` or `symmsg rmall` command to remove devices in a storage group.

Syntax
Use the following syntax to remove a standard device from a composite group:

```bash
symcg -cg CgName -sid SymmID [-i Interval] [-c Count] [-v]
   [-rdf | -hop2] [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]]
   remove dev SymDevName [-force] [-symforce]
   [-vdev | -tgt]
```

or

```bash
symcg -cg CgName [-i Interval] [-c Count] [-v]
   remove ld LdevName [-force] [-symforce]
```

or

```bash
symcg -cg CgName [-i Interval] [-c Count] [-v]
   remove [pd] PdevName [-force] [-symforce]
```
Remove all standard devices from a composite group

Description
Use the `symcg rmall` command to remove all devices from an existing composite group.

Note
If the devices are contained in a storage group, the operation will fail. Use the `symsg remove dev` or `symsg rmall` command to remove devices in a storage group.

Syntax
Use the following syntax to remove all standard devices from a composite group:

```
symcg -cg CgName [-i Interval] [-c Count] [-v]
  [-sid SymmID] [-SA # | ALL] [-P #] [-N #]
  [-cap # [-captype mb | cyl]] [-rdf | -hop2] [-vdev | -tgt]
  [-rdfg GrpNum [-remote_rdfg RemoteGrpNum]]
  [-sel_rdfg SelRdfGrpNum]
  [-devs SymDevStart:SymDevEnd | SymDevName
   ,SymDevStart:SymDevEnd | SymDevName...]]
rmall [-rdf | -hop2] [-force] [-symforce]
  [-R1 | -R2 | -R21 | -noRDF]
```

Options

- `sel_rdfg SelRdfGrpNum`
  Indicates to remove only the devices in the specified group from the composite group

Rename a composite group

Description
Use the `symcg rename` command to rename a composite group.

Note
The command fails if you attempt to rename a logical device name of a device in a composite group containing storage groups. Also, you cannot rename an SRDF consistency composite group that is enabled.

Syntax
Use the following syntax:

```
symcg [-i Interval] [-c Count]
rename OldCGName NewCGName
```
Set SRDF group attributes

Description
Use the `symcg set` command to associate a logical name or an SRDF/Star recovery SRDF group number with an SRDF group to perform operations on all associated devices. If the `-rdfg` argument is not specified, then the action is applied to all SRDF groups.

Syntax
Use the following syntax:

```
symcg -cg CgName [-i Interval] [-c Count] [-v]
    set -name [Name] | -recovery_rdfg GrpNum
    [-rdfg SymmID:GrpNum[,GrpNum,...]|all[,....] |
     name:RdfGroupName[,RdfGroupName]]
```

Composite group creation and output

Description
Use the `symcg list` command to obtain information about the composite groups visible to your host system.

Options
- `-inactive`
  In a GNS-enabled environment, returns the list of composite groups from the inactive group definition list. For information on active and inactive group lists in GNS, refer to Active vs. inactive group lists on page 174
- `-novalid`
  Eliminates the validation of groups during the execution of the `list` command. The `Valid` column does not display in the output.

Syntax
Use the following syntax to list the host-visible composite groups:

```
symcg list
```

Examples
The following example shows how to create a non-consistent RDF1 composite group, associate devices with the group:

Create a non-consistent RDF1 composite group named `MyNewCG`.

```
symcg create MyNewCG -type rdf1
```

Add RDF1 devices to the composite group.

```
symcg -cg MyNewCG addall -devs CEE:CFD -sid 79
symcg -cg MyNewCG addall -devs 2:7 -sid 32
```
Associate RBCV devices with the composite group.

```bash
symbcv -cg MyNewCG associateall -devs E92:EA1 -rdf -rdfg 64 -sid 79
symbcv -cg MyNewCG associateall -devs 48:4D -rdf -rdfg 1 -sid 32
```

Associate RRBCV devices with the composite group.

```bash
symbcv -cg MyNewCG associateall -devs 328:337 -rrdf -rdfg 64 -sid 79
symbcv -cg MyNewCG associateall -devs 30:35 -rrdf -rdfg 1 -sid 32
```

Sample output

As a result of the above command, the `symcg list` command returns the following output:

```plaintext
C O M P O S I T E G R O U P S
Number of            Number of
Name  Type   Valid  Symms RAGs  DGs  Devs   BCVs   VDEVs    TGTs
MyNewCG RDF21   Yes       1    2    2     3      0       0       0
```

Use the `symcg show` command to return additional details about a composite group.

### Display composite group information

#### Syntax

Use the following syntax to list the available composite groups:

```bash
symcg [-i Interval] [-c Count][-v]
      list [-offline] [-v]
symcg list
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Valid</th>
<th>Symms</th>
<th>RAGs</th>
<th>DGs</th>
<th>Devs</th>
<th>BCVs</th>
<th>VDEVs</th>
<th>TGTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>cgr21</td>
<td>RDF21</td>
<td>Yes</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>cgreg</td>
<td>REGULAR</td>
<td>Yes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note**

Composite groups with names longer than 21 characters display with their first 21 characters followed by an asterisk (*). Display composite group information on page 167 explains how to set the environmental variable to display full group names.

### Show composite group details

#### Description

Use the `symcg show` action to return additional details about a composite group.

#### Example

To show the details about composite group cgr21, enter:

```bash
symcg show cgr21
```
## Composite Group Name: cgr21

- Composite Group Type: RDF21
- Valid: Yes
- CG in PowerPath: No
- CG in GNS: No
- RDF Consistency Protection Allowed: No
- RDF Consistency Mode: NONE
- Concurrent RDF: YES
- Cascaded RDF: No
- Number of RDF (RA) Groups: 2
- Number of STD Devices: 3
- Number of CRDF STD Devices: 3
- Number of BCV's (Locally-associated): 0
- Number of VDEV's (Locally-associated): 0
- Number of TGT's Locally-associated: 0
- Number of CRDF TGT Devices: 0
- Number of RVDEV's (Remotely-associated VDEV): 0
- Number of RBCV's (Remotely-associated STD-RDF): 0
- Number of BRBCV's (Remotely-associated BCV-RDF): 0
- Number of RTG'T's (Remotely-associated): 0
- Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV): 0
- Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV): 0
- Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT): 0
- Number of Device Groups: 2
- Device Group Names: dg1
dg2

### Number of Symmetrix Units (1):

1) Symmetrix ID: 000194900341
- Microcode Version: 5977
- Number of STD Devices: 3
- Number of CRDF STD Devices: 3
- Number of BCV's (Locally-associated): 0
- Number of VDEV's (Locally-associated): 0
- Number of TGT's Locally-associated: 0
- Number of CRDF TGT Devices: 0
- Number of RVDEV's (Remotely-associated VDEV): 0
- Number of RBCV's (Remotely-associated STD-RDF): 0
- Number of BRBCV's (Remotely-associated BCV-RDF): 0
- Number of RTG'T's (Remotely-associated): 0
- Number of Hop2 BCV's (Remotely-assoc'ed Hop2 BCV): 0
- Number of Hop2 VDEV's (Remotely-assoc'ed Hop2 VDEV): 0
- Number of Hop2 TGT's (Remotely-assoc'ed Hop2 TGT): 0

#### RDF (RA) Groups (2):

1) RDF (RA) Group Number: 11 (DA)
- Remote Symmetrix ID: 00019490237
- Microcode Version: 5977
- Recovery RA Group: N/A (N/A)
- RA Group Name: N/A

#### STD Devices (3):

<table>
<thead>
<tr>
<th>LdevName</th>
<th>PdevName</th>
<th>Sym Device</th>
<th>Flags</th>
<th>Cap</th>
<th>Config</th>
<th>Sts</th>
<th>CSRT (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEV341_30</td>
<td>/dev/sdl</td>
<td>0030 RDF21+R-5 WD X-2</td>
<td>2063</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEV341_31</td>
<td>/dev/sdm</td>
<td>0031 RDF21+R-5 WD X-2</td>
<td>2063</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEV341_E6</td>
<td>N/A</td>
<td>00E6 RDF21+R-5 WD X-2</td>
<td>2063</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) RDF (RA) Group Number: 18 (11)

#### CRDF STD Devices (3):

<table>
<thead>
<tr>
<th>LdevName</th>
<th>PdevName</th>
<th>Sym Device</th>
<th>Flags</th>
<th>Cap</th>
<th>Config</th>
<th>Sts</th>
<th>CSRT (MB)</th>
</tr>
</thead>
</table>

## Dell EMC Solutions Enabler Array Controls and Management 9.0 CLI User Guide
Show composite groups associated with a device group

Example
The following output shows that the \texttt{dgincg} device group is a member of two composite groups, \texttt{cg110} and \texttt{cgregular}. Also, \texttt{dgincg} is a group type of \texttt{ANY}.

To show the composite groups containing the \texttt{dgincg} device group, enter:

```
symdg show dgincg
```

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name</td>
<td>dgincg</td>
</tr>
<tr>
<td>Group Type</td>
<td>ANY</td>
</tr>
<tr>
<td>Device Group in GNS</td>
<td>No</td>
</tr>
<tr>
<td>Valid</td>
<td>Yes</td>
</tr>
<tr>
<td>Symmetrix ID</td>
<td>000194900341</td>
</tr>
<tr>
<td>Group Creation Time</td>
<td>Tue Dec 1 8:6:9 2009</td>
</tr>
<tr>
<td>Vendor ID</td>
<td>EMC Corp</td>
</tr>
<tr>
<td>Application ID</td>
<td>SYMCLI</td>
</tr>
<tr>
<td>Number of STD Devices in Group</td>
<td>2154</td>
</tr>
<tr>
<td>Number of Locally-associated BCV's</td>
<td>128</td>
</tr>
<tr>
<td>Number of Locally-associated VDEV's</td>
<td>0</td>
</tr>
<tr>
<td>Number of Locally-associated TGT's</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-associated BCV's (STD RDF)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-associated BCV's (BCV RDF)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-associated TGT's (TGT RDF)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-associated TGT's (Hop-2 BCV)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-assoc'd RBCV's (BCV RDF)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-assoc'd BCV's (Hop-2 BCV)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-assoc'd BCV's (Hop-2 VDEV)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Remotely-assoc'd TGT's (Hop-2 TGT)</td>
<td>0</td>
</tr>
<tr>
<td>Number of Composite Groups</td>
<td>2</td>
</tr>
<tr>
<td>Composite Group Names</td>
<td>\texttt{cg110}</td>
</tr>
<tr>
<td></td>
<td>\texttt{cgregular}</td>
</tr>
</tbody>
</table>

Perform control operations on composite group devices

Description
Use the \texttt{symcg -cg} command to perform the following operations on devices within a composite group.

Syntax
Refer to the Dell EMC Solutions Enabler CLI Reference Guide for the \texttt{symcg} command syntax and allowable control operations

GNS repository
Group name services (GNS) provides a common repository to store and maintain SYMAPI device group and composite group definitions across storage arrays that are
visible to all locally attached hosts. Any host with GNS enabled can view and use the
device and composite groups that are contained in the repository regardless of what
host actually ran the commands to create them. This provides redundancy in case of a
failure that causes the host that normally runs Solutions Enabler to lose access to the
VMAX array. It also creates standards for device groups and device names that can be
shared across all hosts in the environment.

Starting with Solutions Enabler V8.0.1, groups are no longer stored in a SYMAPI
database file but are stored either in a local database file on the host or in a global
database on the array. Both the local and global group databases are managed by the
GNS daemon. The setting of SYMAPI_USE_GNS defines the group management
operation mode that governs where the groups are stored:

- If SYMAPI_USE_GNS is set to DISABLE, all group information by default will be
  stored to a local file located in the secure directory:

  /var/symapi/gns/storgnsd.db

  The GNS daemon has write privileges. This file is referred to as the "local group
database" or simply "local file" for groups in this document. By default,
SYMAPI_USE_GNS is set to DISABLE so the group information is stored in a local
database file on the host that created the group.

- If SYMAPI_USE_GNS is set to ENABLE, all group information will be stored in a
global database on the array.

  Enabling GNS allows group definitions to be stored on the array in a shared GNS
repository. This shared GNS repository is visible to any GNS-enabled locally-
attached host, enabling these hosts to perform control operations, regardless of
which host initially defined the group. In addition, if one host goes down, you can
still perform SYMCLI control operation from another local host in your array
environment.

Solutions Enabler SYMAPI and SYMCLI do not directly access the shared repository.
Instead, requests are forwarded to the GNS daemon, which processes all GNS
operations. This daemon is the only entity that directly accesses the GNS shared
repository and is responsible for ensuring that each host has access to the most
current GNS definitions.

From each host, a GNS daemon listens for GNS requests from local clients (same
host) and carries them out on the locally attached array. In addition, the GNS daemon
monitors the GNS repositories on all locally-attached arrays, at a user-configured
polling interval, for changes made to the shared GNS repository by other daemons (on
other hosts). When a change is identified, the GNS daemon updates the host to
ensure that all GNS-enabled hosts refer to the same group definitions. A set of
options are available for controlling the GNS daemon. For information on configuring
the GNS daemon, refer to GNS daemon options file on page 179.

Note

If User Authorization is enabled, configuration and management of GNS requires a
minimum role of StorageAdmin.

Automatic upgrade

When upgrading from an earlier version of Solutions Enabler, all active groups are
automatically migrated from the existing SYMAPI database (either default or
alternate) to a GNS-managed database. This migration happens once for a SYMAPI
database.
Shared group definitions with GNS

A *device group* is a user-defined object comprised of devices that belong to a single array and RA groups on that device. In a GNS-enabled environment, device group definitions are stored in the GNS repository of the array on which the devices within the device group reside and are visible to all hosts locally attached to that array.

A *composite group* is also a user-defined object comprised of devices. However, the device members of a composite group can belong to multiple arrays and RA groups. In a GNS-enabled environment, composite group definitions are distributed across all arrays that contain device members of the composite group by the GNS daemon. A host must be locally attached to all arrays containing devices in the composite group to manage or control that composite group. If a host is only attached to a subset of the arrays that a composite group spans, that group will be visible to the host, but in an invalid and unusable state. This is not a recommended configuration.

The GNS state that is visible from a given host is determined by the set of arrays to which the host is connected. As seen in Figure 5 on page 172, Host-1 is GNS-enabled and locally attached to array A, array B, and array C. Host-1 can access and modify the group definitions on all three arrays. The group definitions that are visible to Host-1 include device groups DG1, DG2, DG3, DG4, DG5, and DG6 and composite group CG1's definition, which contains devices on arrays B and C.

Host-2 is GNS-enabled and locally attached to array B and array C. The group definitions that are visible to Host-2 include device groups DG3, DG4, DG5, and DG6 and composite group CG1. Since Host-2 is locally attached to only array B and C, it cannot see any device groups or composite groups on array A (that is, DG1 and DG2).
Figure 5 Host-visible GNS state

GNS updates to group definitions

When GNS is enabled, device group and composite group definitions are stored in the common GNS repository.
For example, in Figure 6 on page 173, Host-1 makes a change to composite group CG1.

1. The Host-1 GNS daemon gets this request to process.
2. The Host-1 GNS daemon updates the GNS-shared repository on all relevant arrays, in this case arrays A, B, and C.
3. The GNS daemon running on Host-2 detects the change while polling its locally-attached GNS repositories (attached arrays A, B, and C) and updates Host-2 with the updates made by Host-1.
4. Host-2's client application will detect the change on its next group call.

GNS and consistency groups

An SRDF consistency group is a composite group comprised of SRDF devices (RDF1, RDF2, or RDF21) acting in unison to preserve dependent write consistency of a database distributed across multiple SRDF systems. It maintains this consistency by using either Multi-Session Consistency (MSC) for SRDF/A or SRDF Enginuity.
Consistency Assist (SRDF-ECA) for SRDF/S. Both use the SRDF daemon to maintain SRDF consistency.

In a GNS-enabled environment, certain changes made to any composite group set for consistency are automatically propagated to the SRDF daemon on all relevant hosts, such as changes to the group type, SRDF group name, recovery RA group number, device membership, device group membership, and device LdevName. When updates are made to the GNS repository, the GNS daemon updates the SRDF daemon.

For more information on setting SRDF consistency to composite groups, refer to Create a composite group from devices in a storage group on page 157.

GNS device groups and SRDF

In an SRDF scenario, a local GNS-backed device group (either RDF1 or RDF2) can be automatically mirrored on the remote array through SRDF links — for activation and use during a disaster failover situation. By default, the GNS device group definitions are stored on the local (directly attached) array — where the local devices are located.

Optionally, any changes made to the local group definition (for example, adding a standard or BCV device) can be set to automatically maintain a mirrored group definition on the remote array. This remotely mirrored group is for disaster recovery situations, where entire applications (including group aware ones), failover and are restarted on the remote side (where the remote devices are).

As changes are made to the local group definition, GNS automatically propagates corresponding changes to the remote array, so that the two are kept synchronized. For more information on configuring this option, refer to Remote mirror device group definitions on page 181.

GNS behavior in client/server mode

In client/server mode, the SYMAPI_USE_GNS setting in the SYMAPI options file on the SYMAPI server must be enabled to use GNS.

Active vs. inactive group lists

When GNS is enabled, group definitions are stored in the global GNS repository in addition to individual group database files. To facilitate the importing of groups into GNS, limited access to the group definitions held within a group database is provided while GNS is enabled.

GNS setup

Description
Use the SYMAPI_USE_GNS option in the SYMAPI options file to enable or disable GNS on each host.

Options

SYMAPI_USE_GNS

   Enables or disables GNS on each host. Possible values are ENABLE or DISABLE (the default setting).

   • If SYMAPI_USE_GNS is set to ENABLE, all group information is stored in a global database on each array with which specific groups are associated.
• When `SYMAPI_USE_GNS` is set to `DISABLE`, the GNS daemon stores groups in a local database file can be designated by the `SYMCLI_DB_FILE` environment variable. If the file is not specified, the default is used.

**SYMCLI_DB_FILE**

Determines the database to store groups. The GNS daemon may store groups either in the global group database or in a local group database depending on whether `SYMCLI_DB_FILE` is pointing to a private database. If `SYMCLI_DB_FILE` is not set, then the global group database will be used to store groups. Otherwise, the local group database designated by `SYMCLI_DB_FILE` will be used to store groups.

**Note**

It is assumed that applications running with a private configuration database file intend to keep their modifications private, and therefore, store the groups in a private group database file.

If `SYMAPI_USE_GNS` is not set and if `SYMCLI_DB_FILE` is not pointing to a private database, the GNS daemon uses `/var/symapi/gns/storgnsd.db` to store groups.

When you specify an alternate database, the name of the alternate group database file is derived from the value of alternate database name and the group database file is placed under the `/var/symapi/gns` directory. For example, if the alternate SYMAPI database name is `/usr/application/my_symapi_db.bin`, the alternate group database file is `/var/symapi/gns/my_symapi_db.bin_<integer>.db`. The `integer` is a number derived from the original path name.

**Examples**

To enable GNS, enter:

```
SYMAPI_USE_GNS=ENABLE
```

**GNS in a multihost environment**

When configuring GNS in a multihost environment, it is recommended that you first review the groups currently stored on all hosts that share access to a set of arrays. Resolve any potential conflicts with other hosts. Also, if using composite groups, ensure that all hosts on which you intend to enable GNS are local to the same set of arrays to avoid composite groups appearing invalid to hosts that are not attached to all referenced arrays.

When ready, enable GNS on a single array being sure to configure any options or user authentication that you desire. For details on managing GNS through the options file, refer to the Dell EMC Solutions Enabler CLI Reference Guide. In addition to enabling GNS on the host, you can configure GNS User Authentication (set up a specific set of users with access to the GNS daemon) and GNS Daemon Control (start and stop the daemon, and configure GNS daemon options).

Once GNS is enabled on a host, activate those groups that you wish to expose using GNS. Enable GNS on a second host. Validate that the new host can see the previously activated groups and resolve any conflicts with other hosts before activating additional groups.
Note
With Solutions Enabler V7.4 and higher, device and composite groups of type REGULAR are allowed to contain remote SRDF devices. However, on systems running GNS, any peer hosts running older versions of Solutions Enabler see these groups as invalid.

GNS user authentication

GNS is intended to share group definitions across multiple users and hosts in an environment via the host-installed GNS daemons. As such, access to GNS functionality is controlled by limiting permission to the GNS daemon. This access is controlled through the common daemon authorization file, daemon_users. This file is located in the following directories:

<table>
<thead>
<tr>
<th>UNIX</th>
<th>Windows</th>
</tr>
</thead>
<tbody>
<tr>
<td>/var/symapi/config/daemon_users</td>
<td>c:\Program Files\EMC\SYMAPI\config\daemon_users</td>
</tr>
</tbody>
</table>

Note that non-root Solutions Enabler users need to modify c:\Program Files\EMC\SYMAPI\config\daemon_users or /var/symapi/config/daemon_users to authorize the use of the GNS daemon.

Note
It is important to protect this file so that only privileged administrators can modify it.

Users meeting any of the following criteria will be permitted to control and use the GNS daemon:

- User with privileges; UNIX users with root access and Windows users that are a members of the Administrators group
- Users listed in the daemon_users file located on each host from which they require access

Start the GNS daemon

There are three ways to start the GNS daemon:

- The daemon will be started automatically by the Solutions Enabler libraries the first time they attempt to connect with it, which can cause a slight delay in performance on that initial connection while the daemon starts and builds its cache.
Prior to starting storgnsd, ensure that your default group database is current, since storgnsd uses the information stored in it to establish contact with your arrays.

- Start the daemon manually using the stordaemon command line utility as follows:

  ```
stordaemon start storgnsd
  ```

- Set the daemon to start automatically every time the local host is booted using the following command line:

  ```
stordaemon install storgnsd -autostart
  ```

Restarting the daemon, either manually or using the automatic option, is useful because the daemon may take a while to initially construct its cache — depending on the number of groups and arrays it has to load.

### Restart the GNS daemon

If the GNS daemon is stopped for some reason, it can optionally be restarted automatically by an internal Solutions Enabler watchdog mechanism. A combination of the watchdog mechanism and the -autostart can be used to ensure that the daemon is always running, which is important with SRDF consistency composite groups to ensure that the MSC SRDF daemon is updated whenever group changes are made.

The watchdog mechanism is enabled by default. The watchdog daemon will restart the GNS daemon if it crashes or is killed. This behavior can be disabled through the storgns:autorestart entry in the daemon_options file (for more information, refer to GNS daemon options file on page 179).

The restart functionality is provided as follows:

<table>
<thead>
<tr>
<th>Unix</th>
<th>By a dedicated watchdog daemon (storwatchd) which is started automatically as needed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>By the Service Control Manager.</td>
</tr>
</tbody>
</table>

A maximum of three restarts within a 15-minute period will be attempted. Following a third restart (again, within a given 15-minute period), no subsequent restart will be attempted.

### Manage the GNS daemon

You can control the GNS daemon with the stordaemon command. The control options include:

- Stopping the daemon.
- Querying the daemon's status.
- Querying the daemon's log files.

Use the stortaemon -h command to display the command syntax.
Access groups in offline mode

Description
When accessing a non-default alternate group database file (for example, from a different host), there are two ways to specify the file.

- Specify a SYMCLI_GROUP_DB environmental variable to indicate the path of the group database file.
- Specify a -grpfile command line option for symcg and symdg commands.

Both methods must specify a full path name of the alternate group database file. In addition, both methods are restricted to only symcg and symdg list, show, export, and exportall operations.

If the specified file cannot be accessed, no error will be returned. Instead, all access attempts will return a "no groups found" error message.

Syntax
The symcg list, show, export and exportall command syntax is as follows:

```
symcg [-i <Interval>] [-c <Count>] [-v]

... export <CgName> [-file <FileName>] [-rdf]
[-grpfile <GroupsDbFileName>]
exportall [-file <FileName>] [-rdf]
[-grpfile <GroupsDbFileName>]
... list [-offline] [-v]
[-apidb | -rdf_consistency]
[-grpfile <GroupsDbFileName>]
... show <CgName> [-inactive] [-offline | -lock]
[-grpfile <GroupsDbFileName>]
... 
```

The symdg list, show, export and exportall command syntax is as follows:

```
symdg [-i <Interval>] [-c <Count>] [-v]

... export <DgName> [-delete] [-file <FileName>] 
[[[-rdf [-rdfg <GrpNum>]] | [-sid <SymmID>]]
[-grpfile <GroupsDbFileName>]
exportall [-delete] [-file <FileName>] 
[[[-rdf [-rdfg <GrpNum>]] | [-sid <SymmID>]]
[-grpfile <GroupsDbFileName>]
... list [-sid <SymmId>] [-offline] [-v]
[-grpfile <GroupsDbFileName>]
... show <DgName> [-inactive] [-offline | -lock]
[-grpfile <GroupsDbFileName>]
... 
```

View and release GNS daemon external locks

Description
The GNS daemon uses two external locks to maintain exclusive access to the GNS repository on each array: F0 and F1.
Syntax
Use the following command to view available GNS locks:

```
symcfg -sid nnnn -lockn GNS list
```

Use the following command to manually release a GNS lock:

```
symcfg -sid nnnn -lockn GNS release
```

GNS daemon log file

**Description**
The GNS daemon writes its log (trace) messages to the standard location used by all
daemons. The locations are:

**UNIX:**
/var/symapi/log/storgnsd.log0
/var/symapi/log/storgnsd.log1

**Windows**
c:\Program Files\EMC\SYMAPI\log\storgnsd.log0
c:\Program Files\EMC\SYMAPI\log\storgnsd.log1

These two files are written in an alternating manner. When the active one becomes
full, it is closed and the other one is truncated and made active.

**Syntax**
Use the following syntax to display the contents of the log file:

```
stordaemon showlog storgnsd -lines 200
```

GNS daemon options file

**Description**
Configuration options for the GNS daemon are contained within the daemon options
file (storgnsd) located in the following directories:

**Table 11 Locations of GNS configuration options**

<table>
<thead>
<tr>
<th>UNIX</th>
<th>/var/symapi/config/daemon_options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>c:\Program Files\EMC\SYMAPI\config\daemon_options</td>
</tr>
</tbody>
</table>
Syntax
Use the following syntax to specify options in the file:

```
storgnsd:OptName = OptValue
```

Options

OptName
The name of the option

OptValue
The new value

Modify option file values manually

The daemon options file contains a set of parameters that can be modified to affect GNS behavior when using SYMCLI or SYMAPI commands. The file contains editable behavior parameters set to certain optional defaults in the line entries. Commented lines beginning with a pound sign (#) are ignored.

To remove any parameter option, remove the line entry, rename the file, or comment the line by adding a pound sign (#) at the beginning of the line entry.

Modify option file values via the CLI

Description
Option file values can be set using the `stordaemon setoption` CLI utility, which programmatically makes changes to the `daemon_options` file.

By default, only options already present in the file (such as those in use or commented out) can be set. The `-force` option can be supplied to force a change, even if it requires adding a new option line to the file.

Syntax
The following is the command-line syntax for the `stordaemon setoption` option:

```
stordaemon setoption DaemonName -name OptName=OptValue [-force]
```

Note
For information on the possible GNS daemon options file parameters, refer to the Dell EMC Solutions Enabler CLI Reference Guide

Options

OptName
The name of the option

OptValue
The new value
Examples
The following example shows how this utility can be used to set or change an option setting:

```
stordaemon setoption storgnsd -name autorestart=enable
```

The following example shows how this utility can be used to remove an option setting:

```
stordaemon setoption storgnsd -name autorestart=
```

Note
In the above example, an empty value has been passed.

Modify option file values during runtime

Description
You can also set the daemon option value using the `stordaemon setvar` utility, which modifies the value during runtime. The command changes the option value during runtime and will not modify the daemon options file. Upon daemon restart, the daemon option will lose the value which was set using the `setvar` command.

Syntax
The following is the syntax for the `stordaemon setvar` option:

```
Stordaemon setvar Daemonname -name Var=Value
```

Options

Var
The name of the option

Value
The new value

Example
For example:

```
stordaemon setvar storgnsd -name autorestart=enable
```

Remote mirror device group definitions

The option `gns_remote_mirror` in the GNS daemon's options file determines whether GNS should attempt to remotely mirror a device group or a composite group SRDF definition contained in the shared GNS repository for a given array.

You can enable or disable the GNS remote mirror service at runtime without restarting GNS daemon. Note that the GNS daemon does not automatically pick up the change in the daemon_options file. Execute the `stordaemon reload` command to make the new option setting effective.

When enabled, GNS maintains a remote mirrored group definition with the same name as the local one creating a usable group to hosts (including GNS daemons) directly.
connected to the remote arrays. The remote mirrored group has the same name as the local one, and has a mirror image of its contents; in other words, the data reflects the perspective of the local array. This done to ensure that the mirrored group is a legal, usable group to hosts directly connected to the remote arrays.

As a result of remotely mirroring group definitions, the following changes are made to the remote group’s definition:

- The remote group definition maintains the same name and type as the local group.
- The group subtype is reversed: an RDF1 local group becomes an RDF2 remote one; an RDF2 local group becomes an RDF1 remote one.
- Attributes that are unrelated to particular devices or storage arrays are copied to the remote copy without change. For example, modification time, vendor, and group name.
- The remote RA group number (RRAGRP) attribute is changed on the remote side to contain the corresponding local SRDF group number.
- A number of attributes come in pairs: local and remote. On the remote side, these are swapped. The local and remote standard (DEVS and RDEVS), the local and remote BCV device lists (BCVs and RBCVs), and remote BCVs of the remote BCV device lists (BRBCVs and RRBCVs) are swapped.
- The device logical device name list is left unchanged. The device and remote device lists are swapped as noted above, but the logical device name list is not. The same names apply to the local device in both the original and mirrored copy.

Mirroring restrictions

Any group containing one or more of the following configurations cannot be mirrored:

- Groups containing any concurrent devices
- Groups containing any cascaded devices
- Any composite group containing a device group
- Any group containing an SRDF STD device paired with a remote BCV
- Groups containing any hop-2 devices (including 2TGT, 2BCV, 2VDEV devices)
- Device and composite groups of type=ANY
- Groups containing non-standard SRDF devices

Modify mirrored group control

An SRDF group that has been created by the GNS remote mirror service is flagged internally by GNS as being a mirror.

By default, these mirrored groups are read-only and cannot be modified or renamed—although GNS will continue to update them as the local groups upon which they are based are changed. To change this behavior, set the SYMAPI_GNS_MIRRORED_GROUP_CONTROL option in the SYMAPI options file to ENABLE (the default value is DISABLE).

If a mirrored group is directly modified (from a host connected to the remote array on which it is defined), the connection between it and the local group, on which it was based, is broken. At that point, it is no longer a mirror and changes to its base group (the local group) are no longer propagated to it. If a mirrored group is renamed or deleted, GNS will subsequently recreate the mirrored group from its base group.

BCV and remote BCV device alias name swap

In the remote mirror name transformation, the following changes are made:
The BCV alias list becomes the RBCV alias list in the remote mirror. Alias names that have a value of BCVnnn are automatically changed to RBCVnnn.

The RBCV alias list becomes the BCV alias list in the remote mirror. The alias names that have a default value of RBCVnnn are automatically changed to BCVnnn.

The RRBCV logical list becomes the BRBCV list in the remote mirror. Logical names that have a default value of RRBCVnnn are automatically changed to BRBCVnnn.

The BRBCV logical list becomes the RRBCV list in the remote mirror. Logical names that have a default value of BRBCVnnn are automatically changed to RRBCVnnn.

These names are the default names (logical device names) supplied by SYMCLI if you do not provide one. If you override the defaults and supply your own names that look like the above, they will still be transformed as described.

In the unlikely scenario that you have explicitly supplied aliases, for example, BCVnnn and RBCVnnn, it is possible that the above transformation may result in duplicate alias names in the remote mirror. For example, if the original BCV alias list contained BCV001, RBCV001, the remote mirror's RBCV alias list would contain RBCV001, RBCV001, which would cause a name conflict.

The following example illustrates the mirrored group data:

--- Local DG Group, on Symm1 ---
| Type | RDF1 |
| Role | Have a Remote Mirror |
| Remote Symm | Sym2 |
| Local RDFGrp | 2 |
| Remote RDFGrp | 5 |
| Devices | 0001,0002,0003 |
| Remote-Devs | 0091,0092,0093 |
| LDevNames | DEV001,DEV002,DEV003 |
| BCVs | 0010,0011 |
| Remote-BCVs | 0020,0021,0022 |
| BCV LdevName | BCV001,BCV002 |
| RBCV LdevName | RBCV001,RBCV002,RBCV003 |
| Vendor | EMC |
| ModTime | 12345 |
| GateKeepers | /dev/rdsk/c2t0d2 |

--- Remote DG Group, on Symm2 ---
| Type | RDF2 |
| Role | Am a Remote Mirror |
| Remote Symm | Sym1 |
| Local raGrp | 5 |
| Remote raGrp | 2 |
| Devices | 0091,0092,0093 |
| Remote-Devs | 0001,0002,0003 |
| Dev Aliases | DEV001,DEV002,DEV003 |
| BCVs | 0020,0021,0022 |
| Remote-BCVs | 0010,0011 |
| BCV Aliases | BCV001,BCV002,BCV003 |
| RBCV Aliases | RBCV001,RBCV002 |
Identify GNS groups

After configuring your array environment to support the GNS option, you can begin to create and modify groups. Use `symdg show DgName`, for device groups, or `symcg show CgName`, for composite groups, to determine if a group is stored in the GNS group list.

Identify device group definition

Description
For a device group, the output of the `symdg show DgName` command identifies whether a group definition is stored in GNS.

Example

```
symdg show MyRegDeviceGroup
```

Sample output
This sample output shows that group `MyRegDeviceGroup` is stored in the GNS list since the output parameter `Device Group in GNS` has a value of `Yes`. It also shows the device group's GNS mirror state.

```
Group Name: MyRegDeviceGroup

  Group Type : REGULAR
  Device Group in GNS : Yes (Is Mirror)
  Valid : Yes
  Symmetrix ID : 000184500160
  Group Creation Time : Tue Aug 4
                      : 16:44:18 2006
  Vendor ID : EMC Corp
  Application ID : SYMCLI

  Number of STD Devices in Group : 20
  Number of Locally-associated BCVs : 20
  Number of Locally-associated VDEVs : 0
  ...
```

Identify composite group definition

Description
For a composite group, the output of the `symcg show CgName` command identifies whether a group definition is stored in GNS.

Example
The sample output below shows that group `MyCompGroup` is stored in the GNS list since the output parameter `CG in GNS` has a value of `Yes`. It also shows the composite group's GNS mirror state. The group definition has been enabled for SRDF consistency using MSC.

```
% symcg show MyCompGroup
```

Grouping Devices
GNS backup and restore mechanism

You can set the GNS daemon to automatically make a backup copy of local or global groups in a backup file. For global groups, use the backup copy to restore the global database on arrays. For local groups, use the backup copy to restore the groups when the primary group database file is corrupted. This backup file is $N$ hours behind the in-memory database where $N$ is a configurable backup interval with a default value of 6 hours.

Use the following daemon options to control the backup process:

**To enable/disable backups**
Set GNS_DB_BACKUP to either DISABLE or ENABLE where DISABLE is the default. When you set this option to ENABLE, the GNS daemon automatically backs up both the default local database and the global database into a backup file.

**To set the backup interval time**
Set the GNS_DB_BACKUP_INTERVAL to an integer value in hours. This option is only meaningful if GNS_DB_BACKUP option is set to ENABLE. The default backup interval is 6 hours. The valid range for the interval is (1..720).

All GNS database backup files are stored in the /var/symapi/gns directory. For both local and global GNS databases, up to two copies of backup files are maintained:

- For the GNS local database, the backup file names are local_group_db.backup and local_group_db.backup.bak, respectively.
- For the GNS global database, the backup file names are global_group_db.backup and global_group_db.backup.bak respectively.

**Manual backup to the GNS database**

**Description**
To manually backup to the GNS database, use the stordaemon program.

**Syntax**
Use the following syntax for local backup:

```
stordaemon action storgnsd -cmd backup_db local
```
Use the following syntax for global backup:

```
stordaemon action storgnsd -cmd backup_db global
```

**Manual restore from the GNS database**

**Description**
To manually restore from the GNS database, use the `stordaemon` program.

**Syntax**
Use the following syntax for a local restore:

```
stordaemon action storgnsd -cmd restore_db local
```

Use the following syntax for a global restore:

```
stordaemon action storgnsd -cmd restore_db global
changed_records:sid
stordaemon action storgnsd -cmd restore_db global all_records:sid
```

The `changed_records` option only updates those records that differ from group records in the backup file. The `all_records` option rebuilds the entire database using the backup file as source data.

**Troubleshoot GNS**

When using GNS, be aware of the possibility of group name collision and invalid groups and what SYMAPI does to rectify each scenario.

**Group name collisions**

Each GNS daemon attempts to ensure that group names are unique (relative to a group type). However, duplicate-named groups may occur.

If users at two different hosts simultaneously create groups of the same type with the same name using devices on different arrays, both attempts might succeed. Because each host's GNS daemon is polling for changes made elsewhere, the daemons might not detect the name conflict until after the fact. A subsequent consideration change could then allow the GNS daemon to see both groups.

**Note**

For information on renaming composite groups, see Rename a composite group on page 165.

**Example**

If a GNS daemon detects duplicate group names, it returns a state flag informing clients of this fact and modifies the group names to be unique by attaching a numeric suffix. Duplicate device groups with the name `MyDG` could be modified in the following way:

```
MyDG#12345678
MyDG#87654321
```
While in this state (duplicate names), the only operations permitted are those used to resolve the name conflict: group rename and delete (with the `-force` flag). For example:

```
symdg delete MyDG#12345678 -force
symdg rename MyDG#87654321 MyDG
```

Invalid groups

A composite group is marked as invalid if one or more of the arrays that it resides on (in a GNS-enabled environment) cannot be reached. For example, each array that a consistency group spans records the identity of the other arrays that the group spans. If a discrepancy is noticed where a composite group is not defined on an array, even though some other array indicates it should be there, that group is assumed to be invalid.

Groups are also placed into an invalid state if certain internal bookkeeping information maintained by GNS is found to be missing or incorrect. For example, a consistency group spans two arrays and the GNS state recorded on each array verifies that the group also resides on the other array. If at some point one array is found to not contain the group (while the other array still thinks it should be found there), the group is assumed to be invalid.

This could happen if one of the arrays is reinitialized or a host attached only to one array decides to delete the composite group there. Since the group definition is also stored on an unreachable array, that group state is seen as invalid from that host. A user there would have to use the `-force` flag to delete the group. Groups marked as invalid can be deleted with the `-force` flag.

List GNS data about groups

The GNS `stordaemon list` command supports the following features:

- `stordaemon action storgnsd -cmd list_groups`
  Lists groups based on GNS daemon mode. If the GNS daemon is running with `USE_GNS` enabled, it will list all global groups. Otherwise, it will list all local groups in `storgnsd.db`.

- `stordaemon action storgnsd -cmd list_groups global`
  Lists all global groups.

- `stordaemon action storgnsd -cmd list_groups local`
  Lists all local groups.

- `stordaemon action storgnsd -cmd list_groups local:SYMCLI_DB_FILE`
  Lists groups in a private GNS database determined by the environment variable `SYMCLI_DB_FILE`.

Show GNS data about groups

The GNS `stordaemon show` command supports the following features:

- `stordaemon action storgnsd -cmd show_group cg: name`
  Shows composite groups based on GNS daemon mode. If the GNS daemon is running with `USE_GNS` enabled, it will list all global groups. Otherwise, it will list all local groups in `storgnsd.db`.

- `stordaemon action storgnsd -cmd show_group dg: name`
Shows device groups based on GNS daemon mode. If the GNS daemon is running with USE_GNS enabled, it will list all global groups. Otherwise, it will list all local groups in storgnsd.db.

- **stord daemon action** storgnsd -cmd show_group cg: name:local
  Shows all local composite groups.

- **stord daemon action** storgnsd -cmd show_group dg: name:local
  Shows all local device groups.

- **stord daemon action** storgnsd -cmd show_group cg: name:global
  Shows all global composite groups.

- **stord daemon action** storgnsd -cmd show_group dg: name:global
  Shows all global device groups.

- **stord daemon action** storgnsd -cmd show_group cg:
  name:local:SYMCLI_DB_FILE
  Shows composite groups in a private GNS database determined by the environment variable SYMCLI_DB_FILE.

- **stord daemon action** storgnsd -cmd show_group dg:
  name:local:SYMCLI_DB_FILE
  Shows device groups in a private GNS database determined by the environment variable SYMCLI_DB_FILE.
This chapter describes how to enable or disable compression on a storage group, and how to monitor the compression ratio on a storage group or at the SRP level.

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- Inline compression control operations ............................................. 190
- Inline compression display and reporting ........................................ 193
Inline compression overview

For VMAX All Flash arrays running HYPERMAX OS 5977 Q3 2016 or higher, user data can be compressed. Solutions Enabler enables and disables compression on a storage group, and, when enabled, monitors the current Data Reduction Ratio (DRR) on the storage group or at the SRP level. Compression is supported on open systems (FBA) only, including eNAS.

Note

All Flash arrays require compression hardware and proper sizing to accommodate upgrading to and enabling compression. The compression attribute is enabled by default for all FAST managed storage groups, with all FBA devices, if the SRP for the storage group supports compression.

Some key features of compression are:

- When enabling compression on a storage group, all incoming writes are considered for compression.
- When disabling compression on a storage group, all incoming writes stop the compression of new data.
- If an All Flash array is upgraded to HYPERMAX OS 5977 Q3 2016 software, existing storage groups can be enabled for compression and incoming data writes are considered for compression.

Note

Upgraded All Flash arrays require a conversion script (run by customer service personnel) to enable compression.

- All data services are supported (such as, SnapVX, SRDF, D@RE).

Compression is not supported on VMAX3 hybrid arrays (100K, 200K, 400K) or External Flash arrays (no FAST.X support).

Inline compression control operations

On VMAX All Flash arrays with compression feature support, compression is enabled by default.

The symsg CLI command controls the following compression operations:

- Removes compression when creating a storage group using the symsg create -nocompression command.
- Sets or removes compression on an existing storage group using the symsg set command.
- Exports the compression attribute (P <compression enabled>) on the storage group to a text file on the host when using the symsg export/exportall commands.
- Imports the compression attribute on FAST managed storage groups when using the symsg import/importall commands.

When importing a storage group and the target is a VMAX Array running HYPERMAX OS 5977 Q3 2016SR and higher:
- If the imported storage group already exists on the array, the command fails with the error message "Cannot use the specified name because it's already in use".
- If the SRP does not exist on the target array, the storage group is imported and set to use the Optimized service level with no Workload. The compression attribute is cleared if the SRP is not enabled for compression.
- If the service level set on the storage group does not exist on the target array or cannot be supported based on the SRP that is currently used, the storage group is imported and set to use the Optimized service level with no Workload. The compression attribute is cleared if the SRP is not enabled for compression.
- If the both the service level and the SRP set on the storage group do not exist on the target array, the storage group is restored with no service level or SRP and is not FAST managed. The compression attribute is cleared.

If the target is a VMAX array running HYPERMAX OS lower than 5977 Q3 2016SR, the service level, Workload, SRP names, and compression attribute are copied, but the compression attribute is cleared.

### Set or remove compression at storage group level

**Description**
When creating a storage group (`symsg create`), the compression attribute is enabled by default on FAST managed storage groups if the associated SRP supports compression. For storage group to be FAST managed either the -sl or -srp option must be specified, otherwise compression is disabled.

For existing storage groups, the compression attribute can be enabled or disabled with the `symsg set` command using the `-compression` or `-nocompression` options. An error is returned with the `-compression` option if the associated SRP does not support compression.

**Note**
Setting or removing compression on storage groups requires the following permissions:

- Access Type – Base
- Authorization Rights – Storage Admin

**Syntax - symsg create**
To override the default compression setting when creating a storage group, use the following syntax:

```plaintext
symsg -sid <SymmID> [-i <Interval>] [-c <Count>] [-v]
create <SgName>
    [-bw_max <MBperSec>]
    [-iops_max <IOperSec>]
    [-dynamic <NEVER | ALWAYS | ONFAILURE>]
    [-sl <SLName> [-wl <WorkloadName>]]
    [-srp <SRPName>] [-nocompression]
```

The `-nocompression` option can be abbreviated as `-noc`.

Refer to [Create storage groups](#) on page 120 for complete command syntax and options.
Syntax - symsg set
To set or remove compression on an existing storage group use the following syntax:

Note
When setting the compression option the storage group must be FAST managed or the command will fail.

```
symsg -sg <SgName> -sid <SymmID> [ -i <Interval>] [ -c <Count>]  
   set <[-bw_max <MBperSec> | NOLIMIT]  
        [-iops_max <IOperSec> | NOLIMIT]  
        [-dynamic <NEVER | ALWAYS | ONFAILURE>] >  
        [-sl <SLName>] [-wl <WorkloadName>] [-nosl]  
        [-srp <SRPName>] | -nosrp]  
        [-compression | -nocompression] 
```

Note
The -compression option can be abbreviated as -com and -nocompression as -noc.

Refer to Modify storage group properties on page 126 for complete command syntax and options.

Examples
To set compression on storage group Test_SG_1, enter:
```
symsg set -sg Test_SG_1 -sid 146 -com
```
To set remove compression on storage group Test_SG_1, enter:
```
symsg set -sg Test_SG_1 -sid 146 -noc
```

Remove compression at storage container resource level

Description
The default compression attribute can be removed using the -nocompression option.

Note
The compression attribute is cleared if the associated SRP does not support compression.

Syntax
To remove compression for a resource when adding it a storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc -sc_name <StorageContainer> [-noprompt]  
   add -sresource <StorageResourceName>  
   <-sl <SLName> [-wl <WorkloadName>] [-nosl]  
   [-nocompression] >
```
The `-nocompression` option can be abbreviated as `-noc`.

Refer to Add storage resource to storage container for VVols on page 309 for complete command syntax and options.

**Inline compression display and reporting**

**Compression display**
The following commands display the compression attribute on the storage group and storage container resource:

- `symmsg list` – Refer to List storage groups on page 140 for output display.
- `symcfg list -sc` – Refer to List storage containers for VVols on page 314 for output display.
- `symcfg show -sc` – Refer to Show storage container for VVols on page 312 for output display.
- `symmsg show` – Refer to View storage group details on page 143 for output display.

**Compression reporting**

- `symcfg list -tdev` and `symcfg list -tdev -detail` – report the compression ratio (Comp Ratio) of thin devices. The reported device compression ratio is the ratio of Logical Allocated Capacity to the Physical Allocated Capacity. Logical Allocated Capacity is the total allocated capacity calculated using the device logical track size, and the Physical Allocated Capacity is the total allocated capacity calculated using the compressed pool track size. Refer to View thin devices on page 96 or View thin device details on page 97 for output display.

- `symmsg show` – reports the compression attribute (Compression Enabled) and the compression ratio (Compression Ratio) for storage groups. The reported compression ratio is the ratio of Logical Allocated Capacity of all the devices in the storage group to the Physical Allocated Capacity of all devices in the storage group. Logical Allocated Capacity is the total allocated capacity calculated using the device logical track size, and the Physical Allocated Capacity is the total allocated capacity calculated using the compressed pool track size. Refer to View storage group details on page 143 for output display.

- `symcfg list -pool` – reports the compression ratio (Comp Ratio) for each of the thin pools in the array and the total compression ratio for the entire array. The ratio on Total line represents ratio for whole system based on current pools utilization. The calculation is done based on used tracks in each pool. Since DSE tracks are never compressed they are not part of ratio calculation. The Compression Ratio in this case is ratio between sum of Logical Used Pool Capacity and sum of Physical Used Pool Capacity. The Logical Used Pool Capacity is number of used tracks in the pool not counting DSE tracks multiplied by logical track size of 128K. The Physical Used Pool Capacity is number of used tracks not counting DSE tracks multiplied by pool track size. Refer to View all thin device pools on page 94 for output display.

- `symcfg show -thin -pool -detail` – reports the compression state (Compression State) and the compression ratio (Compression Ratio) for
a specified pool. For HYPERMAX OS 5977 and above, the pool ratio is constant for a given pool and calculated as the ratio of the device logical track size track to track size of this pool. Refer to View thin device pool details on page 95 for output display.

- `symcfg list -srp` and `symcfg show -srp` – report the compression state (Compression State) and the Data Reduction ratio (Data Reduction Ratio) for SRPs in the array. The reported DRR ratio is the ratio of Logical Allocated Capacity of all devices in SRP and the Physical Allocated Capacity for all devices in SRP. Logical Allocated Capacity is the total allocated capacity calculated based on the device logical track size and the Physical Allocated Capacity is the total allocated capacity calculated based on the compressed pool track size. Refer to List Storage Resource Pools details on page 208 for output display.

- Efficiency reports– report the overall system efficiency, and the compression efficiency of the thin devices in the SRP. Refer to Report system efficiency on page 196 and Report SRP inline compression efficiency on page 197 for syntax, example code and output display.

- `symcfg show -compression_conversion_status` – reports compression conversion start time, status, and percent complete. Refer to Report array compression conversion status on page 198 for syntax, example code and output display.

### Report data compressibility

**Description**
The `symcfg list -sg_compression` reports the maximum data compressibility on a storage group for compression capable arrays. The reported compressibility is an estimate calculated over the previous 24 hours. The report of storage groups is sorted by the storage group name by default. There is an option to report the compressibility of storage groups in descending order. By default, storage groups already enabled for compression are not reported, but there is an option to list both compression capable storage groups and compression enabled storage groups.

**Options**

- `-by_compressibility`
  Sorts the report by compressibility in descending order. The `-by_com` abbreviated is allowed.

- `-all`
  Reports both compression capable storage groups and compression enabled storage groups.

- `-srp`
  Filters report for storage groups associated only with specified the Storage Resource Pool (SRP). For devices associated with the SRP but not in any storage group these devices are reported as `not_in_sg`.

**Examples**
To list the compressibility for the storage groups on array 188, enter:

```
symcfg list -sid 188 -sg_compression
```
### Sample output

#### STORAGE GROUPS

Symmetrix ID: 000197800188

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
<th>Allocated (GB)</th>
<th>Used (GB)</th>
<th>Estimated Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>106</td>
<td>350.0</td>
<td>350.0</td>
<td>1.2:1</td>
</tr>
<tr>
<td>&lt;not_in_sg&gt;</td>
<td>54</td>
<td>140.5</td>
<td>140.5</td>
<td>3.4:1</td>
</tr>
</tbody>
</table>

Name: SRP_2

<table>
<thead>
<tr>
<th>Storage Group Name</th>
<th>Number</th>
<th>Allocated (GB)</th>
<th>Used (GB)</th>
<th>Estimated Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payroll</td>
<td>200</td>
<td>756.3</td>
<td>756.3</td>
<td>2.2:1</td>
</tr>
<tr>
<td>&lt;not_in_sg&gt;</td>
<td>54</td>
<td>140.5</td>
<td>140.5</td>
<td>3.4:1</td>
</tr>
</tbody>
</table>

Legend:
- (C)ompression

Output with -all option:

#### STORAGE GROUPS

Symmetrix ID: 000197800188

<table>
<thead>
<tr>
<th>Name</th>
<th>Number</th>
<th>Allocated (GB)</th>
<th>Used (GB)</th>
<th>Estimated Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>AcctPay</td>
<td>X</td>
<td>6</td>
<td>40.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Customer</td>
<td>.</td>
<td>106</td>
<td>350.0</td>
<td>350.0</td>
</tr>
<tr>
<td>&lt;not_in_sg&gt;</td>
<td>.</td>
<td>54</td>
<td>140.5</td>
<td>140.5</td>
</tr>
</tbody>
</table>

Name: SRP_2

<table>
<thead>
<tr>
<th>Storage Group Name</th>
<th>Number</th>
<th>Allocated (GB)</th>
<th>Used (GB)</th>
<th>Estimated Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payroll</td>
<td>.</td>
<td>200</td>
<td>756.3</td>
<td>756.3</td>
</tr>
<tr>
<td>&lt;not_in_sg&gt;</td>
<td>.</td>
<td>54</td>
<td>140.5</td>
<td>140.5</td>
</tr>
</tbody>
</table>

Legend: Flags:
- (C)ompression

### Efficiency reporting

The following efficiency ratio and percent saved reporting for the SRP and the overall system is available:

- Virtual Provisioning efficiency
- Snapshot efficiency
- Compression efficiency
- Overall efficiency

Efficiency ratios are reported in units of 1/10th:1.
External storage is not included in the efficiency reports. For mixed SRPs with both internal and external storage only the internal storage is used in the efficiency ratio calculations.

**Reported values**
For both the overall system efficiency and SRP efficiency reporting the following values are reported:

**Virtual Provisioning Efficiency**:
- **Saved (%)** – Percentage savings of the TDEV configured storage presented to the hosts and the TDEV allocated storage.
- **Shared Ratio** – Ratio of the TDEV allocated storage and the TDEV Logical Backend Storage.
- **VP Overall Efficiency Ratio** – Ratio of the TDEV configured storage and the TDEV Logical Backend Storage.

**Snapshot Efficiency**
- **Saved (%)** – Percentage savings of the sum of all TDEV snapshot sizes (at the time of snapshot creation) and the TDEV Snapshot Allocated Space.
- **Shared Ratio** – Ratio of the Snapshot Allocated Storage and the RDP Logical Backend Storage.
- **Snapshot Overall Efficiency Ratio** – Ratio of the sum of all Snapshot sizes and the RDP Logical Backend Storage.

**Compression Efficiency**
- **Compression VP Ratio (%)** – Ratio of the TDEV Logical Backend Storage and the TDEV Physical Used Storage.
- **Compression Snapshot Ratio** – Ratio of the RDP Logical Backend Storage and the RDP Physical Used Storage of the RDP space.
- **Compression Overall Ratio** – Ratio of the sum of all TDEVs + RDP Logical Backend Storage and the TDEVs + RDP Physical Used Storage.

**Overall Efficiency**
- **Overall Efficiency Ratio** – Ratio of the sum of all TDEVs + Snapshot sizes and the Physical Used Storage.

**Report system efficiency**

**Description**
The `symcfg list` command, when used with the `-efficiency` option, reports system efficiency.

**Syntax**
To list system efficiency using the `symcfg list` command, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline] list -efficiency
```

**Note**
The `-efficiency` option can be abbreviated as `-eff`. 

---

Dell EMC Solutions Enabler Array Controls and Management 9.0 CLI User Guide
Examples
To list system efficiency for array 084 using the symcfg list command, enter:

```
symcfg list -sid 084 -efficiency
```

Sample output
For `symcfg list -efficiency` command:

```
SYMME TRIX E FFICIENCY
------------------------------------------------------
SymmID         Ratio   Ratio Enabled    Ratio    Ratio
------------ ------- ------- ------- -------- --------
000197800188   8.4:1   2.5:1     100   10.0:1    1.4:1
```

Report SRP inline compression efficiency

Description
The `symcfg list` command, when used with the `-efficiency` and `-srp` options, reports SRP efficiency.

Syntax
To list SRP efficiency using the `symcfg list` command, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline] list -srp -efficiency
```

Note
The abbreviation `-eff` for `-efficiency` is allowed

Examples
To list SRP efficiency for array 099 using the `symcfg list` command, enter:

```
symcfg list -sid 099 -srp -efficiency
```

Sample output
For `symcfg list -srp -efficiency` command:

```
STORAGE RESOURCE POOLS
Symmetrix ID : 000197800188
------------------------------------------------------
Name         Overall Data Reduction       VP Snapshot
             Ratio       Ratio Enabled    Ratio    Ratio
------------------------ ------- ------- ------- -------- --------
SRP_1             8.4:1   2.5:1     100   10.0:1    1.4:1
Report array compression conversion status

Description
The compression conversion status report requires the -sid option. This information is not stored in the Solutions Enabler database so it is not available for offline access.

Syntax
To report the compression conversion status for an array, use the following syntax:

```
symcfg [-sid <SymmID>] -compression_conversion_status
```

Note
The abbreviation -eff for -efficiency is allowed

Examples
To report the compression conversion status for array 456, enter:

```
symcfg show -compression_conversion_status -sid 456
```

Sample output

| Symm......................: 197123456 |
|--------------------------|----------------------------------|
| Conversion Start..........: 06/14/2016 14:55:12 |
| Status....................: Active |
| Percent Complete..........: 93.2% |
CHAPTER 8

Fully Automated Storage Tiering

This chapter describes Fully Automated Storage Tiering (FAST).

- Fully Automated Storage Tiering ................................................................. 200
- Storage Resource Pool management .......................................................... 201
- FAST information reporting ..................................................................... 203
Fully Automated Storage Tiering

Note

This section describes FAST operations for VMAX3 arrays. The EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS provides additional details about FAST concepts and operations.

EMC Fully Automated Storage Tiering (FAST) provides automated management of VMAX array disk resources to achieve expected service levels. FAST automatically configures disk groups to form a Storage Resource Pool (SRP) by creating thin pools according to each individual disk technology, capacity and RAID type.

FAST technology moves the most active parts of workloads (hot data) to high-performance flash disks and the least-frequently accessed storage (cold data) to lower-cost drives, leveraging the best performance and cost characteristics of each different drive type. FAST delivers higher performance using fewer drives and helps reduce acquisition, power, cooling, and footprint costs. FAST factors in the RAID protections to ensure write-heavy workloads go to RAID 1 and read-heavy workloads go to RAID 6. This process is entirely automated and requires no user intervention.

FAST provides the ability to deliver variable performance levels through Service Levels. Thin devices are added to Storage Groups and the storage group are assigned a specific Service Level which sets performance expectations.

A Service Level is the response time target for a storage group. The Service Level sets the VMAX array with the desired response time target for a storage group. It automatically monitors and adapts to the workload in order to maintain the response time target. The Service Level includes an optional workload type so it can be fine tuned to meet performance levels.

There are five Service Levels. For each one, except Optimized, the workload type, such as Online Transaction Processing (OLTP) or Decision Support System (DSS), is specified. The Optimized service level does not allow for setting the I/O type. A Service Level cannot be modified, however a storage group can be assigned based on the required service level.

FAST monitors the storage groups performance relative to the Service Level and automatically provisions the appropriate disk resources to maintain a consistent performance level.

VMAX3 arrays running HYPERMAX OS 5977 are custom-built and pre-configured with array-based software applications, including a factory pre-configuration for FAST that consists of:

- Data device (TDAT) — an internal device that is dedicated to providing physical storage used by thin devices.
- Data pool — a collection of data devices of identical emulation and protection type, all of which reside on disks of the same technology type and speed. The disks in a data pool are from the same disk group.
- Disk group — a collection of physical drives within the array that share the same performance characteristics.
- Storage Resource Pool (SRP) — one (default) FAST SRP is pre-configured on the array. This process is automatic and requires no setup.
Storage Resource Pool management

The `symconfigure set` command modifies Storage Resource Pool configuration. Configuration modifications include:

- set reserve capacity
- enable or disable SRDF/A DSE
- change SRP description

Modify storage resource pools

Syntax
To modify a Storage Resource Pool (SRP), use the following syntax:

```
symconfigure set srp <SRP Name>,
[,resv_cap = <n | NONE>]
[,rdfa_dse = <ENABLE | DISABLE>]
[,description = ‘SRP Description’]
```

The following security privileges are required to execute the `symconfigure set` command:

- Required Access type: CFGSYM

Options

`resv_cap`
A percentage of the capacity of the SRP reserved for device write I/O activities. Valid values for the percentage are from 1 to 80. NONE disables it. For example, if you set the reserved capacity on a SRP to 30%, then the first 70% of the pool capacity is available for general purpose operations (host I/O allocations, local replication tracks and SRDF/A DSE allocations) and the final 30% of the pool capacity is reserved strictly for device write I/O activities.

**Note**
Existing TimeFinder snapshot sessions created on devices in the SRP are invalid if the free capacity of the SRP, as a percentage of the usable capacity, goes below the reserved capacity.

`rdfa_dse`
There is always one SRP assigned available for SRDF/A DSE allocations. Valid values are enable and disable. The default SRP for FBA emulation is used by default. Enabling `rdfa_dse` on a SRP will make that pool available for SRDF/A DSE allocations (and implicitly sets the currently assigned SRP to "disabled"). The maximum amount of storage from a SRP allowed for DSE is controlled by the `system wide dse_max_cap` setting, as described in the Dell EMC Solutions Enabler SRDF Family CLI User Guide.
Note

This option is not allowed for SRPs with only external storage.

description

SRP description. Maximum description length is 127 characters (excluding null termination character). Valid values are "a - z", "A - Z", "0 - 9", underscore, hyphen",", space, period"." and comma".,".

Examples

To set the existing SRP reserve capacity to a value of 10% and enable SRDF/A DSE operations, enter:

```
symconfigure -sid 230 commit -cmd "set srp Primary_SRP, resv_cap=10, rdfa_dse=ENABLE;"
```

To modify the description of an SRP, enter:

```
symconfigure -sid 087 commit -cmd "set srp DEFAULT_SRP description = 'SRP with description modification';"
```

Restrictions:

- New parameters must be different than existing parameters.
- The target SRP for the operation cannot be the default SRP for FBA emulation, and the specified state cannot be "disabled".

Rename storage resource pools

Syntax

To rename a Storage Resource Pool (SRP), use the following syntax.

```
symconfigure rename srp <SRP Name> to <New SRP Name>;
```

The following security privileges are required to execute the symconfigure rename command:

- Required Access type: CFGSYM
Options

New SRP Name

Modified SRP name. Maximum name length is 32 characters. Valid characters are only alphanumeric characters, hyphens "-", and underscores "_", with leading hyphen or underscore not allowed.

Example

symconfigure -sid 087 commit -cmd "rename srp DEFAULT_SRP to SRP_RENAMED;"

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session.........................Established.
   Processing symmetrix 000197100087
   {rename srp DEFAULT_SRP to SRP_RENAMED;}
   Performing Access checks............................................Allowed.
   .................................................................Done.
The configuration change session has successfully completed.

Restrictions

In a single command file that includes "set srp" and "rename srp" commands, the following rules apply:

- Allows using the old SRP name for "set srp" commands and renaming the SRP as the last command.
- Allows renaming the SRP as the first command and using the new name for the subsequent "set srp" commands.
- Does not allow using the old SRP name for some commands, changing the SRP name, and then using the new SRP name for subsequent commands.

FAST information reporting

FAST reporting lists the Service Level, storage groups, and Storage Resource Pools configured on the array, and also generates reports detailing the demand that storage groups or Service Level are placing on the Storage Resource Pools.

List Service Level

Description
The symcfg list and symcfg show commands report Service Levels and available workloads.

Options
- -all
  Displays only the Service Levels that are allowed for the specific VMAX array.
- -v
Provides a verbose list of Service Levels and workloads with additional descriptions.

- **fba**
  Lists only the Service Levels with FBA emulation.

- **ckd**
  Lists only the Service Levels with CKD emulation. This option available with HYPERMAX OS 5977 Q12106SR or higher.

### Note

CKD devices support only Diamond, Bronze, and Optimized Service Level.

**Example**

To list Service Level details on array 063, enter:

```
symcfg -sid 063 list -sl -detail -all
```

**Sample Output**

Output with `-all` filter:

<table>
<thead>
<tr>
<th>SERVICE LEVEL</th>
<th>Symmetrix ID</th>
<th>Approx Resp Time (ms)</th>
<th>Service Level Base Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimized</td>
<td></td>
<td>N/A</td>
<td>Optimized</td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
<td>OLTP</td>
<td>Diamond</td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
<td>OLTP_REP</td>
<td>Diamond</td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
<td>DSS</td>
<td>Diamond</td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
<td>DSS_REP</td>
<td>Diamond</td>
</tr>
<tr>
<td>Diamond</td>
<td></td>
<td>&lt;none&gt;</td>
<td>Diamond</td>
</tr>
<tr>
<td>Platinum</td>
<td></td>
<td>OLTP</td>
<td>Platinum</td>
</tr>
<tr>
<td>Platinum</td>
<td></td>
<td>OLTP_REP</td>
<td>Platinum</td>
</tr>
<tr>
<td>Platinum</td>
<td></td>
<td>DSS</td>
<td>Platinum</td>
</tr>
<tr>
<td>Platinum</td>
<td></td>
<td>DSS_REP</td>
<td>Platinum</td>
</tr>
<tr>
<td>Platinum</td>
<td></td>
<td>&lt;none&gt;</td>
<td>Platinum</td>
</tr>
<tr>
<td>Gold</td>
<td></td>
<td>OLTP</td>
<td>Gold</td>
</tr>
<tr>
<td>Gold</td>
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<td>OLTP_REP</td>
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<td>Gold</td>
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<td>DSS</td>
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<td></td>
<td>DSS_REP</td>
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</tr>
<tr>
<td>Gold</td>
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<td>&lt;none&gt;</td>
<td>Gold</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>OLTP</td>
<td>Silver</td>
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<tr>
<td>Silver</td>
<td></td>
<td>OLTP_REP</td>
<td>Silver</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>DSS</td>
<td>Silver</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>DSS_REP</td>
<td>Silver</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>&lt;none&gt;</td>
<td>Silver</td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td>OLTP</td>
<td>Bronze</td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td>OLTP_REP</td>
<td>Bronze</td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td>DSS</td>
<td>Bronze</td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td>DSS_REP</td>
<td>Bronze</td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td>&lt;none&gt;</td>
<td>Bronze</td>
</tr>
</tbody>
</table>
Show specific Service Level

Description
The `symcfg show -sl` command displays a specified Service Level.

Options
- `-fba`
  Shows only FBA devices for specified Service Level.
- `-ckd`
  Shows only CKD devices for specified Service Level.

Example
To show information about the Platinum Service Level for array 063, enter:

```
symcfg -sid 063 show -sl Platinum
```

Sample Output

```
Symmetrix ID    : 000197200063
Name                    : Platinum
Service Level Base Name : Platinum

Workloads (5)
{
    Name      (ms)
    --------  -----  
    OLTP      3.0
    OLTP_REP  4.4
    DSS       4.4
    DSS_REP   5.9
    <none>    3.0
}
```

Note
Storage groups on page 119 explains how to create storage groups and how to add and remove devices from a group.

List storage groups

Description
The `symsg list -detail` command shows details for all storage groups, including Service Level, workload, and Storage Resource Pool (SRP) configured for each storage group.

Options
- `-by sl`
  Sorts storage group information by Service Level.
- `-by srp`
Sorts storage group information by SRP.

**Example**
To list storage group details for array 063, enter:

```
symsg -sid 063 list -detail
```

**Sample output**

**Note**

Starting with Solutions Enabler 8.0.1 the `FAST` R column for listing RDF coordination (enabled or disabled) has been removed from the output.

- If the Service Level or SRP name length exceeds 24 characters output display truncates the name to 23 characters and displays "*" for the 24th character.
- When the (F)ast flag is set, it indicates that the storage group has a Service Level or a SRP set and it is FAST-managed.
- A FAST-managed storage group that reports <none> for the Service Level Name uses the Optimized Service Level.
- A FAST-managed storage group that reports <none> for the SRP Name uses the array's default Storage Resource Pool for the emulation.

### STORAGE GROUPS

<table>
<thead>
<tr>
<th>Symmetrix ID:</th>
<th>000197200063</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storage Group Name</strong></td>
<td><strong>Flags</strong></td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>151SG</td>
<td>F.X ...</td>
</tr>
<tr>
<td>EMBEDDED_NAS_DM_SG</td>
<td>FXX ...</td>
</tr>
<tr>
<td>Enasvt</td>
<td>F.X ...</td>
</tr>
<tr>
<td>ESG253_SG</td>
<td>FXX ...</td>
</tr>
<tr>
<td>ESX253_SG</td>
<td>F.X ...</td>
</tr>
<tr>
<td>SVT_ISCSI_SG</td>
<td>F.X ...</td>
</tr>
<tr>
<td>V2SG1</td>
<td>FXX ...</td>
</tr>
<tr>
<td>V2SG_LINUX</td>
<td>FXX ...</td>
</tr>
<tr>
<td>V2SG_SOL</td>
<td>FXX ...</td>
</tr>
<tr>
<td>V2SG_U4V</td>
<td>FXX ...</td>
</tr>
</tbody>
</table>

**Legend:**

- **Flags:**
  - Device (E)mulation: A = AS400, F = FBA, 8 = CKD3380, 9 = CKD3390, M = Mixed, . = N/A
  - (F)ast: X = Fast Managed, . = N/A
  - (M)asking View: X = Contained in Mask View(s), . = N/A
  - Cascade (S)tatus: P = Parent SG, C = Child SG, . = N/A
List Storage Resource Pools

Options
- **-fba**
  Lists only the SRPs with FBA emulation.

- **-ckd**
  Lists only the SRPs with CKD emulation. This option is available for arrays running HYPERMAX OS 5977 Q12016SR or higher.

Examples
To list the details for all SRPs configured on array 087, enter:

```bash
symcfg -sid 087 list -srp -detail
```

To list the details for all SRPs configured on array 087 with -fba emulation, enter:

```bash
symcfg -sid 087 list -srp -fba
```

Sample output
Output with -detail option (reports capacity metrics):

```
STORAGE RESOURCE POOLS
Symmetrix ID : 000197100087

<table>
<thead>
<tr>
<th>Name</th>
<th>Flg</th>
<th>Usable (GB)</th>
<th>Allocated (GB)</th>
<th>Free (GB)</th>
<th>Subscribed (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFAULT_SRP</td>
<td>FX</td>
<td>1847.4</td>
<td>515.1</td>
<td>1332.3</td>
<td>80065.6</td>
</tr>
<tr>
<td>TEST_2</td>
<td>CX</td>
<td>2630.1</td>
<td>0.0</td>
<td>2630.1</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4477.5</td>
<td>515.1</td>
<td>3962.4</td>
<td>80065.6</td>
</tr>
</tbody>
</table>

Legend:
(DF)efault SRP : F = FBA Default, C = CKD Default, B = Both, . = N/A
(R)DFA DSE : X = Usable, . = Not Used
```

Output descriptions:
- **Usable** — indicates the usable capacity of all the disk groups in the SRP.
- **Allocated** — indicates the sum of the device allocations, snapshot allocations, and SRDF/A DSE allocations on the SRP.
- **Free** — lists the difference between the usable and the allocated capacity.
- **Default SRP** — indicates if the SRP is the default for FBA devices.
- **RDFA DSE** — indicates if the SRP usable for SRDF/A DSE operations.
Output without -detail option (no capacity metrics):

```
STORAGE RESOURCE POOLS
Symmetrix ID  : 000197100087
Name                     DR  Description
------------------------ --- ----------------------------------------
DEFAULT_SRP              FX  The Default SRP that will be used for all applications
TEST_SRP                 ..  SRP for testing
Legend:
Flags:
(D)efault SRP : F = FBA Default, C = CKD Default, B = Both, . = N/A
(R)DFA DSE    : X = Usable, . = Not Used
```

Output with -fba filter:

```
STORAGE RESOURCE POOLS
Symmetrix ID  : 000197100087
C A P A C I T Y
-------------------------------- --- ------------------------------------------------
Flg     Usable  Allocated       Free   Subscribed
Name                             DR        (GB)       (GB)       (GB)      (GB)
-------------------------------- --- ---------- ---------- ---------- ------------
DEFAULT_SRP                      FX      1847.4      515.1     1332.3      80065.6
---------- ---------- ---------- ------------
Total                                    1847.4      515.1     1332.3      80065.6
Legend:
Flags:
(D)efault SRP : F = FBA Default, C = CKD Default, B = Both, . = N/A
(R)DFA DSE    : X = Usable, . = Not Used
```

List Storage Resource Pools details

**Example**

To display a detailed list of all SRPs in array 084, enter:

```
symcfg -sid 084 list -srp -v
```

**Sample output**

```
Symmetrix ID  : 000197800084
Name                     : DEFAULT_SRP
Description              :
Default SRP               : FBA
Usable Capacity (GB)     : 8833.8
Used Capacity (GB)       : 494.9
Free Capacity (GB)       : 8339.9
Subscribed Capacity (GB) : 32239.8
Subscribed Capacity (%)  : 297
Reserved Capacity (%)    : None
Compression State        : Enabled
Data Reduction Ratio     : 2.2:1
```
Usable by RDFA DSE : Yes

Disk Groups (2):

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Flgs</th>
<th>Speed</th>
<th>FBA</th>
<th>CKD</th>
<th>Capacity</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DISK_GROUP_001</td>
<td>IEN</td>
<td>N/A</td>
<td>100</td>
<td>0</td>
<td>8833.8</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Available Service Levels (1):

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
</tr>
</tbody>
</table>

Legend:

Flags:
Disk (L)ocation:
I = Internal, X = External
(T)echnology:
E = Enterprise Flash Drive, F = Fibre Channel,
S = SATA, - = N/A
(S)tatus:
N = Normal, D = Degraded, F = Failed

Name : SRP_2
Description :
Default SRP : None
Usable Capacity (GB) : 6437.8
Used Capacity (GB) : 0.9
Free Capacity (GB) : 6436.9
Subscribed Capacity (GB) : 0.9
Reserved Capacity (%) : 15
Compression State : Enabled
Data Reduction Ratio : 2.1:1
Usable by RDFA DSE : No

Disk Groups (1):

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Flgs</th>
<th>Speed</th>
<th>FBA</th>
<th>CKD</th>
<th>Capacity</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>DISK_GROUP_002</td>
<td>IEN</td>
<td>N/A</td>
<td>100</td>
<td>0</td>
<td>6437.8</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Available Service Levels (1):

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
</tr>
</tbody>
</table>

Legend:

Flags:
Disk (L)ocation:
I = Internal, X = External
(T)echnology:
E = Enterprise Flash Drive, F = Fibre Channel,
S = SATA, - = N/A
Output descriptions:

- Default SRP — indicates if the SRP is the default pool for FBA devices.
- Usable Capacity — sum of the useable capacity of all the disk groups in the SRP.
- Allocated Capacity — sum of the device allocations, the snapshot allocations, and the SRDF DSE allocations on the SRP.
- Free Capacity — difference between the useable and the allocated capacity.
- Subscribed Capacity — sum of the sizes of all the thin devices subscribed against the SRP.
- Subscribed Capacity percentage — percentage of the Usable Capacity used by thin devices.
- Reserved Capacity — percentage of the Useable Capacity reserved for non-snapshot activities.

**Note**

Existing TimeFinder snapshot sessions created on devices in the SRP may become invalid if the Free Capacity of the SRP, as a percentage of the Usable Capacity, goes below the Reserved Capacity.

- Compression State: indicates if compression is enabled or disabled for the SRP.
- Data Reduction ratio: ratio of Logical Allocated Capacity of all devices in SRP and the Physical Allocated Capacity for all devices in SRP.
- Useable by RDFA DSE — indicates if the SRP is usable for SRDF/A DSE operations.
- Disk Groups — lists the disk groups configured to the SRP. The list of disk groups is sorted by disk group number.
- Available SLOs — lists the Service Levels that are available for this SRP.

### Show specific Storage Resource Pool

**Description**

The symcfg show -srp command displays a specified Storage Resource Pool (SRP).

**Options**

- **-detail**
  
  Shows detailed information about a specific SRP.

- **-fba**
  
  Shows capacities for SRP with FBA emulation.

- **-ckd**
  
  Shows capacities for SRP with CKD emulation. This option is available for arrays running HYPERMAX OS 5977 Q12106SR or higher.
Example
To show detailed information about the pool named SRP_1 on array 063, enter:

`symcfg -sid 063 show -srp SRP_1`

Sample output

```
Symmetrix ID             : 000197200063
Name                        : SRP_1
Description                 : This is Default SRP2
Default SRP                 : Both
Effective Used Capacity (%) :    15
Usable Capacity (GB)        : 12915.8
Allocated Capacity (GB)     : 1853.9
Free Capacity (GB)          : 152147.3
Subscribed Capacity (%)     :   1177
Reserved Capacity (%)       :    10
Compression State           : Disabled
Data Reduction Ratio        : N/A
Usable by RDFA DSE          : Yes

Disk Groups (2):

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>LTS</th>
<th>Speed</th>
<th>CKD</th>
<th>Usable Capacity (GB)</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GRP_1_300_10K_3R5</td>
<td>IFN</td>
<td>10000</td>
<td>80</td>
<td>12040.9</td>
<td>Internal</td>
</tr>
<tr>
<td>2</td>
<td>GRP_2_960_EFD_R1</td>
<td>IEN</td>
<td>N/A</td>
<td>100</td>
<td>874.9</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>81</td>
<td>18</td>
</tr>
</tbody>
</table>
```

Available Service Levels (6):

- Optimized
- Diamond
- Platinum
- Gold
- Silver
- Bronze

Legend:
- Flgs: Disk (L)ocation:
  - I = Internal, X = External
- (T)echnology:
  - E = Enterprise Flash Drive, F = Fibre Channel,
  - S = SATA, - = N/A
- (S)tatus:
  - N = Normal, D = Degraded, F = Failed

Storage Resource Pool demand reporting

The `symcfg list -srp -demand` command reports the subscribed and the allocated demand, from Service Levels and Storage Groups, placed on the Storage Resource Pools (SRP)s.
Report Service Level demand on Storage Resource Pools

Options

- **type sl**
  Reports the demand placed by Service Levels on the Storage Resource Pools (SRPs). Devices that are not in a FAST managed storage group or are in a FAST managed storage group without an explicit Service Level set will be reported against the Optimized Service Level.

- **details**
  Reports the details of the Service Level demand on the SRP.

- **fba**
  Reports Service Level demand on the SRP for FBA emulations.

- **ckd**
  Reports Service Level demand on the SRP for CKD emulations. This option is available for arrays running HYPERMAX OS 5977 Q12016SR or higher.

Example

To report detailed Service Level demand on the SRPs for **-fba** emulations, enter:

```
symcfg -sid 063 list -srp -demand -type sl -fba
```

To report detailed Service Level demand on the SRPs for **-fba** emulations, enter:

```
symcfg -sid 063 list -srp -demand -type sl -ckd
```

Sample output

Note

The SRDF DSE allocations come from the FBA default pool and will report as 0.0 when using the **-ckd** filter.

Output with **-fba** filter:

```
STORAGE RESOURCE POOLS

Symmetrix ID : 000197200063
Name          : SRP_1
Usable Capacity (GB) : 10531.6
SRDF DSE Allocated (GB) : 0.0
Snapshots Allocated (GB) : 0.0

-----------------------------------------------
Service Level               Subscribed   Allocated
Name           (GB)    (%)      (GB)    (%)
-----------------------------------------------
<none>                152028.3  1443    1746.1   1
Gold               112.8     1 107.8  95
Optimized            0.0     0      0.0     0
-----------------------------------------------
Total                152141.2 1444   1853.9   1
```
Output with –ckd filter:

STORAGE RESOURCE POOLS

Symmetrix ID : 000197200063
Name : SRP_1
Usable Capacity (GB) : 2384.2
SRDF DSE Allocated (GB) : 0.0
Snapshots Allocated (GB) : 0.0

--------------------------------------------------------------------
Service Level | Subscribed Capacity (GB) | Allocated Capacity (GB)
----------------- | ------------------------ | ------------------------
<none>          | 6.2                      | 0.0                      
Total           | 6.2                      | 0.0                      

Report storage group demand on Storage Resource Pool

Options

- **-type sg**
  Reports the demand placed by storage groups on the Storage Resource Pools (SRP)s.

- **-fba**
  Reports SG demand on the SRP for FBA emulations.

- **-ckd**
  Reports SG demand on the SRP for CKD emulations. This option is available for arrays running HYPERMAX OS 5977 Q12016SR or higher.

Examples

To report SRP capacity, enter:

```
symcfg list -demand –srp -sid 188
```

To report detailed SRP capacity information, enter:

```
symcfg list -demand –detail –srp -sid 188
```

To report storage group demand on the SRPs, enter:

```
symcfg -sid 188 list -srp -demand -type sg
```

Sample output

```
SRP     Capacity      Usable Capacity
Symmetrix ID : 000197800188
--------------------------------------------------------------------
<none> Subscribed Capacity Snapshot
Total
--------------------------------------------------------------------
```
### Symmetrix ID: 000197800188

#### Subscribed Capacity
- **Usable Capacity**: 10062.0 GB
- **Subscribed Capacity (%)**: 67.6%
- **Compression State**: Enabled
- **Compression Ratio**: 2.0:1
- **SRDF DSE Allocated (GB)**: 0.0

#### Storage Resource Pools

**Name** : SRP_1

<table>
<thead>
<tr>
<th>SG Name</th>
<th>Subscribed (GB)</th>
<th>Allocated (GB) %</th>
<th>Used (GB)</th>
<th>Comp Ratio</th>
<th>Allocated (GB)</th>
<th>Used (GB)</th>
<th>Comp Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG1</td>
<td>60.0</td>
<td>50.0</td>
<td>25.0</td>
<td>2.0:1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0:1</td>
</tr>
<tr>
<td>SG2</td>
<td>20.0</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>SG3</td>
<td>6723.1</td>
<td>1291.0</td>
<td>645.5</td>
<td>2.0:1</td>
<td>2.0</td>
<td>1.6</td>
<td>1.3:1</td>
</tr>
<tr>
<td>&lt;not_in_sg&gt;</td>
<td>25.0</td>
<td>20.0</td>
<td>20.0</td>
<td>1.0:1</td>
<td>0.0</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6828.1</strong></td>
<td><strong>1361.0</strong></td>
<td><strong>690.5</strong></td>
<td><strong>2.0:1</strong></td>
<td><strong>3.0</strong></td>
<td><strong>2.6</strong></td>
<td><strong>1.2:1</strong></td>
</tr>
</tbody>
</table>

---

**List Storage Resource Pools for thin devices**

**Options**

- `-fba`
  Reports thin devices with FBA emulations.

- `-ckd`
  Reports thin devices with CKD emulations. This option is available for arrays running HYPERMAX OS 5977 Q12106SR or higher.

- `-mb` or `-tb`
  Reports capacities in MB (megabytes) or TB (Terabytes). Default capacities are reported in GB (Gigabytes).
Examples
To list thin devices and associated SRPs, enter:

```
symcfg list -tdev -srp
```

To list thin devices with `-ckd` emulation, and associated SRPs, enter:

```
symcfg list -tdev -srp -ckd
```

To list thin devices with `-fba` emulation, and associated SRPs, enter:

```
symcfg list -tdev -srp -fba
```

Sample output
Output with no emulation type filter:

```
Symmetrix ID : 000197100087

SYMMETRIX THIN DEVICES
--------------------------
<table>
<thead>
<tr>
<th>Sym</th>
<th>Flgs</th>
<th>Total</th>
<th>Allocated</th>
<th>Allocated</th>
<th>SRP Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(GB) (%)</td>
<td>(GB)</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>--------</td>
<td>-----------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>00001</td>
<td>FX</td>
<td>3.2</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00002</td>
<td>FX</td>
<td>3.2</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>80066.7</td>
<td>515.5</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Legend:
Flags:
Device (E)mulation A = AS400, F = FBA, C = CKD, 8 = CKD3380, 9 = CKD3390
(C)urrent SRP X = Device is currently associated with SRP, . = N/A
```

Output descriptions:
- **Total** — configured size.
- **Allocated** — device allocations.
- **Snapshots Allocated** — snapshots allocated to SRP.
- **SRP Name** — associated Storage Resource Pools (SRP)s.

Note
A device only has allocations on more than one Storage Resource Pool, if the device is in the process of moving its allocations to a target Storage Resource Pool. (For example, the pool specified on the storage group that contained the device was changed to a different Storage Resource Pool).
### Output with `-ckd` filter:

Symmetrix ID : 000197100087

<table>
<thead>
<tr>
<th>Sym</th>
<th>Flgs</th>
<th>Total (GB)</th>
<th>Allocated (GB)</th>
<th>Allocated (%)</th>
<th>SRP Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>00105</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00106</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00107</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00108</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00109</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>0010A</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>0010B</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>0010C</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>0010D</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>0010E</td>
<td>9X</td>
<td>0.9</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
</tbody>
</table>

Total: 8.8 GB

Legend:
- **Flags:**
  - **Device (E)mulation** A = AS400, F = FBA, C = CKD, 8 = CKD3380, 9 = CKD3390
  - **(C)urrent SRP** X = Device is currently associated with SRP, . = N/A

### Output with `-fba` filter:

Symmetrix ID : 000197100087

<table>
<thead>
<tr>
<th>Sym</th>
<th>Flgs</th>
<th>Total (GB)</th>
<th>Allocated (GB)</th>
<th>Allocated (%)</th>
<th>SRP Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>00001</td>
<td>FX</td>
<td>3.2</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>00002</td>
<td>FX</td>
<td>3.2</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>010E0</td>
<td>FX</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>DEFAULT_SRP</td>
</tr>
<tr>
<td>010E1</td>
<td>FX</td>
<td>0.2</td>
<td>0.2</td>
<td>100</td>
<td>DEFAULT_SRP</td>
</tr>
</tbody>
</table>

Total: 80057.9 GB

Legend:
- **Flags:**
  - **Device (E)mulation** A = AS400, F = FBA, C = CKD, 8 = CKD3380, 9 = CKD3390
  - **(C)urrent SRP** X = Device is currently associated with SRP, . = N/A
CHAPTER 9

Manage Configuration Changes

This chapter describes configuration change concepts and explains how to perform array and device change operations.

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Configuration change management overview

Use the SYMCLI `symconfigure` command or the `symdev` command to make configuration changes to a locally-connected array or to an RDF-linked array. This command is run from the local host and performs control operations on arrays, as well as array devices, groups, directors, and ports.

Array controls include:

- Setting array-wide metrics
- Determining what type of devices the array will support, such as RAID 6 devices

Device controls include:

- Creating, modifying, and deleting devices
- Mapping and masking devices
- Configuring device pools
- Reserving devices
- Releasing device reservations

Configuration change session rules

The following rules apply to change sessions and concurrent change sessions:

- Concurrent Provisioning — Up to four concurrent configuration change sessions can run at the same time, when they are non-conflicting. Multiple parallel configuration change sessions can run at the same time as long as the changes do not include any conflicts on the following:
  - Device back-end port
  - Device front-end port
  - Device
- The array manages its own device locking.
- A session ID identifies each running session on the array.

Symconfigure command execution formats and options

**Description**

Configuration changes that are submitted to the array are processed in a session. The `symconfigure` command has several formats for executing array configuration changes. The command file format can contain various command entries terminated with a semicolon (;). Multiple changes can be specified in one session, but all changes must fall into one complete operation — for example, creating a device, adding the device to a device pool, and enabling the device state. Additional command file examples are provided with the actions described later in this chapter.

Refer to the Dell EMC Solutions Enabler CLI Reference Guide for the complete manpage description of the `symconfigure` command.

**Options**

- **abort**
  
  Gains control of an existing session to abort it and free any held locks.

- **commit**
Attempts to apply the changes defined in the command file into the specified array.

**list**
Lists the relevant details, depending on the option:
- `-freespace` shows the free physical disk space within the array as it can be used to create new devices for different emulation modes. Free disk space on unformatted disks is shown as available for all emulation modes. If a physical disk has been partially used to create a device, that device is considered formatted and the rest of the available space can only be used for devices of the same emulation mode.
- `-v` displays configuration information that is not stored in the SYMAPI database and that needs to be retrieved directly from the configuration server.
- `-reserved` shows a summary of all reservations.

**prepare**
Validates the syntax and correctness of the operations. Verifies the validity of the command file changes and their appropriateness for the specified array. The prepare action has no function for pool sessions.

**preview**
Ensures the command file syntax is correct. Verifies the validity of the command file changes.

**query**
Returns information about the status of a configuration change session.

**release**
Releases the specified device reservation.

**reserve**
Processes the command file to reserve the indicated devices and displays the resulting reserve ID.

**show**
Shows the details of the specified device reservation.

**verify**
Verifies that the configuration currently running in the specified array complies with the requirements for host-based configuration changes.

**Examples**
There are various ways to execute the `symconfigure` command.

- Using the `-file` option:

  ```
symconfigure commit -sid 3160 -file unmap_dev.cmd
  
  Where `unmap_dev.cmd` contains:
  ```

  ```
  unmap dev 00020:00024 from dir ALL:ALL;
  ```
Note
When using the `symconfigure -file` option, text files can have a maximum comment of 512 characters on Windows. Make sure the comment line does not exceed 512 characters.

- Redirect a number of screen entries to `stdin` to save keystroke entries (for UNIX platforms), and not use a command file. For example, to prepare a chain of `symconfigure` commands on the screen to be redirected to `stdin`, enter:

```
symconfigure -sid 1234 prepare <<DELIM
create dev count=3 size=3200 cyl,
  emulation=FBA, config=2-Way-Mir;
create dev count=1, size = 3200 cyl,
  emulation=FBA, config=unprotected;
DELIM
```

- Use the `-cmd` option. With this option, the commands that would normally be put in a command file are enclosed in quotes. A command can run over many lines, but you cannot press `Enter`. For example:

```
symconfigure -sid 256 -cmd "create dev count=3, size = 3200 cyl, emulation=FBA, config=2-Way-Mir;create dev count=1, size = 3200 cyl, emulation=FBA, config=unprotected;" -v -nop preview
```

Verify and check sessions

Description
Use the `symconfigure verify, preview, and prepare arguments to verify and check a change session that is acting on a specified `symconfigure` command file. The `commit` argument performs these same checks, then attempts to execute the specified configuration change.

The `symconfigure` command modifies configuration operations and components. A lock may be taken out by the specified VMAX array configuration server while the configuration change session is active. Use the `query` option to monitor the stages of session processing. Not all stages are always executed. Use caution when controlling which stages are to be completed, to allow checking and debugging of the command file before the changes are implemented.

Syntax
To verify a change session, use the following syntax:

```
symconfigure -sid <SymmID> verify
  preview
  prepare
  commit

symconfigure -sid <SymmID> [-i <Interval>] [-c <Count>]
  [-session_id <SessionID>] [-v]query
```

Options
- `verify`
Determines if a VMAX array can be modified, as there are restrictions as to what state the configuration must be in before allowing changes to be applied.

**preview**
Verifies that each individual change is valid and the syntax is correct, and then terminates the session without change execution.

**prepare**
Performs the preview checks, validates the change operation (devices are in correct state, etc.), then terminates the session without attempting to make the configuration change.

**commit**
Completes all checks and verifications, and then attempts to make the requested configuration changes in the specified array.

**query**
Checks the status of any configuration change session or whether there is a configuration session running. This option is useful in SRDF environments, where a change to a local array on one host results in a corresponding change to a remote array. The System Manager of a host, connected to the remote array, can monitor the progress of the change. A query is also helpful at sites where the Symmetrix Optimizer is modifying a configuration by rearranging the placement of data.

**Examples**
To check the status of change session 100, on array 345, every 10 seconds for the next two minutes, enter:

```
symconfigure -sid 345 query -i 10 -c 12 -session_id 100
```

Abort configuration session

**Options**

- **-session_id**
  Aborts specified session when multiple sessions are running on the array. If -session_id is not specified the abort command displays each running session and prompts for the session ID.

**Examples**
The abort option allows you to stop a configuration session. To abort a change session on a specific array, enter:

```
symconfigure -sid 12345 abort
```

To abort change session 100, enter:

```
symconfigure -sid 343 abort -session_id 100
```
Restrictions

- Because changes made in the SRDF operations class will initiate actions on the local and remote arrays, it might become necessary to abort processing on a remote array.
- At some point during commit processing, a point of no return is reached. Any attempt to abort will be denied once processing has reached or gone beyond this point.

Configuration change guidelines

Understand your array configuration before making configuration changes. Any changes can impact stored data.

Note

If you have problems with a new configuration, contact the EMC Customer Support Center for assistance in reverting to your previous configuration.

Ensure that all critical data is preserved and safe when creating new or changing device configurations, and do not store data on any device that is not mirrored, or RAID-protected. All configuration changes and device attribute adjustments must meet certain open systems guidelines detailed in the E-Lab Interoperability Navigator, which can be viewed at http://elabnavigator.EMC.com.

Verify viable array configuration

Syntax

Verify that the current array configuration is a viable configuration for host-initiated configuration changes. To verify the current array configuration is ready for changes, use the following syntax:

```
symconfigure verify -sid SymmID
```

Check for free physical disk space

Syntax

Before creating new devices, check for free physical disk space using the following syntax:

```
symconfigure list -freespace [-units CYL | MB] -sid SymmID
```

Note

Free disk space on unformatted disks is shown as available for all emulation modes. New devices are created first on physical disks that have no prior allocations, causing these disks to be committed to that emulation type.
Examine the distribution of free space across formatted disks to see if the desired mirroring can be provided, using one of the following syntax formats:

```
symdev list -sid SymmID -da all -space
```

```
symdisk list -sid SymmID
```

Stop I/O activity on affected devices

**Description**
Configuration changes begin only after issuing the `commit` action. Some classes of change operations may or may not impact current I/O. When possible, before issuing the `commit` action, stop I/O activity on the affected devices.

**Note**
If I/O activity on an affected device occurs before or during a `commit` action, the action may fail. At the very least, heavy I/O activity on unaffected devices impacts how long it takes to commit changes.

**Syntax**
If required, use the following syntax to set the impacted devices for change to be *Not Ready*:

```
symdg -g DgName not_ready [LdevName [LdevName... ]]
```

Mixed array environments

Before issuing a `symconfigure` command to an array containing both open system and mainframe devices, verify that the mainframe Missing Interrupt Handler (MIH) period for each mainframe server attached to the array is set to at least two minutes.

- To view the current MIH period, use the z/OS command `D IOS,MIH`, and note the value for the DASD device class (for example, `DASD=1:30`)
- To change the MIH period, use the z/OS command `SETIOS MIH,DASD=mm:ss`, where `mm:ss` is a period of time in minutes and seconds. Then use the z/OS command `D IOS,MIH` to verify your changes.

Once you have completed your configuration change session, use the `SETIOS MIH,DASD=mm:ss` command to set the MIH period back to its original value. For more information, consult the mainframe system administrator.

Update host with device mapping information

After a configuration change, the host's device information must be updated. Attempting host activity with a device after it has been removed or altered, but before updating the host's device information, can cause host errors. To update the host:

**Procedure**
1. Commit a `symconfigure map` operation.
2. Run the utilities specified for the host platform as described in *Introduce devices to a host* on page 253.
3. Issue the `symcfg discover` command to update the SYMAPI database with the new device mapping information.

4. Resume I/O activity.

**Supported configuration operations**

HYPERMAX OS 5977 supports the following configuration operations.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Supported Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create device</td>
<td>FBA&lt;br&gt;Celerra® FBA&lt;br&gt;CKD&lt;br&gt;AS400_D910_099&lt;br&gt;Thin devices&lt;br&gt;Copy device&lt;br&gt;Add gatekeeper&lt;br&gt;ACLX&lt;br&gt;SCSI3_persist_reserv&lt;br&gt;DIF1&lt;br&gt;AS400_GK&lt;br&gt;Set device identifiers&lt;br&gt;Delete device</td>
</tr>
<tr>
<td>Convert director type</td>
<td>FA to RDF/RDF to FA&lt;br&gt;Add new emulation type&lt;br&gt;Remove emulation type</td>
</tr>
<tr>
<td>Change device emulation</td>
<td>FBA&lt;br&gt;Celerra FBA</td>
</tr>
<tr>
<td>Thin Provisioning</td>
<td>Create thin devices&lt;br&gt;Rename thin pool&lt;br&gt;View thin pools</td>
</tr>
<tr>
<td>Map device (only on non-ACLX enabled ports)</td>
<td>AS400&lt;br&gt;FBA&lt;br&gt;CKD devices to CU image</td>
</tr>
<tr>
<td>Unmap device</td>
<td>AS400&lt;br&gt;FBA&lt;br&gt;CKD devices from CU image</td>
</tr>
<tr>
<td>Set array-wide parameters</td>
<td>Set front-end port attributes&lt;br&gt;R DFA cache percent&lt;br&gt;R DFA host throttle time</td>
</tr>
<tr>
<td>SRDF operations</td>
<td>Add RDF mirror&lt;br&gt;Remove RDF mirror</td>
</tr>
<tr>
<td>Device pools</td>
<td>Rename pool</td>
</tr>
</tbody>
</table>
Set array attributes

Syntax
Use the following command to set certain attributes to control array behavior:

```
symconfigure set Symmetrix [MetricName=MetricValue, MetricName=MetricValue];
```

Options

**MetricName**  
The metric to be set.

<table>
<thead>
<tr>
<th>MetricName</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rdfa_cache_percent</td>
<td>Sets the percentage of write pending cache that can be used by SRDF/A. This is a value from 0 to 100 percent.</td>
</tr>
<tr>
<td>rdfa_host_throttle_time</td>
<td>Sets the number of seconds to throttle host writes to SRDF/A devices when cache is full, before dropping RDF/A sessions. Throttling delays a write from the host until a cache slot becomes free. Values are from 0 to 65535.</td>
</tr>
</tbody>
</table>

View the array metrics

Syntax
To view the current settings for array metrics, use the following syntax:

```
symcfg -sid SymmID -v list
```

Set Service Level name

Syntax
To set to a user-defined Service Level name or reset to the default name, use the following syntax with `symconfigure`:

```
set sl <SLName=NewSLName|BASE NAME>
```
Examples

To set the Service Level default name to a user-defined name, enter:

```
symconfigure -sid 234 commit -cmd "set sl Platinum name=Emc_Platinum;"
```

Execute a symconfigure operation for symmetrix '000000001234' (y/n) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session...............Established.
   Processing symmetrix 000000001234
   { set sl Platinum name=Emc_Platinum;
   }
   Performing Access checks ................................Allowed.
   Terminating the configuration change session..............Done.

The configuration change session has successfully completed.

To reset the Service Level default name to the default name, enter:

```
symconfigure -sid 234 commit -cmd "set sl Emc_Gold name=BASE NAME;"
```

Rules and restrictions for set/reset Service Level name (HYPERMAX OS 5977 or higher)

The following security privileges are required to execute this command:

- Required Access type: CFGSYM
- Required Authorization Rights: Storage Admin

The following naming rules apply:

- Names cannot exceed 32 characters.
- Alphanumeric characters only.
- Hyphens (-) and underscores (_) are allowed, but not as the leading character.

This command will fail if:

- The `sl_name` value is a NULL value, or if the specified SL name does not exist.
- The new Service Level name supplied is already in use, as either a base Service Level name or a Service Level current name.

```
Note
```

Names must be unique when folded to upper case.

- A reset to a base Service Level is performed and a user-defined Service Level does not exist.

External disk group management

Solutions Enabler includes a feature called Federated Tiered Storage (FTS). With FTS, an external LUN (eDisk) can be attached through the SAN to the array and can be used as external back-end disks for that array.
Create devices (HYPERMAX OS 5977 Q12016SR or higher)

Description
Use the `symdev create` command to create new devices, which includes both FBA and CKD devices.

The `symconfigure create` command is also used to create devices but it does not support model types for 3390 CKD devices. See Create devices (HYPERMAX OS 5977 lower than 5977 Q12016SR) on page 229 for syntax for this command.

Note
For CKD devices, CU images must exist for TDEV creation and mapping. Solutions Enabler does not support CU image creation. CU image and split management is done through SymmWin configuration change functions, and is performed by Dell EMC customer support during installation.

Valid device configurations are:
- BCV+TDEV
- TDEV

Syntax
To create one or more devices, use the following syntax:

```
symdev -sid <SymmID> [-noprompt] [-sg <SgName>]
create -tdev -cap # [ -captype <cyl|mb|gb|tb>] [-N <#>]
               [-bcv] [-emulation fba|ckd3380|as400|celerra]
               [-mobility]
               [-device_name <DeviceName> [-number <n | SYMDEV>]]
create -tdev -emulation ckd3390
               <<<-model <1|2|3|9|27|54>> | 
               -cap # [ -captype <cyl|mb|gb|tb>]>> 
               [-device_name <DeviceName> [-number <n | SYMDEV>]]
create -gk|as400_gk|-pedev [-N <#>]
               [-device_name <DeviceName> [-number <n | SYMDEV>]]
```
Options

- **sg <SgName>**
  Adds the newly created device into the specified storage group.

- **cap <#>/ -captype (cyl/mb/gb/tb)**
  Specifies the size of the device needed in number of cylinders (default), megabytes, gigabytes, or terabytes.

### Table 13 Maximum device sizes

<table>
<thead>
<tr>
<th></th>
<th>MBs</th>
<th>CYLs</th>
<th>GBs</th>
<th>TBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBA</td>
<td>671108864</td>
<td>71582788</td>
<td>65536</td>
<td>64</td>
</tr>
<tr>
<td>CKD-3380</td>
<td></td>
<td>3993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CKD-3390</td>
<td></td>
<td>262668 - Maximum size for arrays running HYPERMAX OS 5977 Q12016SR and Q42016SR</td>
<td>1,182,006 - Requires arrays running HYPERMAX OS 5977 Q22017SR or higher.</td>
<td></td>
</tr>
</tbody>
</table>

- **N <#>**
  Specifies the number of devices.

- **emulation**
  Specifies the device emulation type. Valid emulations are:
  - FBA
  - Celerra_FBA
  - AS/400
  - CKD-3380
  - CKD-3390

- **mobility**
  Specifies devices with mobility safe ID. Supports FBA (excluding Celerra FBA and AS400 D910), Gatekeeper, and PE (Protocol Endpoint) devices.

- **device_name**
  Specifies device name. Supported for arrays running HYPERMAX OS 5977 Q22017SR or higher.

- **model <1|2|3|9|27|54>**
  Specifies one of the CKD-3390 emulation models:
  - 1 = CKD3390-1
  - 2 = CKD3390-2
  - 3 = CKD3390-3
Examples
To create four, CKD thin devices each with a capacity of 16000 cylinders, enter:

```
symdev create -sid 005 -tdev -cap 16000 -N 4 -emulation ckd3390 -model 1
Create operation succeeded.
```

Create devices (HYPERMAX OS 5977 lower than 5977 Q12016SR)

Description
Use the `symconfigure create dev` command or the `symdev create` command to create new devices.

Syntax
To create one or more devices, use the following `symconfigure` syntax:

```
symconfigure create dev count=<n>,
    size = <n> [MB | GB | CYL],
    emulation=<EmulationType>,
    config=<DevConfig>,
    [, preallocate size = <ALL>]
    [, allocate_type = PERSISTENT]]
    [, sg=<SgName>]]
    [, mapping to dir <director_num:port>]
    [, starting] target = <scsi_target>,
    lun=<scsi_lun>, vbus=<fibre_vbus>
    [, starting] base_address = <cuu_address>[,...]]
    [, mapping to cu_image = <cu_image_num>,
    split_name=<split_name>,
    [starting] base_address=<base_address>
    [, mvs_ssid=<n>]]
    [, device_attr =
    <SCSI3_PERSIST_RESERV | DIF1 |
    AS400_GK>[,...]]
    [, device_name=<DeviceName> [,number=<n |
SYMDEV> ]]];
```

To create one or more devices, use the following `symdev` syntax:

```
symdev -sid <SymmID> [-noprompt]
create -tdev -cap #@ [-captype <cyl|mb|gb|tb>] [-N #@] [-bcv]
create <-gk|as400_gk|-pedev [-N #@]
```
Options

count/#
Indicates the number of devices to create.

size/-cap/-captype
Specifies the size of the device needed in number of cylinders (default), megabytes, gigabytes, or terabytes.

<table>
<thead>
<tr>
<th>FBA devices</th>
<th>MBs</th>
<th>CYLs</th>
<th>GBs</th>
<th>TBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYPERMAX OS 5977 Q32015SR</td>
<td>67108864</td>
<td>71582788</td>
<td>65536</td>
<td>64</td>
</tr>
<tr>
<td>HYPERMAX OS 5977 lower than Q32105SR</td>
<td>16777216</td>
<td>8947848</td>
<td>16384</td>
<td>16</td>
</tr>
</tbody>
</table>

emulation
Specifies the device emulation type. Valid emulations are:
- FBA
- Celerra_FBA (external gateway)
- AS/400_D910_099

config
The device configuration type. Valid types are:
- TDEV
- BCV+TDEV

preallocate size
Indicates the amount of space pre-allocated to the thin device(s) when it is bound to a pool. The only valid value is ALL.

allocate_type
Indicates the allocation type. The only valid value is PERSISTENT.

sg
The local array storage group name for devices involved in RDF operations.

mapping to dir
Specifies the director and port for the mapping operation
For arrays running HYPERMAX OS 5977, mapping to dir returns a "feature not supported" error when the request includes mapping of devices to be created to ACLX enabled front end ports. In addition, the valid range for port is extended to 0 to 31.

scsi_target
Indicates a hex value for the SCSI target ID.

scsi_lun
Indicates a hex value for the SCSI logical unit number.

**vbus**
The virtual fibre bus address used when mapping to a Fibre Channel director port using volume set addressing.

**base_address**
Indicates a base or alias address for a device being mapped to an EA or EF port. These are mainframe ports which expect devices to be mapped in groups to form CU images.

**mapping to CU image**
Specifies the CU image for the mapping operation

**device_attr**
Specifies the attributes to be set on the new device. Possible values include:
- `SCSI3_persist_reserv` (persistent group reservation) You can set or clear the SCSI-3 persistence attribute only if the device is unmapped.
- `DIF1`
- `AS400_GK`

**device_name**
Specifies the user supplied name with a maximum of 64 characters including the suffix. Any character may be used for the device name except quotes (“ “), which denote the start and end of input. The device name plus an optional suffix can have a maximum of 64 characters. If using a numerical suffix, the device name will be limited to 50 characters (prefix) and the trailing numerical suffix number will be limited to 14 characters. If not using a numerical suffix, all 64 characters can be specified for the device name. The maximum starting suffix is 1000000. If setting a device name when creating RDF pairs, both RDF devices will be set to the same device name if using the SYMDEV option. Solutions Enabler does not check for uniqueness of device names.

**number**
Represents the user supplied number for the starting suffix. Specifying SYMDEV means that the corresponding device number will be used as the suffix.

**Examples**

```
symdev create -sid 005 -cap 10000 -nop -tdev -v
```
Create operation succeeded for devices: 01ff0.

**Restrictions when creating and managing devices**
The following rules and restrictions apply when creating or modifying devices:
- Required Access type: CFGSYM
- Allows for the creation of externally-visible (TDEV) devices (for FBA up to 64TB), without requiring meta devices. The creation and control of meta devices is no longer supported. Array-wide meta settings, previously used to automatically create meta devices are not supported.
Requests to create FBA meta and CKD RAID-10 (ckd_meta) devices are blocked on these arrays.

- Creation of standard (disk group) provisioned devices is blocked. This includes internal devices that are used for the backing of thin pools (DATADEVs and SAVEDEVs) as well as Diskless and VDEV devices, which are implemented as disk group provisioned devices.
- Creation of gatekeeper devices is supported, but they will always be thin devices.
- The ACLX attribute is supported only for thin devices with FBA emulation.
- Encapsulation of user data as disk group provisioned devices is not supported.
- Partial allocation of thin devices is not supported.
- SRDF device types cannot be created or converted when:
  - Domino mode is enabled on any current SRDF pairs.
  - There are any invalid tracks on any of the current SRDF devices.
  - Concurrent SRDF is enabled on a device.
- The only emulation type supported for iSeries devices is D910_099, as it is the only iSeries emulation type that supports thin provisioned devices. The size range is a minimum of 1562 cylinders and a maximum of 1118481 cylinders.
- AS/400_D910_099 thin devices cannot be CKD metadevices, SAVE devices, or DATA devices. In addition, IBM i thin devices cannot have the following attributes:
  - RCVRPNT_TAG
  - ACLX
  - DIF1

To create gatekeeper devices, use the `symconfigure create gatekeeper` command. For HYPERMAX OS 5977 and higher, gatekeeper devices can be added to storage groups using the syntax `sg=SgName`. All information about gatekeepers can be found in the *Dell EMC Solutions Enabler Installation and Configuration Guide* and in the EMC Knowledgebase solution EMC255976 available on EMC Online Support.

Only thin gatekeeper devices can be created on arrays running HYPERMAX OS 5977.

---

**Expand device capacity**

**Description**

The `symdev modify` command expands a device capacity. Refer to Create devices (HYPERMAX OS 5977 Q12016SR or higher) on page 227 or Create devices (HYPERMAX OS 5977 lower than 5977 Q12016SR) on page 229 for maximum FBA and CKD device sizes.

Device expansion of CKD 3390 devices is supported with VMAX arrays running HYPERMAX OS 5977 Q22017SR or higher. Automatic VTOC index rebuild must be enabled or be prepared to submit an ICKDSF batch job to rebuild the VTOC before the newly added space on the volume can be used.

CKD device expansion is not allowed for the following devices and configurations:

- CKD 3380
- **TDATs**
- **CDK device marked as Soft Fenced**
- **Device target size equal to less than the current size**
- **CKD devices with SnapVX sessions**

**Syntax**

To modify device capacity, use the following syntax:

```
```

**Options**

- **-cap**
  
  Specifies the new expanded size for the device.

- **-rdfg**
  
  Lists devices that belong to the specified SRDF group. When used with modify it specifies the SRDF group associated with the SRDF devices and indicates that both sides of the SRDF pair, which are associated with the SRDF group, should be expanded.

**Examples**

To expand device 1fe0 on array 005 to 4TB, enter:

```
symdev modify 1fe0 -sid 005 -cap 4000 -capsize gb -nop -tdev
```

Modify operation succeeded for devices: 1fe0

To expand 4 devices on SRDF group 33:

```
symdev modify -sid 85 -tdev -cap 1000 -capsize mb -dev 007D2:007D5 -v -rdfg 33 -nop
```

Symmetrix: 000197100085
Requested device(s): 007D2:007D5
Symmetrix: 000196801476
Requested device(s): 00A8A:00A8B 00AA2:00AA3

STARTING a TDEV Expand Device operation on Symm 000196801476.

Expanding devices [00A8A:00A8B] ................. Done.
Expanding devices [00AA2:00AA3] ................. Done.

The TDEV Expand Device operation SUCCESSFULLY COMPLETED on Symm 000196801476: 4 device(s) expanded.

STARTING a TDEV Expand Device operation on Symm 000197100085.

Expanding devices [007D2:007D5] ................. Done.

The TDEV Expand Device operation SUCCESSFULLY COMPLETED on Symm 000197100085: 4 device(s) expanded.

Modify devices operation succeeded.
Copy devices

Copying the attributes of an existing device into available disk space configures new devices based on the copied attributes. To configure new devices this way, either specify the quantity of disk space to configure into the new devices, or the number of devices to be created. The quantity of disk space represents the new space that will be available for the host to use, and not the space allocated in the array to manage the request according to the device protection requirements. In addition, copied attributes can be changed. For example, copied attributes of a standard device, can be changed to BCVs on the new device.

Copy a similar device

Syntax

To configure a device by copying a similar device, use the following syntax:

```markdown
symconfigure configure [nn.
nn[MB | GB] | nn devices] copying dev SymDevName[mapping to dir DirectorNum:PortNum [masking hba [awwn=awwn | wwn=wwn | iscsi=iscsi | aiscsi=aiscsi] host_lun=lun [dynamic_lun]] [,device_name=DeviceName [,number=n | SYMDEV]] [overriding [size=< n > [MB | GB | CYL]] [emulation=<EmulationType>] [config=<DevConfig>] [data_member_count=< n >] [mvs_ssid=< n >] [disk_group=< n >| name:<DskGrpName>]]];
```

Note

For arrays running HYPERMAX OS 5977, the configure operation is blocked if the source device specified by `SymDevName` is a `TDAT` device.

- `n.nn [MB | GB]`  
  Specifies the quantity of disk space to configure.

- `nn devices`  
  Specifies the number of devices to create.

- `SymDevName`  
  The device name of the model device.

- `DirectorNum PortNum`
The mapping attributes of the device are not copied. If the new devices are to be mapped, you must specify the director/port addresses.

**mapping to dir**
Specifies the director and port for the mapping operation.
Returns a feature not supported error when the request includes mapping of devices to be created to ACLX enabled front end ports. In addition, the valid range for PortNum is extended to 0 to 31.

**masking hba**
The masking attributes of the model device are not copied. If the new devices are to be masked, you must specify the host HBA to which the devices should be masked.

**host_lun**
Specifies the LUN addresses to be used for each device that is to be added for the host HBA.

**dynamic_lun**
Specifies to use the dynamic LUN addressing features but does not require a LUN address for each device. The LUN addresses are assigned based on what may already be in use for that host HBA.

**device_name**
Specifies the user supplied name with a maximum of 64 characters including the suffix. The legal characters for the device name include all alpha, numeric, underscore( _ ) and period( . ). The device name plus an optional suffix can have a maximum of 64 characters. If using a numerical suffix, the device name will be limited to 50 characters (prefix) and the trailing numerical suffix number will be limited to 14 characters. If not using a numerical suffix, all 64 characters can be specified for the device name. The maximum starting suffix is 1000000.

**number**
Represents the user supplied number for the starting suffix. Specifying SYMDEV will mean that the corresponding device number will be used as the suffix.

**overriding**
Indicates that you will be overriding some of the characteristics of the copied device.

**size**
Specifies the size of the new devices.

**emulation**
Specifies the device emulation type. Valid emulations are FBA and AS/400_D910_099.

**config**
The device configuration type. Valid configuration types are TDEV and TDEV+BCV.

**mvs_ssid**
When creating devices in an array that also contains CKD devices, a z/OS (MVS) subsystem ID (mvs_ssid) value can be provided so the new FBA devices are not seen as part of an existing subsystem ID group.

**name**
Specifies the name of the remote disk group. By default, the disk group name is DISK_GROUP_xxx, where xxx is the disk group number.

Usage is: disk_group=# or disk_group=name:DskGrpName

Convert devices

Syntax
To convert a device configuration type, use the following syntax:

```bash
symconfigure convert dev <SymDevName>[:<SymDevName>] to 
<DevConfig> [emulation=EmulationType,] 
[ ra_group=<n> 
>, remote_dev=<SymDevName>, 
invalidate=<invalidate_opt>, [remote_mvs_ssid=<n> 
>], 
start_copy=<YES | NO> ] [mvs_ssid=<n> 
>] [raidset = [TRUE | FALSE]];
```

Note
An IBM i thin device (TDEV) can be converted to a BCV+TDEV device, and a BCV +TDEV device can be converted to a TDEV device.

Options

SymDevName
Specifies the name of the device targeted for change. To target more than one device, indicate the first and last devices in a series separated by a colon (:).

DeviceConfig
Specifies the desired device configuration type. Table 15 on page 238 lists allowable configuration conversions.

dev
Indicates the device's emulation type.

ra_group
Specifies the RA group number in the SRDF environment.

remote_dev
Specifies the name of the remote array device targeted for change. If a range of SymDevNames is specified in the first line of the convert statement, the remote SymDevName value is increased incrementally to arrive at the corresponding device number.

invalidate_opt
Indicates the SRDF device to invalidate so a full copy can be initiated from the remote mirror. Allowed values are R1 (invalidate the source), or R2 (invalidate the target). The value NONE is not supported in Solutions Enabler V7.0 and higher.

remote_mvs_ssid
Specifies the remote z/OS (MVS) subsystem ID that is assigned to any device created as a result of removing any mirror(s). If not provided, the original MVS
SSID is assigned when available. If the MVS SSID group is full, supply a new MVS SSID. Only one `remote_mvs_ssid` can be used in a session; it is applied to all devices created within that session.

**start_copy**
Indicates whether an SRDF pair should be synchronized after the configuration change is committed.

---

**Note**
When creating SRDF devices, all conversions within a session must have:

- Device configuration settings that reflect the same destination SRDF type (RDF1 or RDF2).
- The same `ra_group` number.
- The same `invalidate` option.
- The same `start_copy` option.

---

**mvs_ssid**
Specifies the z/OS (MVS) subsystem ID that is assigned to any device created as a result of removing any mirror(s). If not provided, the original MVS SSID is assigned when available. If the MVS SSID group is full, supply a new MVS SSID. Only one `mvs_ssid` can be used in a session; it is applied to all devices created within that session.

**raidset**
When requesting to convert a RAID-S group to unprotected devices, set `raidset` equal to `TRUE` and list the first RAID-S member. It is not necessary to list the other members.

**Example**
To convert two existing BCV devices (0001C and 0001D) to an RDF1-BCV configuration and to invalidate the source R1 and synchronize the SRDF pair, enter:

```
symconfigure convert dev 0001C:0001D to RDF1-BCV, ra group=1, remote_dev=0001c, invalidate=R1, start_copy=YES;
```

### Device conversion restrictions

**Restrictions**
The following restrictions apply when converting devices:

- The `convert` command can be used for three different classes of device configuration changes, as long as the class types are performed in separate sessions.

---

**Note**
Changes for multiple operation classes can be executed in the same session, except for dynamic SRDF changes and device pool changes.

The three class types that cannot be used in the same session are:

- Add/remove BCV/DRV attributes
- Add/remove SRDF attributes
- Increase/decrease mirroring
- Full swap operations require the R1 and R2 devices to be the same size.
- One member of a raidset cannot be converted to unprotected without converting all members to unprotected.
- When adding/removing SRDF attributes, there are no restrictions on I/O. The SRDF pair must be split or failed over. If failed over, the R1 device must be unmapped.
- When adding/removing BCV attributes, there are no restrictions on I/O. The standard/BCV pair must be split.
- The SRDF mode on an SRDF device pairing will be Adaptive Copy Disk by default, unless the SYMAPI_DEFAULT_RDF_MODE is set in the option file. If the device being converted is a diskless R1 device, the RDF mode will default to Adaptive Copy Write Pending, regardless of the option file setting.

Valid thin device conversions

Thin devices can be converted to other thin device configurations, as shown in the following table.

---

Note

---

Table 15 Thin device conversions

<table>
<thead>
<tr>
<th>Original thin device</th>
<th>Converted to</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDEV a</td>
<td>RDF1+TDEV</td>
</tr>
<tr>
<td>TDEV a</td>
<td>RDF2+TDEV</td>
</tr>
<tr>
<td>TDEV</td>
<td>BCV+TDEV</td>
</tr>
<tr>
<td>BCV+TDEV b</td>
<td>TDEV</td>
</tr>
<tr>
<td>RDF1+TDEV a</td>
<td>TDEV</td>
</tr>
<tr>
<td>RDF2+TDEV a</td>
<td>TDEV</td>
</tr>
<tr>
<td>BCV+TDEV a</td>
<td>RDF1-BCV+TDEV</td>
</tr>
<tr>
<td>BCV+TDEV a</td>
<td>RDF2-BCV+TDEV</td>
</tr>
<tr>
<td>RDF1+TDEV a</td>
<td>RDF1-BCV+TDEV</td>
</tr>
<tr>
<td>RDF2+TDEV a</td>
<td>RDF2-BCV+TDEV</td>
</tr>
<tr>
<td>R1-BCV+TDEV a</td>
<td>R1+TDEV</td>
</tr>
<tr>
<td>R2-BCV+TDEV a</td>
<td>R2+TDEV</td>
</tr>
<tr>
<td>R1+TDEV</td>
<td>R1-BCV+TDEV</td>
</tr>
<tr>
<td>R2+TDEV</td>
<td>R2-BCV+TDEV</td>
</tr>
</tbody>
</table>

a. Not for VMAX 10K Series systems; all devices are dynamic RDF capable by default.
b. BCV+TDEV to TDEV is the only supported conversion for a BCV+TDEV device.
Convert a thin device

Example
To convert a thin device TDEV to an RDF1 thin device, enter:

```
symconfigure convert dev 00015 to RDF1+TDEV;
```

To create a thin R1 BCV device by converting a thin BCV device, enter:

```
symconfigure -sid 397 -nop -v -cmd "convert dev 015F2 to RDF1-BCV +TDEV ra_group=10 remote_dev=16A invalidate=R1 start_copy=no;" commit
```

Thin device recommendations to maximize I/O activity

Adhere the following restrictions/conditions to avoid impact on I/O activity:

- The BCV attribute is not allowed on thin SRDF devices or thin dynamic SRDF devices.
- The device being converted must not be part of a clone session.

Set device attributes

Syntax - symconfigure
To set the device attributes or emulation of a number of devices in a range, use the following form of the symconfigure set command:

```
symconfigure set dev SymDevName[::SymDevName] [emulation=EmulationType] [identity = NO identity] [attribute=[NO] device_attr];
```

Options - symconfigure

emulation
Specifies the device emulation type, which can be the following: FBA or CELERRA_FBA.

Note
You cannot set the device emulation type for Data Domain devices.

identity
Restores the devices identity to its original value.

attribute
Indicates if a device attribute restricts how a device can be accessed.
Examples - symconfigure
To convert five devices (00015 to 00019) to Celerra FBA emulation, enter:

```
symconfigure set dev 00015:00019 emulation=CELERRA_FBA;
```

Syntax - symdev
To set the device attributes or emulation of a number of devices in a range, use the following form of the symdev set command:

```
symdev -sid SymmID set SymDevName <-as400_gk | -bcv | -dif1>
-device_name DeviceName [-number <n | SYMDEV>]
-emulation < fba | celerra >
```

To unset a device name for a device, use the symdev unset command:

```
symdev -sid SymmID unset SymDevName <-as400_gk | -bcv | -dif1>
```

Options - symdev

device_name
   Specifies the DeviceName to be set.

emulation
   Specifies the device emulation type, which can be the following: FBA or CELERRA.

Device attribute values

Possible values include:

- **SCSI3_persist_reserv** (From PowerMaxOS 5978, this is enabled by default for thin devices and it is not allowed to be modified)
- **AS400_GK**
- **DIF1**
- **BCV**

**Note**

You cannot set device attributes for Data Domain devices.

Set device attribute restrictions

The following restrictions apply when setting device attributes:

- A device that is mapped or masked to an FCoE port cannot have the RCVRPVT_TAG attribute.

- When setting the device emulation type, the devices must be unmapped. No I/O to the devices involved.

- When setting the attribute type to a mapped device, it is recommended that you minimize the I/O activity to the affected devices.

  The following restrictions apply to setting the DIF1 device attribute:

- The DIF1 attribute can only be set on FBA devices.
Set device identifiers

Description
Solutions Enabler supports device identifier management on arrays. This support allows defining names and identifiers for EMC array devices, HP devices, and VMS devices. The definitions are configured in a command file and processed with the `symconfigure` command.

A device name or identifier can be set on a single device, a range of devices, or multiple ranges of devices. Device identifiers do not have to be unique for all devices.

Syntax
The format of the command file for setting device identifiers follows:

```
symconfigure set dev SymDevName[;SymDevName]
   [[device_name = 'DevName'] | [NO DevName]]
   [[hp_identifier = 'hp_id'] | [NO hp_identifier]]
   [[vms_identifier = vms_id] | [NO vms_identifier]];
```

Restrictions
The device identifier can include a `device_name` and the `hp_id` or a device name and the `vms_id`. The device identifier cannot include both the `hp_id` and the `vms_id`.

- Restrictions for `device_name`:
  - `DevName` can be less than or equal to 64 characters in length.
  - Any character may be used except quotes, which are used to mark the start and end of the input.
  - The names are case sensitive.
  - There is no default device name for a device.
Restrictions for hp_id:
- hp_id can be less than or equal to 128 characters in length.
- Any character may be used except quotes which are used to mark the start and end of the input.
- The identifiers are case sensitive.
- There is no default HP identifier for a device.

Restrictions for vms_id:
- A vms_id can be a number between 0 and 32766.

Identifier exclusions
Device identifiers cannot be set on the following devices:
- Metamembers. The device identifier of the metahead device will display, if applicable.
- The following internal devices (device identifiers display as N/A):
  - VAULT
  - SFS
  - DRV
  - SAVE (device names will be allowed for this device type)
  - DATA (device names will be allowed for this device type)

View device identifiers
Use the symdev list command to view device identifiers.

CLI commands are usually limited to an 80-character output, but if the user requests the hp_id of a device to be displayed, the line could be over 80 characters in length. A new form of the symdev list command displays the device identifiers.

This CLI command does not work in offline mode.

Note
Device name, device nice name, HP device identifiers, and VMS device identifiers cannot be used in any control command. All these device identifiers are only for display. Both HP device identifiers and VMS device identifiers can be set on any host and any devices.

Delete devices
Description
Use the symconfigure delete dev command or the symdev delete command to delete devices.
Syntax
To delete one or more devices, use the following syntax:

```
symconfigure delete dev SymDevName[:SymDevName]
```

```
symdev -sid <SymmID> [-noprompt]
    delete -devs <<SymDevStart>:<SymDevEnd> | <SymDevName>
    [,<<SymDevStart>:<SymDevEnd> | <SymDevName>>...]
```

Examples
To delete device 00015 from array 345, create a command file containing the following:

```
delete dev 00015;
```

Then commit the option using the symconfigure command:

```
symconfigure -sid 345 -file delete_dev.cmd -v -noprompt commit
```

Using the symdev command:

```
symdev delete 1f00 -sid 005 -nop
Delete devices operation succeeded.
```

Restrictions
- The delete commands are blocked if the source device specified by `SymDevName` is a TDAT device.
- The device must not be mapped to a front-end port.

Device reservation management

Use the configuration change functionality to reserve devices and front-end mapping addresses for future configuration and masking operations. This feature reserves the devices/addresses you plan on using, verifies that no one else has reserved the resources, and releases the reservations when the task is complete.

All reservations are assigned a reserve ID, indicating that the specified devices/addresses are reserved. Any attempt to use the reserved devices/addresses will return a message indicating that the devices/addresses are reserved.

There are two types of device reservations:
- **Enforced** — Reservations are enforced by the SYMAPI library, and require specifying the reserve ID to use the devices. This is the default behavior when reserving devices.
- **Advisory** — Reservations are enforced by co-operating applications. Some applications can ignore advisory reservations, allowing knowledgeable users to make configuration changes on reserved devices, provided that their changes are compatible with the reserving task's goal.

Both types of reservations can have expiration dates associated with them, which will automatically release a reservation if not released explicitly by the user.
Device reservations are honored only when devices are explicitly specified during Solutions Enabler configuration change operations. Operations that allow the array operating system to choose devices (such as when a meta is formed and only the metahead is specified) do not honor device reservations.

Device reservations are enabled (TRUE) by default in the options file. To disable device reservations, set the SYMAPI_ENABLEDEVICE_RESERVATIONS parameter in the options file to FALSE.

Device reservations are enforced (TRUE) by default in the options file. To disable the enforcing of device reservations, set the SYMAPI_ENFORCEDEVICE_RESERVATIONS parameter in the options file to FALSE.

**Note**

For information on changing the options file parameters, refer to the Dell EMC Solutions Enabler Installation and Configuration Guide or the Dell EMC Solutions Enabler CLI Reference Guide.

---

## Reserve devices

### Syntax

To reserve devices, use the following form:

```
symconfigure -sid SymmID [-expire ExpirationDate]  
   [-f[ile] CmdFile | 'redirect stdin' | -cmd "Cmd"]  
   -owner Owner -comment UserComment[-enforce | -advise]  
  reserve
```

**Note**

When reserving devices, note the returned reserve ID for subsequent processing.

### Options

- **ExpirationDate**
  
  Specifies the date and time for a device reservation to expire. This is an optional parameter, and if not specified, defaults to no expiration. The format for this parameter is:

  ```
  [mm/dd[/yy]:][hh:mm[:ss]]
  ```

  If you only provide the `hh:mm`, the current day will be assumed. If you only provide the `mm/dd`, the current year will be assumed. You can also specify a four-digit year.

- **CmdFile**
  
  Specifies the name of any ASCII text file containing a set of commands to process at a higher time. This file can be used in the following ways:

  - To reserve devices for specific configuration change operations, and the file lists configuration change commands.
To reserve devices for non-specific operations, use the following file syntax:

```
reserve dev SymDevName[:SymDevName]
```

Using this method allows you to reserve devices for other applications.

**Note**

For arrays running HYPERMAX OS 5977, the `reserve dev` operation is blocked if the source device specified by `SymDevName` is a TDAT device.

**Owner**

Specifies the name of the owner of the reservation (up to 31 characters long).

**UserComment**

Indicates a user-specified comment detailing the device reservation (up to 255 characters long).

- **-enforce**
  
  Specifies an enforced reservation (default).

- **-advise**
  
  Specifies an advisory reservation.

## Commit changes on reserved devices

**Description**

When committing changes on devices reserved with the Enforced flag, you must supply the appropriate reserve ID. If you do not have the reserve ID and someone else has reserved the devices, the commit will fail. If you have reserved the devices, or no one else has reserved the devices, then the commit will succeed.

When committing changes on devices reserved with the Advisory flag, some applications may not require a reserve ID. However, the `symconfigure` command does require a reserve ID.

**Syntax**

To commit changes on devices reserved with the `-enforce` option, use the following form:

```
symconfigure -sid SymmID -f[ile] CmdFile commit
  [-reserve_id=ResvID[,ResvID[,ResvID]]]
  [-remote_reserve_id=ResvID[,ResvID[,ResvID]]]
```

**Examples**

To commit the changes in the command file `delete.cmd`, enter:

```
symconfigure -sid 3241 -file delete.cmd commit -reserve_id 5
```
Manage Configuration Changes

View reserved devices on an array

Syntax
To view the devices reserved on an array, use the following command:

```
symconfigure -sid SymmID -reserved list
```

View details on reservation ID

Syntax
To view details on a specific reservation ID, use the following command:

```
symconfigure -reserve_id ResvID show
```

Options

*ResvID*
The device reservation ID.

Release reserved devices

Description
When releasing device reservations, supply the appropriate reserve ID. Performing a configuration change on reserved devices will not release them. Releasing a reservation is an independent step.

Syntax
To release reserved devices, use the following form:

```
symconfigure -sid SymmID [-noprompt] -reserve_id ResvID[,ResvID[,ResvID]] release
```

Options

*ResvID*
Specifies the device reservation ID.

Examples
To release the set of devices with the ID 5 and 7, enter:

```
symconfigure -sid 3241 release -reserve_id 5,7
```

Device pool management

VMAX3 and All Flash arrays running are shipped with pre-configured thin pools. During the pre-configuration process, the physical disks are partitioned into a set of internal disk groups based on the technology, capacity, and rotational speed of the disk and protection scheme desired. In addition each disk group is fully provisioned with DATA devices, thin pools are created, and the data devices are assigned to the thin pool created for that disk group.
If physical disks are added after system delivery, the install process either creates one or more new disk groups, DATA devices, and thin pools to accommodate those disks, or adds the physical disks to existing disk pools, provisions them into DATA devices consistent with the disk group definition and adds the devices to the pool for that disk group.

For details on thin pool provisioning and restrictions, refer to Thin device management and reporting overview on page 90.

Map CKD devices to CU image (HYPERMAX OS 5977 Q12016SR or higher)

Syntax
To map a CKD device to a CU image, use the following syntax:

```
symconfigure map dev <SymDevName>[:<SymDevName>]
to cu_image = <cu_image_num>,
split_name=<split_name>,
[mvs_ssid=<n>],
starting base_address=<base_address>;
```

**Note**
Parameters after the `map dev` command can be in any order.

**Options**

**cu_image**
Specifies CU image number for mapping CKD devices to CU image.

**split_name**
Specifies the array subsystem split name.

**mvs_ssid**
MVS host subsystem ID. This option is only required if creating a new image with the mapping request.

**base_address**
Indicates a base address for a device being mapped to a CU image.

**Note**
The `symconfigure create dev` and `symconfigure configure dev` commands can also be used to map a CKD device to a CU image. Refer to Dell EMC Solutions Enabler CLI Reference Guide for command detail.

Rules and restrictions
- Requires SDR Access Type.
- Requires Storage Admin rights.
- FBA devices can only be mapped to CU images containing only FBA devices. Mixed FBA and CKD devices in a single CU image is not supported.
Unmap CKD devices from CU image (HYPERMAX OS 5977 Q12016SR or higher)

Syntax
To unmap a CKD device from a CU image, use the following syntax:

```
symconfigure unmap dev <SymDevName>[:<SymDevName>]
   from cu_image = <cu_image_num>,
   split_name=<split_name>;
```

Options
- **cu_image**
  Specifies CU image number for mapping CKD devices to CU image.
- **split_name**
  Specifies the array subsystem split name.

Rules and restrictions
- Requires SDR Access Type.
- Requires Storage Admin rights.

Assign PAV alias addresses to CU image mapped devices

Description
When assigning PAV alias addresses to CU image mapped devices, the aliases are propagated to all director ports to which the devices are mapped. Devices within the range that are not mapped are skipped. If any devices in the range are mapped to a different CU image than the first device, an error will be returned. If the device range has base addresses with gaps, the aliases will also have gaps.

Mainframe ports expect devices to be mapped in groups to form CU images. The first digit in the address is the CU image number, which can range from 0 to 0xF. The remaining two digits can range from 00 to 0xFF.

Syntax
To assign a PAV alias address range to a CU image, use the following form:

```
Note
The add pav alias_range command is supported on arrays running HYPERMAX OS 5977 Q12016SR or higher. It is not supported on arrays running HYPERMAX OS 5977 lower than Q12016SR.
```

```
symconfigure add pav alias_range
   nnnnnn
   :
   nnnnn
   to mvs_ssid =
   nnn
```
To assign PAV alias addresses to devices mapped to EA or EF ports, use the following syntax:

**Note**
The `add pav alias` command is supported on arrays running HYPERMAX OS 5977 lower than Q12016SR. It is not supported on arrays running HYPERMAX OS 5977 Q12016SR or higher.

```
symconfigure add pav alias to dev SymDevName[:SymDevName], alias count=nnn
```

**Examples**
To add a PAV alias range to a CU image using SSID 140, enter:

```
symconfigure add pav alias_range addr 00080:0009f to mvs_ssid=140
```

To add the alias A60 to device 01D, which is already mapped, enter:

```
symconfigure add pav alias to dev 01D starting alias=A60
```

To add total PAV aliases to device 37a, enter:

```
symconfigure add pav alias to dev 37a , alias count=32
```

Remove PAV alias addresses from CU image

**Syntax**
To remove a PAV alias address range from a CU image, use the following syntax:

```
symconfigure remove pav alias_range from mvs_ssid = nnn
```

**Note**
The `remove pav alias_range` command is supported on arrays running HYPERMAX OS 5977 Q12016SR or higher. It is not supported on arrays running HYPERMAX OS 5977 lower than Q12016SR. The `remove pav alias` command is supported on arrays running HYPERMAX OS 5977 lower than Q12016SR. It is not supported on arrays running HYPERMAX OS 5977 Q12016SR or higher.

Map FBA devices to director ports

**Description**
The Device Reallocation feature allows for mapping FBA devices to front-end director ports, or mapping a range of devices to consecutive addresses starting from a specified address.
Syntax
To map a FBA device to a director port, use the following command:

```
symconfigure map dev SymDevName[:SymDevName] to dir
DirectorNum:PortNum[, emulation = EmulationType]
[starting][target = ScsiTarget,] lun = ScsiLun[, vbus = FibreVbus]
```

---

**Note**
Parameters after the `map dev` command can be in any order.

**Options**

**emulation**
Indicates the device's emulation type. This option is required when performing operations on a Celerra device, and indicates that you are aware that you are changing the Celerra environment. Solutions Enabler supports mapping IBM i thin devices.

**lun**
Specifies the SCSI logical unit number (hex value).

**starting**
Specifies the starting address for the range of devices.

**target**
Specifies the SCSI target ID (hex value).

**vbus**
Specifies the virtual bus (vbus) address for mapping to an FA port if using volume set addressing.

**Examples**
To map device 00030 to director 16A, port 0, and SCSI target/LUN 0, 7, enter in the command file:

```
symconfigure map dev 00030 to dir 16A:0 target=0, lun=7;
```

To map a device 00032 to director 16A, port 0, and SCSI target/LUN 0, 2 and update the device masking database by specifying the WWN 20000000c920b484 of the host bus adapter (HBA) port through which a host accesses the device, enter the following command:

```
symconfigure map dev 00032 to dir 16A:0 target=0, lun=2, wwn=20000000c920b484;
```

**Restrictions**

- When mapping, there are no restrictions on I/O if adding a second path.
- After committing a `symconfigure` mapping operation, update the device mapping information within the host system environment. Attempting host activity with a device after it has been removed or altered, but before the host's device information has been updated, can cause host errors.
To update the hosts, run the utilities designed for the specific platform as described in introduce devices to a host on page 253. After the host environment is updated, I/O activity can resume with the array device.

- The `map dev` command returns a feature not supported error when mapping devices to ACLX enabled front end ports.
- The `map dev` command returns a feature not supported error if the devices are encapsulated devices being used as TimeFinder SnapVX source devices.

**Obtain list of addresses**

**Syntax**

To obtain a list of used addresses, including the next available address, use the following command:

```bash
symcfg list -SA all -address -available
```

**Unmap FBA devices from director port**

**Description**

The Device Reallocation feature allows for unmapping devices from front-end director ports.

Unmapping can be from one or all ports. Since all devices with the same SSID must either be mapped or unmapped, specify an SSID when unmapping only some devices in a CU image.

**Syntax**

To unmap devices from a director port, use the following form:

```bash
symconfigure unmap dev SymDevName[:SymDevName] from dir <ALL:ALL | ALL:PortNum | DirectorNum:ALL | DirectorNum:PortNum> [, emulation = EmulationType] [, devmask_access = remove | retain];
```

**Options**

- **emulation**
  
  Indicates the device's emulation type. This option is required when performing operations on a Celerra device, and indicates that you are aware that you are changing the Celerra environment.

**Restrictions**

The `unmap dev` command returns a feature not supported error when unmapping devices from ACLX enabled front end ports.

**I/O activity and unmapping devices**

The following items describe how to avoid impacting I/O.

- When unmapping, no I/O activity is allowed on any devices in the specified mapped path. Devices must be made **Not Ready** or **Write Disabled**.
For example, to make the device Not Ready:

```bash
symdg create -type [REGULAR | RDF1 | RDF2] DgName
symdg -g DgName -sid SymmID add dev SymDevName
symdg -g DgName not_ready
```

- When unmapping only one path to a multi-pathed device, you may prefer to write disable that path only:

```bash
symdg -g DgName -SA 16A -p 0 write_disable
```

To make a device Not Ready without creating a device group:

```bash
symdev -sid SymmID not_ready SymDevName
```

---

**Note**

Do not use the `write_disable` argument with the `symrdf` command, as this write disables the source (R1) device(s) or the target (R2) device(s) to its/their local hosts.

- After committing a `symconfigure` mapping operation, update the device mapping information within the host system environment. Attempting host activity with a device after it has been removed or altered, but before the host's device information has been updated, can cause host errors.

  To update the hosts, run the utilities designed for the specific platform as described in *Introduce devices to a host* on page 253. After the host environment is updated, I/O activity can resume with the array device.

---

### Managing PowerPath initiator and host registration

The following items describe how to manage PowerPath initiator and host registrations.

- To enable PowerPath initiator registration on an array use:

  ```bash
  sympath -sid <SymmID> enable -initiator_registration
  ```

- To disable PowerPath initiator registration on an array use:

  ```bash
  sympath -sid <SymmID> disable -initiator_registration
  ```

- To enable PowerPath host registration on an array use:

  ```bash
  sympath -sid <SymmID> enable -host_registration
  ```

- To disable PowerPath host registration on an array use:

  ```bash
  sympath -sid <SymmID> disable -host_registration
  ```
Introduce devices to a host

After reconfiguring an array by moving, deleting, adding, or modifying one or more devices, update the host so that the host recognizes the new array configuration. For some platforms, the `symcfg scan` command is available to perform the host update. These include Sun Solaris, HP-UX, IBM AIX, Tru64/OSF1, and Windows systems.

After mapping devices to a host or changing device channel addresses, the following actions are required to introduce devices for each of the following host types.

Introduce devices to Sun Solaris systems

**Syntax**
To add or modify devices while online in the Solaris environment, use the following form:

```
drvconfig | symcfg scan
  disks
  devlinks
```

**Note**
Follow the instructions in the Solaris documentation to introduce new devices to the host environment.

Introduce devices to HP-UX systems

**Syntax**
To view mapping change results for HP-UX hosts, use the `ioscan` command in a statement similar to the following:

```
ioscan -fnC disk
```

To define newly connected physical volumes to the HP-UX host system without rebooting it, use the following form:

```
insf -e
```

**Note**
For more information, refer to the HP 9000 documentation.

Introducing devices to IBM AIX systems

To introduce new devices for AIX hosts, perform the following actions:

**Procedure**
1. From the SMIT menu, select Devices > Fixed Disk > Add a Disk.
2. Select the EMC SYMMETRIX definition from the disk table.
3. Select the SCSI bus on which the new disk resides.
4. Type the connection address for the new device (target, LUN).
5. Select EXECUTE.
6. Repeat steps 2 through 5 for each new device being added to the configuration.

Introducing devices to HP Tru64 UNIX systems

To introduce new devices for Tru64 UNIX hosts, perform the following actions:

Procedure
1. At the prompt, type:
   \texttt{scsimgr \textasciitilde scan\_bus bus=BUSNUM}
2. Repeat for each LUN:
3. Write a label to the device you are defining:
   \texttt{disklabel \_rw rz<lun\_letter><unitID> <label>}
4. Change the ownership on the device to a particular application:
   \texttt{chown <owner>:<group> *rz<lun_letter><unitID> *}
5. Follow the host documentation to introduce new devices to the host environment.

Introducing devices to Windows systems

To introduce new or changed devices for Windows hosts, while the system remains online:

Procedure
1. From the desktop, select \textbf{Start > Settings > Control Panel > Add /Remove Hardware}. Complete the wizard to discover and add the new devices.
2. Partition and format the new devices as described in the documentation for the specific Windows OS version.

Set SRDF group attributes

Description
SRDF group attributes allow you to assign priorities to SRDF/A sessions, and to set the minimum amount of time before attempting an SRDF/A cycle switch. Use the \texttt{symrdf} command to set SRDF attributes for arrays running Solutions Enabler. Refer to the Dell EMC Solutions Enabler SRDF Family CLI User Guide for more details.

\textbf{NOTICE}

Starting with Solutions Enabler V8.0.1, the ability to set SRDF group attributes using the \texttt{symconfigure} command is no longer available. Use the \texttt{symrdf} command to set SRDF attributes for arrays running Solutions Enabler.
Swap RA groups

Description
Use the `symrdfs` command to set swap devices in an RA group from target to source. Refer to the Dell EMC Solutions Enabler SRDF Family CLI User Guide for more details.

**NOTICE**
Starting with Solutions Enabler V8.0.1, the ability to swap SRDF group attributes using the `symconfigure swap ra group` command is no longer available. Since `symconfigure` support for performing application-specific functions requires more restrictive access and authorization rights, generally requires more system resources (due to the session management overhead) and is more time-consuming, this functionality is no longer supported.
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 7 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.
vWitness requirements

vWitness requires the following:

- **Array requirements:**
  - Two VMAX arrays running HYPERMAX OS 5977.945.890 or later.
  - SRDF/Metro license installed on each array.
  - eManagement guest for Unisphere on each array. eManagement is standard on VMAX All Flash arrays, and can be added to VMAX3 arrays in the field. Contact your EMC representative for more information.
  - RA (Fibre/SAN) or RE (Ethernet/IP) connectivity between the paired arrays.
  - Ethernet/IP connectivity between each array and each vWitness instance it uses.

- **vApp host requirements:**
  - VMware ESX 4.0 or higher
  - Depending on the vApp, the host must meet the following:
    - Solution Enabler Virtual Appliance: Single processor; 2 GB of memory; dual disks, with 16 GB of disk space and 5 GB of expandable disk space
    - Unisphere for VMAX: Dual core processor, 16 GB of memory, and 120 GB of disk space

vWitness Management

Solutions Enabler CLI commands are available to configure, manage, and monitor a storage system's access to vWitness instances. The CLI allows for the following vWitness operations:

- Add vWitness definition
- Enable vWitness definition
- Modify vWitness definition
- Remove vWitness definition
- Suspend vWitness definition
- View vWitness definitions

Refer to the Dell EMC SRDF/Metro vWitness Configuration Guide for Solutions Enabler command syntax and examples.

Add director

**Note**

Adding the first RF Director will also enable SRDF. From Solutions Enabler V8.4 and higher, no BIN file change is required to add the first RF instance and enable SRDF. This enhancement adds flexibility to add and remove SRDF on VMAX3 and/or VMAX All Flash arrays for NDM migrations without the need to contact Customer Support.
Syntax
To add a director, use the following syntax:

```
add dir slot_num = <director slot_number> type=<FA|FE|SE|RF|RE>;
```

Examples

```
symconfigure -sid 084 commit -cmd "add dir slot_num = 1 type=FA;"
```

Execute a symconfigure operation for symmetrix '000197100084' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change
   session....................Established.
   Processing symmetrix 000197100084
   
   add dir slot_num = 1 type=FA;
   }
   Performing Access
   checks............................................Allowed.
   ... Local:  COMMIT............................................Done.
   Created FA type director: 1f     Terminating the configuration
   change session...............Done.
   The configuration change session has successfully completed.

Restrictions
The following restrictions apply to adding directors:

- Requires the following security privileges:
  - Access Type: CFGSYM
  - Authorization Rights: Storage Admin

- Addition of the following directors is not supported:
  - IM – Infrastructure Management
  - ED – Enginuity Data Services
  - DS – SAS back-end
  - DA – Fibre back-end
  - DX – external storage back-end
  - EF – Ficon front-end

Remove director

Note
Removing the last RF Director will also disable SRDF. From Solutions Enabler V8.4 and higher, no BIN file change is required to remove the last RF instance and disable SRDF. This enhancement adds flexibility to add and remove SRDF on VMAX3 and/or VMAX All Flash arrays for NDM migrations without the need to contact Customer Support.
Syntax
To remove a director, use the following syntax:

```
remove dir director_num
```

Examples

```
symconfigure -sid 084 commit -cmd "remove dir 1f;"
```

Execute a symconfigure operation for symmetrix '000197100084' (y/n)? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session................Established.
   Processing symmetrix 000197100084
   remove dir 1f;
   }
   Performing Access checks.................................Allowed.
   
   Terminating the configuration change session.............Done.
The configuration change session has successfully completed.

Restrictions
The following restrictions apply to adding directors:

- Access Type: CFGSYM
- Authorization Rights: Storage Admin

Port to director emulation support

Only a single emulation instance of a specific type (FA, DA, RF, EF, etc.) is available per director board. If more connectivity is needed, add additional ports to an existing emulation instance. That instance uses all cores configured to it to drive the workload across all ports assigned to it.

Each director board can contain up to 32 physical ports. These physical ports can be assigned to compatible emulation instances (and are numbered from 0-31) based on the rules outlined below. In addition, directors containing a Fibre Channel emulation have 32 virtual ports (numbered 32-63), which are reserved for use by internal guests. A capability attribute on each physical port determines the set of front-end emulations to which the port may be assigned.

The following emulation types support associating (assigning) unused ports to front-end emulations and disassociating (freeing) them:

- FA
- RF

Association of ports to EF (FICON) emulations is not supported.

Associate ports to director emulations

Description
Use the `symconfigure associate port` command to associate one or more physical ports to a director emulation type in the specified director board.
Syntax
To associate a port to a director, use the following syntax:

```
symconfigure associate port <port_num> [, <port_num> . . .] to dir <dir_num> ;
```

Options

`dir_num`

The director number of the emulation.

Example

To associate ports 2 and 4 to emulation type FA on director 7E, enter:

```
symconfigure associate port 2,4 to dir 7E ;
```

Restrictions

- The following security privileges are required to execute this operation:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Only free ports can be associated with director emulations. To display free ports, use the CLI command `symcfg list -sid xxx -port -free`.
- Associating ports to RE and EF emulations is not supported.
- Virtual ports cannot be associated or disassociated from an emulation.
- Ports cannot be added to IM, EDS, or DA emulations. If the specified director is running one of those emulations, the operation fails with the error `SYMAPI_C_DIR_IS_NOT_A_FRONT_DIR`.
- If any of the specified ports is already associated with an emulation, the operation fails with the error `SYMAPI_C_PORT_ALREADY_ASSOCIATED` and none of the specified ports will be associated.
- If the capabilities of any of the specified ports are incompatible with the emulation running on the director, the operation fails with the error `SYMAPI_C_EMULATION_PORT_MISMATCH` and none of the specified ports will be associated.
- Fibre Channel ports can only be associated with FA and RF emulations.
- Associating ports to director emulation configures the ports in Offline state. You have to change the state of the ports to Online to make them usable.

Verify port status after association

Description

After successfully assigning the ports to a given emulation on a director, issue the `symcfg list -dir ALL` command to verify that the ports are assigned to the requested director.

Examples

```
symcfg list -dir ALL -sid 064
```
Sample output

Symmetrix ID: 000197100064 (Local)

<table>
<thead>
<tr>
<th>Ident</th>
<th>Type</th>
<th>Engine</th>
<th>Cores</th>
<th>Ports</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM-7A</td>
<td>IM</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>IM-8A</td>
<td>IM</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>ED-7B</td>
<td>EDS</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>ED-8B</td>
<td>EDS</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>DF-7C</td>
<td>DISK</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>Online</td>
</tr>
<tr>
<td>DF-8C</td>
<td>DISK</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>Online</td>
</tr>
<tr>
<td>FA-7E</td>
<td>FibreChannel</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>Online</td>
</tr>
<tr>
<td>FA-8E</td>
<td>FibreChannel</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>Online</td>
</tr>
<tr>
<td>RF-7G</td>
<td>RDF_BI_DIR</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>Online</td>
</tr>
<tr>
<td>RF-8G</td>
<td>RDF_BI_DIR</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>Online</td>
</tr>
</tbody>
</table>

Disassociate ports from director emulations

Description
Use the `symconfigure disassociate port` command to disassociate one or more physical ports from an emulation type in the specified director board.

Syntax
To disassociate a port from a director type, use the following syntax:

```
symconfigure disassociate port <port_num>[,<port_num>]. . .] from
dir <dir_num>;
```

Options

- **dir_num**
  - The director number of the emulation.

Example
To disassociate ports 1 and 4 from emulation type FA on director 7E, enter:

```
symconfigure disassociate port 1,4 from dir 7E ;
```

Restrictions
- The following security privileges are required to execute this operation:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Disassociating ports from RE and EF emulations is not supported.
- Virtual ports cannot be associated or disassociated from an emulation.
- Passthru ports cannot be disassociated from an emulation.
- Ports cannot be removed from IM, EDS, or DA emulations. If the specified director is running one of those emulations, the operation fails with the error `SYMAPI_C_DIR_IS_NOT_A_FRONT_DIR`.
- If any of the specified ports is not associated with the specified director, the operation fails with the error `SYMAPI_C_EMULATION_PORT_MISMATCH` and none of the specified ports will be disassociated.
If the specified director is running an FA or FE emulation and one of the specified ports is in a port group, the operation fails with the error SYMAPIC C_DIR HAS PORT IN USE.

If the specified director is running an SE emulation and one of the specified ports has IP interface configured on it, the operation fails with the error SYMAPIC C_DIR HAS PORT IN USE.

If the specified director is running an RF emulation and one or more of the specified ports has RDF groups defined on it, the operation fails with the error SYMAPIC C_DIR HAS PORT IN USE.

Ports can be disassociated from director emulations only if they are in Offline state.

Verify port status after disassociation

**Description**
After dissociating ports from a given director emulation, issue the `symcfg list -port -free` command to list the ports currently available to be associated with a director along with their supported interface types, maximum speed, and status.

**Examples**

```
symcfg list -port -free -sid 064
```

**Sample output**

```
Symmetrix ID: 000197100064

<table>
<thead>
<tr>
<th>Slot</th>
<th>Port</th>
<th>FCISDRE</th>
<th>Gb/sec</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>...Y...</td>
<td>1</td>
<td>Powered</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>...Y..Y</td>
<td>1</td>
<td>Powered</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>.Y......</td>
<td>1</td>
<td>Powered</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>.Y......</td>
<td>1</td>
<td>Powered</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>Y....Y.</td>
<td>1</td>
<td>Powered</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>Y....Y.</td>
<td>1</td>
<td>Powered</td>
</tr>
</tbody>
</table>

Legend:
Flags:
(F)A  : Y = Yes,  . = No
F(C)OE : Y = Yes,  . = No
F(I)CON: Y = Yes,  . = No
(S)E   : Y = Yes,  . = No
(D)X   : Y = Yes,  . = No
(R)F   : Y = Yes,  . = No
(R)(E) : Y = Yes,  . = No
```

**Set port characteristics**

**Syntax**
To set the port characteristics of a specified director, use either `symconfigure` or `symcfg` command.
symcfg set

symcfg set -fa_loop_id <0-125>

symcfg set [enable|disable] -port_flag <VSA, NonPart, ACLX, OpenVMS, ShowACLX, SoftRst, EnvSet, DisQRst, SC3, SPC2, OS2007, ARB>

Options:

- **fa_loop_id**
  
  Use to assign FA port address, between 0 and 125.

- **port_flag**
  
  The Fibre Channel director or SE port flag name.

  - **ARB**: When enabled, a SCSI bus reset only occurs to the port that received the reset (not broadcast to all channels).
  - **VSA**: Enabled for VolumeSetAddressing for HP-UX hosts.
  - **NonPart**: When enabled, the Fibre Channel director only uses hard-assigned addressing when it initializes on the loop. Otherwise, soft-assigned addressing is used during loop initialization (the default).
  - **ACLX**: When enabled, allows storage provisioning using Auto-provisioning Groups.
  - **OVMS**: Enabled for an OpenVMS fibre connection.
  - **ShowACLX**: Enabled/Disabled, to make the ACLX device visible or to remove visibility from the ACLX device respectively. By default all ACLX enabled ports will have the ShowACLXDevice attribute disabled.
  - **DisQRst**: When enabled, a Unit Attention (UA) that is propagated from another director does not flush the queue for this device on this director. Used for hosts that do not expect the queue to be flushed on a 0629 sense (only on a Hard Reset).
  - **EnvSet**: When enabled, this flag enables the environmental error reporting by the array to the host on the specific port.
  - **OS2007**: HP_UX & Windows Longhorn specific setting.
  - **SC3**: When enabled, the Inquiry data is altered when returned by any device on the port to report that the array supports SCSI 3 protocol. When this flag is disabled, the SCSI 2 protocol is supported.
  - **SoftRst**: When enabled for a Bull/GCOS-7 host, the array port supports the SCSI Soft Reset option.
  - **SPC2**: SPC-2 in inquiry data.

symconfigure set port

**Note**

When setting port attributes if the port is online, the port is taken offline (except for ShowACLX), temporarily. When setting port attributes, it is recommended that you temporarily suspend I/O activity to the effected ports during this operation.
**gige**
Indicates that one or more network address values are going to be specified for a front-end Gig-E director. Addresses should use the Internet standard dot notation.

**primary_ip_address**
The IP address for a front-end Gig-E port.

**primary_netmask**
The IP netmask for a front-end Gig-E port.

**default_gateway**
The gateway or router address for a front-end Gig-E port.

**isns_ip_address**
The IP address for the Internet Storage Name Service (ISNS) associated with a front-end Gig-E port.

**primary_ipv6_address**
The IPv6 address for the front-end Gig-E port.

**primary_ipv6_prefix**
The IPv6 mask prefix for a front-end Gig-E port. The value can be 0-128, indicating the number of initial bits in the subnet that are identical.

**fa_loop_id**
The FA director loop ID (arbitrated loop physical address). Valid values are 0 through 125. (Hard Addressing must be enabled.) Not applicable for Gig-E ports.

**hostname**
The 12-character hostname.

**Example:**

Note

This command cannot be used to set port characteristics for iSCSI physical front end ports and iSCSI target virtual ports. Use the modify iscsi_target command.

**FlagName**
A SCSI or fibre port flag. Possible values for the SCSI protocol flags are in Table 16 on page 265, and the values for the fibre protocol flags are in Table 17 on page 268.

**NOTICE**
Incorrectly changing the port flags can render the storage system inaccessible. Be sure of your needs before resetting these flags.
To turn on the write protect access logix (ACLX) for director 7E, port 0, enter:

```
symconfigure set port 7e:0 ACLX=enable;
```

## SCSI protocol flags

### Table 16 SCSI protocol port flags

<table>
<thead>
<tr>
<th>SCSI protocol flags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto_Busy</td>
<td>When enabled specifically for Unisys A-series platforms only, this flag enables the auto-busy mechanism so that the array returns a Busy to all Unisys host requests.</td>
</tr>
<tr>
<td>Avoid_Force_Negotiate</td>
<td>When enabled for Sequent V4.2.3 and lower, the array never initiates negotiations. Normal array behavior is to initiate negotiations after an offline-to-online transition. This is for hosts that do not handle negotiations.</td>
</tr>
<tr>
<td>Avoid_Reset_Broadcast</td>
<td>When enabled, a SCSI bus reset only occurs to the port that received the reset (not broadcast to all channels).</td>
</tr>
<tr>
<td>Command_Reordering</td>
<td>When enabled with Tag Command Queuing in use, the incoming SCSI commands become reordered to Simple Queuing. The default is enabled and should only be disabled upon a request from EMC.</td>
</tr>
<tr>
<td>Common_Serial_Number</td>
<td>This flag should be enabled for multipath configurations or hosts that need a unique serial number to determine which paths lead to the same device.</td>
</tr>
</tbody>
</table>

*Note*  
This flag is not supported on arrays running HYPERMAX OS 5977. Setting this flag will return a feature not supported error.

<p>| Cyl_Count_In_Name²                      | When this flag is enabled, the array with the specified port embeds the cylinder count into the product ID returned in the SCSI Inquiry command. Enabled for Pyramid only when it is desirable to embed the array support into the Pyramid kernel. |</p>
<table>
<thead>
<tr>
<th>SCSI protocol flags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disable(False Disconnect)</td>
<td>When enabled for debugging, this flag prevents the port from performing a False Disconnect operation. (Default is disabled and currently, you cannot change this flag.)</td>
</tr>
<tr>
<td>Disable_Interleaved_Cmds</td>
<td>When enabled (always), metavolume command interleaving is being supported. This allows multiple metamembers to operate at the same time on the same volume.</td>
</tr>
<tr>
<td>Disable_Mini_Q</td>
<td>When enabled for debugging, this flag disables the use of the Mini Queue on the port. (Default is disabled and currently, you cannot change this flag.)</td>
</tr>
<tr>
<td>Disable_Q_Reset_on_UA</td>
<td>When enabled, a Unit Attention (UA) that is propagated from another director does not flush the queue for this device on this director. Used for hosts that do not expect the queue to be flushed on a 0629 sense (only on a Hard Reset).</td>
</tr>
<tr>
<td>Disable_Ultra</td>
<td>When enabled, this flag disables Ultra SCSI on an Ultra capable SA port. (Default is disabled and currently, you cannot change this flag.)</td>
</tr>
<tr>
<td>Environ_Set</td>
<td>When enabled, this flag enables the environmental error reporting by the array to the host on the specific port.</td>
</tr>
<tr>
<td>Linked_Commands</td>
<td>When enabled, this flag enables support of SCSI linked commands. It allows a host to chain SCSI commands in a manner similar to mainframe Channel Command Words (CCWs). (Default is enabled, and currently, you cannot change this flag.)</td>
</tr>
</tbody>
</table>
| PBAY_Monitor                   | For the Sequent platforms only to allow emulation of the Sequent PBAY. When enabled, this flag enables low-level polling of the SCSI bus in order to intercept the nonstandard SCSI operations required for a Sequent PBAY disk subsystem. Must be used for the Sequent cluster operation for the Symmetry system for Sequent V4.2.x operating systems only. Must not be used on versions higher than V4.2.x or
**Table 16** SCSI protocol port flags (continued)

<table>
<thead>
<tr>
<th>SCSI protocol flags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for any NUMA-Q systems and also not used for Fibre Channel.</td>
</tr>
<tr>
<td><strong>SCSI_3</strong></td>
<td>When enabled, the Inquiry data is altered when returned by any device on the port to report that the array supports SCSI 3 protocol. When this flag is disabled, the SCSI 2 protocol is supported.</td>
</tr>
<tr>
<td><strong>SCSI_Support</strong></td>
<td>When enabled, this flag provides a stricter compliance with SCSI standards for managing device identifiers, multi-port targets, unit attention reports, and the absence of a device at LUN 0.</td>
</tr>
<tr>
<td><strong>Set_Qerr</strong></td>
<td>This flag should be enabled for SGI platforms only to flush the queue on a contingent allegiance condition (CAC). Must be used for V5.3 and V6.2 SGI operating systems and cluster environments. Not used on versions higher than V6.2.</td>
</tr>
<tr>
<td><strong>Soft_Reset</strong></td>
<td>When enabled for a Bull/GCOS-7 host, the array port supports the SCSI Soft Reset option.</td>
</tr>
</tbody>
</table>
| **SPC2_Protocol_Version** | This flag should be enabled (default) in a Windows 2003 environment running Microsoft HCT test version 12.1. When setting this flag, the port must be offline.  
  Note: Reboot the host after setting this flag. |
| **Wide_Transfer**         | When enabled, this flag enables SCSI Wide operation. (Default is enabled, and currently, you cannot change this flag.)                   |

a. Not available for host-based configuration changes.

**Fibre protocol flags**

The following table lists the Fibre protocol flags and their descriptions.
### Table 17 Fibre protocol port flags

<table>
<thead>
<tr>
<th>Fibre protocol flags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACLX</td>
<td>When enabled, allows storage provisioning using Auto-provisioning Groups.</td>
</tr>
<tr>
<td>Auto_Negotiate</td>
<td>When enabled, allows two fibre ports to <em>handshake</em> and settle on an optimal speed for data transfer.</td>
</tr>
<tr>
<td>Non_Participating</td>
<td>When enabled along with the Hard_Addressing flag, the Fibre Channel director only uses hard-assigned addressing when it initializes on the loop. Otherwise, soft-assigned addressing is used during loop initialization (the default).</td>
</tr>
<tr>
<td>OpenVMS a</td>
<td>Enabled for an OpenVMS fibre connection.</td>
</tr>
<tr>
<td>Volume_Set_Addressinga</td>
<td>When enabled along with the Disk_Array flag for HP-UX hosts, the volume set addressing mode is selected. VSA mode allows octal addressing.</td>
</tr>
</tbody>
</table>

**a.** A block is added to prevent OpenVMS and Volume_Set_Addressing Fibre protocol port flags from being set at the same time on any given port, as setting these two flags together may result in data loss. This block will be effective for all operating system levels supported.

### Setting a port to show ACLX device

Devices cannot be mapped to ACLX enabled ports. To make the ACLX device visible or to remove visibility from the ACLX device, set the `Show_ACLX_Device` attribute on front end ports to ENABLE or DISABLE, respectively. By default all ACLX enabled ports will have the `Show_ACLX_Device` attribute disabled.

**Example**

To make the ACLX device visible, enter:

```
symconfigure -sid 230 commit -cmd "set port 5E:0 Show_ACLX_device=ENABLE;"
eexecute 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 port 5E:0 Show_ACLX_device=ENABLE; }
   Performing Access checks.............................. Allowed.
```

Manage Configuration Changes
Report flag details

Description
To report the new SHOW_ACLXDEVICE port attribute configured on an array port, use either the list -fa -v or the list -fa -detail command. The following is an example output reporting the port detail for an ACLX device:

Note
Environment option SYMAPICTRL_OF_NONVISIBLE_DEV in the options file must be enabled (or not present in the options file) if there is no device from the local host mapped to this port.

Example
To list port detail for an ACLX device, enter:

```
symcfg -sid 064  list -port -fa 7e -detail
```

The following is an example output reporting the port detail for an ACLX device:

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100064</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMMETRIX DIRECTOR PORTS</td>
</tr>
<tr>
<td>Ident  Port  WWN         Type          ASVPG  Gb/sec  Status</td>
</tr>
<tr>
<td>-----  ----  -------------  ------------  -----  ------  -------</td>
</tr>
<tr>
<td>FA-7E  0  50000972C011C918 FibreChannel ...X.       8  Online</td>
</tr>
<tr>
<td>FA-7E  1  50000972C011C919 FibreChannel XX...       8  Online</td>
</tr>
</tbody>
</table>

Legend:
Flags:
(A)CLX Enabled : X = True, . = False
(S)how ACLX device Enabled : X = True, . = False, - = N/A
(V)olume Set Addressing : X = True, . = False
(P)oint to Point : X = True, . = False
VNX (G)ateway Direct Attach : X = True, . = False

Remote Machine Table (RMT) Management

Overview
Solutions Enabler V9.1 and higher supports configuring Remote Machine Table (RMT) entries used for SRDF configuration through RE Directors. This includes ability to create, modify and delete Remote Array Serial Number (Remote Machine), Remote IP Address, Remote Director, Remote Port (Remote Target) in the Remote Machine Table (RMT).

Syntax

```
symcfg -sid <SymmID> -rmt
    create -remote_sid <SymmID>
    -remote_dir <#> -remote_p <#
```
The **create -rmt** command creates a new RMT entry consisting of a remote Symmetrix serial number. The remote target consists of the RE director port and the IP address assigned to it. Only one remote target can be specified along with the RMT entry.

The **modify -rmt** command is used to modify IP addresses (IPv4 and/or IPv6) of an existing RMT entry's remote targets. Only one remote target can be specified at a time.

The **modify -rmt** command is used to delete a remote target from the RMT entry. The RMT entry is automatically deleted when the last remote target gets deleted.

**Options**

- **-ipv4_address**
  Specifies a valid IPv4 address.

- **-ipv6_address**
  Specifies a valid IPv6 address.

- **-remote_dir**
  Specifies the remote RE director number.

- **-remote_p**
  Specifies the remote RE director port number.

- **-remote_sid**
  Specifies the unique Symmetrix ID of the remote array.

**Examples**

To create an RMT entry for array 188, enter:

```
symcfg -sid 188 -rmt create -remote_sid 048 -remote_dir 1g -remote_p 8 -ipv4_address 111.111.111.123 -ipv6_address 1:0:0:0:ffff:6f6f:6f7b
```

Create RMT entry for Symmetrix unit '000197800188' (y/[n]) ? y
RMT entry 'create' operation succeeded for Symmetrix Unit '000197800188'.
To use `modify -rmt` to change the IPv4 and IPv6 address for array 188, enter:

```
symcfg -sid 188 -rmt modify --remote_sid 048 --remote_dir 1g --remote_p 8 --ipv4_address 111.111.111.124 --ipv6_address 1:0:0:0:ffff:6f6f:6f7c
```

Modify RMT entry for Symmetrix unit '000197800188' (y/[n]) ? y

RMT entry 'modify' operation succeeded for Symmetrix Unit '000197800188'.

To use `modify -rmt` to add a remote target to the existing remote_sid, enter:

```
symcfg -sid 188 -rmt modify --remote_sid 048 --remote_dir 2f --remote_p 9 --ipv4_address 112.100.111.130 --ipv6_address 2:1:0:1:0:ffff:7f7f:6f7d
```

Modify RMT entry for Symmetrix unit '000197800188' (y/[n]) ? y

RMT entry 'modify' operation succeeded for Symmetrix Unit '000197800188'.

To delete a remote target from the RMT entry for array 188, enter:

```
symcfg -sid 188 -rmt delete --remote_sid 048 --remote_dir 1g --remote_p 8 --ipv4_address 111.111.111.123 --ipv6_address 1:0:0:0:ffff:6f6f:6f7b
```

Delete RMT entry for Symmetrix unit '000197800188' (y/[n]) ? y

RMT entry 'delete' operation succeeded for Symmetrix Unit '000197800188'.
CHAPTER 10

Manage multiple iSCSI targets

This chapter describes how to manage multiple iSCSI targets and IP addresses on SE emulation.

- Manage multiple iSCSI targets overview ......................................................... 274
- Report iSCSI target information ................................................................. 293
- Expanded port group management for iSCSI targets .............................. 296
- Report iSCSI target port information ......................................................... 298
Manage multiple iSCSI targets overview

Arrays running HYPERMAX OS 5977 Q3 2015 SR or higher allow multiple iSCSI targets (IQNs) and IP addresses on SE director emulations. Solutions Enabler, using the `symconfigure` command, provides support for managing (create, modify and delete) IP interfaces and iSCSI targets, and allows attaching and detaching IP interfaces to and from the iSCSI targets. In addition, static IP routes can be added, for routing packets going out of IP interfaces configured on SE director emulations.

The following set of rules and restrictions apply to the management of IP interfaces, iSCSI targets and IP routes:

- Each SE director port supports up to 64 IP interfaces. The maximum number of IP interfaces per SE director emulation is 1000.
- On an SE director emulation, each IP interface is uniquely identified by its IP address/network_id combination. A vlan ID (0 - 4094) must also be configured on this interface, and it must be unique across all IP interfaces defined on the same physical port.
- Each IP interface can be configured with either IPv4 or IPv6 IP address, but not both.
- The maximum number of iSCSI targets per SE director emulation is 256.
- Each iSCSI target must be assigned a network ID, and can be attached to up to 8 IP interfaces on the same SE director emulation. Each of the attached IP interfaces must have the same network ID as the iSCSI target.
- An iSCSI target is uniquely identified by its IQN (iSCSI target name, ASCII string in IQN format). The IQN can be user specified, otherwise HYPERMAX OS generates a globally-unique IQN when the iSCSI target is created. An iSCSI target can also be uniquely identified by a director emulation number and virtual port number, the iSCSI target virtual port. HYPERMAX OS assigns a iSCSI virtual port (0 - 255) when each iSCSI target is created.

**Note**

iSCSI targets are used as endpoints to the iSCSI protocol; an iSCSI virtual port is different from the SE emulation physical ports.

- The maximum number of IP routes (IPv4 + IPv6) per director emulation is 1024.

iSCSI Configuration sessions

Configuration changes in `symconfigure` sessions are done in the order that they are given. If an IP Interface or iSCSI target is created during a configuration session these can be modified or used by other configuration changes that are called for later in the same session. Therefore, if an IP Interface or iSCSI target is deleted during a configuration session, attempts to modify or use these by other configuration changes that are called for later in the same session will fail.

Arrays without embedded management and only iSCSI front-end emulations

Special operating rules exist for arrays that contain only iSCSI front-end emulations (SEs) and are running without Embedded Management. On these systems, during the installation process, HYPERMAX OS creates a bootstrap iSCSI target on one of the SE emulations, an IP Interface object (with a pre-defined IP address) on one of that SE’s physical ports, and maps the ACLX device to that iSCSI Target. This provides control access through that IP address to all hosts and allows the initial provisioning of control hosts and creation of masking views. HYPERMAX OS blocks all host I/Os while this bootstrap iSCSI target exists. To enable host I/Os, delete this bootstrap
iSCSI target after provisioning is established. Solutions Enabler provides the following features to support the iSCSI bootstrap target:

- A filter option is added to the `symcfg list` command that displays properties of the iSCSI bootstrap target on the array.
- With the exception of detaching from its IP Interface, all operations for the iSCSI bootstrap target are disabled. It cannot be added to a port group or a masking view, and the configuration cannot be modified (rename, modify or attach to another IP Interface).

Create IP interface on SE director port

**Description**

Use the `create_ip_interface` command to create an IP interface on a SE director port. Only one IP address is allowed and it must be either IPv4 or IPv6. This command requires an IP address, a subnetwork prefix, a network ID, and a vlan ID.

**Syntax**

To create an IP interface, use the following syntax:

```
create ip_interface dir <director_num> port <port_number>,
    ip_address=<IPaddress>, ip_prefix=<ip_prefix>,
    network_id = <network_id>, vlanid=<vlanid>
    [, mtu = <MTU>];
```

**Options**

- **director_num**
  
  SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

- **port_num**
  
  Port number on a director where the IP interface is created. Valid values are 0-31.

- **IPaddress**
  
  For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

- **ip-prefix**
  
  For IPv4 prefix value is 1-30. For IPv6 prefix value is 1-128.

- **network_id**
  
  Valid values are 1 - 16383.

- **vlanid**
  
  Valid values are 0 - 4094.

- **MTU**
  
  Maximum transmission unit. Valid values are 1200 - 9000. The default value is 1500.
Examples

Create command file `create_ip_interface.cmd`:

```
create ip_interface dir 7E port 2, ip_address = 111.111.111.123,
    ip_prefix = 24, network_id = 10, vlanid = 10
```

To commit command file, enter:

```
symconfigure -sid 230 -file create_ip_interface.cmd commit
```

Execute a symconfigure operation for symmetrix '00019710230' (y/[n]) ? y

A Configuration Change operation is in progress. Please wait...

```
Establishing a configuration change
session..................Established.
Processing symmetrix 000197100230
{
    create ip_interface dir 7E port 2, ip_address =
        111.111.111.123,
        ip_prefix = 24, network_id = 10, vlanid = 10;
}
Performing Access
checks..................................Allowed.
... Terminating the configuration change session............Done.
```

The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director must be a SE director emulation.
- Port must be configured to the director emulation.
- IP address syntax must be valid syntax and the IP prefix must be in the valid range.
- Network ID must be in the valid range.
- Vlan ID must be in the valid range.
- MTU must be in the valid range.
- Maximum IP interfaces per SE director emulation is 1000.
- Maximum IP interface per SE director physical port is 64.
- Vlan ID must be unique to the IP Interface for the specified SE director physical port.
- Subnet mask of the IP Interface must be unique on a network ID within the specified SE director emulation.
- IP address must be unique within the same network ID for the specified SE director emulation.
Modify IP interface on SE director emulation

Syntax
To modify an IP interface, use the following syntax:

```plaintext
modify ip_interface dir <director_num>,
ip_address = <IPaddress>, network_id = <network_id>
[, new_network_id = <network_id>]
[, new_ip_address = <IPaddress>]
[, ip_prefix = <ip_prefix>]
[, mtu = <mtu>];
```

Options

director_num
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

IPaddress
For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

ip-prefix
For IPv4 prefix value is 1-30. For IPv6 prefix value is 1-128.

network_id
Valid values are 1 - 16383.

vlanid
Valid values are 0 - 4094.

MTU
Maximum transmission unit. Valid values are 1200 - 9000. The default value is 1500.

Examples
Create command file modify_ip_interface.cmd:

```plaintext
modify ip_interface dir 7E, ip_address= 111.111.111.123, network_id = 10, ip_prefix = 24;
```

To commit command file, enter:

```plaintext
symconfigure -sid 230 -file modify_ip_interface.cmd commit
```

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
{   modify ip_interface dir 7E , ip_address= 111.111.111.123,
    network_id = 10, ip_prefix = 24;
}
Performing Access checks..........................Allowed.

Terminating the configuration change session..............Done.
The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Director must be a SE director emulation.
- Port must be configured to the director emulation.
- IP address syntax must be valid syntax and the ip prefix must be in the valid range.
- Network ID must be in the valid range.
- MTU must be in the valid range.
- IP address and network ID combination must exist for the director emulation.
- IP address or ip prefix must result in a unique subnet mask across the array.
- IP interface cannot be attached to an iSCSI target.
- IP address or network ID must result in a unique IP address/network ID combination across the array.
- The IP address and network_id together must be globally unique across the entire array.
- Command will fail if all properties are the same as those being changed.

Delete IP interface on SE director emulation

Syntax

To delete an IP interface, use the following syntax:

```
delate ip_interface dir <director_num>, ip_address = <IPaddress>, network_id = <network_id>;
```

Options

**IPaddress**

For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

**director_num**

SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**network_id**

Valid values are 1 - 16383.
Examples
Create command file delete_ip_interface.cmd:

```
delete ip_interface dir 7E, ip_address=111.111.111.123, network_id = 10;
```

To commit command file, enter:

```
symconfigure -sid 230 -file delete_ip_interface.cmd commit
```

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
{
    delete ip_interface dir 7E, ip_address=111.111.111.123,
    network_id = 10;
}
Performing Access checks..................................Allowed.

Terminating the configuration change session..............Done.
```

The configuration change session has successfully completed.

Restrictions
- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Director must be a SE director emulation.
- IP address syntax must be valid syntax.
- IP address must exist for the director emulation.
- Network ID must be in the valid range.
- IP interface cannot be attached to an iSCSI target.

Create iSCSI target on SE director emulation

Description
Use the `create_iSCSI_tgt` command to create an iSCSI target on a SE director emulation. A network ID must be specified, and the IQN (iSCSI qualified name) can either be specified, or if not specified, it is auto-generated by the array. Newly created iSCSI targets are automatically assigned an iSCSI virtual port number (0-255), local to the SE director emulation, and are used to uniquely identify the iSCSI target. These virtual ports are used as endpoints to the iSCSI protocol, and are different from physical ports that are mapped to a SE emulation.

Optional settings include IP address, SCSI flags, and the TCP port.
Syntax
To create iSCSI target, use the following syntax:

```bash
create iscsi_tgt dir <director_num>,
    network_id = <network_id>
    set_default_flags = <ENABLE | DISABLE>]
    [, ign = <IQN>] [, ip_address = <IPaddress> [...]]
    [, flag_name = ENABLE [...]]
    [, tcp_port=<tcp_port>];
```

Options

director_num
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

network_id
Valid values are 1 - 16383.

set_default_flags
Specifies whether to use iSCSI target default flags (flags listed below).

IQN
iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

IPaddress
For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

tcp_port
Valid values are 1 - 65535. Default value is 3260.

flag_name
Valid flag values are:
- SOFT_RESET
- ENVIRON_SET
- DISABLE_q_RESET_ON_UA
- AVOID_RESET_BROADCAST
- SCSI_3 (DEFAULT is ENABLED)
- SPC2_PROTOCOL_VERSION (DEFAULT is ENABLED)
- ISID_PROTECTED
- SCSI_SUPPORT1 (DEFAULT is ENABLED)
- Volume_Set_Addressing
- OpenVMS
Examples

Create command file iscsi_tgt_create.cmd, with IQN specified:

```bash
create iscsi_tgt dir 7E, iqn = iqn.2013-06.com.emc:sn.11111111,
network_id = 10, ip_address= 111.111.111.123;
```

To commit command file, enter:

```bash
symconfigure -sid 230 -file iscsi_tgt_create.cmd commit
```

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
   { create iscsi_tgt dir 7E, iqn = iqn.2013-06.com.emc:sn.11111111,
     network_id = 10, ip_address= 111.111.111.123;
   }
   Performing Access checks.................................Allowed.
   
   Created IQN : iqn.2013-06.com.emc:sn.11111111

   Committing configuration changes..............................Committed.
   Terminating the configuration change session...............Done.

The configuration change session has successfully completed.

Create command file iscsi_tgt_create.cmd, without IQN specified:

```bash
create iscsi_tgt dir 7E, network_id = 10, ip_address= 111.111.111.123;
```

---

Note

IQN is auto-generated when the command file is committed.

To commit command file, enter:

```bash
symconfigure -sid 230 -file iscsi_tgt_create.cmd commit
```

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
   { create iscsi_tgt dir 7E, network_id = 10,
     ip_address= 111.111.111.123;
   }
Performing Access checks..................................Allowed.


 Committing configuration changes..........................Committed.
 Terminating the configuration change session..............Done.

The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Director must be a SE director emulation.
- Maximum iSCSI targets per SE director emulation is 1000.
- IP address syntax must be valid syntax.
- IQN must be unique to the array.
- IP address must exist in the director emulation.
- Network ID of the IP interface must match the network ID of the iSCSI target.
- Network ID must be a valid value.
- Maximum IP addresses per iSCSI target is 8.
- ACLX flag cannot be set or modified on an iSCSI target. This flag is always enabled.
- SHOW_ACLX_DEVICE flag cannot be set or modified on an iSCSI target. This flag is always enabled for bootstrap iSCSI targets and always disabled for user-created iSCSI targets.

Modify iSCSI target

Description
Use the modify iscsi_tgt command to modify scsi port attributes and the TCP port value of the iSCSI target.

Syntax
To modify an iSCSI target, use the following syntax:

```
modify iscsi_tgt
<[iqn = <IQN>] | [iscsi_dirport =
<director_num>:<port_number>]>[
[, flag_name=ENABLE | DISABLE [, ...]][, tcp_port=<tcp_port>]
[, network_id=<network_id>];
```

Options

- **director_num**
  SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

- **port_num**
Port number on a director where the IP interface is created. Valid values are 0-31.

**iQN**

iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

**network_id**

Valid values are 1 - 16383.

**tcp_port**

Valid values are 1 - 65535. Default value is 3260.

**flag_name**

Valid flag values are:

- SOFT_RESET
- ENVIRON_SET
- DISABLE_Q_RESET_ON_UA
- AVOID_RESET_BROADCAST
- SCSI_3 (DEFAULT is ENABLED)
- SPC2_PROTOCOL_VERSION (DEFAULT is ENABLED)
- ISID_PROTECTED
- SCSI_SUPPORT1 (DEFAULT is ENABLED)
- Volume_Set_Addressing
- OpenVMS

**Examples**

To enable scsi_3 flag, create command file `iscsi_tgt_mod.cmd`:

```
modify iscsi_tgt, iqn = iqn.2013-06.com.emc:sn.11111111, scsi_3= enable;
```

To commit command file, enter:

```
symconfigure -sid 230 -file iscsi_tgt_mod.cmd commit
```

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
{ modify iscsi_tgt, iqn = iqn.2013-06.com.emc:sn.11111111, scsi_3= enable;
}
Performing Access checks...............................Allowed.

...Terminating the configuration change session...........Done.
The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director must be a SE director emulation.
- iSCSI target must exist but cannot be the bootstrap target.
- If modifying SCSI flags, iSCSI target must be in an offline state.
- Specified SCSI flag must be a valid flag.
- Network ID must be a valid value.
- Network ID of the IP interface must match the network ID of the iSCSI target.
- If modifying network ID, iSCSI target must be in an offline state.
- iSCSI target cannot be attached to an IP interface.
- ACLX flag cannot be set or modified on an iSCSI target. This flag is always enabled.
- SHOW_ACLXDEVICE flag cannot be set or modified on an iSCSI target. This flag is always enabled for bootstrap iSCSI targets and always disabled for user-created iSCSI targets.

Delete iSCSI target

Description
To delete an iSCSI target either specify either the IQN (iSCSI qualified name) or the iSCSI virtual port equivalent as the iSCSI target.

Syntax
To delete an iSCSI target, use the following syntax:

```
delete iscsi_tgt <[iqn = <IQN>] | [iscsi_dirport = <director_num>:<port_number>]>;
```

Options

**IQN**
iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

**director_num**
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**port_num**
Port number on a director where the IP interface is created. Valid values are 0-31.
Examples
Create command file `iscsi_tgt_delete.cmd`:

```plaintext
delete iscsi_tgt iscsi_dirport = 7E:0 ;
```

To commit command file, enter:

```plaintext
symconfigure -sid 230 -file iscsi_tgt_delete.cmd commit
```

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
{
  delete iscsi_tgt, iqn = iqn.2013-06.com.emc:sn.1111111;
}
Performing Access
checks..............................Allowed.
Terminating the configuration change session..............Done.
The configuration change session has successfully completed.
```

Restrictions
- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director must be a SE director emulation.
- iSCSI target must exist.
- The iSCSI target cannot be the bootstrap target if no masking views exist on the array.
- iSCSI target must be in an Offline state.
- iSCSI target cannot be in a port group.

Rename iSCSI target

Description
To rename an iSCSI target specify either the IQN (iSCSI qualified name) or the iSCSI virtual port equivalent as the iSCSI target, and specify the new IQN.

Syntax
To rename an iSCSI target, use the following syntax:

```plaintext
rename iscsi_tgt <[iqn = <IQN>] | [iscsi_dirport =<director_num>:<port_number>]>
  to new_iqn = <IQN>;
```

Options

- `IQN`
iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

**director_num**
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**port_num**
Port number on a director where the IP interface is created. Valid values are 0-31.

### Examples
Create command file `iscsi_tgt_rename.cmd`:

```
rename iscsi_tgt iqn = iqn.2013-06.com.emc:sn.11111111,
to new_iqn = iqn.2013-12.com.emc:sn.11111111
```

To commit command file, enter:

```
symconfigure -sid 230 -file iscsi_tgt_rename.cmd commit
```

Execute a symconfigure operation for symmetrix '0000197100230' (y/ [n]) ? y

A Configuration Change operation is in progress. Please wait...

Establishing a configuration change session..............Established.
Processing symmetrix 000197100230

```
{ rename iscsi_tgt iqn = iqn.2013-06.com.emc:sn.11111111,
to new_iqn = iqn.2013-12.com.emc:sn.11111111 ;
}
```

Performing Access checks.................................Allowed.

```
Terminating the configuration change session.............Done.
```

The configuration change session has successfully completed.

### Restrictions
- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director port must be a SE director emulation.
- Existing and new IQN naming rules apply. See Options.
- iSCSI target must exist.
- The iSCSI target cannot be the bootstrap target.
- New IQN must be unique.

### Attach IP interface to iSCSI target

**Description**
To attach an IP interface to an iSCSI target, specify either the IQN (iSCSI qualified name) or the iSCSI virtual port equivalent as the iSCSI target.
Syntax
To attach an IP address, use the following syntax:

```
attach ip_interface ip_address = <IPaddress>, to iscsi_tgt
    <[iqn = <IQN>] | [iscsi_dirport =
    <director_num>:<port_number>]>;
```

Options

**IPaddress**
For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

**IQN**
iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

**director_num**
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**port_num**
Port number on a director where the IP interface is created. Valid values are 0-31.

Examples
Create command file `iscsi_tgt_attach.cmd` using the IQN:

```
attach ip_interface ip_address = 10.10.10.1, to iqn = iqn.
    2013-06.com.emc:sn.11111111
```

Create command file `iscsi_tgt_attach.cmd` using the iSCSI virtual port:

```
attach ip_interface ip_address = 10.10.10.1, to iscsi_dirport = 7E:
    0;
```

To commit file, enter:

```
symconfigure --sid 230 --file iscsi_tgt_attach.cmd commit
```

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
    
    attach ip_interface ip_address = 10.10.10.1, to iqn = iqn.
    2013-06.com.emc:sn.11111111;
```

Performing Access checks..............................Allowed.

```
    Terminating the configuration change session............Done.
```
The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director port must be a SE director emulation.
- iSCSI target must exist.
- IP address must exist on the director emulation of the iSCSI target's with the same network ID.
- IP address must have no assignment to any iSCSI target on the director emulation.

Detach IP interface from iSCSI target

Description
To detach an IP interface from an iSCSI target, specify either the IQN (iSCSI qualified name) or the iSCSI virtual port equivalent of the iSCSI target.

Syntax
To detach an IP address, use the following syntax:

```
detach ip_interface ip_address = <IPaddress> from iscsi_tgt
   ([iqn = <IQN>] | [iscsi_dirport = <director_num>:<port_number>]);
```

Options

**IPaddress**
For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

**IQN**
iSCSI qualified name. Must start with either "iqn." or "eui." strings and must include alphanumeric characters, colons, dashes, and periods. Maximum length is 255 characters.

**director_num**
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**port_num**
Port number on a director where the IP interface is created. Valid values are 0-31.

Examples
Create command file `iscsi_tgt_detach.cmd` using the IQN:

```
detach ip_interface ip_address = 10.10.10.1, from iscsi_tgt iqn = iqn.2013-06.com.emc:sn.11111111 ;
```
Create command file `iscsi_tgt_detach.cmd` using the iSCSI virtual port:

```bash
detach ip_interface ip_address = 10.10.10.1, from iscsi_tgt
iscsi_dirport = 7E:0;
```

To commit file, enter:

```bash
symconfigure -sid 230 -file iscsi_tgt_detach.cmd commit
```

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
{   detach ip_interface ip_address = 10.10.10.1, from
    iscsi_tgt iqn = iqn.2013-06.com.emc:sn.1111111;
}
Performing Access checks.................................Allowed.
. . .
Terminating the configuration change session...............Done.
The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director port must be a SE director emulation.
- iSCSi target must exist.
- IP address must be attached to the iSCSI target.

Add IP route to SE director emulation

Syntax

To add IP route, use the following syntax:

```bash
add ip_route dir <director_num>,
ip_address = <IPAddress>, ip_prefix =<ip_prefix>,
gateway = <IPAddress>
[, network_id = <network_id>];
```

Options

- **director_num**
  SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

- **IPAddress**
  For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.
**ip-prefix**
For IPv4 prefix length is 1-32 characters. For IPv6 length is 1-128 characters.

**network_id**
Valid values are 1 - 16383.

**Examples**
Create command file **add_ip_route.cmd**:

```
add ip_route dir 7E, ip_address = 10.10.10.0, ip_prefix = 24, gateway = 10.10.9.1, network_id = 10;
```

To commit command file, enter:

```
symconfigure -sid 230 -file add_ip_route.cmd commit
```

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

```
{add ip_route dir 7E,ip_address = 10.10.10.0, ip_prefix = 24, gateway = 10.10.9.1 , network_id = 10;}
```

Performing Access checks.................................Allowed.

Terminating the configuration change session.............Done.

The configuration change session has successfully completed.

**Restrictions**
- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For specified director port, director port must be a SE director emulation.
- IPv4 and IPv6 routes can be added separately, but not in the same command.
- A default route through a gateway can be specified as follows:
  - For IPv4 — *ip_address* (destination) 0.0.0.0 with *ip_prefix* =0.
  - For IPv6 — *ip_address* (destination) ::, with *ip_prefix* =0.
- Only one default gateway per director emulation is allowed.
- Maximum IP routes per SE director board is 1024.
Remove IP route from SE director emulation

Syntax
To remove IP route, use the following syntax:

```
remove ip_route dir <director_num>,
ip_address = <Ipaddress>,
[, network_id = <network_id>];
```

Options

**director_num**
SE director where the IP interface is created. Valid values are 1 - 128 and must represent an SE director emulation.

**IPaddress**
For IPv4, must be specified with dotted decimal notation format. For IPv6 must be specified in colon-hexadecimal format.

**network_id**
Valid values are 1 - 16383.

Examples

Create command file `remove_ip_route.cmd`:

```
remove ip_route dir 7E, ip_address = 1:1:2:: , network_id = 10;
```

To commit command file, enter:

```
symconfigure -sid 230 -file remove_ip_route.cmd commit
```

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
  { remove ip_route dir 7E, ip_address = 1:1:2:: , network_id = 10;
  }
  Performing Access checks..................................Allowed.
  ...........................................Terminating the configuration change session.............Done.
```

The configuration change session has successfully completed.

Restrictions

- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
- Required Authorization Rights: Storage Admin
- For specified director port, director port must be a SE director emulation.
- The IP route must exist.

**Example iSCSI configuration**

**Configuring a Single IP interface and iSCSI target**
The following example configures an iSCSI target on an SE director that can be used for provisioning LUNs to an IPv4 accessible host:

- Create an iSCSI target with a given IQN and network_id of 10 on an SE director emulation.
- Create an IP interface on a physical port associated to the same SE director emulation by giving it an IPv4 address and network prefix of 13.17.253.21/24, a vlan ID of 0 (must be unique to the port), and the network_id of 10.
- Attach to the iSCSI target the configured IP interface using its IPv4 address.
- Add a default IPv4 route (0.0.0.0) on the same SE director using the configured IPv4 interface for the outgoing IPv4 packets.

**Configuring a Second IP interface to the same iSCSI Target**
The following example configures a second IP interface to the existing iSCSI target (configured above) on the same SE director:

- Create a second IP interface on a physical port associated to the same SE director emulation by giving it a different IPv4 address and network prefix of 13.17.255.23/24, a vlan ID of 1 (must be unique to the port), and the same network_id of 10.
- Attach to the iSCSI target the configured IP interface using its IPv4 address.
- Add a default IPv4 route (0.0.0.0) on the same SE director using the configured IPv4 interface for the outgoing IPv4 packets.

The iSCSI target can now be used to make devices visible to hosts by adding it to a port group.

**Symconfigure command restrictions for iSCSI targets**

The following is a list of `symconfigure` command behavior for iSCSI targets:

- `symconfigure set port` — Does not support setting port characteristics for iSCSI physical front end ports and iSCSI target virtual ports. Use `modify iscsi_tgt` command to set flags on iSCSI target virtual ports.
- `symconfigure set port copying port` — Does not support copying port characteristics for iSCSI physical front end ports and iSCSI target virtual ports.
- `symconfigure associate port` — Supports association of one or more free iSCSI physical ports to SE director emulation. The following restrictions for this command are:
  - If any of the specified ports is already associated with an emulation, the operation fails and displays error.
  - If any of the specified ports are non iSCSI physical ports and the director emulation specified is SE, the operation fails and displays error.
  - If the specified ports are iSCSI physical ports and the director emulation specified is anything other than SE, the operation fails and displays error.
Association of ports to director emulation configures the ports in an *Offline* state. Ports states must be explicitly changed to *Online* to make them usable.

- `symconfigure disassociate port` — Supports disassociation of one or more iSCSI physical ports from SE director emulation. The following restrictions for this command are:
  - If any of the specified ports is not associated with the specified director, the operation fails and displays error.
  - Ports must be in *Offline* state.
  - Ports cannot have any devices mapped to it.
  - If the specified director is running an SE emulation and one of the specified iSCSI physical port is in a port group, the operation fails and displays error.

- `symconfigure convert dir` — Does not support conversion of SE director to a different director emulation type and vice versa.

- `symconfigure preview` — Can only provide the best effort checks described in the `symconfigure IP` and iSCSI target management operations.

### Set online or offline state for iSCSI targets

**Description**
Some iSCSI target operations require the associated port to be an *Offline* state. Once operations are complete the port must be returned to the *Online* state to connect with a host.

**Syntax**
To set iSCSI target online/offline states, use the following syntax:

```
symcfg -sid <SymmID> [-noprompt] [-v]  
-SE <#> <-p <#> | -iscsi_port <#>>  
online  
offline
```

### Report iSCSI target information

iSCSI target information is reported using the `symcfg list -ip`, `list _iscsi_tgt`, and `list -route` commands.

### List array IP addresses

**Syntax**
To list the IP addresses configured on an array, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline]  
list -ip [-SE <#|ALL>] [-p <#>] [-by_ip]  
list -ip [-RE <#|ALL>] [-p <#>] [-by_ip]
```

**Examples**
To list IP addresses configured on SE port 10H of array 230, enter:

```
symcfg -sid 230 list -ip -se 10H
```
List array iSCSI targets

Syntax
To list iSCSI target configured on an array, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline]
      list -SE <#|ALL>>
          <-iscsi_tgt [-iqn <TargetIQN> | -iscsi_port <#> | -bootstrap]
                 [-by_iqn] [-detail]>
```

Options
- `iqn TargetIQN`
  Lists only the specified IQN.
- `iscsi port #`
  Lists only the targets configured on the iscsi virtual port.
- `bootstrap`
  Lists only the bootstrap iSCSI target.
- `by_iqn`
  Display sort order is by IQN.
- `detail`
  Lists details of IP interfaces and scsi port flags settings for each iSCSI target.

Examples
To list the iSCSI targets on SE director 10H for array 230, enter:

```
symcfg -sid 230 list -iscsi_tgt -SE 10H
```

Sample output

```
Note
Use the SYMCLI_FULL_NAME option to display more than 57 characters for the IQN.
```

Symmetrix ID: 000197100230 (Local)

<table>
<thead>
<tr>
<th>Dir:P</th>
<th>NetId</th>
<th>Status</th>
<th>IQN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>10.10.10.1/24</td>
<td>1500 0</td>
</tr>
<tr>
<td>10H:00</td>
<td>1</td>
<td>2 10.10.11.1/24</td>
<td>1500 -</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3ffe:80c0:22c0:1049:1260:1600:3ce0:1234/64</td>
<td>1500 1</td>
</tr>
<tr>
<td>10H:02</td>
<td>1</td>
<td>11.11.11.1/24</td>
<td>1500 0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>11.11.12.1/24</td>
<td>1500 128</td>
</tr>
</tbody>
</table>
List array IP routes

Syntax
To list IP routes configured on an array, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline]
  list -route [-SE <#>] [ -ipv4 | -ipv6 ] [-v]
```

Options
-ipv4 | -ipv6
  Lists only ipv4 or ipv6 routes

Examples
To list -ipv4 route for SE director 10H on array 230, enter:

```
symcfg -sid 230 list -route -SE 10H -ipv4
```

Sample output

```
Symmetrix ID: 000197100230 (Local)
Director Identification: SE-10H

Network Id : 5
Destination                             Gateway
--------------------------------------- ---------------------------------------
87.215.195.176/29                       0.0.0.0
62.58.50.0/25                           62.58.236.234

Network Id : 6
Destination                             Gateway
--------------------------------------- ---------------------------------------
192.168.1.0/24                          0.0.0.0
10.0.0.0/8                              0.0.0.0
```

Note
In above table 87.215.195.176/29 means destination ipv4 address is 87.215.195.176 and prefix length = 29 (equivalent to netmask = 255.255.255.248).

Output for -ipv6 route:

```
Symmetrix ID: 000197100230 (Local)
Director Identification: SE-10H
Network Id : 7
```
Destination Gateway
--------------------------------------- ---------------------------------------
::1/128                                 ::1
8000:1:1::/64                           4000:1:1::1

Expanded symcfg and sympd reporting for iSCSI targets

Description
The symcfg list -address and sympd list commands include the -iscsi_port # option to support iSCSI targets.

Syntax
For the symcfg list -address command use the following syntax with the -iscsi_port # option:

```
symcfg [-sid <SymmID>] [-offline] list [-SE <# | ALL>] [<v | -port [-detail] [-p <#>]] [-address [-available]] [-iscsi_port <#>]
```

For the sympd list command use the following syntax with the -iscsi_port # option:

```
```

Expanded port group management for iSCSI targets

Description
For port group management, the symaccess command includes two options to support iSCSI targets, -iscsi_dirport and -iqn options. These options are used with the following symaccess port group operations:

- create, delete, rename add, remove
- list and show
- set, enable, disable, delete, and list CHAP

Additional symaccess commands that support iSCSI targets but do require any CLI changes are:

- The symaccess copy -type port and copy view commands that copy a port group with iSCSI ports to a target array only if the target array is running HYPERMAX OS 5977 or higher.
- The symaccess backup and symaccess restore commands backup and restore port groups with iSCSI targets. These commands also backup and restore a provision view masking record with iSCSI virtual ports.
Syntax
For port group management (create, add, remove, list, set CHAP, enable CHAP and display for iSCSI targets, use the following syntax with the -iscsi_dirport and -iqn options.

```
symaccess -sid <SymmID> -name <GroupName> -type port
  create
  create -dirport <Dir>:<Port>[, <Dir>:<Port>...]
  create -iscsi_dirport <Dir>:<Port>[, <Dir>:<Port>...]
  create -iqn <TargetIQN>[, <TargetIQN>...]
delete [-force] [-noprompt]
rename -new_name <NewGroupName>
```

```
symaccess -sid <SymmID> -name <GroupName> -type port
  [-celerra] [-rp] [-ckd]
  add -dirport <Dir>:<Port>[, <Dir>:<Port>...]
  add -iscsi_dirport <Dir>:<Port>[, <Dir>:<Port>...]
  add -iqn <TargetIQN>[, <TargetIQN>...]
```

```
symaccess -sid <SymmID> -name <GroupName> -type port
  [-ckd] [-force] [-unmap [-celerra] [-rp]]
remove -dirport <Dir>:<Port>[, <Dir>:<Port>...]
remove -iscsi_dirport <Dir>:<Port>[, <Dir>:<Port>...]
remove -iqn <TargetIQN>[, <TargetIQN>...]
```

```
symaccess -sid <SymmID> | -file <backup_filename>
  list -type port [-name <GroupName>] [-detail | -v]
  [-dirport <Dir>:<Port>] [-iscsi_dirport <Dir>:<Port> | -iqn <TargetIQN>]
show <GroupName> -type port
```

```
symaccess -sid <SymmID>
  -dirport <Dir>:<Port> | -iscsi_dirport <Dir>:<Port> | -iqn <TargetIQN>
set chap -cred <Credential> -secret <Secret>
```

```
symaccess -sid <SymmID>
  [-dirport <Dir>:<Port>] [-iscsi_dirport <Dir>:<Port>] [-iqn <TargetIQN>]
enable chap
disable chap
delete chap
```

```
symaccess -sid <SymmID> | -file <backup_filename>
  list chap [-dirport <Dir>:<Port>] [-iscsi_dirport <Dir>:<Port>] [-iqn <TargetIQN>] [-v]
```

Restrictions
- Either the -iscsi_dirport or -iqn is specified in a command, not both.
- For FA director type only the -dirport option is used in a command.
For SE director type on the -iscsi_dirport is used in a command.

Fibre channel ports and iSCSI targets virtual ports are not allowed in the same port group.

Report iSCSI target port information

Port information for iSCSI targets is reported, with expanded displays, using the following symaccess commands:

- `show -type port`
- `show view`
- `list hba`
- `list devinfo`
- `list assignment`
- `list chap`
- `list logins`

Show port group with iSCSI targets

Description

The `symaccess show -type port` command is expanded to show the iSCSI target name of the iSCSI virtual target port.

Examples

```
symaccess show host1083_ports -sid 001 -type port
```

Sample output

Displays the the iSCSI target name of the iSCSI virtual target port under Director Idenfication.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>: 000197100001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Group Name</td>
<td>: host1083_ports</td>
</tr>
<tr>
<td>Last update time</td>
<td>: 12:57:49 AM on Mon Apr 15, 2014</td>
</tr>
</tbody>
</table>

Director identification

<table>
<thead>
<tr>
<th>Director</th>
<th>WWN Port Name / iSCSI Target Name</th>
</tr>
</thead>
</table>

Show masking view with iSCSI targets

Description

The `symaccess show view` command is expanded to show the iSCSI target name of the iSCSI virtual target port.

Examples

```
symaccess show view host1083_view -sid 001
```
```
Sample output
Displays the the iSCSI target name of the iSCSI virtual target port under Director Identification.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Masking View Name</th>
<th>Last updated at</th>
<th>View last update time</th>
<th>Initiator Group Name</th>
<th>Host Initiators</th>
</tr>
</thead>
<tbody>
<tr>
<td>000197100001</td>
<td>host1083_view</td>
<td>12:51:37 PM on Tue May 13,2014</td>
<td>01:37:41 PM on Thu Apr 02,2015</td>
<td>hba1_2</td>
<td>{</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ISCSI : iqn.2002-06.com.host1083 [alias: api1083/api1083]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port Group Name</th>
<th>Director Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>host1083_ports</td>
<td></td>
</tr>
</tbody>
</table>

Director Identification

<table>
<thead>
<tr>
<th>Director</th>
<th>Port</th>
<th>WWN Port Name / iSCSI Target Name</th>
</tr>
</thead>
</table>
```

```
List HBAs with iSCSI targets (HYPERMAX OS 5977 or higher)

Examples

```bash
symaccess list hba
```

Sample output
Displays iSCSI target virtual port in the Dir:Port column.

```
symaccess list hba

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Physical Device Path</th>
<th>Symmetrix ID</th>
<th>Dir:Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>iqn.2002-06.com*</td>
<td>clt50060482D52D5F02d0s23</td>
<td>000197100266</td>
<td>07G:128</td>
</tr>
</tbody>
</table>
```

List device information with iSCSI targets

Examples

```bash
symaccess list devinfo -ig my_ig -sid 001
```

Sample output
Displays iSCSI target virtual port in the Dir:Port column.

```
Symmetrix ID          : 000197100001
Initiator Group Name  : my_ig
Last update time      : 01:20:37 PM on Fri Apr 18,2014
Group last update time: 01:20:37 PM on Fri Apr 18,2014
Host Initiators       |
  {                     |
| ISCSI : iqn.2002-06.com.host1082 [alias: api1082/api1082] |
```
List device assignments with iSCSI targets

Examples

```bash
symaccess list assignments --dev C3:C6 --sid 001
```

List no assignments:

```bash
symaccess list no_assignments --dirport 15E:310 --sid 001
```

Sample output

With assignments, displays iSCSI target virtual port in the `Dir:Port` column.

```bash
Symmetrix ID: 000197100001
Sym Dev Identifier Type Dir:Port
------ ----------------- ----- ----------------
000C3 iqn.2002-06.com* iSCSI SE-10G:128
000C4 iqn.2002-06.com* iSCSI SE-10G:128
000C5 10000000C9AE1298 FIBRE FA-7E:000
000C6 - - - - -
```

Note

With no_assignments, SE directors are not displayed.

List CHAP information with iSCSI targets

Examples

```bash
symaccess list chap --sid 001
```

Sample output

Displays iSCSI target virtual port in the `Identifier` column and `Director Port` column, and displays the iSCSI target name of the iSCSI target virtual port.

```bash
Symmetrix ID: 000197100001
Director Identification: SE-9G
Director Port: 128
iSCSI Target Name: iqn.1992-04.com.emc:sn.11121318
```
List login information with iSCSI targets

Examples

```
symaccess list logins -sid 001
```

Sample output
Displays iSCSI target virtual port in the Director Port field under the SE director.

```
Symmetrix ID: 000197100001
Director Identification: FA-5E
Director Port: 0

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
<th>Node Name</th>
<th>Port Name</th>
<th>FCID</th>
<th>In</th>
<th>Fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000000c9ae1298</td>
<td>Fibre</td>
<td>10000000c9ae1298</td>
<td>10000000c9ae1298</td>
<td>2b1b00</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Director Identification: SE-9G
Director Port: 128

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
<th>Node Name</th>
<th>Port Name</th>
<th>FCID</th>
<th>In</th>
<th>Fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>iqn.2002-06.com*</td>
<td>iSCSI</td>
<td>api1082</td>
<td>api1082</td>
<td>2b1b00</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
```

List storage group demand with iSCSI targets

Examples

```
symsg -sid 584 list -demand -by_port
```

Sample output
Displays iSCSI target virtual port in the Dir:Port column.

```
Symmetrix ID: 000197100584

<table>
<thead>
<tr>
<th>Director</th>
<th>IO Limit</th>
<th>Bandwidth Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>Demand</td>
<td>Nolimit</td>
</tr>
<tr>
<td>Excess</td>
<td>Flags</td>
<td></td>
</tr>
<tr>
<td>DIR:Port</td>
<td>HD</td>
<td>SGs (MB/Sec)</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>05E:000</td>
<td>NN</td>
<td>0</td>
</tr>
<tr>
<td>+1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Output with -v (verbose) option, displays the iSCSI target virtual port in the
Dir:Port column, and the iSCSI Target Name of the iSCSI target port (or virtual port) and the WWN Port Name of fibre channel ports.

Symmetrix ID: 000197100584

Director Identification : FA-7E
Director Port : 0
WWN Port Name : 5000097300092150
Port Total Demand (IO/Sec) : 0
Number of SGs without Limit (IO/Sec): 1

Port Negotiated Speed (MB/Sec) : N/A
Port Total Demand (MB/Sec) : 1000
Percent Port Capability (%) : N/A
Port Excess (MB/Sec) : N/A
Number of SGs without Limit (MB/Sec): 0

Storage Groups (1)

<table>
<thead>
<tr>
<th>Name</th>
<th>MB/Sec</th>
<th>(%)</th>
<th>IO/Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>app_psg1</td>
<td>1000</td>
<td>0</td>
<td>NoLimit</td>
</tr>
<tr>
<td>app_csg1</td>
<td>1000</td>
<td>0</td>
<td>NoLimit</td>
</tr>
<tr>
<td>app_csg2</td>
<td>NoLimit</td>
<td>0</td>
<td>NoLimit</td>
</tr>
</tbody>
</table>

Director Identification : SE-9G
Director Port : 128
iSCSI Target Name : iqn.1992-04.com.emc:sn.11121318
Port Total Demand (IO/Sec) : 0
Number of SGs without Limit (IO/Sec): 1
....
CHAPTER 11

Manage storage environment for VMware VVols

This chapter describes how to manage a storage environment for VVols using the Solutions Enabler CLI.

- Storage management for VVols overview ............................................................ 304
- Solutions Enabler CLI support for VVol management ......................................... 307
- CLI command support for Protocol Endpoint (PE) devices for VVols ............... 311
- Report storage containers for VVols ................................................................. 312
- Report PE and VVol devices ............................................................................. 315
- Unsupported operations/features for VASA protocol endpoints ....................... 317
Storage management for VVols overview

Note

VVols are supported on VMAX3 arrays VMAX All Flash arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

VMware VVols allow data replication, snapshots, encryption etc. to be controlled at the VMDK level instead of the LUN level, where these data services are performed on a per VM (application level) basis from the storage array. Types of VVols are:

- **Config-VVol** — Stores virtual machine configurations, metadata, logs, etc.
- **Data-VVol** — Stores operating system, application binary and user data.
- **Swap-VVols** — Used for memory swaps.
- **Memory-VVols** — Stores VVol snapshots and clones.

To support management capabilities of VVols, the storage/vCenter environment requires the following:

- **EMC VMAX VASA Provider** — The VASA Provider (VP) is a software plug-in that uses a set of out-of-band management APIs (VASA version 2.0). The VASA Provider exports storage array capabilities and presents them to vSphere through the VASA APIs. VVols are managed by way of vSphere through the VASA Provider APIs (create/delete) and not with the Unisphere for VMAX user interface or Solutions Enabler CLI. After VVols are setup on the array, Unisphere and Solutions Enabler only support VVol monitoring and reporting.

- **Storage Containers (SC)** — Storage containers are chunks of physical storage used to logically group VVols. SCs are based on the grouping of Virtual Machine Disks (VMDKs) into specific Service Levels. SC capacity is limited only by hardware capacity. At least one SC per storage system is required, but multiple SCs per array are allowed. SCs are created and managed on the array by the Storage Administrator. Unisphere and Solutions Enabler CLI support management of SCs.

- **Protocol Endpoints (PE)** — Protocol endpoints are the access points from the hosts to the array by the Storage Administrator. PEs are compliant with FC and replace the use of LUNs and mount points. VVols are "bound" to a PE, and the bind and unbind operations are managed through the VP APIs, not with the Solutions Enabler CLI. Existing multi-path policies and NFS topology requirements can be applied to the PE. PEs are created and managed on the array by the Storage Administrator. Unisphere and Solutions Enabler CLI support management of PEs.
Figure 8 VMAX3 VVol Architecture
Manage storage environment for VMware VVols

VMAX3 VVol Architecture

Control Path

Data Path

Solutions Enabler

VASA Provider

Linusphere

CLI

PE

PE

VMAX3

Gold

Silver

Diamond

Gold

Gold

Bronze

vSphere

vSphere

Container 1: 600 TB

Container 2: 200 TB
Table 18  VVol architecture component management capability

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>VVol device management (create, delete)</td>
<td>VASA Provider APIs / Solutions Enabler APIs</td>
</tr>
<tr>
<td>VVol bind management (bind, unbind)</td>
<td></td>
</tr>
<tr>
<td>Protocol Endpoint device management (create, delete)</td>
<td>Unisphere/Solutions Enabler CLI</td>
</tr>
<tr>
<td>Protocol Endpoint-VVol reporting (list, show)</td>
<td></td>
</tr>
<tr>
<td>Storage Container management (create, delete, modify)</td>
<td></td>
</tr>
<tr>
<td>Storage container reporting (list, show)</td>
<td></td>
</tr>
</tbody>
</table>

Solutions Enabler CLI support for VVol management

This section describes the Solutions Enabler CLIs modified to support VVol management and includes the following CLI actions:

- Create/delete storage containers
- Modify storage container descriptions
- Add/modify storage resource to storage containers
- Remove storage resource from storage containers
- Create Protocol Endpoint (PE) devices

For VVol management functions (create/delete VVols, PE binding) refer to the EMC VASA Provider documentation or applicable VMware vCenter documentation.

Create storage container for VVol management

**Note**
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Description**
Creates a new storage container on a specified array.

**Syntax**
To create a storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc create -name <StorageContainer> -type vvols -description <Description>
```

The following security privileges are required to use this command:

- Required Access type: CFGSYM

**Options**
- `-name`
Storage container name. Must not exceed 63 characters in length, must begin with an alpha-numeric character and may contain hyphens and underscore characters. Names are not case sensitive but is case preserving.

**-description**

Storage container description. Cannot exceed 128 characters, and contains only the following characters: a-z A-Z 0-9 _ ! @ $# ^ & * ( ) - . along with the space character.

**-type**

The only option is **vvols**.

### Rules and restrictions:

Maximum number of storage containers allowed per array is 16.

## Delete storage container for VVols

**Note**

VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Syntax**

To delete a storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc delete -sc_name <StorageContainer>
```

The following security privileges are required to use this command:

- Required Access type: CFGSYM

**Rules and restrictions:**

Storage container must not have any devices consuming any of the resources defined in the container.

## Modify description for storage container for VVols

**Note**

VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Syntax**

To change a storage container description, use the following syntax:

```
symcfg -sid <SymmID> -sc set -sc_name <StorageContainer> -description <Description>
```

The following security privileges are required to use this command:

- Required Access type: CFGSYM

Options

**-description**
Storage container description. Cannot exceed 128 characters, and contains only the following characters: a-z A-Z 0-9 _ ! @ # $ % ^ & * ( ) - . along with the space character.

Add storage resource to storage container for VVols

**Note**
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Syntax**
To add a storage resource to a storage container, use the following syntax:

```bash
symcfg -sid <SymmID> -sc -sc_name <Storage Container> add -sresource <StorageResourceName> -sl <SLName> -wl <WorkloadName> -srp <SRPName> [-noc] -subscribed_max <GB>
```

The following security privileges are required to use this command:
- Required Access type: CFGSYM

**Options**

- **-sresource**
  Storage resource name. Must be unique and not exceed 63 characters in length. Must begin with an alpha-numeric character and may contain hyphens and underscore characters. Names are not case sensitive but is case preserving.

- **-sl**
  Service Level name must be supplied, along with optional workload and the maximum amount of subscribed storage, in GBs, provisioned to the storage container. Service Level name must be unique to the container.

- **-wl**
  Workload name must be unique to the container.

- **-srp**
  If SRP name is not provided, then the default SRP for the FBA emulation is used.

- **-noc**
  When adding a resource to a storage container the compression attribute is enabled by default on FAST managed storage groups if the associated SRP supports compression. The compression attribute is removed using this option. Compression is allowed only on VMAX All Flash Array and only FBA devices.

**Rules and restrictions:**
- Maximum number of resources per container is 32.
Modify storage resource for storage container for VVols

**Note**
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Syntax**
To change the storage size limit for the storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc -sc_name <StorageContainer> set -sresource <StorageResourceName> -subscribed_max <GB>
```

The following security privileges are required to use this command:
- Required Access type: CFGSYM

**Rules and restrictions**
Subscribed limit must be the same or greater than the current aggregate subscription of devices using the resource.

Remove storage resource from storage container for VVols

**Note**
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Syntax**
To remove a storage resource from a storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc -sc_name <StorageContainer> remove -sresource <StorageResourceName>
```

The following security privileges are required to use this command:
- Required Access type: CFGSYM

**Rules and restrictions**
There must be no devices using the resource.

Create Protocol Endpoint (PE) devices for VVols

**Note**
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

**Description**
A PE identifies an access point to an array for one or more VMWare virtual machines, through which a VMWare Virtual Volume (VVol) receives IO. From a VM host, PEs
provide a connection point for the management of very large numbers of VVols. A PE provides a data path from ESXi vSphere to VVols but does not have a backing storage.

Note
A PE must be in a storage group that belongs to a masking view so it is visible to the host.

Syntax
To create PE devices, use the following syntax:

```
symdev -sid <SymmID> create -pedev [-N <#>]
```

Options
- `-N, #`
  Number of PEs to create. Maximum per array is 1,024.

**CLI command support for Protocol Endpoint (PE) devices for VVols**

Note
VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

Description
The following table lists the Solutions Enabler CLI commands that support PE devices, but do not require syntax changes for this support. Refer to *EMC Solutions Enabler Command Reference Guide* for command syntax.

**Table 19 Supported CLI commands for PE devices**

<table>
<thead>
<tr>
<th>Command</th>
<th>Rules and restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>symdev delete</code></td>
<td>• Specified storage group cannot be FAST managed.</td>
</tr>
<tr>
<td></td>
<td>• Storage group cannot contain VVols.</td>
</tr>
<tr>
<td><code>symconfigure delete</code></td>
<td>• PE cannot be bound to a VVol or group of VVols.</td>
</tr>
<tr>
<td></td>
<td>• PE cannot belong to a storage group with VVols.</td>
</tr>
<tr>
<td><code>symconfigure set device_name</code></td>
<td>For PEs, only the device_name option can be used with this command.</td>
</tr>
<tr>
<td><code>symaccess add</code> (allows user access to add PE devices to storage group)</td>
<td>Specified storage group cannot be FAST managed.</td>
</tr>
<tr>
<td><code>symsg add</code> (allows adding PE devices to storage group)</td>
<td>Storage group cannot contain any other PEs.</td>
</tr>
</tbody>
</table>
### Table 19 Supported CLI commands for PE devices (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Rules and restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>symsg remove</code></td>
<td>(allows removing PE devices from storage group)</td>
</tr>
<tr>
<td></td>
<td>PE cannot be bound to a VVol.</td>
</tr>
<tr>
<td><code>symsg set</code></td>
<td>(there are limited set options for PE devices)</td>
</tr>
<tr>
<td></td>
<td>For a storage group with PE devices, command cannot request FAST management for the storage group.</td>
</tr>
</tbody>
</table>

### Report storage containers for VVols

**Note**

VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

Use the `symcfg list -sc` and `symcfg show -sc` commands to display storage containers for VVols. The `list` command displays the storage containers on a specified array. The `show` command displays the resources and subscription capacities of a specified storage container.

### Show storage container for VVols

This topic applies only to arrays running HYPERMAX OS 5977 or higher.

**Syntax**

To show details and storage resources for a storage container, use the following syntax:

```
symcfg -sid <SymmID> -sc show -sc_name <StorageContainer>
```

**Options**

- `-detail`
  - Shows the used subscribed capacity for the storage container.

**Examples**

To list the storage containers for array 0084, enter:

```
symcfg -sid 0084 show -sc -sc_name Datastore1
```
Sample output

Note

The storage resource names in a Storage Container display in alphanumeric order. Up to 24 characters of each storage resource, and 15 characters of Service Level and SRP name display. If the storage resource name exceeds 24 characters, the first 23 characters are displayed, followed by the "*" character to denote that the name is truncated. If the Service Level or SRP name exceeds 15 characters, the first 14 characters are displayed, followed by the "*" character to denote that the name has been truncated. If the SYMCLI_FULL_NAME environment variable is set none of the names are truncated.

Symmetrix ID                  : 000197800084
Name                          : Datastore1
Type                          : VVOLS
Description                   : 20TB Diamond Compressed
Subscribed Capacity Limit (GB) : 20000.0
Subscribed Capacity (GB)      : 1300.1
Subscribed Capacity (%)       : 7

Storage Resources (1):

------------------------------------------------------------------------------------------------------------------
| Capacity | Flg Service Level | SRP Name | Workload Name | Limit Subs | Comp Ratio |
------------------------------------------------------------------------------------------------------------------
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20000.0</td>
<td>1.5:1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1300.1</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>20000.0</td>
<td>1.5:1</td>
</tr>
</tbody>
</table>
------------------------------------------------------------------------------------------------------------------

Legend:
Flags:
(C)ompression  X = Compression Enabled, . = N/A

Output using the -detail option to display used subscribed capacity:

Symmetrix ID                  : 000197800084
Name                          : Datastore1
Type                          : VVOLS
Description                   : 20TB Diamond Compressed
Subscribed Capacity Limit (GB) : 20000.0
Subscribed Capacity (GB)      : 1300.1
Subscribed Capacity (%)       : 7

Storage Resources (1):

------------------------------------------------------------------------------------------------------------------
| Comp Name | Flg Service Level | SRP Name | Workload Name | Capacity Limit Subs (GB) | Subs (GB) (%) |
------------------------------------------------------------------------------------------------------------------
| Diamond_oltprep | X Diamond      | OLTP_REF DEFAULT_SRP | 20000.0 | 1300.1 | 7 |
| Total      |                  |          |               | 20000.0 | 1300.1 | 7 |
------------------------------------------------------------------------------------------------------------------
List storage containers for VVols

Syntax
To list storage containers, use the following syntax:

```
symcfg -sid <SymmID> -sc list
```

Options
- `-detail`
  Lists the type of storage container (`vvols` is the only supported type).
- `-v` (-`verbose`)
  A "show" of all storage containers on the array are displayed.

Examples
To list the storage containers for array 0084, enter:

```
symcfg -sid 0084 list -sc -detail
```

Sample output

**Note**

Storage container names display in alphanumeric order. Up to 32 characters of each Storage Container name displays. If the name exceeds 32 characters, the first 31 characters are displayed, followed by the "*" character to denote that the name is truncated. If the SYMCLI_FULL_NAME environment variable is set, the storage container name is not truncated.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197100084</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Datastore1</td>
</tr>
<tr>
<td>Description</td>
<td>20TB Diamond Compressed</td>
</tr>
</tbody>
</table>

Using the `-v` and `-detail` options to display container resource details:

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197800084</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Datastore1</td>
</tr>
<tr>
<td>Type</td>
<td>VVOLS</td>
</tr>
<tr>
<td>Description</td>
<td>20TB Diamond Compressed</td>
</tr>
<tr>
<td>Subscribed Capacity Limit (GB)</td>
<td>20000.0</td>
</tr>
<tr>
<td>Subscribed Capacity (GB)</td>
<td>1300.1</td>
</tr>
<tr>
<td>Subscribed Capacity (%)</td>
<td>7</td>
</tr>
</tbody>
</table>
### Storage Resources (1):

<table>
<thead>
<tr>
<th>Subs Name</th>
<th>Subs</th>
<th>Comp</th>
<th>Flg</th>
<th>Service Level</th>
<th>SRP</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Workload Name</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(GB)</td>
<td>(GB)</td>
</tr>
<tr>
<td>Diamond_oltprep</td>
<td>X</td>
<td></td>
<td></td>
<td>Diamond</td>
<td>OLTP_REP DEFAULT_SRP</td>
<td>20000.0</td>
</tr>
<tr>
<td></td>
<td>1300.1</td>
<td>7</td>
<td>1.5:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20000.0</td>
</tr>
<tr>
<td></td>
<td>1300.1</td>
<td>7</td>
<td>1.5:1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Name: Datastore2
- **Type:** VVOLS
- **Description:** 10TB Diamond storage
- **Subscribed Capacity Limit (GB):** 10000.0
- **Subscribed Capacity (GB):** 1085.0
- **Subscribed Capacity (%):** 1

---

### Legend:

**Flags:**
- (C)ompression
- X = Compression Enabled, . = N/A

---

### Report PE and VVol devices

#### Note

VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

Use the following commands to display PE and VVol devices:
- `symdev list`
- `symdev show`
List PE devices and VVOL devices

Description
The `symdev list` command with no filters lists all devices including PE devices, but not VVols. Filters are used to list only PE or VVols devices.

Syntax
To list PE devices or VVols devices, use the following syntax:

```
symdev -sid <SymmID> list -vvol | -pedev | -nopedev
```

Options
- **-pedev**
  Lists only PE devices. Abbreviated `-ped`.
- **-vvol**
  Lists only VVol devices. Abbreviated `-vvo`.
- **-nopedev**
  Excludes PE devices from device list. Abbreviated `-nope`.

Examples
To list only the PE devices for array 064, enter:

```
symdev list -sid 064 -pedev
```

To list only the VVol devices for array 064, enter:

```
symdev list -sid 064 -vvol
```

Sample output
Output with no filters applied (lists PEs and other devices, VVols do not list without the `-vvol` filter):

```
Symmetrix ID: 000194900064

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Dir</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>Physical</td>
<td>SA :P</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>00105</td>
<td>Not Visible</td>
<td>????:?</td>
</tr>
<tr>
<td>00106</td>
<td>Not Visible</td>
<td>????:?</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Unsupported operations/features for VASA protocol endpoints

Note

Protocol Endpoints/VVols are supported on VMAX3 arrays running HYPERMAX OS 5977 Q1 2016SR or higher.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Affected CLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDF (Remote Data Facility)</td>
<td>Pairing of a PE device with another device on a remote array is not allowed.</td>
<td>symrdf</td>
</tr>
<tr>
<td>TimeFinder</td>
<td>Replication of PE devices or any object that contains PE devices is not allowed.</td>
<td>symmir, symclone, symsnapvx</td>
</tr>
<tr>
<td>ORS (Open Replicator)</td>
<td>Replication of PE devices or any object that contains PE devices is not allowed.</td>
<td>symrcopy</td>
</tr>
<tr>
<td>QOS (Quality of Service)</td>
<td>QOS of PE devices or any object that contains PE devices is not allowed.</td>
<td>symqos</td>
</tr>
<tr>
<td>ACL (Access Control Logic)</td>
<td>ACL operations of PE devices or any object that contains PE devices is not allowed.</td>
<td>symacl</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Affected CLI</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>Base control</strong></td>
<td>Base control CLI does not support VASA PEs or any object containing PEs.</td>
<td>• symdev <em>(except symdev list)</em>&lt;br&gt;• sympdev</td>
</tr>
<tr>
<td><strong>Groups</strong></td>
<td>Device group and composite group CLIs do not support VASA PEs or any object that contains PE devices.</td>
<td>• symdg&lt;br&gt;• sympd</td>
</tr>
</tbody>
</table>

**Note**
Storage group management is supported for VASA PE. Storage group must belong to a masking view so the PE is visible to a host.
This chapter describes the RecoverPoint Integration feature and the symrpi command used to manage storage groups for RecoverPoint protection.

- RecoverPoint integration overview .......................................................... 320
- RecoverPoint integration naming conventions ........................................ 320
- RecoverPoint device rules and restrictions ............................................. 320
- RecoverPoint integration control operations ......................................... 322
- RecoverPoint integration reporting ......................................................... 335
**RecoverPoint integration overview**

The RP Integration feature integrates these arrays with an external RP appliance cluster, providing data protection using RP Continuous Data Protection (CDP) between arrays and Continuous Remote Replication (CRR) between data centers. TimeFinder SnapVX technology is the underlying replication technology used for this implementation. The integration includes a set of RP hosts configured as a cluster, and the HBAs on those hosts are zoned to an array through FA ports. Solutions Enabler, through the `symrpri` command, creates and tags RP storage groups on the array, and then by adding devices from existing storage groups on the array to the RP storage group, makes the devices visible to the RP cluster. This enables the RP system to replicate the volumes to local or remote arrays.

RecoverPoint integration support:

- VMAX3 and VMAX All Flash arrays running HYPERMAX OS 5977 Q217SR
- PowerMax arrays running PowerMaxOS

**RecoverPoint integration naming conventions**

Solutions Enabler must create storage groups for the explicit use by the RecoverPoint Cluster and array CLI to protect them from illegal commands. The RP integration environment requires the following object naming conventions:

- The first storage group uses the format `RP_<ClusterName>_SG`. Subsequent storage groups must use the format: `_RP_<ClusterName>_SG<n>`.  
- Cluster names
  - Maximum length of 32 characters
  - Must begin with alphanumeric character
  - Embedded hyphens are allowed, underscores are not allowed
  - Not case sensitive and are reported in upper case

**RecoverPoint device rules and restrictions**

This section outlines the Solutions Enabler control operation rules and restrictions for RP devices for arrays running HYPERMAX OS 5977 Q217SR or higher.

**Base controls**

For base controls `hold`, `unhold`, `ready`, `not_ready`, `write_disable`, `rw_enable` following rules apply:

- Base control operations are not allowed on `RP_Internal` devices for the `hold`, `unhold`, `ready` and `not_ready` actions.
- Base control operations are only allowed on `RP_Internal` devices for the `rw_enable` and `write_disable` actions when initiated by the RP system.
- Base control operations are only allowed on `RPExternal` devices when initiated by the RP system.

The `symdev`, `symcg`, `symdg`, and `symsg` commands are modified to comply with these rules.
Device configuration change
Array devices used by the RP system cannot be explicitly tagged through the use of
device setting commands. Devices are tagged as RP devices when an application
storage group is RP protected. Solutions Enabler configuration change operations,
extcept for valid RP actions or symrpi commands, are denied access to RP_Internal
devices. The following lists the device configuration restrictions for RP-tagged
devices:

- **RP_Internal** devices cannot be RDF devices.
- **RP_External** devices cannot be RDF R1, R11, R2, R22, R21, R1BCV, or RDF Metro
devices.
- **RP_External** or **RP_Internal** devices cannot have the BCV attribute.

The symconfigure command is modified to comply with these rules.

Provisioning
A permissions flag is no longer required for the following actions on masking views
(both **RP_Internal** or **RP_External** devices):

- Creating a masking view that will contain RP-tagged devices.
- Adding a device to a masking view that contains RP-tagged devices.
- Deleting a masking view that contains RP-tagged devices.
- Removing a port group from a masking view that contains RP-tagged devices.
- Removing a device from a masking view that contains RP-tagged devices.

Adding **RP_Internal** devices to a masking view, other than a RP masking view is not
allowed.

The symmsg (add/remove operations) and symaccess commands are modified to
comply with these rules.

Open Replicator
Open Replicator operations are not allowed on RP-tagged control devices (external or
internal). If the symrcopy create command is issued it fails and an error is
returned.

TimeFinder
The following rules apply to TimeFinder operations:

- TimeFinder (Mirror, Clone, Snap) operations are not allowed on **RP_Internal** or
  **RP_External** devices.
- TimeFinder SnapVX operations are allowed when the source or target device is a
  **RP_External** device.
- TimeFinder SnapVX operations are allowed for valid RP application when the
target device of the device pair is a **RP_Internal** device.

The symsnapvx command is modified to comply with these rules.

RDF
The following rules apply to RDF operations:

- **RP_Internal** devices cannot be RDF devices.
- **RP_External** cannot be RDF R1, R11, R2, R22, R21, R1BCVs or RDF Metro devices.
- Since R1 devices can be changed to R2 devices during a RDF swap or failover
  operation, the following commands are blocked, when issued to a RDF pair, where
  the R1 device is a **RP_External** device:
- symrdf swap
- symrdf failover -establish
- symrdf failover -restore

The symrdf command is modified to comply with these rules.

RDF/Star
RP_Internal and RP_External devices cannot be Star devices.
The symstar command is modified to comply with these rules.

RecoverPoint integration control operations

The RecoverPoint integration process is managed by the symrpi CLI command and includes the following operations:
- Environment setup or remove
- Environment expand
- Create repositories
- Create or delete journal
- Protect or unprotect storage groups
- List any or all of the RP clusters configured on an array

RecoverPoint Environment setup - description and actions

Description
The environment setup operation creates the infrastructure that allows host-visible devices in application storage groups to be visible to the RP Appliance Cluster. Prior to running this action the storage administrator must do the following:
- Create an initiator group using the naming convention RP_<ClusterName>_IG and populate it with WWNs of the HBAs on the RP Appliance Cluster nodes.
- Create a port group using the naming convention RP_<ClusterName>_PG and add it to the array front-end ports that are zoned to the RP appliance HBAs.
- If the RP environment is expected to grow, then create multiple port groups, using different director:port pairs, when creating the groups. The naming convention for expandable port groups is RP_<ClusterName>_PG<n>, where <n> is an index between 1 and 15.

Note
This operation is restricted and must be run by the storage administrator on the Solutions Enabler control host. It cannot be executed by the RP system.

Actions
The environment setup operation performs the following actions:
- Validates the cluster name is unique, otherwise the operation fails.
- Validates the RP initiator group and port group, and fails the operation if they do not exist.
- If creating multiple port groups, ensures that none of the director:port pairs are the same across the port groups, otherwise the operation fails.
- Validates that each initiator in the initiator group is zoned to each port in the port group, and fails the operation if not zoned properly.
Validates that there is at least one login entry for an initiator from the initiator group to a port from the port group, otherwise setup operation fails.

Creates a RP storage group named _RP_<ClusterName>_SG and assigns an internal ID.

Creates a RP storage group named _RP_<ClusterName>_Attic that is used during environment removal actions.

Creates six gatekeeper devices that are tagged RP_Internal.

Adds the six GK devices to the RP storage group.

If the -repository flag is specified in the environment -setup command, creates a 5.7 GB repository file tagged as RP_Internal and adds it to the RP storage group.

Creates the masking view _RP_<ClusterName>_MV using initiator group _RP_<ClusterName>_IG, port group _RP_<ClusterName>_PG, and storage group _RP_<ClusterName>_SG.

If other Port Groups exist with the naming convention _RP_<ClusterName>_PG<n>, creates the masking view _RP_<ClusterName>_MV<n>, using initiator group _RP_<ClusterName>_IG, port group _RP_<ClusterName>_PG<n>, and storage group _RP_<ClusterName>_SG<n>.

Setup RecoverPoint environment

Description
The symrpi environment -setup command configures the RecoverPoint Cluster environment on the target array. Once the environment setup action completes, the operation continues with an environment expand action. This operation looks for port groups named _RP_<ClusterName>_PG<n>, and if none are found the operation completes with success.

This operation requires the following security privileges:

- Access type – CFGSYM
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (-sid symID)
- RP Cluster name (-cluster ClusterName)

Syntax
To setup the RP environment on a target array, use the following syntax:

```bash
symrpi -sid symID -cluster ClusterName environment -setup -repository -nop
```

Options

- **-repository**
  Creates a Repository device with the environment setup action.

- **-nop**
  Requests that no prompts are returned after the command is executed. The default is to prompt for command confirmation.
Examples
To configure the cluster CorpRPCluster on array 385 with a -repository device, enter:

```
symrpi -sid 395 -cluster CorpRPCluster environment -setup -repo
```

Execute 'Environment Setup' operation on cluster 'CorpRPCluster' (y/[n])? y

An RP 'Environment Setup' operation is in progress for cluster 'CorpRPCluster'. Please wait...

Analyze Configuration..............................................Validated.
Setup RecoverPoint Environment..................................Started.
Setup RecoverPoint Environment..................................Done.

Devices created: 0258B

The RP 'Environment Setup' operation successfully executed for cluster 'CorpRPCluster'.

An RP 'Environment Expand' operation is in progress for cluster 'CorpRPCluster'. Please wait...

The RP 'Environment Expand' operation successfully executed for cluster 'CorpRPCluster'.

Expected command behavior when RP environment is already setup on the array:

```
symrpi -sid 124 -cluster CorpRPCluster environment -setup -repository
```

A RP 'Environment Setup' operation is in progress. Please wait...

The RecoverPoint Environment already exists for this Symmetrix

RecoverPoint journal device creation - description and actions

Description
The create journal devices operation creates a number of journal devices of a specified size and makes those devices visible to the RP Appliance.

Note
This operation can be run by the storage administrator on the Solutions Enabler control host or by the RP system.

Actions
The create journal operation performs the following actions:

- Validates that the cluster exists on the target array, otherwise the operation fails.
- Validates that there is enough space in at least one of RecoverPoint storage groups to hold the new journal devices. Saves the internal identifier that the array assigned to that RecoverPoint storage group, and fails if the storage group does not exist. The operation also fails if none of the RP storage groups has the capacity to store the new journal devices.
- Validates that there is adequate space in at least one of the collections of Recover Point Storage Groups, otherwise the operation fails.
- If there is no storage group named _RP_<ClusterName>_Journal defined on the array, creates an empty storage group with this name, and assigns it the
Optimized service level on a hybrid array, and the Diamond service level on an All-Flash array.

Note
Changing the storage group attributes on this storage group such as service level or compression is allowed. For this storage group compression is disabled by default.

- Creates $N$ devices of the specified size that are tagged $RP_{-}Internal$, and assigns a nice-name to each device.
- Adds the created journal devices to the $RP_{-}<ClusterName>_{-}Journal$ storage group.

Create RecoverPoint journal devices

Description
The `symrpi create -journal` command creates a number of journal devices of a specified size and makes those devices visible to the RP Appliance. This operation requires the following security privileges:

- Access type – CREATEDV
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (`-sid symID`)
- RP Cluster name (`-cluster ClusterName`)
- Size of each journal volume (`-cap n`). Default is Mb.
- Number of journal volumes (`-N n`)

Options
- `captype (cyl/mb/gb/tb)`
  Capacity type for journal size.

Syntax
To create journal devices, use the following syntax:

```
symrpi -sid symID -cluster ClusterName create -journal -cap n -N n
```

Examples
To create two 2200 Mb journal devices for the RP cluster CorpRPCluster, enter:

```
symrpi -sid 124 -cluster CorpRPCluster create -journal -cap 2200 -N 2 -nop
```

A RecoverPoint 'create Journal' operation is in progress for cluster 'CorpRPCluster'. Please wait...

```
Analyze Configuration............................................Validated.
Create Devices.................................................Started.
Create Devices.................................................Done.
Devices Created: 005B6 005B7
```
RecoverPoint Environment expand - description and actions

Description
The environment expand operation expands the RP environment to accommodate additional Production, Replica, RP Internal volumes. This expansion operation addresses the limitation of the initial RP environment that can only accommodate 4096 devices, due to the array restriction that only 4096 volumes can be visible to a host from a masking view. This action is initiated by the RP appliance or the storage administrator, and results in the creation of a new masking view that creates an additional 4096 devices that are visible to the RP Cluster.

Note
If VSA (Volume Set Addressing) is enabled on the director port then the maximum RP expansion is 2000 devices.

During expansion the initial RP initiator group is reused, therefore virtual initiators in separate RP initiator groups are not used. Reuse of the initial initiator group requires that the storage administrator create additional port groups. The naming convention for the Port Groups must be RP_<clusternam>_PG<n>, where <n> is consecutive index between 1 and 15. When issuing an expansion of the RP environment, the original initiator named RP_clusternam_IG is used during the creation of the Recover Point masking view RP_<ClusterName>_MV<n>. If the Recover Point port groups don't exist during the expansion then the expansion command completes with no other Masking Views being created.

This action is not restricted so it can executed by the RP system or run by the storage administrator on the Solutions Enabler control host.

Actions
The environment setup operation performs the following actions:

- Validates that the cluster exists, otherwise the operation fails.
- Validates that the port group exists, otherwise the operation fails.
- If creating multiple port groups, ensures that none of the director:port pairs are the same across the port groups, otherwise the operation fails.
- Validates that the initial initiator group exists.
- Validates that each initiator in the initiator group is zoned to each port in the port group, otherwise the operation fails.
- Validates that there is at least one entry in the Login History Table (LHT) linking an initiator from the initiator group to a port from PG<n>, otherwise the operation fails.
- Determines the next index <n> in the range (1 - 15) for the Port Group RP_<ClusterName>_PG<n>. This operation fails if:
  - all port groups do not exist.
  - if the initial initiator group does not exist.
  - if the corresponding _RP_<clusternam>_SG<n> already exists.
  - if the corresponding RP_<clusternam>_MV<n> already exists.
- Creates the RP storage group _RP_<clusternam>_SG<n>.
- Adds one of the 6 GK devices from storage group _RP_<ClusterName>_SG to the storage group _RP_<ClusterName>_SG<n>.
- Creates the masking view RP_<ClusterName>_MV<n> using initiator group RP_<ClusterName>_IG<n>, port group RP_<ClusterName>_PG<n>, and storage group _RP_<ClusterName>_SG<n>.

Expand RecoverPoint environment

Description
The symrpi environment -expand command expands the RecoverPoint Cluster environment on the target array. This operation requires the following security privileges:
- Access type – CFGSYM
- Authorization rights – Storage Admin

The command requires the following parameters:
- Target array (-sid symID)
- RP Cluster name (-cluster ClusterName)

Syntax
To expand the RP environment on a target array, use the following syntax:

```
symrpi -sid symID -cluster ClusterName environment -expand -nop
```

Options
- -nop
  Requests that no prompts are returned after the command is executed. The default is to prompt for command confirmation.

Examples
To expand the RP environment for the cluster CorpRPCluster on array 124, enter:

```
symrpi -sid 124 -cluster CorpRPCluster environment -expand -nop
```

Note
This example shows three additional port groups added.

An RP 'Environment Expand operation is in progress for cluster 'CorpRPCluster'. Please wait...

Setup and Expand RecoverPoint Environment..................Started.
Setup and Expand RecoverPoint Environment..................Done.
Setup and Expand RecoverPoint Environment..................Started.
Setup and Expand RecoverPoint Environment..................Done.
Setup and Expand RecoverPoint Environment..................Started.
Setup and Expand RecoverPoint Environment..................Done.

The RP 'Environment Expand' operation successfully executed for cluster 'CorpRPCluster'.
RecoverPoint journal device deletion - description and actions

**Description**
The delete journal devices operation removes visibility of journal devices from the RP Appliance and deletes the devices.

**Note**
This operation can be run by the storage administrator on the Solutions Enabler control host or by the RP system.

**Actions**
The delete journal operation performs the following actions:

- Validates that the specified RP Cluster exists on the target array, otherwise the operation fails.
- If removing specific Journal devices from RP storage group:
  - Validates that the device exists, otherwise the operation fails.
  - Validates that the device is a RP Journal Device, otherwise the operation fails.
  - Removes the device from the RP storage group that contains the journal devices.
  - Removes the devices from the RecoverPoint Journal storage group associated with the specified cluster.

**Note**
Even if the delete operation results in the removal of all Journal devices, the storage group is not be deleted.

- Deletes the device(s).

Delete RecoverPoint journal devices

**Description**
The `symrpi delete -journal` command removes visibility of Journal devices from the RP Appliance and deletes devices. This operation requires the following security privileges:

- Access type – CREATEDV
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (`-sid symID`)
- RP Cluster name (`-cluster ClusterName`)
- Devices to delete (`-dev <SymDevStart>:<SymDevEnd> | SymDevName`)

**Syntax**
To delete journal devices, use the following syntax:

```
symrpi -sid symID -cluster ClusterName delete -journal
```
Examples
To delete -journal devices 005B5 - 005B9 for cluster CorpRPCluster on array 124, enter:

```bash
symrpi -sid 124 -cluster CorpRPCluster delete -journal -dev 005B5:005B9
```

A RecoverPoint 'delete Journal' operation is in progress for cluster 'CorpRPCluster'. Please wait...

Analyze Configuration...........................................Validated.
Delete Devices...................................................Started.
Delete Devices...................................................Done.

The RecoverPoint 'Delete Journal' operation successfully executed for cluster 'CorpRPCluster'.

RecoverPoint device protection - description and actions

Description
The protect storage group operation protects the external storage group devices on the RP Cluster for use by the RP Appliance.

Note
This operation is issued by the storage admin on the Solutions Enabler control host to initially protect devices in a storage group. It can also be issued, either by the storage admin or by the RP Appliance, on a previously protected storage group to protect newly added devices.

Actions
The storage group protect operation performs the following actions:

- Validates that the cluster exists on the target array, otherwise the operation fails.
- Examines each device in the production storage group, determines if it is eligible for RP protection, then constructs a device list for RP tagging.
- Validates that there is enough room in at least one of the RP storage groups for the devices in the device list, otherwise the operation fails.
- Sets the *RP_External* tag on the device.

Rules and Restrictions
For devices to be eligible for RP protection the following restrictions apply. If any devices in the storage group do not meet these requirements the protect operation fails:

- Must have FBA emulation.
- Cannot have CKD, Celerra-FBA, or AS400 emulation
- Cannot be an Open Replicator control device
- Cannot be part of a SRDF STAR configuration
- Cannot be SRDF R1, R11, R2, R21, or R22 devices
- Cannot be part of a SRDF/Metro configuration
- Cannot be part of a NDM migration (neither source or target)
- Cannot have BCV attribute
- Cannot be encapsulated
Any devices that are dedicated gatekeeper devices (< 20 cylinders) are not eligible for RP protection.

The protect operation will also fail for the following reasons:

- Specified storage group does not exist
- Specified storage group is empty
- Specified storage group is a child storage group in a cascaded relationship
- Specified storage group contains devices tagged `RP_Internal`
- Specified storage group contains RP protected devices that belong to another RP protected RP Cluster
- Specified storage group has more than 1024 devices, however this limit check is ignored if the storage group protect command is issued from the RP software

Protect devices for RecoverPoint

Description

The `symrpi protect` command protects the external storage group devices to the RP Cluster for use by the RP Appliance. This operation requires the following security privileges:

- Access type – RPA (for all devices in the storage group)
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (`-sid symID`)
- RP Cluster name (`-cluster ClusterName`)
- Specified storage group for protection (`-sg SgName`)

Syntax

To RP protect devices, use the following syntax:

```
symrpi -sid symID -cluster ClusterName protect -sg SgName
```

Examples

To protect devices in storage group `MyCorp_Production` for CorpRPCluster on array 124, enter:

```
symrpi -sid 124 -cluster CorpRPCluster protect -sg MyCorp_Production -nop
```

A RecoverPoint 'SG Protect' operation is in progress for cluster 'CorpRPCluster'. Please wait...

- Analyze Configuration...Validated.
- Protect Storage Group...Started.
- Protect Storage Group...Done.

The RecoverPoint 'SG Protect' operation successfully executed for Cluster 'CorpRPCluster'.

---

**Note**

Cannot be a Data Domain device
RecoverPoint device protection removal - description and actions

Description
The unprotect storage group operation removes protection for the devices in a specified storage group on the RP Cluster.

Note
This operation is restricted and must be run by the storage administrator on the Solutions Enabler control host. It cannot be executed by the RP system.

This action can be used with a Symforce flag to remove storage groups from RP protection, when the RP Appliance is not available.

Actions
The storage group unprotect operation performs the following actions:

- Validates that the cluster exists on the target array, otherwise the operation fails.
- Validates that the specified storage group exists on the target array, otherwise the operation fails.
- Validates that the device is tagged as RP_External, otherwise the operation fails if device is tagged as RP_Internal or has no tagging.
- Removes the RP_External from the device.
- Removes the devices from the RP storage group that contains the production device.

Unprotect devices for RecoverPoint

Description
The symrpi unprotect command removes protection, for the devices in a specified storage group on the RP Cluster. This operation requires the following security privileges:

- Access type – RPA (for all devices in the storage group)
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (-sid symID)
- RP Cluster name (-cluster ClusterName)
- Specified storage group or devices to unprotect (-sg SgName) or (-devs SymDevStart:SymDevEnd |SymDevName...)

Syntax
To unprotect devices for RP, use the following syntax:

```
symrpi -sid symID -cluster ClusterName unprotect -sg SgName
```

Options
- **-symforce**
  Required with this command to force removal of all RP resources associated with the storage group when the RP Appliance is not available.
Examples
To remove protection for devices in storage group MyCorp_Production for CorpRPCluster on array 124, enter:

```
symrpi -sid 124 -cluster CorpRPCluster unprotect -sg MyCorp_Production -nop
```

A RecoverPoint 'SG Unprotect' operation is in progress for cluster 'CorpRPCluster'. Please wait...

Analyze Configuration..........................Validated.
Unprotect Storage Group..........................Started.
Unprotect Storage Group..........................Done.

The RecoverPoint 'SG Unprotect' operation successfully executed for Cluster 'CorpRPCluster'.

RecoverPoint repository creation - description and actions

Description
The create repository operation creates a 5.7 GB Repository device, tags it as an internal device, and adds it to the RP storage group.

Note
This operation can be run by the storage administrator on the Solutions Enabler control host or by the RP system.

Actions
The create repository operation performs the following actions:

- Validates that the cluster exists on the target array, otherwise the operation fails.
- Validates that there is enough space in at least one of the RecoverPoint storage groups to hold the device. Saves the internal identifier that the array assigned to that RecoverPoint storage group, and fails if the storage group does not exist.
- Validates that there is adequate space in at least one of the collections of Recover Point Storage Groups, otherwise the operation fails.
- Creates a 5.7 Gb repository file tags as RP_Internal and adds it to the RP storage group with internal identifier.

Create repository for RecoverPoint

Description
The symrpi create -repository command adds a 5.7 GB repository device to the RecoverPoint Cluster for use by the RecoverPoint system, and is valid even if multiple repository devices already exist.

This operation requires the following security privileges:

- Access type – CREATEDV
- Authorization rights – Storage Admin

The command requires the following parameters:

- Target array (-sid symID)
- RP Cluster name (-cluster ClusterName)
Syntax
To recreate a repository for RP, use the following syntax:

```
symrpi -sid symID -cluster ClusterName create -repository -nop
```

Examples
To create a Repository device for cluster CorpRPCluster on array 124, enter:

```
symrpi -sid 124 -cluster CorpRPCluster create -repository -nop
```

A RecoverPoint 'Repository Create' operation is
in progress for cluster 'CorpRPCluster'. Please wait...

Analyze Configuration........................................Validated.
Create Repository Device RecoverPoint......................Started.
Create Repository Device RecoverPoint......................Done.

Devices Created: 005B6

The RecoverPoint 'Repository Create' operation successfully executed for
cluster 'CorpRPCluster'.

RecoverPoint environment removal - description and actions

Description
The environment remove operation removes the RP environment from the array.

Note
This operation is restricted and must be run by the storage administrator on the
Solutions Enabler control host. It cannot be executed by the RP system.

Prerequisite cleanup actions
The following actions from the RP System are required prior to the environment
remove operation, otherwise the operation fails:

- Verify that there is no Repository volume associated with the RP Cluster on the
  array.
- Remove all journal volumes associated with the RP Cluster on the array.
- Remove all replication infrastructure (SDDF and SnapVX sessions) associated with
devices that were protected by the RP Cluster on the array.
- Remove RP protection from all production devices that were protected by the RP
  Cluster on the array.
- Remove all Access TDEVs on the array that are associated with the RP Cluster.
  Creating Access TDEVs is an operation restricted to only the RP system and
cannot be executed by Solutions Enabler. These devices are used by RP during the
replication process.

Actions
The environment remove operation performs the following actions:
Remove environment for RecoverPoint

Description
The `symrpi environment remove` command removes the RP environment from the array. This command is performed after all application storage groups have been unprotected from the RP cluster.

Note
This operation can take a long time to execute depending on the number and size of the devices to be removed. A warning message displays when this remove action is requested.

This operation requires the following security privileges:
- Access type – CFGSYM
- Authorization rights – Storage Admin

The command requires the following parameters:
- Target array (`-sid symID`)
- RP Cluster name (`-cluster ClusterName`)

Syntax
To remove the RP environment on a target array, use the following syntax:

```
symrpi -sid symID -cluster ClusterName environment -remove -symforce -nop
```

Options
- `symforce`
  Required with this command to force removal of all RP resources associated with the storage group when the RP Appliance is not available.

- `nop`
Requests no prompts are returned after the command is executed. The default is to prompt for command confirmation.

Examples
To remove the RP environment for cluster CorpRPCluster on array 124, enter:

```
symrpi -sid 124 -cluster CorpRPCluster environment -remove -symforce -nop
```

Warning: The 'Environment Remove' operation on cluster 'CorpRPCluster' may take a long time.

A RP 'Environment Remove' operation is in progress for cluster 'CorpRPCluster'. Please wait...

- Analyze Configuration..............................................Validated.
- Remove Masking View(s).................................................Validated.
- Remove Storage Group(s)..............................................Validated.
- Remove RecoverPoint Environment..............................Started.
- Remove Masking View(s).................................................Started.
- Remove Storage Group(s)..............................................Started.
- Remove RecoverPoint Environment..............................Done.

The RP 'Environment Remove' operation successfully executed for cluster 'CorpRPCluster'.

RecoverPoint integration reporting

The `symrpi list` command along with command options lists the following information:

- Summary information about each RP Cluster
- Specific cluster information – summary or details
- Specific production storage group information protected by a specific RP Cluster – summary or details

List RecoverPoint clusters

Description
The `symrpi list` command lists summary information (number of protected storage groups and total number of protected devices and journals) about all RP clusters configured on the array.

Syntax
To list RP clusters on target array, use the following syntax:

```
symrpi list -sid symID
```

Examples
To list the clusters on array 084, enter:

```
symrpi list -sid 084
```
Sample output

Sample output

Symmetrix ID: 000197100084

<table>
<thead>
<tr>
<th>Cluster Name</th>
<th>SGs</th>
<th>Count</th>
<th>Count</th>
<th>Count</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production_Cluster</td>
<td>3</td>
<td>182</td>
<td>182</td>
<td>2</td>
<td>.</td>
</tr>
<tr>
<td>Test_Cluster</td>
<td>37</td>
<td>1243</td>
<td>1197</td>
<td>112</td>
<td>R</td>
</tr>
</tbody>
</table>

Legend:
Flags:
(R)epository, . – N/A

List specific RecoverPoint cluster

Description

The symrpi list -cluster command lists summary information about a specific RP cluster, as well as summary information on each production storage group containing devices protected by the cluster. This command displays for each storage group count of devices in the group (sum of all devices in its children for a cascaded group), the count of devices protected under that storage group, and the number of data copies being maintained by RP for the group. The copy count is reported as Mixed if it the count varies between devices within the group.

Syntax

To list information for an RP cluster, use the following syntax:

```
symrpi list -sid symID -cluster ClusterName
```

Options

- **-details**
  Provides additional information when one or more storage groups have the Devices Removed flag set. This option displays information on devices that have been removed from the storage group where they were RP protected.

Examples

To list information for Production_Cluster on array 084, enter:

```
symrpi list -sid 084 -cluster Production_Cluster
```

Sample output

Symmetrix ID      : 000198700084
RP Cluster        : Production_Cluster
Repository        : Yes
Journal Devices   : 2
Access TDevs      : 5
Repository Devices: 2
Protected Devices : 3

<table>
<thead>
<tr>
<th>Protected SG</th>
<th>Count</th>
<th>Count</th>
<th>Count</th>
<th>Copies</th>
<th>DP</th>
</tr>
</thead>
</table>

Array integration with RecoverPoint

Dell EMC Solutions Enabler Array Controls and Management 9.0 CLI User Guide
Output with -detail option, which shows a set of devices (113A - 113F) that were removed from the storage group MyCorp_oracle_archive after it was RP-protected.

---

**Device**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>05D8D</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8E</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8F</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9A</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9B</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9C</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9D</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05DA2</td>
<td>REPOSITORY</td>
</tr>
<tr>
<td>05DA3</td>
<td>REPOSITORY</td>
</tr>
<tr>
<td>00100</td>
<td>PROTECTED</td>
</tr>
<tr>
<td>05D85</td>
<td>PROTECTED</td>
</tr>
<tr>
<td>05D86</td>
<td>PROTECTED</td>
</tr>
</tbody>
</table>

**Legend:**

**Flags:**

(D)evices: A – Added, R – Removed, . – N/A

(P)rotect: N – Needs Re-protect, . – N/A
List Recover Point protected storage group

Description
The `symrpi list -cluster -sg` command lists summary information about a specific production storage group protected by a specific RP Cluster. This command displays summary information about the storage group and its protection properties, the number of devices within the group, the count of devices that are protected under the group, and for each device the number of data copies maintained by RP.

Syntax
To list information for an RP protected storage group, use the following syntax:

```
symrpi list -sid symID -cluster ClusterName -sg SGName -dev_info <journal | atdev | protected | repository | all>
```

Options

- **-detail**
  Provides the additional detail on each device within the storage group. This option displays the number of copies RecoverPoint maintains on the device and the current RecoverPoint status of the device, related to this storage group.

Examples
To list information for storage group `MyCorp_Production Production_Cluster` on array `084`, enter:

```
symrpi list -sid 084 -cluster Production_Cluster -sg MyCorp_Production
```

Sample output

```
Symmetrix ID : 000198700084
RP Cluster   : Production_Cluster
Storage Group: MyCorp_Production
Device Count : 38
Protected Device Count : 35
Copies       : 2
Flags        : Devices Added, Needs Re-Protect
```
Output with -detail option, which shows a set of devices added to the storage group MyCorp_Production that are not RP protected.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000198700084</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP Cluster</td>
<td>Production_Cluster</td>
</tr>
<tr>
<td>Storage Group</td>
<td>MyCorp_Production</td>
</tr>
<tr>
<td>Device Count</td>
<td>38</td>
</tr>
<tr>
<td>Protected Device Count</td>
<td>35</td>
</tr>
<tr>
<td>Copies</td>
<td>2</td>
</tr>
<tr>
<td>Flags</td>
<td>Devices Added, Needs Re-Protect</td>
</tr>
</tbody>
</table>

Device List:

<table>
<thead>
<tr>
<th>Device Copies Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>------ ------ ------</td>
</tr>
<tr>
<td>003BF       2 Protected</td>
</tr>
<tr>
<td>003C0       2 Protected</td>
</tr>
<tr>
<td>003EF       0 Unprotected</td>
</tr>
<tr>
<td>003F0       0 Unprotected</td>
</tr>
<tr>
<td>003F1       0 Unprotected</td>
</tr>
<tr>
<td>00401       2 Protected</td>
</tr>
<tr>
<td>00402       2 Protected</td>
</tr>
</tbody>
</table>

Output with -dev_info all option, which shows all of the devices added to the storage group on array 406.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197800406</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP Cluster</td>
<td>Production_Cluster</td>
</tr>
<tr>
<td>Repository</td>
<td>Yes</td>
</tr>
<tr>
<td>Journal Devices</td>
<td>5</td>
</tr>
<tr>
<td>Access TDevs</td>
<td>5</td>
</tr>
<tr>
<td>Repository Devices</td>
<td>2</td>
</tr>
<tr>
<td>Protected Devices</td>
<td>3</td>
</tr>
<tr>
<td>Protect</td>
<td>Protect</td>
</tr>
<tr>
<td>Protected SG Dev Count</td>
<td>3</td>
</tr>
<tr>
<td>Dev Data Count</td>
<td>3</td>
</tr>
<tr>
<td>Flags</td>
<td>0</td>
</tr>
<tr>
<td>Device Name</td>
<td>Type</td>
</tr>
<tr>
<td>05D8A</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8B</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8C</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8D</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8E</td>
<td>JOURNAL</td>
</tr>
<tr>
<td>05D8F</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9A</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9B</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9C</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05D9D</td>
<td>ATDEV</td>
</tr>
<tr>
<td>05DA2</td>
<td>REPOSITORY</td>
</tr>
<tr>
<td>05DA3</td>
<td>REPOSITORY</td>
</tr>
<tr>
<td>00100</td>
<td>PROTECTED</td>
</tr>
<tr>
<td>05D85</td>
<td>PROTECTED</td>
</tr>
<tr>
<td>05D86</td>
<td>PROTECTED</td>
</tr>
</tbody>
</table>

Legend:

Flags:

D(evices: A - Added, R - Removed, . - N/A
(P)rotect: N - Needs Re-protect, . - N/A
Report RecoverPoint device types

Description
The `symdev list -rp` command lists all the RP external or internal devices on a target array.

For an RP tagged device, the `symdev show` command lists the device tag type (external or internal).

Syntax
To list all RP devices (external or internal), use the following syntax:

```
symdev -sid SymID list -rp [external|internal]
```

Examples
To list all RP external devices on array 476, enter:

```
symdev -sid 476 list -rp external
```

To list the RP device tag type for RP device 1E3, enter:

```
symdev -sid 476 show 1E3
```

Sample output
For all RP external devices on array:

```
Symmetrix ID: 000196801476

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Dir</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sym</td>
<td>Physical</td>
<td>SA :P</td>
</tr>
<tr>
<td>00080</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00081</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00082</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00083</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00084</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00085</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00086</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00087</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00088</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>00089</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>000E8</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>001E3</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>001E4</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>001E5</td>
<td>Not Visible</td>
<td><em><strong>:</strong></em> TDEV</td>
</tr>
<tr>
<td>....</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

For RP device tag type for specific RP device:

```
Device Physical Name       : Not Visible
Device Symmetrix Name     : 001E3
Device Serial ID          : N/A
```
<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000196801476</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of RAID Groups</td>
<td>0</td>
</tr>
<tr>
<td>Encapsulated Device</td>
<td>No</td>
</tr>
<tr>
<td>Encapsulated WWN</td>
<td>N/A</td>
</tr>
<tr>
<td>Encapsulated Device Flags:</td>
<td>None</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Device Service State</td>
<td>Normal</td>
</tr>
<tr>
<td>Device Status</td>
<td>Ready (RW)</td>
</tr>
<tr>
<td>Device SA Status</td>
<td>Ready (RW)</td>
</tr>
<tr>
<td>Device User Pinned</td>
<td>False</td>
</tr>
<tr>
<td>Host Access Mode</td>
<td>Active</td>
</tr>
<tr>
<td>Device Tag(s)</td>
<td>RecoverPoint External</td>
</tr>
<tr>
<td>Extent Based Clone</td>
<td>None</td>
</tr>
<tr>
<td>Snapvx Source</td>
<td>False</td>
</tr>
<tr>
<td>Snapvx Target</td>
<td>False</td>
</tr>
<tr>
<td>Data Destaged</td>
<td>True</td>
</tr>
<tr>
<td>DIF1 Flag</td>
<td>False</td>
</tr>
<tr>
<td>Gatekeeper Device</td>
<td>False</td>
</tr>
<tr>
<td>AS400 GK</td>
<td>False</td>
</tr>
<tr>
<td>Host Cache Registered</td>
<td>False</td>
</tr>
<tr>
<td>Optimized Read Miss</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Array integration with RecoverPoint
CHAPTER 13

FAST.X

This chapter describes FAST.X concepts and explains how to configure and manage FAST.X using the SYMCLI.

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- Delete an external disk group ........................................................................ 347
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FAST.X

FAST.X attaches external storage to VMAX3 arrays (100K, 200K, and 400K) and directs workload movement to these external arrays while having access to the array features such as local replication, remote replication, storage tiering, data management, and data migration. In addition, it simplifies multi-vendor or EMC storage array management. FAST.X uses DX director emulation. The DX director is transparent to other director emulations and operating array infrastructure, and allows the array to act on the external logical units as if they were internal physical drives.

Figure 9 High-level overview of FAST.X environment

FAST.X overview

FAST.X external provisioning requires a FAST.X license and Advanced Suite license pack.

FAST.X for VMAX 100K, 200K, and 400K arrays, supports external provisioning for the following platforms:

- Data Domain eDisk encapsulation for EMC ProtectPoint – ProtectPoint allows for direct backup from VMAX3 arrays to Data Domain platforms. Support is provided for one external disk group and one associated pool to store external devices. The disk group and pool are created automatically during the VMAX array pre-configuration process and all encapsulated virtually-provisioned devices are added during this process.

- XtremIO, VNX, VMAX, Cloud Array and some third party arrays — Integration with Service Levels allows FAST management in these external arrays.

For more information on FAST.X refer to *EMC VMAX3 Family with HYPERMAX OS Product Guide.*
VMAX 250F, 450F, 850F, and 950F arrays, do not support FAST.X, but do support external provisioning for Cloud Array and ProtectPoint.

### Solutions Enabler features supported with FAST.X

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST VP</td>
<td>FAST management integrated with Service Levels.</td>
</tr>
<tr>
<td>VLUN migration</td>
<td></td>
</tr>
<tr>
<td>Open Replicator</td>
<td>- Full support for externally provisioned device for ORS, and RP operations.</td>
</tr>
<tr>
<td></td>
<td>- Support for encapsulated devices that are not geometry limited for only ORS and RP operations.</td>
</tr>
<tr>
<td></td>
<td>- Encapsulated devices that are geometry limited are not supported for ORS pull operations.</td>
</tr>
<tr>
<td>SRDF</td>
<td>- All SRDF operations are supported for externally provisioned devices with any RDF personality (R1, R2, etc.).</td>
</tr>
<tr>
<td></td>
<td>- All SRDF operations are supported for encapsulated devices that are not geometry limited with any RDF personality, (R1, R2, etc.).</td>
</tr>
<tr>
<td></td>
<td>- Encapsulated devices that are geometry limited are supported for SRDF migration operations only. Support is limited to R1 devices. The rules of</td>
</tr>
<tr>
<td></td>
<td>operation (R2 larger than R1) apply.</td>
</tr>
<tr>
<td></td>
<td>- Encapsulated Data Domain devices used for ProtectPoint cannot be part of any SRDF device pair.</td>
</tr>
<tr>
<td>SRDF/SAR</td>
<td>The symreplicate CLI supports both encapsulated and externally provisioned devices, as follows:</td>
</tr>
<tr>
<td></td>
<td>- Supports externally provisioned devices.</td>
</tr>
<tr>
<td></td>
<td>- Supports encapsulated devices that are not geometry limited.</td>
</tr>
<tr>
<td></td>
<td>- Does not support encapsulated devices that are geometry limited for any SAR operation.</td>
</tr>
<tr>
<td></td>
<td>The symrecover CLI supports both encapsulated and externally provisioned devices, as follows:</td>
</tr>
<tr>
<td></td>
<td>- Supports externally provisioned devices.</td>
</tr>
<tr>
<td></td>
<td>- Supports encapsulated devices that are not geometry limited.</td>
</tr>
<tr>
<td></td>
<td>- Does not support encapsulated devices that are geometry limited.</td>
</tr>
<tr>
<td></td>
<td>- Encapsulated Data Domain devices used for ProtectPoint cannot be part of any SRDF device pair.</td>
</tr>
<tr>
<td>SRDF/Star</td>
<td>- Supports externally provisioned devices.</td>
</tr>
<tr>
<td></td>
<td>- Supports encapsulated devices that are not geometry limited.</td>
</tr>
<tr>
<td></td>
<td>- Does not support encapsulated devices that are geometry limited for any Star operation.</td>
</tr>
<tr>
<td></td>
<td>- Encapsulated Data Domain devices used for ProtectPoint cannot be part of any SRDF device pair.</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>TimeFinder</td>
<td>• Supports externally provisioned devices as source and target devices for TimeFinder/Snap, Clone, and Mirror (TF/Clone Emulation) operations.</td>
</tr>
<tr>
<td></td>
<td>• Supports encapsulated devices that are not geometry limited as source and target devices for TimeFinder/Clone, and TimeFinder/Mirror (TF/Clone</td>
</tr>
<tr>
<td></td>
<td>Emulation) operations.</td>
</tr>
<tr>
<td></td>
<td>• Supports encapsulated devices that are geometry limited only for TimeFinder/Clone operations. These devices can be used as a source devices and the</td>
</tr>
<tr>
<td></td>
<td>rules for operations to larger target devices apply.</td>
</tr>
<tr>
<td></td>
<td>• Encapsulated Data Domain devices used for ProtectPoint cannot be part of Clone/Mirror sessions.</td>
</tr>
</tbody>
</table>

### eDisks

With a VMAX3 array attached to external storage, FAST.X virtualizes an external array's SCSI logical units as VMAX disks called eDisks. eDisks have two modes of operation:

- **Encapsulation** — Preserves existing data on external arrays and accesses it through VMAX devices. These devices are called *encapsulated devices*.
- **External Provisioning** — Uses external storage as raw capacity for new VMAX devices. These devices are called *externally provisioned devices*. Existing data on the external devices is deleted when they are externally provisioned.

**Restrictions**

The following restrictions apply to eDisks:

- Must be unprotected devices. The RAID protection scheme of eDisks is dependent on the external array.
- Cannot be AS400, CKD, or gatekeeper devices.
- Cannot be used as VAULT, SFS, or ACLX devices.

### eDisk encapsulation

eDisk encapsulation has two modes of operation:

- **Encapsulation for disk group provisioning (DP encapsulation)** — The eDisk is encapsulated and exported from the VMAX array as disk group provisioned devices.
- **Encapsulation for virtual provisioning (VP encapsulation)** — The eDisk is encapsulated and exported from the VMAX array as thin devices. For both modes, the array automatically creates the necessary VMAX devices. If the eDisk is larger than the maximum VMAX device size or the configured minimum auto meta size, the array creates multiple VMAX devices to account for the full size of the eDisk. These VMAX devices are concatenated into a single concatenated meta device and allow access to the complete volume of data available from the eDisk.
Create external disk group

Description
eDisks require an external disk group (where eDisks are added).

Syntax
To create an external disk group, use the following syntax:

```
symconfigure create disk_group DskGrpName disk_location = <external>
```

Note
The disk group name serves as an additional identification mechanism and does not replace disk group numbers.

Example
To create a disk group for a storage pool named hr_sg_pool, enter:

```
symconfigure -sid 2012 -cmd "create disk_group hr_disk_group disk_location = external;" commit
```

Restrictions
The following restrictions apply when creating disk groups.

- Creating external disk groups is not supported in HYPERMAX OS 5977 and later.
- The maximum number of external disk groups allowed on an array is 512.
- A disk group cannot be created and deleted in the same session.
- The specified disk group name must be unique; the check for uniqueness is case insensitive.
- The maximum characters allowed in a disk group name is 32. Only alphanumeric characters, hyphens "-" and underscores "_" are allowed. The name cannot start with a hyphen "-" or underscore "_".
- The disk group name given cannot have the same format as the default disk group names, for example DISK_GROUP_001.

Delete an external disk group

Syntax
To delete a disk group by disk group number or by disk group name, use the following syntax:

```
symconfigure delete disk_group <DskGrpNum | name:DskGrpName>;
```

Examples
To delete a disk group with the name hr_disk_group, enter:

```
symconfigure -sid 2012 -cmd "delete disk_group name:hr_disk_group;" commit
```
Restrictions
The following restrictions apply when deleting disk groups:

- The disk group must be empty.
- The disk group name or number must exist.
- Only external disk groups can be deleted.

The following rules apply to physical disks and disk groups when using this feature:

- An external disk group can only contain external disks.
- Every external disk in the array must belong to an external disk group.

Add an eDisk

Description
When adding an eDisk to a VMAX array, it must be added to an existing external disk group.

Note
Use the `symsan` command to obtain the WWN of the external LUN to specify in the `add external_disk` command. Refer to the EMC Solutions Enabler SYMCLI Command Reference for the `symsan` manpage.

Syntax
For HYPERMAX OS 5977 lower than Q12016SR and for ProtectPoint on Data Domain platforms, to add an eDisk use the following syntax:

```
add external_disk wwn=<wwn> encapsulate_data=<YES | NO> [SRP=<SRPName>] [dir=<Director_num>];
```

For HYPERMAX OS 5977 Q12016SR and higher to add an eDisk, use the following syntax:

```
add external_disk wwn=<wwn> encapsulate_data=<YES | NO> [keep_data=<YES [sg=<sgname>] | NO [SRP=<SRPName>]]> [dir=<Director_num>];
```

Options

encapsulate_data
Set this option to `YES` to encapsulate data on external LUNs. For HYPERMAX OS 5977 Q12016SR or higher, when adding an external disk encapsulate_data is used ONLY when configuring eDisks on Data Domain for use with ProtectPoint.

keep_data (HYPERMAX OS 5977 Q12016SR and higher)
This option can only be specified when encapsulate_data is set to `NO`. Set this option to `YES` to retain existing data on external LUNs. If set to `YES`, accepts a
Storage Group name. If set to NO, accepts a valid SRP configured on the array. If no SRP is specified then DEFAULT_SRP is used.

**Examples**

For HYPERMAX OS 5977, to virtualize external LUN with WWN 6002198000002DDA8B into SRP "EXTERNAL_SRP", enter:

```bash
symconfigure -sid 087 commit -cmd “add external_disk wwn=6002198000002DDA8B encapsulate_data=NO SRP=EXTERNAL_SRP;”
```

For HYPERMAX OS 5977 Q12016SR and higher, to virtualize external LUN with WWN 6002198000002DDA8B and retain existing data (incorporation), enter:

```bash
symconfigure -sid 087 commit -cmd “add external_disk wwn=6002198000002DDA8B encapsulate_data=NO keep_data=YES sg=SG1;”
```

**Rules and restrictions for adding eDisks**

**HYPERMAX OS 5977 or higher:**

- Required Access type: CFGSYM.
- External LUN size must be between 42 cylinders and 16TB.
- Requires the Advanced Suite license pack and FAST.X license to add eDisks.

**HYPERMAX 5977Q32015SR or higher**

All external LUNs from the same array, virtualized in the same SRP, must be the same size.

**HYPERMAX OS 5977 Q32015SR or lower**

A total of 2048 eDisks per system can be virtualized on the array. This includes both encapsulation and external provisioning.

**HYPERMAX 5977 Q12016SR or higher:**

- If eDisk is added with keep_data set to YES, data can remain on external array indefinitely. To remove external LUN, first use the start drain on external_disk command to drain the data to VMAX. When drain is complete, remove the external LUN.
- If keep_data is set to YES:
  - Specified Storage Group cannot contain CKD devices.
  - Specified Storage Group, if empty, must have SRP configured as FBA DEFAULT on the array.
  - Specified Storage Group, if empty, cannot be set to SRP configured as CKD DEFAULT.
- A total of 2048 eDisks per engine can be virtualized on the array. This includes both encapsulation and external provisioning.
Show external disk information

Examples
To show external disk information for spindle ID 1E05, enter:

```
symdisk show -spid 1E05 -sid 432
```

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000194900432</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
<td>DX-2F</td>
</tr>
<tr>
<td>Interface</td>
<td>N/A</td>
</tr>
<tr>
<td>Target ID</td>
<td>N/A</td>
</tr>
<tr>
<td>Spindle ID</td>
<td>1E05</td>
</tr>
<tr>
<td>External WWN</td>
<td>60000970000184700306533030314345</td>
</tr>
<tr>
<td>External Array ID</td>
<td>000194900345</td>
</tr>
<tr>
<td>External Device Name</td>
<td>00040</td>
</tr>
<tr>
<td>Disk Group Number</td>
<td>512</td>
</tr>
<tr>
<td>Disk Group Name</td>
<td>DISK_GROUP_512</td>
</tr>
<tr>
<td>Disk Location</td>
<td>External</td>
</tr>
</tbody>
</table>

Hypers (1):

```
{
  # Vol Emulation Dev Type Mbr Sts Cap(MB)
  ---- ----- ----------- ---- ---- ---- -------
  1 N/A FBA 00510 Ext-Data 1 1 RW
17261 }
```

Remove an eDisk

Description
For externally provisioning eDisks, the VMAX devices on the eDisk must be drained before it can be removed. See Start drain on eDisk on page 352 on how to start draining an external disk.

For encapsulated eDisks, the devices on the eDisk must be unmapped and not be part of a migration, local replication, remote replication, or ORS session. RAID groups and any disk group provisioned devices or DATA devices created during the encapsulation are removed. Thin devices are unbound but they are not removed.

Syntax
To remove an eDisk, use the following syntax:

```
remove external_disk <wwn=<wwn> | spid=<SpindleID>>
[force_remove=<YES | NO>];
```

Options

force_remove
This option forces the removal of an external encapsulated disk when data is still in the VMAX cache. This can occur when the device has iVTOC and write pending tracks.
Examples
To remove an eDisk specifying the eDisks WWN, enter:

```
symconfigure commit -cmd "remove external_disk
wwn=600009700001847003065330314345;"
```

To remove an eDisk using the specifying the spindle ID, enter:

```
symconfigure commit -cmd "remove external_disk spid=2256;"
```

Rules and restrictions for removing eDisk
- Required Access type: CFGSYM
- Required Authorization Rights: Storage Admin
- HYPERMAX OS 5977 requires Advanced Suite license pack and FAST.X license.
- The specified WWN or spindle ID must represent an external disk.
- The specified external disk must exist.
- The specified WWN or spindle ID must represent an external disk virtualized for external provisioning.
- The specified external disk must be in the Drained state.

List external spindle state

Syntax
To list the state of an external spindle, use the following syntax:

```
symdisk list -external -spindle -state [-spid <SymID>]
```

To list external spindle states for an array, use the following syntax:

```
symdisk list -external -spindle -state [-sid <#>]
```

Examples
To list external spindle states for array 084, enter:

```
symdisk list -external -state -spindle -sid 084
```

Sample output

```
Symmetrix ID : 000197100084

<table>
<thead>
<tr>
<th>Spindle</th>
<th>FLG</th>
<th>Vendor</th>
<th>Product</th>
<th>Array ID</th>
<th>State</th>
<th>Drained (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8000</td>
<td>P</td>
<td>EMC</td>
<td>XtremIO</td>
<td>000012345678</td>
<td>Active</td>
<td>N/A</td>
</tr>
<tr>
<td>8001</td>
<td>P</td>
<td>EMC</td>
<td>XtremIO</td>
<td>000012345678</td>
<td>Draining</td>
<td>50</td>
</tr>
<tr>
<td>8002</td>
<td>P</td>
<td>EMC</td>
<td>XtremIO</td>
<td>000012345678</td>
<td>Drained</td>
<td>100</td>
</tr>
</tbody>
</table>

Legend:
```
Output descriptions for State values:

- **Active** — At least one data device associated with the eDisk is enabled.
- **Draining** — At least one data device associated with the eDisk is draining.
- **Drained** — All data devices associated with the eDisk are disabled and not draining.
- **Drained (%)** — If the eDisk is fully allocated then the Drained % starts from 0. Otherwise it starts from a value depending upon the allocated tracks on the external disk. For example if the external disk is 100% allocated then the Drained % value starts from approximately 0%. If it is 70% allocated then the Drained % value starts at approximately 30%.
- **Disabled** — If draining is stopped using stop drain, the eDisk state becomes disabled and is not available for allocations.

### Verify eDisk state

**Syntax**

To verify the state of an external disk, use the following syntax:

```
Note
The ExternalWWN argument for the -spid option must refer to an eDisk.
```

```
```

**Examples**

To verify the **Active** state for spindle 8000, enter:

```
symdisk verify -external -sid 084 -spid 8000 -active
```

All disk(s) are in the 'Active' state.

To verify the **Draining** state for spindle 8000, enter:

```
symdisk verify -external -sid 084 -spid 8000 -draining
```

None of the disk(s) are in the "Draining" state.

### Start drain on eDisk

**Description**

The start drain command starts the background draining process. Use the symdisk verfiy or symdisk list -state commands to monitor the draining progress. (See **Verify eDisk state** on page 352 or **List external spindle state** on page 353.)
When draining is complete the external disk state is "Drained". If draining is stopped using the `stop drain` command, the external disk state changes from "Disabled" and the disk is not available for allocations. See Stop drain on eDisk on page 354 for `stop drain` command.

**Syntax**

To start the drain on an external disk, use the following syntax:

```bash
start drain on external_disk <wwn=<wwn> | spid=<SpindleID>>;
```

**Examples**

To start drain on external disk specifying the WWN, enter:

```bash
symconfigure -sid 087 commit -cmd "start drain on external_disk wwn=600219800002DDA8B;"
```

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session...............Established.
   Processing symmetrix 000197100087
   start drain on external_disk wwn=600219800002DDA8B;
   Performing Access checks.................................Allowed.
   . . .
   Terminating the configuration change session..............Done.
The configuration change session has successfully completed.

To start drain on external disk specifying the spindle ID, enter:

```bash
symconfigure -sid 087 commit -cmd "start drain on spid=23;"
```

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session...............Established.
   Processing symmetrix 000197100087
   start drain on external_disk spid=23;
   Performing Access checks.................................Allowed.
   . . .
   Terminating the configuration change session..............Done.
The configuration change session has successfully completed.

**Restrictions**

- The following security privileges are required to execute the `start drain` command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Requires Advanced Suite license pack and FAST.X license.
- The specified WWN or spindle ID must represent an external disk.
- The specified external disk must exist.
The specified WWN or spindle ID must represent an external disk virtualized for external provisioning.

- The specified external disk cannot be in the Draining or Drained state.
- Sufficient free capacity must be available in the SRP, for all the allocated tracks produced from draining the external disk.

**Stop drain on eDisk**

**Description**
Stopping the drain process, moves the external disk state to Disabled.

**Syntax**
To stop the drain on an external disk, use the following syntax:

```
stop drain on external_disk <wwn=<wwn> | spid=<SpindleID>>;
```

**Examples**
To stop drain on external disk specifying the WWN, enter:

```
symconfigure –sid 087 commit -cmd "stop drain on external_disk wnn=6002198000002DDA8B;"
```

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session.................Established.
   Processing symmetrix 000197100087
   { stop drain on external_disk wnn=6002198000002DDA8B;
     } Performing Access checks..............................Allowed.
     . . .
     Terminating the configuration change session...........Done.
The configuration change session has successfully completed.

To stop drain on external disk specifying the spindle ID, enter:

```
symconfigure –sid 087 commit -cmd "stop drain on external_disk spid=23"
```

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session.................Established.
   Processing symmetrix 000197100087
   { stop drain on external_disk spid=23;
     } Performing Access checks..............................Allowed.
     . . .
     Terminating the configuration change session...........Done.
The configuration change session has successfully completed.

**Restrictions**
- The following security privileges are required to execute the start drain command:
Activate eDisk

Description
Activating an edisk is allowed when the external disk is in *DISABLED*, *DRAINED* or *DRAINING* state, and this action moves the edisk to *ACTIVE* state. Activating the edisk which is in *DRAINING* state stops the drain operation before activating.

Syntax
To activate an external disk, use the following syntax:

```
activate external_disk <wwn=<wwn> | spid=<SpindleID>>;
```

Examples
To activate an external disk specifying the WWN, enter:

```
symconfigure –sid 087 commit -cmd "activate external_disk
wwn=6002198000002DDA8B;"
```

To activate an external disk specifying the spindle ID, enter:

```
symconfigure –sid 087 commit -cmd "activate external_disk
spid=23;"
```

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session...............Established.
   Processing symmetrix 000197100087
   activate external_disk wnn=6002198000002DDA8B;
   }
   Performing Access checks.................................Allowed.
   ...
   Terminating the configuration change session..........Done.
The configuration change session has successfully completed.

Execute a symconfigure operation for symmetrix '000197100087' (y/[n]) ? y
A Configuration Change operation is in progress. Please wait...
   Establishing a configuration change session...............Established.
   Processing symmetrix 000197100087
   activate external_disk spid=23;
   }
   Performing Access checks.................................Allowed.
   ...

- Required Access type: CFGSYM
- Required Authorization Rights: Storage Admin
- Requires Advanced Suite license pack and FAST.X license.
- The specified WWN or spindle ID must represent an external disk.
- The specified external disk must exist.
- The specified WWN or spindle ID must represent an external disk virtualized for external provisioning.
- The specified external disk cannot be in the *Drained* state.
Terminating the configuration change session..............Done.
The configuration change session has successfully completed.

**Restrictions**

- The following security privileges are required to execute the `start drain` command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- Requires Advanced Suite license pack and FAST.X license.
- The specified WWN or spindle ID must represent an external disk.
- The specified external disk must exist.
- The specified WWN or spindle ID must represent an external disk virtualized for external provisioning.
- The specified external disk cannot be in the `Active` state.
CHAPTER 14

Device masking with Auto-Provisioning Groups

This chapter explains how to confine host access to array devices using auto-provisioning groups and the SYMCLI `symaccess` command.

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- Manage masking views................................................................. 365
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- Display auto-provisioning group information................................. 382
Auto-provisioning groups

Auto-provisioning groups creates groups of host initiators, front-end ports, and logical devices. These groups are associated to form a masking view, where controls are managed. This feature reduces the number of commands needed for masking devices, and allows for easy management of the masking view.

Storage provisioning with the `symaccess` command creates a group of devices, a group of director ports, a group of host initiators, and with one command, associates them into a *masking view*. Once a masking view exists, devices, ports, and initiators are easily added or removed from these groups. The `symaccess` command can list login history and be used to manage the port flags on an initiator.

Provisioning limits

<table>
<thead>
<tr>
<th>Provisioning object</th>
<th>Configuration limitations</th>
</tr>
</thead>
</table>
| Devices             | Maximum 16K per each director  
|                     | Maximum 4K per each storage group |
| Initiator group     | Maximum 64 initiator addresses (or 64 child IG names) per group |
|                     | **Note**  
|                     | Using multiple child initiator groups in a cascaded initiator group with multiple initiators, allows a masking view to exceed the limit of 64 initiators. |
| Storage group       | Maximum 16K storage groups per array  
|                     | Maximum 64 child storage groups per each parent storage group  
|                     | Maximum 4K storage groups with host I/O limits defined |
| Port group          | Maximum 16K port groups per array  
|                     | Maximum 32 ports in a port group |
| Masking view        | Maximum 64K masking views per array |
| LUN addresses       | Maximum 4K LUN addresses per director port |
Create a masking view

The steps for creating a masking view are:

1. Create a storage group (one or more devices).
2. Create a port group (one or more director/port combinations).
3. Create an initiator group (one or more host WWNs or iSCSIs).
4. Create a masking view containing the storage group, port group, and initiator group.

The devices are automatically masked and mapped when a masking view is created.

Figure 10 Masking view overview

After the masking view is created, any objects (devices, ports, initiators) added to a group automatically become part of the masking view.

Auto-provisioning session rollback

Auto-provisioning operations (create masking views, or add devices or ACLX-enabled ports to existing views) continue to map devices to ports, but if the masking view update fails these devices are unmapped when the session is rolled back.

Storage groups containing CKD devices must already be mapped, and must use the optional flag -ckd. Storage groups containing Celerra devices can be masked (and mapped) using the -celerra option. Storage groups containing devices tagged for RecoverPoint are masked and mapped using the -rp option.

HYPERMAX OS 5977 or higher

Explicit mapping and unmapping of ACLX-enabled ports using the `symconfigure` command is not supported. To make the ACLX device visible or to remove visibility from the ACLX device, modify the new SHOW_ACLX_DEVICE attribute on front end ports. By default, ACLX-enabled ports have the SHOW_ACLX_DEVICE attribute disabled, making the ACLX device not visible to hosts zoned to the port. One ACLX-enabled port is pre-configured with the SHOW_ACLX_DEVICE attribute enabled. During device remove, port remove, or masking view delete operations, the -unmap option is ignored.
Create an auto-provisioning session

This section details the following steps for creating an auto-provisioning session:

1. Discover the host HBAs.
2. List (identify) the host HBAs.
3. Create groups and views.

Discover host HBAs

Description
During the initial array setup, a search, from the controlling host, for each HBA connected to array devices is performed using the symaccess discover command. The symaccess discover command sends information about this connection back to its host system. The discover command is the primary mechanism by which hosts, other than the control station, identify their paths to the array.

Examples
To discover host HBAs: enter

```
  symaccess discover hba
```

When the symaccess discover command finds a host HBA, it reads the login history table and performs the following:

1. Creates an ASCII alias and writes it to the login history table.

   Note
   There is a -rename option that is used with the symaccess discover command, to force a write of the discovered hostname/HBA name (or IP address) to the login history table and the initiator group.

2. Prints the initiator identifier (WWN/iSCSI) of the HBAs connected to the masked channel and the array.

List host HBAs

Description
The symaccess discover and symaccess list commands do not use the ACLX device to determine the available connections. Therefore, connections available through all gatekeeper devices are listed regardless of the host visibility of the ACLX device. For the symaccess list command, the connections displayed include the paths detected through either the ACLX device or any gatekeeper device. If multiple gatekeepers, including the ACLX device, are available for detecting connections, only one entry is displayed for each unique connection to the array.

Note
An iSCSI initiator cannot log in to the array until it belongs to a masking view that includes that specific port on the array.
Examples
To list host HBAs, enter:

```
symaccess list hba
```

Sample output
Shows only one unique connection through multiple gatekeepers.

<table>
<thead>
<tr>
<th>Identifier Dir:Port</th>
<th>Physical Device Path</th>
<th>Symmetrix ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000000c99527b2 01E:009</td>
<td>/dev/sdh</td>
<td>000197100086</td>
</tr>
<tr>
<td>01E:008</td>
<td>/dev/sdw</td>
<td>000197300005</td>
</tr>
<tr>
<td>01E:000</td>
<td>/dev/sdb</td>
<td>000198700030</td>
</tr>
</tbody>
</table>

Create groups and views

The `symaccess` command is used to create the initiator groups, port groups, and storage groups that make up the masking view.

Restrictions and limitations
The following are restrictions and limitations for the `symaccess create` command:

- Storage Admin rights are required.
- The command fails if the device list contains both FBA and CKD devices.
- The command fails if the list of child SGs contain both FBA and CKD devices.
- The command fails if the device list contains CKD devices and a workload is given.
- The command fails if the device list contains CKD devices and the Service Level or SRP given do not support CKD devices.

Create storage groups

Description
The `symaccess` and the `symsg` commands support storage group operations. Use the `symaccess` command for creating storage groups by specifying a range of devices, a list of devices, a device group, a storage group, or a device file.

Note
Host I/O Limits can be set for a storage group. Host I/O Limits are settings that limit the amount of front-end (FE) bandwidth (MBs) and I/Os per second (IOPs) that are consumed by a set of array devices over a set of director ports. Host I/O Limits for storage groups on page 135 provides feature details and restrictions.

Syntax
To create a storage group, use the following syntax:

```
symaccess -sid SymmID create -name GroupName -type storage [devs SymDevStart:SymDevEnd | SymDevName[,SymDevName[,SymDevName...]]] | <-g DgName [-std] [-bcv] [-vdev] [-tgt]>
```
LUNs are assigned by the array when the masking view is created, not when devices are added to the storage group.

Examples
To create a storage group SG_1 and add device range 050:055, enter:

```
symaccess create -sid 458 -name SG_1 -type storage devs 050:055
```

Create port groups

Description
A port can belong to more than one port group. However, for arrays running HYPERMAX OS 5977 or higher, different types of ports (physical FC ports, virtual FC ports and iSCSI virtual ports) cannot be mixed within a single port group.

Syntax
To create a port group, use the following syntax:

```
symaccess -sid SymmID-name GroupName -type port create [-dirport Dir:Port[,Dir:Port...]]
```

Examples
To create a port group PG_1 with three front-end ports, enter:

```
symaccess create -sid 458 -name PG_1 -type port -dirport 7E:0,7G:1,8F:0
```

Create initiator groups

Description
An initiator group is a container of one or more host initiators (Fibre or iSCSI). Each initiator group can contain up to 64 initiator addresses or 64 child IG names. Initiator groups cannot contain a mixture of host initiators and child IG names. Initiator groups are created using the HBA's WWN, iSCSI, a file containing WWNs or iSCSI names, or another initiator group name.
Note

Different types of initiators (external Fibre Channel WWNs, internal guest Fibre Channel WWNs and iSCSI IQNs) cannot be mixed within a single Initiator Group. In addition, all child IG names added to a parent initiator group must contain the same Initiator type.

Syntax

To create an initiator group, use the following syntax:

```bash
symaccess -sid SymmID
create -name GroupName -type initiator
[-consistent_lun]
[-wwn wwn | -iscsi iscsi | -file InitiatorFilename | -ig InitiatorGroupName ]
```

Options

-**-consistent_lun**

Use this option if the devices of a storage group (in a view) need to be seen on the same LUN on all ports of the port group. If the `-consistent_lun` option is set on the initiator group, the host LUN number assigned to devices is the same for the ports on the HBA. If this option is not set, the system will choose the first available LUN on each individual port.

Examples

To create an initiator group, IG_1, enter:

```bash
symaccess create -sid 458 -name IG_1 -type initiator -file IG_1
```

The file IG_1 contains:

```bash
wwn:210000e08b04daac
```

Create a masking view

Description

A masking view is a container of a storage group, a port group, and an initiator group, and makes the storage group visible to the host. Devices are masked and mapped automatically. The groups must contain some devices entries.
Volume dynamic addressing is enabled by default. The array assigns the next available LUN address on the FA port when the masking view is created. The LUN assigned on the FA port will not necessarily match the masking LUN.

When you create a masking view, if Host I/O Limits have been set for the storage group, they become active with the `symaccess create view` command.

**Note**
Encapsulated devices that are being used as TimeFinder SnapVX source or target devices cannot be masked to a host.

**Syntax**
To create a masking view, use the following syntax:

```bash
symaccess create view -name <MaskingViewName> -sg <StorageGroupName> -pg <PortGroupName> -ig <InitiatorGroupName> [-lun <Addr>]
```

**Options**
- `-lun <Addr>`

  Specifies the LUN address for the devices being added to the masking view. When creating a new masking view using groups, only one LUN address is allowed. Multiple LUNs are allowed when using a device list, port list, and HBA list to create a view.

**Examples**
To create a masking view with storage group `SG_1`, port group `PG_1`, initiator group `IG_1`, and LUN 6, enter:

```bash
symaccess -sid 458 create view -name MV_1 -sg SG_1 -pg PG_1 -ig IG_1 -lun 6
```
After creating a masking view:
If additional storage is needed, devices added to the storage group are automatically
masked and mapped in the masking view. This also applies to front-end ports and host
initiators.

For managing other storage, create a second storage group and then create a masking
view using the same port group and initiator group. The same number of LUNs can be
supplied. Supplying this value is optional and the corresponding input flag should be
supplied when it is given.

In a clustered environment, some devices may be seen by the entire cluster, but
gatekeeper devices may only need to be seen by individual hosts.

Manage masking views

This section explains how to perform the following management operations on
masking views:

- Delete masking views
- Name groups and views
- Back up and restore views
- Copy groups and views

Delete masking views

Syntax

Note
When a masking view is deleted, all groups in the masking view remain intact. Any
device reservations continue to be enforced when a masking view is deleted.

To delete a masking view, use the following syntax:

```
symaccess -sid SymmID delete view -name ViewName
```

Examples
For example, to delete masking view MV_1, on array 458, enter:

```
symaccess -sid 458 delete view -name mv_1
```

Name groups and masking views

Syntax
To rename a storage group, port group, or an initiator group, using the following
syntax:

```
symaccess -sid SymmIDrename -name GroupName
-type <storage | port | initiator> -new_name NewGroupName
```
To rename a masking view, using the following syntax:

```
symaccess -sid SymmID rename view -name ViewName -new_name NewViewName
```

If the new name already exists, an error returns.

**Storage group and masking view naming rules:**

- Maximum group name length is 64 characters and are not case sensitive.
- Group Name must begin with an alphanumeric character, and embedded hyphens and underscore characters are valid.
- Group names must be unique per group type, but different group types can share the same name. For example, a storage group, a port group, and an initiator group can all have the name `Financial_DB`. However, two storage groups cannot be named `Financial_DB`.
- Renaming of an initiator group is propagated to the higher group if the group is cascaded.

**Back up and restore masking views**

**Description**
The masking views, including storage groups, port groups, and initiator groups can be backed up to and restored from a file.

**Syntax**
To backup the masking views to a file, use the following syntax:

```
symaccess -sid SymmID -f BackupFilename [-noprompt] backup
    restore [-remove_ckd] [-unused_sgs] [-disassociate]
```

The `symaccess` command validates the consistency of the Auto-provisioning data before the `backup` or `restore` actions are performed.

**Options**

- **-noprompt**
  Eliminates the prompt for confirmation of the operation.

- **-remove_ckd**
  Skips all CKD devices within the backup, allowing the backup to be restored if the CKD devices are no longer mapped.

- **-disassociate**
  Disassociates the storage group from a FAST policy if the storage group contains invalid devices for FAST.

**Examples**

```
symaccess backup -sid 266 -f aclx_backup -nop
```
Example output with consistency errors:

```
Starting a backup operation................
There are inconsistencies in the masking database. The operation cannot be performed.
```

Example output with no consistency errors:

```
Starting a backup operation................
The masking data on Symmetrix 000192600266 was backed up to file aclx_backup.
```

Copy groups and masking views

Description
Groups and a copy of a storage, port, or initiator group, or a complete masking view can be copied from one array to another. When copying, any child view or cascaded initiator group are included in the copy action.

Syntax
To copy groups or views from one array to another, use the following syntax:

```
symaccess -sid SymmID -target_sid SymmID copy -name GroupName -type storage
[-reserve_id ResvID[,ResvID[,ResvID...]]]
copy -name GroupName -type initiator | port
    copy -name ViewName view [-ckd] [-celerra] [-rp]
       [-reserve_id ResvID[,ResvID[,ResvID...]]]
```

Options
- `-reserve_id`
  Includes any device reservations.

- `-ckd`
  Specifies that the view contains CKD devices

- `-celerra`
  Specifies that the view contains Celerra devices (the devices will also be mapped).

- `-rp`
  Includes devices that have been tagged for RecoverPoint.

Examples
For example, to copy masking view `mv_1` from array 207 to array 123, enter:

```
symaccess -sid 207 -target_sid 123 copy -name mv_1 view
```

Manage storage groups

After creating a storage group, as explained in Create storage groups on page 361, the following actions can be performed:

- Add devices
• Remove devices
• Rename a storage group
• Delete storage groups
• List and show storage group information

Add devices to storage group

Description
A storage group can contain up to 4k array device numbers, and devices can belong to more than one storage group. When adding devices specify the device names, a range of devices, a list of devices in a device group, or devices in a device file. Device reservations are still enforced when they are added to a storage group.

Note
Solutions Enabler supports adding storage groups (symaccess ad sg) that have Host I/O Limits set to a parent storage group, that is in a view using a port group with FCoE ports.

Syntax
To add devices to an existing storage group, use the following syntax:

\[
\text{symaccess} \ -\text{sid} \ SymmID \ -\text{name} \ GroupName \ -\text{type} \ storage \ [-\text{reserve\ id} \ ResvID[,ResvID[,ResvID...]]] \\
\quad [-\text{ckd}] \ [-\text{Celerra}] \ [-\text{rp}] \\
\text{add\ devs} \ SymDevStart:SymDevEnd \ [-\text{lun} \ Addr] \ | \ SymDevName \ [-\text{lun} \ Addr] \ | \\
\quad SymDevName,SymDevName,SymDevName... \\
\quad [-\text{lun} \ Addr] \ | \ -\text{lun} \ Addr,Addr,Addr... \\
\text{add} \ -g \ DgName \ [-\text{std}] \ [-\text{bcv}] \ [-\text{vdev}] \ [-\text{tgt}] \ [-\text{lun} \ Addr] \\
\quad \text{add\ -file} \ DeviceFileName \ [\text{src}] \ [\text{tgt}] \ [-\text{lun} \ Addr] \\
\text{add\ sg} \ SgName \ [,SgName1,SgName2,..,SgNamen] \\
\quad [-\text{lun} \ Addr, Addr, Addr...]
\]

Options
-ckd
   Adds CKD devices to a storage group.

-celerra
   Adds (and maps) Celerra devices to a storage group.

-rp
   Adds devices tagged for RecoverPoint to a storage group.

LUN address designation
When devices are added at the storage group creation time, do not specify a LUN address. The LUN address is determined when the masking view is created.

LUN addresses should only be supplied if the storage group is already contained within a view. In this case, a single LUN can be given, or one for each device range. If the LUN address is not specified, the array will assign the LUN address.

Restrictions
• Requires Storage Admin rights.
Whether SG is FAST Managed or not, the command fails if adding FBA devices and the SG has CKD devices.

Whether SG is FAST Managed or not, the command fails if adding CKD devices and the SG has FBA devices.

Workload cannot be specified for CKD devices. The command fails if adding CKD devices to an SG if that SG has Workload set.

Remove devices from storage group

Description
Deleting a storage group requires that all devices are removed. However a storage group cannot be completely emptied if it is associated with a masking view,

Syntax
To remove devices or child storage groups from a storage group, use the following syntax:

```
symaccess -sid SymmID -name GroupName -type storage
    [-reserve_id ResvID[,ResvID[,ResvID...]]] [-force]
    [-unmap [-celerra] [-ckd] [-rp]
    remove devs SymDevStart:SymDevEnd | SymDevName |
    SymDevName,SymDevName,SymDevName...
remove -g DgName [-std] [-bcv] [-vdev] [-tgt]
remove -file DeviceFileName [src] [tgt]
remove sg SgName1,SgName1,SgName2,,SgNameN
```

Examples
For example, to remove the BCV devices in device group Prog2 from storage group SG_Prod on array 458, enter:

```
symaccess -sid 458 -name SG_Prod -type storage remove -g Prog2 -bcv
```

Rename a storage group

Syntax
To rename a storage group, port group, or an initiator group, using the following syntax:

```
symaccess -sid SymmIDrename -name GroupName -type <storage | port | initiator> -new_name NewGroupName
```

Delete a storage group

Description
A storage group should be empty before it is deleted. It cannot be deleted if it is associated with a masking view or is in use by a FAST policy. To delete both a storage group and a masking view, delete the masking view first, then delete the storage group.
Syntax
To delete a storage group, use the following syntax:

```
symaccess -sid SymmID delete <view -name ViewName
[-reserve_id ResvID,[],ResvID[]]] > |
< -name GroupName -type <storage
[-reserve_id ResvID[],ResvID[]]] |
port | initiator> [-force] > [-noprompt] [-emulation ckd]
```

Options
- **-force**
  
  If the storage group still contains devices, forces the delete action.

Examples
To delete storage group SG_1 from array 458, enter:

```
symaccess -sid 458 -name sg_1 -type storage delete
```

List and show storage group information

Description
Storage group information is requested from the array or from the backup file.
Information for a device range or a list of devices can be specified.

Syntax
To view storage group information, use the following syntax:

```
symaccess -sid <SymmID>
[-offline] | -file <backup_filename>
list -type storage
    [-devs <SymDevStart:SymDevEnd | SymDevName | <SymDevName,SymDevName...>>]
    [-name GroupName] [-v | -detail]
    show GroupName -type storage
```

Manage port groups

Port groups contain director and port identification and belong to a masking view.
Ports can be added to and removed from the port group. Port groups no longer
associated with a masking view can be deleted. In addition, CHAP authentication can
be enabled and disabled on port groups. This section details the following port
management operations:

- Add ports
- Remove ports
- Delete port groups
- Copy a port group from array to array
- List and show port group information
- Lock down a Fibre Channel ID
Note

The symaccess control operations add, remove, backup, and restore are modified to support the extended FA director port range.

Add ports to port group

Description
Ports and iSCSI targets are added to an existing port group by specifying the name and type of the group, and the director port or iSCSI target information. Only a single front-end emulation of each type (FA, EF, etc.) can be assigned to each director, however each of these emulations can be assigned a variable number of physical ports (up to 32, numbered from 0 - 31). The symaccess control operations copy -type port or copy view copies the extended FA director port range (0 to 31) to the target array.

Syntax
To add ports to a port group, using the following syntax:

```
symaccess -sid SymmID -name GroupName -type port [-ckd] [-celerra] [-rp]
    add -dirport Dir:Port[,Dir:Port[,Dir:Port...]]
    add -iscsi_tgt iSCSI [,iSCSI...]
```

Options
- ckd
  Specifies CKD devices.
- celerra
  Specifies Celerra devices.
- rp
  Specifies RecoverPoint devices.

Examples
To add port 4 of Fibre director 16D to port group PG_1 on array 245, enter:

```
symaccess -sid 245 -name PG_1 -type port add -dirport 16D:4
```

Remove ports from port group

Syntax

Note
A port group cannot be emptied if it is associated with a masking view. To remove a port or an iSCSI target, use the following syntax:

```
symaccess -sid SymmID -name GroupName
    -type port [-ckd] [-force] [-celerra] [-rp]
    remove -dirport Dir:Port[,Dir:Port[,Dir:Port...]]
    remove -iscsi_tgt iSCSI [,iSCSI...]
```
Options
- **force**
  Forces the port removal.

Example
To remove port 4 of Fibre director 16D from port group PG_1 on array 245, enter:

```bash
symaccess -sid 245 -name PG_1 -type port remove -dirport 16D:4
```

Delete port groups

Syntax
A port group cannot be deleted if it is associated with a masking view. To delete a port group, use the following syntax:

```bash
delete <view -name ViewName> [-force] | -name GroupName -type <storage | port | initiator> [-noprompt]
```

Options
- **force**
  Forces the port group removal.

Examples
To delete port group PG_1 on array 245, enter:

```bash
symaccess -sid -name PG_1 -type port delete
```

Copy a port group from array to array

Syntax
To copy a port group from one array to another, use the following syntax:

```bash
symaccess -sid SymmID -target_sid SymmID copy -name GroupName -type port
```

List and show port group information

Syntax
To display port group information, use the following syntax:

```bash
symaccess -sid <SymmID> [-offline] | -file <backup_filename>
  list -type port [-dirport Dir:Port] [-name GroupName] [-detail | -v]
  show GroupName -type port
```
Fibre Channel ID lockdown

Fibre Channel ID (FCID) lockdown is a security feature that limits host device access by adding Fibre Channel ID information of a switch within a fabric to device access records in the login history table. This feature handles WWN spoofing and the threat it poses to networked systems in a shared (same director port) storage port configuration.

This feature sets Fibre Channel ID (FCID) of the WWN of the HBA to be secured. The FCID is then added to the database record for the WWN of the specified HBA with the specified director and is locked. Once a Fibre Channel ID is locked, no user with a spoofed WWN can log in. If a user with a spoofed WWN is already logged in, that user loses all access through that HBA.

**NOTICE**

When an HBA logs in to a director port, the Fibre Channel ID accompanies it, indicating to the director port where to send its response. By specifying Fibre Channel ID information of the switch, the valid physical path through the SAN for a particular HBA is locked down. Only an HBA with a Fibre Channel ID that matches the FCID specified in the device masking record is able to log in to the storage port. It is recommended that at least two HBAs be available on the administrator host. If one HBA becomes locked out, the host will have access through the other HBA and can correct the record in the database.

Locking down a Fibre Channel ID

To find the Fibre Channel ID, lock it down, verify that it is locked down, and then force the change to take effect, use the following procedure:

**Procedure**

1. Find the WWN. If the device is visible, run the `symaccess list hba` command to find the device path of the HBA to protect.
2. Find the Fibre Channel ID value.
3. Run the `symaccess set lockdown` command on with the FCID of the Fibre Channel ID found in step 2.
   
   For example, to implement the Fibre Channel ID lockdown feature on Fibre Channel `021300` for director `16A`, port `0`, enter:

   ```
   symaccess -sid 018 set lockdown on 021300
   ```

4. For the change to take effect, either reboot the host or pull the cable from the director and then replace the cable.

Manage initiator groups

This section describes how to manage initiator groups and includes the following tasks:

- Add initiators
- Remove initiators
- Delete initiators
- Initiator group flags
- Set HBA flags
- Replace a HBA
- Rename a HBA
- CHAP authentication

Add initiators to initiator group

Description
Initiators are added to an existing initiator group by specifying the initiator type (-wwn or -iscsi), the initiator group name, or by using an input file.

Syntax
To add initiators to an initiator group, use the following syntax:

```
symaccess -sid SymmID -name GroupName -type initiator
-wwn wwn | -iscsi iscsi | -ig InitiatorGroupName | -f InitiatorFilename add
```

Add individual initiators to initiator group

Examples
To add initiator WWN 10000000c94ef69c to the initiator group IG_1 on array 245, enter:

```
symaccess -sid 245 -name IG_1 add -type initiator -wwn 10000000c94ef69c
```

Add initiators to initiator group using an input file

Examples
When using an input file, each initiator must be placed on a new line and start with either WWN: or iSCSI:, or IG:, depending on the type of the initiator or initiator group name. The following is an example of the format for an initiator file:

```
WWN:10000000c94ef69c
iSCSI:iscsiname
IG:IgName
#WWN:10000000c94ef69d
```

Note
If the format of the initiator does not match the label at the start of the line, the file returns an error. A commented line, which the system ignores, is specified by placing the pound sign (#) at the beginning of a line.

Cascaded initiator groups

An initiator group can be added to another initiator group, only if it does not contain any initiator groups.

The following scenario describes cascaded initiator groups:

- HOST1 contains WWN1 & WWN2, which are added to IG_1.
- HOST2 contains WWN3 & WWN4, which are added to IG_2.
- IG_3 is created and contains IG_1 & IG_2.

In this example, gatekeeper devices for HOST1 can be assigned to IG_1, while different gatekeeper devices for HOST2 can be assigned to IG_2. The application devices needed by both hosts can be assigned to IG_3.

---

**Note**

If using the Volume Set Addressing flag, both the parent and child initiator group must have the flag.

---

**Remove initiators from initiator group**

**Syntax**

To remove an initiator from an initiator group, use the following syntax:

```
 symaccess -sid SymmID -name GroupName -type initiator -wwn wnn | -iscsi iscsi | -ig InitiatorGroupName | -f InitiatorFilename [-login] remove
```

**Options**

- `-login`
  
  Removes the initiator from the array's login history table.

**Examples**

To remove initiator WWN 10000000c94ef69c from the initiator group IG_1 on array 245, enter:

```
symaccess -sid 245 -name IG_1 remove -type initiator -wwn 10000000c94ef69c
```

**Deleting initiator groups**

**Syntax**

To delete an initiator group, use the following syntax:

```
 delete <view -name ViewName> [-force] | -name GroupName -type <storage | port | initiator > [-noprompt]
```

**Examples**

To delete initiator group IG_1 on array 245, enter:

```
symaccess -sid -name IG_1 -type initiator delete
```
Initiator group flags

Table 20 Initiator group flags

<table>
<thead>
<tr>
<th>Initiator group</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume_Set_Addressing</td>
<td>[V]</td>
</tr>
<tr>
<td>Disable_Q_Reset_on-UA</td>
<td>[D]</td>
</tr>
<tr>
<td>Environment_Set</td>
<td>[E]</td>
</tr>
<tr>
<td>Avoid_Reset_Broadcast</td>
<td>[ARB]</td>
</tr>
<tr>
<td>OpenVMS</td>
<td>[OVMS]</td>
</tr>
<tr>
<td>SCSI_3</td>
<td>[SC3]</td>
</tr>
<tr>
<td>SPC2_Protocol_Version</td>
<td>[SPC2]</td>
</tr>
<tr>
<td>SCSI_Support1</td>
<td>[OS2007]</td>
</tr>
</tbody>
</table>
To view the flag set in initiator group my_ig on array 266, enter:

```
symaccess -sid 266 show my_ig -type init -detail
```

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000192600266</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiator Group Name</td>
<td>my_ig</td>
</tr>
<tr>
<td>Last updated at</td>
<td>10:52:15 AM on Wed Mar 31, 2010</td>
</tr>
<tr>
<td>Port Flag Overrides</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td>OS2009(OS2009)</td>
</tr>
<tr>
<td>Common_Serial_Number(C) Disabled</td>
<td>Avoid_Reset_Broadcast(ARB)</td>
</tr>
<tr>
<td>Consistent Lun</td>
<td>No</td>
</tr>
<tr>
<td>Originator Port wwn</td>
<td>1234567822446688</td>
</tr>
<tr>
<td>User-generated Name</td>
<td>1234567822446688/1234567822446688</td>
</tr>
<tr>
<td>FCID Lockdown</td>
<td>No</td>
</tr>
<tr>
<td>Heterogeneous Host</td>
<td>No</td>
</tr>
<tr>
<td>Port Flag Overrides</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Enabled</td>
</tr>
<tr>
<td></td>
<td>OS2009(OS2009)</td>
</tr>
<tr>
<td>Common_Serial_Number(C) Disabled</td>
<td>Avoid_Reset_Broadcast(ARB)</td>
</tr>
<tr>
<td>CHAP Enabled</td>
<td>N/A</td>
</tr>
<tr>
<td>Type</td>
<td>Fibre</td>
</tr>
</tbody>
</table>

Set HBA flags

Description
This feature allows specific host flags to be enabled and disabled on the director port. The HBA port flags are set on a per initiator basis, and the HBA must belong to an initiator group.

Note
Setting HBA port flags replaces setting the heterogeneous host configuration flags. To switch to setting HBA port flags, the heterogeneous host configuration must be disabled for a given HBA and all flags must be reset.

Syntax
To set (or reset) the HBA flags, use the following syntax:

```
symaccess -sid SymmID -wwn wwn | -iscsi iscsi
set hba_flags <on <flag,flag,flag...> <-enable |<disable> | off [flag,flag,flag...>]
```

Options

hba_flags
Sets the record in the database to hold information on the HBA port setting that may differ than the current setting on the FA.

on | off
Turns HBA flags on or off.

flag
Specifies the overridden HBA port flags as listed:

### Table 21 Supported HBA flags

<table>
<thead>
<tr>
<th>Supported HBA ports:</th>
<th>Supported initiator group ports:</th>
<th>Flag:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid_Reset_Broadcast</td>
<td>Avoid_Reset_Broadcast</td>
<td>[ARB]</td>
</tr>
<tr>
<td>Disable_Q_Reset_on_UA</td>
<td>Disable_Q_Reset_on_UA</td>
<td>[D]</td>
</tr>
<tr>
<td>Environ_Set</td>
<td>Environ_Set</td>
<td>[E]</td>
</tr>
<tr>
<td>OpenVMS</td>
<td>OpenVMS</td>
<td>[OVMS]</td>
</tr>
<tr>
<td>SCSI_3</td>
<td>SCSI_3</td>
<td>[SC3]</td>
</tr>
<tr>
<td>SCSI_Support1</td>
<td>SCSI_Support1</td>
<td>[OS2007]</td>
</tr>
<tr>
<td>Volume_Set_Addressing</td>
<td>Volume_Set_Addressing</td>
<td>[V]</td>
</tr>
</tbody>
</table>

- **-enable**

   Enables the specified HBA port flag(s) on a per initiator basis.

- **-disable**

   Disables the specified HBA port flag(s) on a per initiator basis.

### Examples

To turn on HBA flags and enable the Common_Serial_Number and SCSI_3 flags, and disable the Disable_Q_Reset_on_UA flag on an HBA with the WWN 210000e08b0995b7 for array 031, director 16A port 0, enter:

```
symaccess -sid 031 set hba_flags on C,SC3 -enable -wwn 210000e08b0995b7-dir 16A -p 0
symaccess -sid 031 set hba_flags on D -disable -wwn 210000e08b0995b7-dir 16A -p 0
```

### Sample output

The `symaccess show -detail` output displays the flags that are turned on and off for each HBA initiator that has the feature enabled.

```
symaccess -sid 237 -type initiator -detail show Prodl
Symmetrix ID : 000190300237
Last updated at : 08:46:54 AM on Tue Jul 29, 2008
Initiator Group Name : Prodl
Originator Port wwn : 10000000c94ef69c
   User-generated Name : api196/10000000c94ef69c
   FCID Lockdown : No
   Heterogeneous Host : No
   Port Flag Overrides : No
   Type : Fibre
Originator Port wwn : 5006016839a00c5c
   User-generated Name : 5006016839a00c5c/5006016839a00c5c
   FCID Lockdown : No
   Heterogeneous Host : No
   Port Flag Overrides : No
   Type : Fibre
iSCSI Name : Symm_iScsi
```
Replacing a HBA

If a host adapter fails, or needs replacement for any reason, assign the devices associated with the old adapter to a new adapter use the replace action with the following syntax:

```
symaccess replace -wwn wwn -new_wwn NewWWN [-noprompt]
symaccess replace -iscsi iscsi -new_iscsi NewiSCSI [-noprompt]
```

To swap HBAs:

**Procedure**

1. Run `symaccess list logins` to view the old WWN/iSCSI HBAs.
2. Swap the HBA boards according to the host instructions.
3. Run `symaccess list hba` or `discover` to view the new initiator (for example WWN).
4. Run `symaccess replace` to substitute a new WWN for all occurrences of the old WWN. For example, to replace old WWN `20000000c920b484` with new WWN `20000000c920b393`:

    ```
symaccess -sid 814 replace -wwn 20000000c920b484 -new_wwn 20000000c920b393
    
```
5. Run `symaccess discover -rename` to establish the new AWWN and assign an AWWN to the new HBA in the login history table.

Rename a HBA

**Syntax**

To rename the alias for a specified initiator within a group, use the following syntax:

```
symaccess -sid SymmID rename -wwn wwn -alias alias | -iscsi iscsi -alias alias
```

Using CHAP authentication

CHAP (Challenge Handshake Authentication Protocol) manages a credential name and a CHAP secret, which are similar to a username and a password, though more secure than the standard Password Authentication Procedure (PAP).
Enable CHAP on an iSCSI initiator

**Syntax**
To enable CHAP on an iSCSI initiator, use the following syntax:

```
symaccess -sid SymmID -iscsi iscsi enable chap
```

Enable CHAP on a director and port

**Syntax**
To enable CHAP on a director and port, use the following syntax:

```
symaccess -sid SymmID [-dirport Dir:Port] enable chap
```

Set the CHAP credential and secret

**Syntax**
To set the CHAP credential and secret, use the following syntax:

```
symaccess -sid SymmID [-dirport Dir:Port] -iscsi iscsi set chap -cred Credential -secret Secret
```

Disable CHAP on a specific director and port

**Syntax**
To disable CHAP on a specific director and port, use the following syntax:

```
symaccess -sid SymmID [-dirport Dir:Port] disable chap
```

Delete CHAP from a specific director and port

**Syntax**
To delete CHAP from a specific director and port, use the following syntax:

```
symaccess -sid SymmID [-dirport Dir:Port] delete chap
```

Display CHAP information

**Examples**
To display CHAP information for array 001.

```
symaccess list chap -sid 001
```

**Sample output**

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197100001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director Identification</td>
<td>SE-9G</td>
</tr>
<tr>
<td>Director Port</td>
<td>310</td>
</tr>
<tr>
<td>iSCSI Target Name</td>
<td>iqn.1992-04.com.emc:sn.11121318</td>
</tr>
<tr>
<td>Protocol</td>
<td>CHAP</td>
</tr>
</tbody>
</table>
Verify the auto-provisioning database

Description
Use the `symaccess verify` command to verify that the auto-provisioning database is consistent. Any inconsistencies display in the command output. This command can also be used with a backup file. Add the `-log` option for reporting the inconsistencies in a log file.

Syntax
To verify the auto-provisioning database, use the following syntax:

```
symaccess -sid SymmID | -file BackupFileName verify [-log]
```

Options
- `-log`
  Reports database inconsistencies in a log file

Examples
When database is consistent:

```
symaccess -sid 266 verify
```

Starting a verify operation.................
The auto provisioning database is consistent

Verification of a database backup file when database has inconsistencies:

```
symaccess -file /tmp/bkup1.file verify
```

Starting a verify operation.................
Found SG 'stor_grp1' to contain the view flag but didn't find a matching view
Found IG 'init_grp1' contains invalid initiator records
Found masking view 'mask_view1' with parent IG 'init_grp1' but no masking records for the child IG 'child_grp1' are present
There are inconsistencies in the auto provisioning database
Display auto-provisioning group information

Syntax
To display auto-provisioning group information, use the following syntax:

```bash
symaccess -sid SymmID [-offline] | -file BackupFilename list [-name GroupName] [-v]
  list -type <storage [-devs <SymDevName[:SymDevName]>] | port [-dirport Dir:Port] | initiator [-wwn wnn | -iscsi iscsi] > [-name GroupName] [-detail | -v]
  list devinfo [-ig InitiatorGroupName]
  list view [-name ViewName][-v][-detail]
  show GroupName -type <initiator [-detail] | port | storage>
  show view ViewName [-ig ChildInitiatorGroupName]
  symaccess -sid SymmID | -file BackupFilename  list chap [-dirport Dir:Port][-v]
  symaccess -sid SymmID  list assignment [-v] -devs <SymDevStart:SymDevEnd | SymDevName | <SymDevName,SymDevName...>
  list no_assignments [-dirport Dir:Port]
```

Options

- **-offline**
  
  For use with the `symaccess list` and `show` commands. When the `-offline` option is used, the command reports the data from the symapi configuration database file and not from the array. Alternatively, set the SYMCLI_OFFLINE environment variable to 1 to enable the offline mode for reporting.

- **-detail**
  
  Displays all auto-provisioning details. Without using the `-detail` option, any column without data does not display. If the `-detail` option is provided, the column without data displays a dash (`-`).

Modified reporting commands for extended FA director port range

Only a single front-end emulation of each type (FA, EF, etc.) can be assigned to each director, however each of these emulations can be assigned a variable number of physical ports (up to 32, numbered from 0 - 31). The following `symaccess` reporting commands support the extended FA director port range:

- For `symaccess show -type port, show view, and symaccess show backupfile view output, the Director Identification section supports reporting for the extended port range. In addition new fields are added: the WWN port name, which displays the Fibre channel director port WWN, and the iSCSI name, which displays the name of the iSCSI director port.

- For `symaccess list hba, symaccess list devinfo output, and symaccess list assignments the Dir:Port field supports reporting for the extended port range.

- The `symaccess list chap output` supports reporting for the extended port range. In addition, a new field is added, the iSCSI Target Name, which displays the iSCSI name for the iSCSI director port.

- For `symaccess list no_assignments` and `symaccess list logins output, the Director Port field supports reporting for the extended port range.`
Note

The `symaccess list no_assignments` output reports that "All devices available on this director/port are assigned" for ACLX enabled ports.

---

Display masking views

Description

The `symaccess show view` command lists the masking view and the associated initiator group, the port group, the storage group, and any child groups. This command also displays the time the group was modified and the time the associated masking view was modified.

Options

- `-detail`
  
  Displays all masking view details, and columns without data displays a dash (`-`). Without using the `-detail` option, any column without data does not display.

Examples

To list all masking views on array 237, enter:

```
symaccess -sid 237 list view
```

To list the details for masking view `view1_86`, enter:

```
symaccess -sid 0225 show view view1_86 -detail
```

Use the `-detail` option with the `show` command to display all the details of a view, including the child initiator groups.

Sample output

For all masking views on array 237:

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Masking View Name</th>
<th>Initiator Group Port Group Storage Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>000190300237</td>
<td>View1</td>
<td>IG_1          PG_1                        SG_1</td>
</tr>
<tr>
<td>View2</td>
<td>WinHost</td>
<td>PG</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Detailed output for masking view `view1_86`:

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Masking View Name</th>
<th>Last update time</th>
<th>View last update time</th>
<th>Initiator Group Name</th>
<th>Host Initiators</th>
</tr>
</thead>
<tbody>
<tr>
<td>000196700255</td>
<td>view1_86</td>
<td>04:36:39 AM</td>
<td>04:36:39 AM</td>
<td>ig1_86</td>
<td>{</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mon Aug 31, 2015</td>
<td>Mon Aug 31, 2015</td>
<td></td>
<td>IG : ig2_86</td>
</tr>
</tbody>
</table>
Port Group Name : pg1_86

Director Identification

Director
Ident Port WWN Port Name / iSCSI Target Name
------ ----
FA-1D 027 500009735003fc1b

Storage Group Name : sg2_86

Number of Storage Groups : 0
Storage Group Names : None

Masking View Name : view1_86

Initiator Group Name : ig2_86 *

Host Initiators

WWN : adddde9db4bf88f
[alias: adddde9db4bf88f/adddde9db4bf88f]

Port Group Name : pg1_86

Director Identification

Director
Ident Port WWN Port Name / iSCSI Target Name
------ ----
FA-1D 027 500009735003fc1b

Storage Group Name : sg2_86

Number of Storage Groups : 0
Storage Group Names : None

Sym Dev Dir:Port Physical Device Name Host Lun Attr Cap(MB)
------ -------- --------------------- ---- ---- -------
00060 01D:027 Not Visible 1 1796
-------
Total Capacity 1796

* Denotes a cascaded Initiator Group within the specified Masking View

---

**View auto-provisioning group details**

**Syntax**

To display storage group, port group, or initiator group details, using the `symaccess list` and `symaccess show` commands, use the following syntax:

```
symaccess -sid SymmID [-offline] | -f BackupFilename
list [-name GroupName] [-v]
list -type <storage [-devs SymDevName <:SymDevName>] | port
[-dirport Dir:Port] | initiator [-wwn wwn | -iscsi iscsi] > [-v] [-name GroupName]
```

---
show GroupName -type <storage | port | initiator [-detail]>
show view ViewName

Options

-type
Use this option to list groups of a specific type: (initiator, port, or storage).

-v
Lists details of a group and any children in the group.

-details
Shows detail of a masking view or any of the groups in the masking view.

Examples
To list details of a storage group or any child storage group, enter:

```
symaccess list -type storage -v
```

To show details of a masking view or any of the groups in the masking view, enter:

```
symaccess show view -detail
```

Sample output
For storage group:

```
Symmetrix ID           : 000195700601
Storage Group Name     : backup_storage
Device Count           : 1
Storage Group Count    : 0
Masking View Count     : 0
Last update time       : 12:32:26 AM on Fri Apr 06,2012
Group last update time : 12:32:26 AM on Fri Apr 06,2012
Masking View Names     : None
Storage Group Name     : Mkt_storage (IsParent)
Device Count           : 0
Storage Group Count    : 1
Masking View Count     : 0
Last update time       : 08:10:22 PM on Tue Feb 14,2012
Group last update time : 10:32:26 AM on Fri Apr 06,2012
Masking View Names     : Mkt_view *
```

* Denotes Masking Views through a cascaded group

For masking view:

```
Symmetrix ID           : 000195700601
Masking View Name      : HR_view
Last update time       : 04:30:24 AM on Tue Apr 03,2012
View last update time  : 04:35:36 AM on Tue Apr 03,2012
Initiator Group Name   : HR_hosts
    Host Initiators
    { IG : HR_host_GrpA
    }
Port Group Name        : HR_ports
```
Device masking with Auto-Provisioning Groups

<table>
<thead>
<tr>
<th>Director Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ FA-15E:1</td>
</tr>
</tbody>
</table>
| Storage Group Name      :
| HR_storage              |
| Number of Storage Groups:
| 0                       |
| Storage Group Names     : None

<table>
<thead>
<tr>
<th>Sym</th>
<th>Dev</th>
<th>Dir:P</th>
<th>Physical Device Name</th>
<th>Host</th>
<th>Lun</th>
<th>Attr</th>
<th>Cap(MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>----</td>
<td>-----</td>
<td>-------</td>
<td>----------------------</td>
<td>------</td>
<td>-----</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>01C27</td>
<td>15E:1</td>
<td>Not Visible</td>
<td></td>
<td>1</td>
<td>300000</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>----</td>
<td>-----</td>
<td>-------</td>
<td>----------------------</td>
<td></td>
<td></td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Capacity</td>
<td>300000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

View auto-provisioning device assignments

Syntax
To display the assignments for one or more devices, use the following syntax:

```
symaccess -sid SymmID list assignments -devs SymDevStart: SymDevEnd | SymDevName | SymDevName, SymDevName... [-v]
```

Examples
To list the assignments for device range 20:22 and device 24 on array 120, enter:

```
symaccess -sid 120 list assignments -devs 20:22,24
```

Sample output

```
Symmetrix ID          : 000192600120
Device Identifier        Type | Dir:P
---------------------|-----|-------
00020 10000000c9594dce | FIBRE | FA-7E:1
210000e08b04daac | FIBRE | FA-7E:1
210000e08b1ed7f1 | FIBRE | FA-7E:1
00021 10000000c9594dce | FIBRE | FA-7E:1
210000e08b04daac | FIBRE | FA-7E:1
210000e08b1ed7f1 | FIBRE | FA-7E:1
00022 10000000c9594dce | FIBRE | FA-7E:1
210000e08b04daac | FIBRE | FA-7E:1
210000e08b1ed7f1 | FIBRE | FA-7E:1
00024 10000000c9594dce | FIBRE | FA-7E:1
210000e08b04daac | FIBRE | FA-7E:1
210000e08b1ed7f1 | FIBRE | FA-7E:1
```
Display device list with no auto-provisioning assignments

Syntax
To display a list of devices with no assignments, use the following syntax:

```
symaccess -sid SymmID list no_assignments
[-dirport DirNum:PortNum]
```

Examples
To list the devices without assignments for array 120, enter:

```
symaccess -sid 120 list no_assignments
```

Sample output

```
Symmetrix ID             : 000192600120
Director Identification  : FA-7F
Director Port            : 0
ACLX Enabled             : No
No devices were found for this director/port
Director Identification  : FA-7F
Director Port            : 1
ACLX Enabled             : Yes
Devices not yet assigned :
  00030
  00031
  00032
  00033
  00034
  ...
```

List initiator group devices

Syntax
To list all the devices masked to an initiator group, use the following syntax:

```
symaccess -sid SymmID list devinfo [-ig InitiatorGroupName]
```

When using the -detail option, the initiator group displays include the child initiator group device information.

View the HBA alias name

Example
To display the alias names for masking view host1082_view, enter:

```
symaccess show host1082_view -sid 001 view
```
**Sample output**

Display supports up to 32 characters each for the alias node name and the alias port name.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>: 000197100001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masking View Name</td>
<td>: host1082_view</td>
</tr>
<tr>
<td>Last updated at</td>
<td>: 12:51:37 PM on Tue May 13, 2014</td>
</tr>
<tr>
<td>View last update time</td>
<td>: 01:37:41 PM on Thu Apr 02, 2015</td>
</tr>
<tr>
<td>Initiator Group Name</td>
<td>: hbal_2_3</td>
</tr>
</tbody>
</table>

**Host Initiators**

<table>
<thead>
<tr>
<th>WWN</th>
<th>10000000C99DE136</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[alias: api019010000000C99DE136]</td>
</tr>
</tbody>
</table>

**Port Group Name**

| Port Group Name | : host1082_ports |

**Director Identification**

<table>
<thead>
<tr>
<th>Director</th>
<th></th>
<th>Port</th>
<th>WWN Port Name / iSCSI Target Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA-3E</td>
<td>001</td>
<td>5000097300092110</td>
<td></td>
</tr>
<tr>
<td>SE-10G</td>
<td>000</td>
<td>iqn.1992-04.com.emc:5000097300092194</td>
<td></td>
</tr>
</tbody>
</table>

**Storage Group Name**

| Storage Group Name | : application_sg |

Number of Storage Groups : 0

Storage Group Names : None

<table>
<thead>
<tr>
<th>Sym</th>
<th>Dev</th>
<th>Dir:Port</th>
<th>Physical Device Name</th>
<th>Lun</th>
<th>Attr</th>
<th>Cap(MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00083</td>
<td>3E:000</td>
<td>Not Visible</td>
<td>1</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>9H:000</td>
<td>Not Visible</td>
<td>1</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10G:000</td>
<td>Not Visible</td>
<td>1</td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**Total Capacity**

6
This section describes the SYMCLI query commands and various tools for monitoring and managing storage array performance.

Chapters include:

Chapter 15, "Configuration Query Operations"

Chapter 16, "Events and Logs"

Chapter 17, "XML Structured Output"
Querying and Reporting
CHAPTER 15

Configuration Query Operations

This chapter describes how to use the SYMCLI to collect and display configuration data for array disks, and virtual environments.

- Configuration data overview ................................................................. 392
- SCSI-level data .................................................................................. 392
- Array-level data .................................................................................. 397
- Device-level data ................................................................................. 426
- Disk-level data .................................................................................... 452
Configuration data overview

The Solutions Enabler SYMCLI provides various commands that are used to query different levels of the storage environment. These levels include:

- **SCSI-level** — Returns data at the SCSI level, whereby the SYMCLI issues SCSI INQUIRY and SCSI READ CAPACITY to return low-level physical device data (such as vendor, configuration, and basic configuration) and host HBA information (such as vendor, model, firmware, and basic configuration).

- **Array-level** — Returns detailed data about the configuration of one or all arrays. The data returned includes host relationship information (local or remote), cache size, and number of devices. Other details include vendor specific configuration information, ports, flags, adapters, Data at Rest Encryption data, pool information, and environment data.

- **Device-level** — Returns device level data on locally or remotely attached arrays. Device-level data includes capacity, cache, emulation, configuration, group, and usage information that is critical to all other storage management operations.

- **Disk-level** — Returns detailed information about the raw disks such as detailed identification, vendor, and capacity.

- **Virtual environment** — Returns configuration information about a VMware or Microsoft Hyper-V environment, such as the type and capacity of their storage pools.

### SCSI-level data

The `syminq` command is used to obtain SCSI disk device information using a SCSI INQUIRY command, and optionally SCSI READ CAPACITY command, on host HBAs and one or all locally attached physical devices. This command returns SCSI-level data for EMC arrays, StorageWorks, or HDS devices.

The `syminq` command can return a list all of the HBAs on the local host. Using the options available, the scope of this request can be limited to only the Fibre HBAs, SCSI HBAs, iSCSI HBAs, or HBAs derived from a SNIA API query. In the UNIX environment, if the SNIA libraries are unavailable, HBA information is obtained from the lost log files.

Returned results can be limited to devices with target mapping information (only devices mapped through fibre HBAs using the `-mapinfo` option), or to device identifiers (by a user or application by using the `-identifier` option). Identifiers are limited to `device_name`, `nice_name`, `hp_id`, and `vms_id`.

The *EMC Solutions Enabler SYMCLI Command Reference Guide* describes the various options available with the command.

---

**Note**

Data returned from issuing any `syminq` command is not stored in the configuration database.
SCSI device list

Examples
To list all devices listed by physical device name, enter:

```
syminq
```

Sample output

<table>
<thead>
<tr>
<th>Device</th>
<th>Product</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Type</td>
<td>Vendor</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>fsys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/dev/sda</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdb</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdi</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdj</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdk</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdn</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdo</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdp</td>
<td>GK</td>
<td>EMC</td>
</tr>
<tr>
<td>/dev/sdq</td>
<td>GK</td>
<td>EMC</td>
</tr>
</tbody>
</table>

Devices listed by array ID

Examples
To list devices by array ID, enter:

```
syminq -symmids
```

Sample output

<table>
<thead>
<tr>
<th>Device</th>
<th>Symmview</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Symmetric</td>
<td>ID</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td></td>
</tr>
<tr>
<td>/dev/sdb</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sdc</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sdd</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sde</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sdf</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sdg</td>
<td>00190300215</td>
<td>5977</td>
</tr>
<tr>
<td>/dev/sdh</td>
<td>00190300215</td>
<td>5977</td>
</tr>
</tbody>
</table>

...
List of devices without capacity

Examples
To list devices without issuing a SCSI READ CAPACITY, enter:

```
syminq -symmids -nocap
```

Sample output

```
Device           Symmetrix             Device
---------------- --------------------- ---------------------
Name      Type   ID               Rev  Ser Num
---------------- --------------------- ---------------------
/dev/sdv  BCV    000190300516     5977 1600028000
/dev/sdw  BCV    000190300516     5977 1600029000
/dev/sdx  BCV    000190300516     5977 160002A000
/dev/sdy  BCV    000190300516     5977 160002B000
/dev/sdz  BCV    000190300516     5977 160002C000
```

List of devices with WWN

Options
-colon
Use this option to return a list of devices with WWN for each device using colons as spacers.

Examples
To list the WWN for each device, enter:

```
syminq -wwn
```

Sample output

```
Device                               Device
------------------ ---- ---------------- --------------------------------
Name                Num   Array ID         WWN
------------------ ---------------- --------------------------------
/dev/sda            N/A   N/A              N/A
/dev/sdb            0005E 000194900306     60000970000194900306533030303545
/dev/sdy            000E6 000194900306     60000970000194900306533030304536

Output with -colon option:

```
Device                               Device
------------------ ---- ---------------- -----------------------------------------------
Name                Num   Array ID         WWN
------------------ ---------------- -----------------------------------------------
/dev/sda            N/A   N/A              N/A
/dev/sdb            0005E 000194900306   60:00:09:70:00:01:94:90:03:06:53:30:30:30:35:45
/dev/sdy            000E6 000194900306   60:00:09:70:00:01:94:90:03:06:53:30:30:45:36
```
Device list in pdevfile format

Examples
To list device names in a format suitable for use as pdevfile:

```
syminq -pdevfile
```

Sample output

```
# Symm id  pdev               dev dir  dir_port
000187900771 /dev/rdsk/c2t0d0s2 0017 15D  0
000187900771 /dev/rdsk/c2t0d1s2 0018 15D  0
000187900771 /dev/rdsk/c2t0d2s2 0019 15D  0
000187900771 /dev/rdsk/c2t0d3s2 001A 15D  0
```

List HBA information

Options
- **-fibre**
  Lists only the Fibre HBAs.

- **-scsi**
  Lists only the SCSI HBAs.

- **-iscsi**
  Lists only the iSCSI HBAs.

- **-sni**
  Returns HBA information using the native SNIA SMI-S Provider rather than by issuing a SCSI inquiry. The returned data will be exactly the same as the data returned with a -fibre SCSI inquiry; the only difference is how the data is obtained.

Examples
To obtain a list of the local host's HBAs, enter:

```
syminq hba
```

Note
HBA returned data will vary slightly when the **-scsi** or **-iscsi** option is specified.

Sample output

```
Host Name                                         : api171
HBA Type            : FibreChannel
HBA Name            : Emulex-LPe11002-E-1
Vendor              : Emulex Corporation
Model               : LPe11002-E
Serial Number       : VM63487963
Firmware Version    : 2.50A4 (Z2F2.50A4)
Driver Version      : 8.1.10.3; HBAAPI(I) v2.1.d, 07-28-06
```
List device mapping information

Syntax
To list mapping information, use the following syntax:

```
symq -mapinfo[PdevName]
    [-sym[-powerpath]|-hds|-storworks]
    [-cache | -nocache][-colons][-winvol]
```

Examples

```
symq -mapinfo
```

Sample output

<table>
<thead>
<tr>
<th>Device</th>
<th>Target Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>HBA Port WWN</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>/dev/rdsk/c0t0d0s2</td>
<td>N/A</td>
</tr>
<tr>
<td>/dev/rdsk/c1t1d0s2</td>
<td>N/A</td>
</tr>
<tr>
<td>/dev/rdsk/c2t500009720813558d0s2</td>
<td>210000e08b80a234</td>
</tr>
<tr>
<td>/dev/rdsk/c2t500009720813558d1s2</td>
<td>210000e08b80a234</td>
</tr>
<tr>
<td>/dev/rdsk/c2t500009720813558d2s2</td>
<td>210000e08b80a234</td>
</tr>
<tr>
<td>/dev/rdsk/c2t500009720813558d3s2</td>
<td>210000e08b80a234</td>
</tr>
<tr>
<td>/dev/rdsk/c2t500009720813558d4s2</td>
<td>210000e08b80a234</td>
</tr>
</tbody>
</table>
List device identifiers

Description
To list the array device identifiers assigned to devices by the user or other applications, use the `syminq -identifier` option and specify one of the four options: device_name, nice_name, hp_id, or vms_id.

Examples
To list the VMS device identifiers, enter:

```
syminq -identifier vms_id
```

Sample output

```
Device Name  Num Vendor  Array ID  VMS ID
---------- ----------- ----------- ----- ----
/dev/sdb    0005E EMC  000194900306 94
/dev/sdc    0005F EMC  000194900306 95
/dev/sdy    000E6 EMC  000194900306 230
```

Array-level data

The `symcfg` command provides arguments and options to report specific array-level components. The storage array data includes the following:

- Storage arrays — A list of all arrays attached to the host and configuration details about them.
- Registered applications — Applications registered with SYMAPI that have accessed all or specified arrays to which your host is connected.
- Host connections — Detailed information about the hosts that have accessed a array, the host node name and the array ID, director/port information, and array capacity.
- PowerPath host registration — Detailed information about the PowerPath hosts that have registered on an array, including the host name, array ID, OS version, PowerPath version and cluster information.
- Director information — Configuration and status information about all directors of a specified array including address, port, and status information. Details can be limited to a specific type of director.
- SELs (Symmetrix External Locks) and Semaphores — Status information on SELs (by number or type) and SYMAPI semaphores.
- Cache management — Information on the LRU cache, including the cache slots that each LRU occupies, and the percentage of the total cache utilized.
- Network services — A list of network services available to SYMAPI client applications.
- Environment data — Detailed information on the memory boards, and the array's environmental data, including fans and power supplies, can be obtained.
- CU Images — Information for mainframe users.
- Microcode patches — A list of installed operating environment for array patches.
• Bay location descriptions — A list of the bay names and location details of the array.
• Data at Rest Encryption — Information about hardware-based, on-array, back-end encryption for arrays.

List arrays

Description
To query storage environment configuration data, the arrays in the storage environment must first be identified. Each array has a serial number (SID) that is used to uniquely identify it. The `symcfg` command lists all the accessible arrays by SID including the model number and the number of accessible devices. Use the SID with other command options to obtain configuration information for the array directors and devices.

Examples
To list all array IDs connected to a host, enter:

```
symcfg list
```

To obtain a detailed list for a specific array, using the verbose option (`-v`), enter:

```
symcfg list -v -sid 2300
```

Sample output
Output listing all arrays connected to a host.

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Attachment</th>
<th>Model</th>
<th>Mcode</th>
<th>Cache</th>
<th>Num Phys</th>
<th>Num Symm</th>
<th>Devices</th>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>000190100097</td>
<td>Local</td>
<td>VMAX40K</td>
<td>5977</td>
<td>98304</td>
<td>20</td>
<td>32088</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000000006206</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>32768</td>
<td>0</td>
<td>4139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187900035</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>8192</td>
<td>0</td>
<td>1314</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187900041</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>8192</td>
<td>0</td>
<td>960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000190300174</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>16384</td>
<td>0</td>
<td>335</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000190300175</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>16384</td>
<td>0</td>
<td>914</td>
<td></td>
<td></td>
</tr>
<tr>
<td>000190300184</td>
<td>Remote</td>
<td>VMAX40K</td>
<td>5977</td>
<td>16384</td>
<td>0</td>
<td>417</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Output listing details (`-v`) for array 2300.

<table>
<thead>
<tr>
<th>Product Model</th>
<th>: VMAX40K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmtrix ID</td>
<td>: 000195602300</td>
</tr>
<tr>
<td>Microcode Version (Number)</td>
<td>: 5977 (16F40000)</td>
</tr>
<tr>
<td>Microcode Registered Build</td>
<td>: 0</td>
</tr>
<tr>
<td>Microcode Date</td>
<td>: 10.16.2012</td>
</tr>
<tr>
<td>Microcode Patch Date</td>
<td>: 10.16.2012</td>
</tr>
<tr>
<td>Microcode Patch Level</td>
<td>: 159</td>
</tr>
<tr>
<td>Symmwin Version</td>
<td>: 30</td>
</tr>
<tr>
<td>Enginuity Build Version</td>
<td>: 5977.159.30</td>
</tr>
<tr>
<td>Service Processor Time Offset</td>
<td>: - 00:00:02</td>
</tr>
<tr>
<td>Cache Size (Mirrored)</td>
<td>: 18432 (MB)</td>
</tr>
<tr>
<td># of Available Cache Slots</td>
<td>: 253968</td>
</tr>
<tr>
<td>Max # of System Write Pending Slots</td>
<td>: 152777</td>
</tr>
<tr>
<td>Max # of DA Write Pending Slots</td>
<td>: 0</td>
</tr>
<tr>
<td>Max # of Device Write Pending Slots</td>
<td>: 7638</td>
</tr>
<tr>
<td>Max # of Replication Cache Slots</td>
<td>: 43174</td>
</tr>
<tr>
<td>Replication Usage (Percent)</td>
<td>: 10</td>
</tr>
</tbody>
</table>
Reporting differences
The following items describe reporting differences that are dependent on HYPERMAX, and Solutions Enabler versions:

- For HYPERMAX OS 5977 lower than Q12016SR, the Replication Usage (Percent) is reported as N/A.
- For compatibility modes earlier than 8.2 the Replication Usage (Percent) field displays as Replication Cache Usage (Percent).

List arrays by system resource demand

Description
The symcfg list -demand command reports system resource demand. This feature is supported on arrays running HYPERMAX OS 5977 Q22017SR or higher.

Examples
To list system resource demand, enter:

    symcfg list -demand -sid 188

To list resource demand details for array 188, enter:

    symcfg list -demand -v -sid 188

To list metadata details for array 188, enter:

    symcfg list -demand -md -sid 188

To list array capacity details for array 188, enter:

    symcfg list -demand -detail -sid 188

Sample output

symcfg list -demand -sid 188

<table>
<thead>
<tr>
<th>ArraY</th>
<th>C a p a c i t y</th>
<th>R e p o r t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscribed Capacity</td>
<td>Snapshot Capacity</td>
<td>Usable Capacity</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>SymmID</td>
<td>Total (TB)</td>
<td>Allc (%)</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>0001978800188</td>
<td>208.00</td>
<td>77</td>
</tr>
</tbody>
</table>
Output with -verbose (-v) option for specified array:

```
symcfg list -demand -v -sid 188
```

**Symmetrix ID**: 000197800188

**Array Usage**
- User Subscribed (TB): 208.00
- Allocation (%): 77
- Non Shared (TB): 144.00
- Shared (TB): 16.00
- System Subscribed (TB): 2.00
- Snapshot capacity (TB): 416.00
- Modified (%): 14
- Non Shared (TB): 41.60
- Shared (TB): 14.60
- Usable Capacity (TB): 116.30
- Used (%): 66
- Used Capacity (TB): 76.20
- User Used (TB): 74.20
- System Used (TB): 2.00
- Temp Used (TB): 22.30
- Encapsulated (TB): 0.00

**Meta Data Usage**
- System (%): 77
- Replication (%): 95
- Frontend (%): 70
- Backend (%): 75

Metadata option (-md) for specified array:

```
symcfg list -demand -md -sid 188
```

**META DATA USAGE**

<table>
<thead>
<tr>
<th>SymmID</th>
<th>System (%)</th>
<th>Replication (%)</th>
<th>Frontend (%)</th>
<th>Backend (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>000197800188</td>
<td>77</td>
<td>95</td>
<td>70</td>
<td>75</td>
</tr>
</tbody>
</table>

```
symcfg list -demand -detail -sid 188
```

**ARRAY CAPACITY REPORT**

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Subscribed Capacity (TB) (%)</th>
<th>Snapshot Capacity (TB) (%)</th>
<th>Usable Capacity (TB) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Allocated</td>
<td>NonShared</td>
<td>Shared</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>000197800188</td>
<td>208.00</td>
<td>77</td>
<td>144.00</td>
</tr>
</tbody>
</table>

**Data at Rest Encryption**

Data at Rest Encryption (D@RE) provides hardware-based, on-array, back-end encryption for VMAX family arrays. Back-end encryption protects information from unauthorized access when disk drives are removed from the system. Data Encryption provides encryption on the back end using Fibre Channel I/O modules that incorporate AES-XTS 256-bit data-at-rest encryption. These modules encrypt and decrypt data as it is being written to or read from disk. All configured drives are encrypted, including data drives, spares, and drives with no provisioned volumes. In addition, all array disk data is encrypted, including array File System and PowerVault contents.

Data at Rest Encryption supports either an internal embedded key manager, or RSA Data Protection Manager for external, enterprise-grade key management. For external
key management, Data at Rest Encryption is qualified for interoperability with the RSA Key Manager Appliance version 2.7 SP1, and the RSA Data Protection Manager (DPM) version 3.1 (appliance).

Note

For more information refer to the *EMC VMAX3 Family Product Guide*.

By securing data on enterprise storage, Data Encryption ensures that the potential exposure of sensitive data on discarded, re-used, or stolen media is reduced or eliminated. As long as the key used to encrypt the data is secured, encrypted data cannot be read. In addition to protecting against threats related to physical removal of media, this also means that media can readily be repurposed by destroying the encryption key used for securing the data previously stored on that media. In this way, disk rotation, migration and upgrade are secured, without changes to operational procedures.

Data Encryption is compatible with all array system features, allows for encryption of any supported local drive types or volume emulations, and provides encryption without performance degradation or disruption to existing applications or infrastructure.

Note

All key management is transparent to the storage administrator; no direct control of keys is allowed through Solutions Enabler. Encryption must be turned on by an EMC Customer Engineer during the installation of the array. There is no way to turn encryption on or off using Solutions Enabler.

DARE External Key Management

Solutions Enabler V9.1 introduces DARE-External Key Manager to support managing and configuring the PowerMax arrays. Through a secure channel, DARE certificates and passwords are delivered through Solutions Enabler to MMCS without Dell EMC Customer Engineer involvement.

Key management procedure overview

The following provides an overview of the external key management procedure:

1. Start a maintenance session.
2. Perform DARE-External Key Management configuration operation.
3. Perform a commit operation.
4. Verify the successful completion of the operation.
5. End the maintenance session.

Restrictions and limitations

- This feature will be limited to PowerMax OS 5978_Q219SR and later releases only
- The following security privileges are required to execute this command:
  - Required Access type: CFGSYM
  - Required Authorization Rights: Storage Admin
- For update hosts operation, User should provide the information of all the hosts on which EKM runs, not only the one that is changing. For update hosts operation the number of EKM server list cannot exceed four servers.
List data encryption status

**Options**

- **-v**
  Lists array details including data encryption status.

**Examples**

To list data encryption status (using **-v** option) for array 343, enter:

```
symcfg list -sid 343 -v
```

**Sample output**

If encryption has not been turned on at install time, the `symcfg -v` command displays *Symmetrix Data Encryption as Disabled.*

If encryption is not supported on the array, the `symcfg -v` command displays *Symmetrix Data Encryption as N/A.*

Symmetrix ID: 000194900343
Time Zone: Eastern Standard Time
Product Model: VMAX
Symmetrix ID: 000194900343
3 Dynamic Mirrors: Enabled
Cache Partitioning: Disabled
IPSec Status: Pass Thru
Allow spare in mirror 4 position: Disabled
Disks Service: Customer Replaceable
Symmetrix Data Encryption: Enabled

List Data encryption key (DEK) audit log

**Description**

Every key management event generates an entry in the array audit log, including initial DEK configuration information.

**Example**

```
symaudit list -text -sid 012 -function_class Security
```

**Sample output**

```
AUDIT LOG DATA
Symmetrix ID: **********012
Record Number | Date     | Time       | Function | Action | Activity |
--------------|----------|------------|----------|--------|----------|
           2   | 11/30/10 | 14:50:55   | Security | Init   | SW_Men_6829
DARE Local Install.
           3   | 11/30/10 | 14:50:55   | Security | Create | SW_Men_6829
New KEK key generated. MUID:
                  61A3770EDBEE3154463E15A5FA91006C6ADA4F9C14C96653635962DE21F636125
           4   | 11/30/10 | 14:50:55   | Security | Create | SW_Men_6829
```
### Post-drive replacement DEK audit log

**Description**
When a drive replacement results in the destruction of the Data Encryption Key for the original drive and the creation of a DEK for the new drive, these events are logged in the array Audit Log.

**Example**
The following output lists this information for array 012:

```
$ symaudit list -text -function_class Security -sid 012
```

**Sample output**

```
AUDIT LOG DATA
Symmetrix ID : *********012
Record Number Date Time Function Class Action Activity
------- -------- -------- ---------- ------- ------- -------------------
135  11/30/10  10:15:58  Security Modify SW_Men_E757
     DEK key deactivated. Drive WWN: 200000024b65edce Location: DA08 C1:3E MUID: E0252F83955C803D03596CD3311CED715FA98566F99E2F6EC0DF325A4758E

136  11/30/10  10:15:59  Security Delete SW_Men_E757
     DEK key destroyed. Drive WWN: 200000024b65edce Location: DA08 C1:3E MUID: E0252F83955C803D03596CD3311CED715FA98566F99E2F6EC0DF325A4758E

142  11/30/10  10:17:49  Security Create SW_Men_E757
     New DEK key generated. Drive WWN: 200000024b65de7ea Location: DA08 C1:3E MUID: 5EC4CF4E2B4D92C98A99EF9A8A19E527B090D95E75C305DAD21E98ED630C5A467
```

### View application registrations with array access

**Examples**
For example, to list all the applications that have host to array connection for array 282, enter:

```
symapp -list -sid 282
```
Note

Omit the `-sid` option list connections for all arrays.

```
symcfg list -applications -sid 282
```

Sample output

Note

If Embedded Management is configured on the VMAX array, the node name and IP address listed in the output is the nodename and IP address identified by the NAT gateway, and not the internal identity of the eManagement Guest. For more information on eManagement refer to the *EMC VMAX3 Family Product Guide*.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Host</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>000192600282</td>
<td>HK192600282</td>
<td>SYMACCESS</td>
</tr>
<tr>
<td>0.0.0.1</td>
<td>API101</td>
<td>SYMACCESS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Node Name</th>
<th>IP Address</th>
<th>ID</th>
<th>Vendor ID</th>
<th>Version</th>
<th>Attr</th>
</tr>
</thead>
<tbody>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SYMACCESS</td>
<td>EMC Corp</td>
<td>7.3.0.194</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>EVTdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.194</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SMBASE</td>
<td>EMC Corp</td>
<td>7.3.12.9</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SYMACCESS</td>
<td>EMC Corp</td>
<td>7.3.0.177</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>EVTdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.177</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SMBASE</td>
<td>EMC Corp</td>
<td>7.3.11.8</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>EVTdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.175</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SYMLMF</td>
<td>EMC Corp</td>
<td>7.3.1202.0</td>
<td>-</td>
</tr>
<tr>
<td>HK192600282</td>
<td>0.0.0.1</td>
<td>SYMACCESS</td>
<td>EMC Corp</td>
<td>7.3.0.175</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>API101</th>
<th>10.247.80.101</th>
<th>ID</th>
<th>Vendor ID</th>
<th>Version</th>
<th>Attr</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.234</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMRDF</td>
<td>EMC Corp</td>
<td>7.3.0.230</td>
<td>(M)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.230</td>
<td>(M)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GNSdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.230</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.227</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.227</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GNSdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.227</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GNSdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.227</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.226</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GNSdaemon</td>
<td>EMC Corp</td>
<td>7.3.0.226</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.224</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.224</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMRDF</td>
<td>EMC Corp</td>
<td>7.3.0.193</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.189</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYMCFG</td>
<td>EMC Corp</td>
<td>7.3.0.189</td>
<td>(R)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend for Attribute(s):

(M) : Application Registered Remotely via RDF links (Multi-Hop).
(R) : Application Registered Remotely via RDF links (One-Hop).

**List host connections to arrays**

**Options**

- `--connections`
Returns the host connections to the array. Only hosts that have at least one registered application are listed.

**Examples**

To list the host connections to array 097 enter:

```
symcfg list -connections -capacity -sid 097
```

**Note**

To view the host connections for all arrays, omit the `-sid` option.

```
symcfg list -connections -capacity
```

**Sample output**

When displaying all arrays, the output is sorted according to each array.

<table>
<thead>
<tr>
<th>Host</th>
<th>Symmetrix</th>
<th>Capacity (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Node Name</td>
<td>Director Port</td>
</tr>
<tr>
<td>6I</td>
<td>Node Name</td>
<td>Director Port</td>
</tr>
<tr>
<td>6I</td>
<td>000190100097 FA-3B</td>
<td>0</td>
</tr>
<tr>
<td>6I totals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LBQA0074</td>
<td>000190100097 FA-3B</td>
<td>0</td>
</tr>
<tr>
<td>LBQA0074 totals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>api105</td>
<td>000190100097 FA-3A</td>
<td>0</td>
</tr>
<tr>
<td>api105 totals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>api150</td>
<td>000190100097 FA-3A</td>
<td>0</td>
</tr>
<tr>
<td>api150 totals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>api31</td>
<td>000190100097 FA-7A</td>
<td>0</td>
</tr>
<tr>
<td>api31 totals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lbqa0074</td>
<td>000190100097 FA-3B</td>
<td>0</td>
</tr>
<tr>
<td>lbqa0074 totals:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**List PowerPath host registration records**

**Options**

`-ppreg`

Returns the PowerPath host registration records stored on the target array.

**Examples**

To list the PowerPath host registration records on all arrays enter:

```
symcfg list -ppreg
```

**Note**

To view the host connections for all arrays, omit the `-sid` option.
**Sample output**

**Note**
When displaying all arrays, the output is sorted according to each array

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197800188</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Name:</td>
<td>hostabc</td>
</tr>
<tr>
<td>OS Version:</td>
<td>osver123</td>
</tr>
<tr>
<td>OS Revision:</td>
<td>osrev123</td>
</tr>
<tr>
<td>Hardware Vendor Name:</td>
<td>hvn123</td>
</tr>
<tr>
<td>PowerPath Version:</td>
<td>ppver123</td>
</tr>
<tr>
<td>PowerPath Patch Level:</td>
<td>ppl123</td>
</tr>
<tr>
<td>PowerPath License Info:</td>
<td>ppl123</td>
</tr>
<tr>
<td>Host Registration Time:</td>
<td>04/17/1979 00:16:15</td>
</tr>
<tr>
<td>Host Connectivity type:</td>
<td>FC</td>
</tr>
<tr>
<td>Cluster Info:</td>
<td></td>
</tr>
<tr>
<td>Cluster Name:</td>
<td>cluster123</td>
</tr>
<tr>
<td>Cluster Node Name:</td>
<td>clusnode123</td>
</tr>
<tr>
<td>WWNs:</td>
<td>(1): 3132333435363738</td>
</tr>
<tr>
<td>VMs:</td>
<td>(1)</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname11</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor11</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname12</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor12</td>
</tr>
<tr>
<td>Host Name:</td>
<td>hostxyz</td>
</tr>
<tr>
<td>OS Version:</td>
<td>osver567</td>
</tr>
<tr>
<td>OS Revision:</td>
<td>osrev567</td>
</tr>
<tr>
<td>Hardware Vendor Name:</td>
<td>hvn567</td>
</tr>
<tr>
<td>PowerPath Version:</td>
<td>ppver567</td>
</tr>
<tr>
<td>PowerPath Patch Level:</td>
<td>ppl567</td>
</tr>
<tr>
<td>PowerPath License Info:</td>
<td>ppl567</td>
</tr>
<tr>
<td>Host Registration Time:</td>
<td>07/19/2067 13:34:09</td>
</tr>
<tr>
<td>Host Connectivity type:</td>
<td>FC</td>
</tr>
<tr>
<td>Cluster Info:</td>
<td></td>
</tr>
<tr>
<td>Cluster Name:</td>
<td>cluster567</td>
</tr>
<tr>
<td>Cluster Node Name:</td>
<td>clusnode567</td>
</tr>
<tr>
<td>WWNs:</td>
<td>(1): 3132333435363738</td>
</tr>
<tr>
<td>VMs:</td>
<td>(1)</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname21</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor21</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname22</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor22</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname23</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor23</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname24</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor24</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname25</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor25</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname26</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor26</td>
</tr>
<tr>
<td>VM Name</td>
<td>vmmname27</td>
</tr>
<tr>
<td>OS Vendor Info:</td>
<td>vmosvendor27</td>
</tr>
</tbody>
</table>
List host connections sorted by host names

Options

-ipv6
Displays a layout that does not truncate node names or addresses.

Examples
To list all of the host connections sorted by host names for array 097, enter:

```
symcfg list -connections -sorthost -sid 097
```

Sample output

<table>
<thead>
<tr>
<th>Host</th>
<th>Symmetrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node Name</td>
<td>IP Address</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
</tr>
<tr>
<td>6I</td>
<td>172.23.195.65</td>
</tr>
<tr>
<td>LBQA0074</td>
<td>172.23.195.74</td>
</tr>
<tr>
<td>api105</td>
<td>172.23.192.105</td>
</tr>
<tr>
<td>api150</td>
<td>172.23.192.150</td>
</tr>
<tr>
<td>api31</td>
<td>172.23.192.31</td>
</tr>
</tbody>
</table>

Supported director configuration types

Use the `symcfg list` command to gather information about the array directors. The following director types are supported:

DA — Disk directors
DX — External disk directors
EA — ESCON directors
SE — Gig-E directors
EF — FICON (Fibre-ESCON) directors
RA — SRDF directors
RE — RDF Gig-E directors
RF — RDF Fibre directors
FA — Front-end (Fibre Channel) directors, including Fibre Channel over Ethernet (FCoE)
List director configuration data

Examples
To list configuration and status information about all directors on array 00019490004, enter:

```
symcfg list -dir ALL -sid 064
```

Sample output

```markdown
Symmetrix ID: 000197100064 (Local)

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Type</th>
<th>Engine</th>
<th>Cores</th>
<th>Ports</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM-7A</td>
<td>IM</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>IM-8A</td>
<td>IM</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>ED-7B</td>
<td>EDS</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>ED-8B</td>
<td>EDS</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>Online</td>
</tr>
<tr>
<td>DF-7C</td>
<td>DISK</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>Online</td>
</tr>
<tr>
<td>DF-8C</td>
<td>DISK</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>Online</td>
</tr>
<tr>
<td>FA-7E</td>
<td>FibreChannel</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>Online</td>
</tr>
<tr>
<td>FA-8E</td>
<td>FibreChannel</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>Online</td>
</tr>
<tr>
<td>RF-7G</td>
<td>RDF_BI_DIR</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>Online</td>
</tr>
<tr>
<td>RF-8G</td>
<td>RDF_BI_DIR</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>Online</td>
</tr>
</tbody>
</table>
```

List port flag information

Syntax
To list port flag information, use the following syntax:

```
symcfg [-sid <SymmID>] [-offline] list -port -free
        <[-slot <#>] [-dx | -fa | -fcoe | -re | -rf | -se] [-speed <#>] | -dir <#>}
```

Options
- **-free**
  Lists the ports that are not associated with a director emulation.
- **-dx**
  Lists only DX (external) directors.
- **-fa**
  Lists only FA (Fibre) directors.
- **-fcoe**
  Lists only FCOE (Fibre Channel Over Ethernet) directors.
- **-re**
  Lists only RE (RDF Gig-E) directors.
- **-rf**
Lists only RF (RDF Fibre) directors.

- **se**

Lists only SE (Gig-E) directors.

Support for multiple cores and ports

All director types can support multiple cores. The actual number of cores assigned to a director are statically configured. Use the *symcfg list - dir* command to view the number of cores assigned to a given director. In addition, all director types are capable of supporting a variable number of ports. Solutions Enabler supports reporting existing port associations, as well as the number and identity of ports available for association (free ports) and their respective supported interface types. A port's supported interface types determine which directors a given free port may be associated with.

List director information by type

**Examples**

To list all front-end directors (-FA) for array 005, enter:

```
symcfg list -FA ALL -sid 005
```

**Note**

Director types, -CA and -SA, are no longer supported. Special format displays such as those previously produced by the specification of -FA or -SE options are no longer supported. Two new director types are supported for Infrastructure Manager (IM) and Enginuity Data Services (EDS).

**Sample output**

```
Symmetrix ID: 000197300005 (Local)

<table>
<thead>
<tr>
<th>Symmetrix</th>
<th>DIRECTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ident</td>
<td>Type</td>
</tr>
<tr>
<td>----</td>
<td>--------</td>
</tr>
<tr>
<td>FA-1E</td>
<td>FibreChannel</td>
</tr>
<tr>
<td>FA-2E</td>
<td>FibreChannel</td>
</tr>
<tr>
<td>FA-3E</td>
<td>FibreChannel</td>
</tr>
<tr>
<td>FA-4E</td>
<td>FibreChannel</td>
</tr>
</tbody>
</table>
```

List director details by name and type

**Options**

- **-v (verbose)**

Lists details about a specific director and type.

**Examples**

To display information about the Gig-E director 5G on array 064, enter:

```
symcfg list -SE 5G -sid 064 -v
```
Sample output

Symmetrix ID: 000197100064 (Local)
Time Zone : EDT
Product Model : VMAX40K
Symmetrix ID : 000195700064

Director Identification: SE-5G
Director Type : GigE
Director Status : Online
Director Symbolic Number : 05G
Director Numeric Number : 101
Director Engine Number : 1
Director Slot Number : 5
Number of Director Cores : 2
Number of Director Ports : 1
Director Port: 16
WWN Port Name : 5000097300039118
Director Port Status : Online
Negotiated Speed (Gb/Second) : 1
Director Port Speed (Gb/Second) : 4

List director port data

Options

-port
Lists ports that are online or offline on SA, FA, SE, or RA directors.

-p <#>
Restricts output to a specific port number.

Examples

To list port status for all SE directors on array 230, enter:

`symcfg list -port -SE ALL -sid 230 -detail`

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 0001971000230</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Y M M E T R I X</td>
</tr>
<tr>
<td>Ident</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>SE-9G</td>
</tr>
<tr>
<td>SE-10G</td>
</tr>
<tr>
<td>SE-9H</td>
</tr>
<tr>
<td>SE-10H</td>
</tr>
</tbody>
</table>

Legend:

- Flags:
  (A)CLX Enabled: X = True, . = False, - = N/A
  (C)HAP Enabled: X = True, . = False, - = N/A
  (R)ADIUS Enabled: X = True, . = False, - = N/A

List addresses of devices mapped to directors

Options

-address
Identifies the address information for devices accessible through specific directors from a host-based view of the storage environment.

**Examples**

To list the address information for all director types on array **064**, enter:

```
symcfg list -dir ALL -sid 064 -address
```

To list address information for port **10** on director **FA 2E**, enter:

```
symcfg list -sid 075 -FA 2E -address -p 10
```

**Sample output**

For all director types:

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100064 (Local)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>FA-8E</td>
</tr>
<tr>
<td>FA-8F</td>
</tr>
<tr>
<td>FA-2E</td>
</tr>
<tr>
<td>FA-2F</td>
</tr>
</tbody>
</table>

For port **10** on director type **FA**:

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100075 (Local)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>FA-2E</td>
</tr>
<tr>
<td>FA-2F</td>
</tr>
<tr>
<td>FA-2G</td>
</tr>
<tr>
<td>FA-2H</td>
</tr>
</tbody>
</table>

Total: 4

| Mapped Devices: 4 |
| Port Available Addresses: 4092 |
| Including Metamembers: 4 |

Legend for Available address:

(s): The Available Addresses for a director are shared among its ports (shared)

**Note**

When LUN information is not available, VBUS TID, and LUN address are reported as N/A.

List the next available device address

**Options**

- **-available**
  - Returns the next available address that can be used for a device.
Examples
To list next available address on array 097, enter:

```
symcfg list -dir all -address -available -sid 097
```

Sample output

Note
VBUS, TID, and LUN address values with an asterisk (*) represent a gap in the address assignments, or are the next available address in the run.

<table>
<thead>
<tr>
<th>Symmetrix ID: 000190100097</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>FA-3A</td>
</tr>
<tr>
<td>0E2A</td>
</tr>
<tr>
<td>04AA</td>
</tr>
<tr>
<td>04AE</td>
</tr>
<tr>
<td>04B2</td>
</tr>
<tr>
<td>04B6</td>
</tr>
<tr>
<td>04BA</td>
</tr>
<tr>
<td>04BE</td>
</tr>
<tr>
<td>04C2</td>
</tr>
<tr>
<td>04C6</td>
</tr>
<tr>
<td>-</td>
</tr>
</tbody>
</table>

Take RA directors offline

Examples
To take RA-12 for array 097 offline, enter:

```
symcfg offline -RA 12 -sid 097
```

Bring RA directors online

Examples
To bring RA director 12 online for array 097, enter:

```
symcfg online -RA 12 -sid 097
```

Take front-end director ports offline

Examples
To take port 4 of SA-12 in array 097 offline, enter:

```
symcfg offline -SA 12 -P 4 -sid 097
```

NOTICE

Do not turn off the only connection from the host to the array, otherwise another host that has connection to the array must be used to bring a director port back online.
Bring front-end director ports online

Examples
To bring port 4 of SA-12 in array 097 back online, enter:

```
symcfg online -SA 12 -P 4 -sid 097
```

Array external locks

Array external locks are used by SYMAPI (locks 0 to 15) and also for applications assigned by EMC (>15) to lock access to the entire array during critical operations. (Base SRDF operations use lock 0 and the Optimizer uses lock 13.) Use the `symcfg list -lockn` command, to list all locks on one or all arrays or just the locks targeted to specific operations.

List all array locks

Examples
To return a list of all host-visible arrays (local and remote), along with details about all array exclusive locks, enter:

```
symcfg list -lockn all
```

Sample Output
The returned list contains three local arrays that have no known locks, as specified by the N/A values. Remote array 000187900039 has an exclusive lock number 15 for a configuration change activity (ConfigChg).

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Attachment</th>
<th>Lock</th>
<th>Lock Number</th>
<th>Usage</th>
<th>Held (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000006196</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000184600063</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000184600282</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000187900039</td>
<td>Remote</td>
<td>EXCLUSIVE</td>
<td>15</td>
<td>ConfigChg</td>
<td>307</td>
</tr>
</tbody>
</table>

In the previous example,

List lock number details

Examples
To return a list of all host-visible arrays (local and remote), and details about lock 0, enter:

```
symcfg list -lockn 0
```
Sample output

Note

If an array is holding a lock other than 0, the output still returns a lock number of N/A.

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Attachment</th>
<th>Status</th>
<th>Usage</th>
<th>Held (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000006190</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000184600063</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000184600282</td>
<td>Local</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>000187900039</td>
<td>Remote</td>
<td>Unknown</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

List lock details

Options

-v

Lists extended lock information about the application and host that owns the lock

all

Lists locks for all arrays.

#

Lists specific lock number.

RDF

Lists SRDF locks only.

RDFA

Lists SRDF/A locks only.

SRDF_MSCS

Lists SRDF MSCS locks only.

GNS

Lists GNS locks only.

Examples

To list information about lock 23, enter:

```
symcfg list -lockn 23 -sid 190
```

To return verbose information about lock 15, enter:

```
symcfg list -lockn 15 -sid 207 -v
```

Sample output

Output for information on lock 23.

<table>
<thead>
<tr>
<th>Symmrix ID: 000000006190</th>
</tr>
</thead>
<tbody>
<tr>
<td>SymmID</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>000000006190</td>
</tr>
<tr>
<td>000184600063</td>
</tr>
<tr>
<td>000184600282</td>
</tr>
<tr>
<td>000187900039</td>
</tr>
</tbody>
</table>
Output for verbose information on lock 15.

<table>
<thead>
<tr>
<th>SymmID</th>
<th>Attachment</th>
<th>Status</th>
<th>Number</th>
<th>Usage</th>
<th>Held (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>000000006190</td>
<td>Local</td>
<td>Locked</td>
<td>23</td>
<td>Unknown</td>
<td>20</td>
</tr>
</tbody>
</table>

Symmtrix ID: 000192600207

Symmetrix ID: 000192600207  (local)
Lock Number: 15
Lock Usage: Config Change
Time Held in Seconds: 1801
Lock Holder ID: 0xf000128e
Initiator: 0
Director Number: 55
Logical Path ID: -1
Lock Owner: Config Server
Config Change Session ID: 4356
Migration Session Name: N/A

Release an array lock

Description
The symcfg release command determines the lock owner and releases the lock. If held by an SRDF control operation, or by the configuration change server, SYMCLI blocks the user command and displays a failure message identifying the lock owner. The lock owner can be a configuration change session, a migrate session, or an internal change. Using the symconfigure or the symmigrate command, abort the correct session that owns the lock.

Note
Releasing a lock on an array is available but not recommended unless it is confirmed that the lock is stranded.

For information about device external locks that only target specific devices, refer to Device external locks on page 451.

Examples
To release an external lock 0, which has confirmed to be stranded on array 097, enter:

```
symcfg -sid 097 -lockn 0 release
```

List all LRU cache management groups

Examples
To view a list of all LRUs for array 6196, enter:

```
symcfg list -lru all -sid 6196
```

Sample output

<table>
<thead>
<tr>
<th>LRU Num</th>
<th>LRU Name</th>
<th>Cache Slots</th>
<th>Percent of Total</th>
</tr>
</thead>
</table>
Network configuration file

The Solutions Enabler configuration file netcnfg is used by the SYMCLI client library to specify attributes of a remote server where array management operations should be directed. Each line in the file associates a user-chosen service name with host name or IP address, port, and security level information.

The netcnfg file is a template and an editable file located in the SYMAPI configuration directory. The location of this directory varies according to operating system. The Solutions Enabler Installation Guide explains how to set up a Solutions Enabler client and configure services in the netcnfg file.

List SYMAPI services

Description
The symcfg -services list command validates the syntax of the netcnfg file entries and displays the configured network services available for use by the SYMAPI client connection.

Examples

```
symcfg list -services
```

Sample output

<table>
<thead>
<tr>
<th>SYMAPI NET SERVICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Pairing Method</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Node Name</td>
</tr>
<tr>
<td>Address</td>
</tr>
<tr>
<td>Port Number Level</td>
</tr>
</tbody>
</table>

- **Pairing Method descriptions:**
  - Single — Single entry service name.
• Ordered — The SYMAPI client library first attempts a client/server session with the server named as the first of the two entries in the `netcnfg` file. If that attempt fails, the library tries the second entry.

• Balanced — The SYMAPI client library applies a random number to select the first entry to attempt a client/server session. So it may select the first or the second entry in the `netcnfg` file.

List memory board information

Description
Memory board information includes the number of boards, the slot number, and the capacity information in MBs.

Examples
To view the available memory board information for all arrays, enter:

```
symcfg list -memory
```

Mainframe CU image and split information reporting

The `symcfg list` command is used to report mainframe CU (Controller Unit) image and split information if the storage environment contains devices mapped to either EA (ESCON) or EF (FICON) front-end directors. Since devices in the mainframe environment are managed with respect to the CU image that they are a part of, SYMCLI creates a view of the CU images that are defined within the array. A CU image definition includes the SSID assigned to the image, the split name, the front-end ports to which it is mapped, the devices included in the image, and their base and alias addresses. It also indicates whether it uses dynamic or static PAV (parallel access volumes) and whether the CU is online or not.

The `ficon_split` option reports split information on the array.

List mainframe CU images

Examples
To list CU images for array 086, enter:

```
symcfg -sid 086 list -cuimage
```

Sample output

```
Symmetrix ID           : 000197100086
PAV Aliasing           : DynamicStandardPAV

CU image number: 0x00

    Sub System ID            : 0x0140
    Split Name               : split0
    CU status                : N/A
    PAV Aliasing             : DynamicStandardPAV
    Director Port Assignments (02)  : EF-01H:24, EF-01H:26
    Number of Devices        : 0
    Device Ranges            : N/A
```
### Configuration Query Operations

#### Show mainframe CU images

**Examples**

To show CU images for array **086**, enter:

```bash
symcfg -sid 086 show -cuimage 1
```

**Sample output**

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>: 000197100086</th>
</tr>
</thead>
<tbody>
<tr>
<td>CU image number</td>
<td>: 0x01</td>
</tr>
<tr>
<td>Sub System ID</td>
<td>: 0x0060</td>
</tr>
<tr>
<td>Split Name</td>
<td>: split0</td>
</tr>
<tr>
<td>CU status</td>
<td>: Offline</td>
</tr>
<tr>
<td>PAV Aliasing</td>
<td>: DynamicStandardPAV</td>
</tr>
<tr>
<td>Director Port Assignments (02)</td>
<td>: EF-01H:24</td>
</tr>
<tr>
<td></td>
<td>: EF-01H:26</td>
</tr>
<tr>
<td>Number of Devices</td>
<td>: 2</td>
</tr>
<tr>
<td>Number of Base Addresses</td>
<td>: 2</td>
</tr>
<tr>
<td>Number of Aliases Addresses</td>
<td>: 0</td>
</tr>
<tr>
<td>Range of Alias Addresses</td>
<td>: 31 - 30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SymDev</th>
<th>Base Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0032A</td>
<td>120</td>
</tr>
<tr>
<td>00D24</td>
<td>130</td>
</tr>
</tbody>
</table>

| CU image number       | : 0x01         |
| Sub System ID         | : 0x0141       |
| Split Name            | : split1       |
| CU status             | : Offline      |
| PAV Aliasing          | : DynamicStandardPAV |
| Director Port Assignments (02) | : EF-01H:25 |
|                       | : EF-01H:27    |
| Number of Devices     | : 3            |
| Number of Base Addresses | : 3            |
| Number of Aliases Addresses | : 0            |
| Range of Alias Addresses | : 41 - 50     |

<table>
<thead>
<tr>
<th>SymDev</th>
<th>Base Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
List mainframe splits

Syntax

```
symcfg [-sid <SymmID>] [-offline]
  list -ficon_split [-v]
  show -ficon_split <Split Name>
  list -ficon_split -address [-available]
```

Options

- **-ficon_split**
  Lists splits.

- **-v (-verbose)**
  Lists split details (ie: CU image number, Ficon port assignments)

- **-address (-avail)**
  Lists base address for split.

- **-available (-addr)**
  Lists device base address available for split.

Examples

To list splits for array 086, enter:

```
symcfg sid 086 list -ficon_split
```

To list splits, device base address, and base address for devices available for split, for array 086, enter:

```
symcfg sid 086 list -ficon_split -addr -avail
```

Sample output

Output for splits:

```
S P L I T S
Symmetrix ID: 000197100086

---------- ------ ---
Split Name    Serial Flg
#    M

---------- ------ ---
split0        123456 H
split1        123457 H
split2        123458 D

Legend:
  Flags:
  (M)ode H = Hyper PAV, D = Dynamic PAV
```
Output for split device base address, and base address for devices available for split:

<table>
<thead>
<tr>
<th>Split</th>
<th>CU</th>
<th>Device Name</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend for Available address:

(s): The Available Addresses for a split are shared among its ports (shared)

**List operating system patches**

**Examples**

To list all of the OS patches installed on a array 207, enter:

```
 symcfg list -upatches -sid 207
```

**Environmental data**

Use the list -env_data option to list the status of the major hardware modules including fans, power supplies, drive enclosures, and link control cards. An array ID must be specified when querying for environmental data.
List all environment data on array

Examples
To list an overall status for all environmental components on array 150, enter:

```
symcfg -sid 150 list -env_data
```

Show environmental data on array component

Examples
To return a detailed status for each environmental component for SystemBay on array 150, enter:

```
symcfg -sid 150 show -env_data SystemBay
```

List environmental data for specific service state

Options
- `-service_state`

Returns data for possible service states: degraded, failed, or normal. To list all service states except one prefix the service state value with not, such as

```
-service_state notfailed
```

Examples
To list the environmental data for array 150 with a service state of failed, enter:

```
symcfg -sid 150 list -env_data -service_state failed
```

Note
Returned data only contains information about the bay containing the failure, and the components in the failed state.

Listing array environmental data example

Examples
To list environmental data details for array 64, enter:

```
symcfg list -env_data -v -sid 64
```

Sample output

```
Symmetrix ID               : 000195700064
Timestamp of Status Data  : 09/21/2011 14:01:51
System Bays
Bay Name                             :    SB-1
    Bay LED state                :    Normal  (On)
    Front Door Bay LED state     :    Normal  (On)
    Rear Door Bay LED state      :    Normal
    Number of Standby Power Supplies :    2
    Number of Drive Enclosures  :    1
```
<table>
<thead>
<tr>
<th>Number of Enclosure Slots</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of MIBE Enclosures</td>
<td>2</td>
</tr>
<tr>
<td>Status of Contained Modules</td>
<td></td>
</tr>
<tr>
<td>Standby Power Supplies</td>
<td></td>
</tr>
<tr>
<td>SPS-1A (Aggregate)</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-TRAY-1A</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-BATTERY-1A</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-1B (Aggregate)</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-TRAY-1B</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-BATTERY-1B</td>
<td>Normal</td>
</tr>
<tr>
<td>Enclosure Slot Number</td>
<td>1</td>
</tr>
<tr>
<td>Enclosure Slot State</td>
<td>Normal</td>
</tr>
<tr>
<td>MM-7</td>
<td>Normal</td>
</tr>
<tr>
<td>MM-8</td>
<td>Normal</td>
</tr>
<tr>
<td>DIR-1</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-A</td>
<td>Normal</td>
</tr>
<tr>
<td>FAN-1</td>
<td>Normal</td>
</tr>
<tr>
<td>BOOT-DRIVE-0</td>
<td>Normal</td>
</tr>
<tr>
<td>DIR-2</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-B</td>
<td>Normal</td>
</tr>
<tr>
<td>FAN-2</td>
<td>Normal</td>
</tr>
<tr>
<td>BOOT-DRIVE-0</td>
<td>Normal</td>
</tr>
<tr>
<td>Drive Enclosure Number</td>
<td>1</td>
</tr>
<tr>
<td>Drive Enclosure State</td>
<td>Normal</td>
</tr>
<tr>
<td>SSC</td>
<td>Normal</td>
</tr>
<tr>
<td>LCC-A</td>
<td>Normal</td>
</tr>
<tr>
<td>LCC-B</td>
<td>Normal</td>
</tr>
<tr>
<td>ICM-A</td>
<td>Normal</td>
</tr>
<tr>
<td>ICM-B</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-A</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-B</td>
<td>Normal</td>
</tr>
<tr>
<td>FAN-1</td>
<td>Normal</td>
</tr>
<tr>
<td>FAN-2</td>
<td>Normal</td>
</tr>
<tr>
<td>MIBE Name</td>
<td>MIBE-A</td>
</tr>
<tr>
<td>MIBE State</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-A</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-B</td>
<td>Normal</td>
</tr>
<tr>
<td>CM</td>
<td>Normal</td>
</tr>
<tr>
<td>MIBE Name</td>
<td>MIBE-B</td>
</tr>
<tr>
<td>MIBE State</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-A</td>
<td>Normal</td>
</tr>
<tr>
<td>PS-B</td>
<td>Normal</td>
</tr>
<tr>
<td>CM</td>
<td>Normal</td>
</tr>
<tr>
<td>Drive Bays</td>
<td></td>
</tr>
<tr>
<td>Bay Name</td>
<td>DB-1A</td>
</tr>
<tr>
<td>Bay LED state</td>
<td>Normal (On)</td>
</tr>
<tr>
<td>Number of Standby Power Supplies</td>
<td>4</td>
</tr>
<tr>
<td>Number of Drive Enclosures</td>
<td>16</td>
</tr>
<tr>
<td>Status of Contained Modules</td>
<td></td>
</tr>
<tr>
<td>Standby Power Supplies</td>
<td></td>
</tr>
<tr>
<td>SPS-1A (Aggregate)</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-TRAY-1A</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-BATTERY-1A</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-1B</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-4A</td>
<td>Normal</td>
</tr>
<tr>
<td>SPS-4B</td>
<td>Normal</td>
</tr>
<tr>
<td>Enclosure Number</td>
<td>2</td>
</tr>
<tr>
<td>Enclosure State</td>
<td>Normal</td>
</tr>
<tr>
<td>MM-A</td>
<td>Normal</td>
</tr>
<tr>
<td>MM-B</td>
<td>Normal</td>
</tr>
<tr>
<td>DIR-3</td>
<td>Normal</td>
</tr>
<tr>
<td>DIR-4</td>
<td>Normal</td>
</tr>
</tbody>
</table>
List device pools

Syntax

```bash
symcfg [-sid SymmID] [-offline] [-mb | -gb | -tb]
   [-i Interval] [-c Count]
list [-pool [-snap][-rdfa_dse [-rdfg GrpNum]][-thin]
```

Options

- **-i Interval -c Count**
  Checks status of the pool(s) continuously for a certain period of time.

- **-v**
  List details of each pool in the returned data set. It is equivalent to using the `GrpNum` command on all desired pools.

- **-mb | -gb | -tb**
  By default, the space consumption of devices and pools is shown as a number of tracks. For the `symcfg list` and `symcfg show` commands, the output is shown in megabytes, gigabytes, or terabytes by specifying one of these options. The gigabytes display has one decimal point precision.

- **-pool**
  Lists information for TF/Snap, SRDFA/DSE, and thin pools in a common output.

- **-snap**
  Lists information for TF/Snap pools only.

- **-rdfa_dse**
  Lists information for SRDF/A DSE pools only.

- **-rdfg**
  Used with `-rdfa_dse GrpNum` to limit the display to the SRDF/A DSE pools that are related to the specified SRDF group. This includes pools that are associated with the group and pools that have been disassociated from the group, but may still have some data for the group.

- **-thin**
  Displays information about thin device pools only.

- **-all**
  Includes both enabled and disabled devices in the calculations for Free Tracks and Full %. Otherwise, only enabled devices are included. When specifying the `-all` option, both enabled and disabled devices are included in the calculations of Free Tracks and Full %. Otherwise, only enabled devices are included. For example, without the `-all` option, the Free Tracks field include free tracks from all enabled devices and the Full % field would be based on the Enabled tracks. With the `-all` option specified, the Free Tracks field include free tracks from both enabled and disabled devices and the Full % would be based on the Usable Tracks.

- **-fba | -ckd | -ckd3390 | -ckd3380 | -as400**
Filters the pool display to the specified emulation type.

**Examples**
To list details about all thin pools in array 087:

```
symcfg list -pool -sid 087 -thin -all -detail
```

**Sample output**

```
Symmetrix ID: 000197100087

SYM MET R I X T H I N  P O O L S
-------------------------------------------------------------------
Pool       Flags  Dev               Total     Usable       Free       Used
Name       PTECSL Config           Tracks     Tracks     Tracks     Tracks  (%)  (%)  (%)
------------ ------ ------------ ---------- ---------- ---------- ---------- ---- ---- ----
DG1_CKD10K  TFC-EI 2-Way Mir       6274800    6274800    6274800          0    0    0    0          0
DG1_FBA10K  TFF-EI 2-Way Mir      11536560   11536560    2469946    9066614   78    0    0          0
DG2_FBA7_2  TSF-EI RAID-5(3+1)     21546000   21546000    21546000          0    0    0          0
DG3_FBA7_2  TSF-EI 2-Way Mir        3591000    3591000    3591000          0    0    0          0
Total                             42948360   42948360   33881746    9066614   21    0    0          0

Legend:
(P)ool Type:
S = Snap,  R = Rdfa DSE  T = Thin
(T)echnology:
S = SATA, F = Fibre Channel, E = Enterprise Flash Drive, M = Mixed, = N/A
Dev (E)mulation:
F = FBA, A = AS400, 8 = CKD3380, 9 = CKD3390, = N/A
(C)ompression:
E = Enabled, D = Disabled, N = Enabling, S = Disabling, = N/A
(State:
E = Enabled, D = Disabled, B = Balancing
Disk (L)ocation:
I = Internal, X = External, M = Mixed, = N/A
```

**Note**
The pool State indicates whether there are any devices enabled in the pool.

**Show thin pool rebalancing**

**Syntax**
To show pool rebalancing parameters, use the following syntax:

```
symcfg show -thin -pool PoolName -detail -all -sid SymmID
```

**Note**
Pool rebalancing is for thin pools only and is not applicable to Snap or SRDF/A DSE pools.

**Examples**
To show pool rebalancing parameters for thin pool Mig_trg2 on array 432, enter:

```
symcfg show -pool Mig_trg2 -thin -sid 432 -all -detail
```
Sample output

Symmetrix ID: 000194900432
Symmetrix ID                     : 000194900432
Pool Name                        : Mig_trg2
Pool Type                        : Thin
Disk Location                    : External
Technology                       : N/A
Dev Emulation                    : FBA
Dev Configuration                : 2-Way Mir
Pool State                       : Enabled
Compression State                : Enabled
  # of Devices in Pool             : 10
  # of Enabled Devices in Pool     : 10
  # of Usable Tracks in Pool       : 99000
  # of Allocated Tracks in Pool    : 14081
  # of Thin Device Tracks          : 11549
  # of DSE Tracks                  : 2298
  # of Local Replication Tracks    : 234
  # of Tracks saved by compression : 0
  # of Shared Tracks in Pool       : 0
Pool Utilization (%)             : 3
Pool Compression Ratio (%)        : 0
Max. Subscription Percent        : N/A
Rebalance Variance               : N/A
Max devs per rebalance scan      : N/A
Pool Reserved Capacity           : N/A

Legend:
  Enabled devices FLG:
  (S)hared Tracks : X = Shared Tracks , . = No Shared Tracks
  Bound devices FLG:
  S(T)atus    : B = Bound, I = Binding, U = Unbinding, A = Allocating,
                 D = Deallocating, R = Reclaiming, C = Compressing,
                 N = Uncompressing, . = Unbound

Note
The FLG S flag field indicates whether or not there are shared allocations on each
device as noted in the above legend.

Table 22 Pool Rebalancing Parameters

<table>
<thead>
<tr>
<th>Pool Rebalancing Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rebalancing variance</td>
<td>Targets the device utilization variance for the rebalancing algorithm. The rebalancing algorithm attempts to level distribution of data in a pool so that the percentage utilization of any device in the pool is within the target variance of the percentage utilization of any other device in the pool.</td>
</tr>
<tr>
<td>Max devs per rebalance scan</td>
<td>Lists the maximum number of devices in a pool to use in the rebalancing algorithm. The default is 256.</td>
</tr>
</tbody>
</table>
List feature registrations and usage data

**Description**
The `symcfg list -feature` command lists feature class registrations and usage data for a specified array. Where appropriate, capacity types and limits are also displayed.

**Options**
- `-v`
  - Displays usage information.
- `-class`
  - Limits the feature display to a specified class of features.

**Examples**
To list feature class registrations for Local Replication class on array 341, enter:

```
symcfg list -feature -sid 341 -class Local Replication
```

**Sample output**

```
Symmetrix ID : 000194900341
Feature Name           : TimeFinder/Mirror
Feature Type           : Product
Feature Class          : Local Replication
Feature Capacity Type  : TB of Total Capacity
Feature Capacity       : 0
SATA Capacity          : 0
Enabled Status         : Disabled
Enabled Change Date    : 05-Jan-2011 17:10
Feature Name           : SYMM_TF_CLONE
Feature Type           : Product
Feature Class          : Local Replication
Feature Capacity Type  : TB of Registered Capacity
Feature Capacity       : 500
SATA Capacity          : 0
Enabled Status         : Disabled
Enabled Change Date    : 10-Mar-2011 14:32
Feature Name           : SYMM_TF_SNAP
Feature Type           : Product
Feature Class          : Local Replication
Feature Capacity Type  : TB of Total Capacity
Feature Capacity       : 100
SATA Capacity          : 500
Enabled Status         : Disabled
Enabled Change Date    : 10-Mar-2011 14:30
```

**Device-level data**

From the perspective of software running on a host system, an array is many *physical devices* connected to one or more I/O controllers. A host application addresses each of these devices using a physical device name. Each physical device defined in the configuration database has a specific set of attributes (such as vendor ID, product ID, revision level, and serial ID).
A device can map to a part of a physical disk or to an entire disk. The part of a physical disk to which a device is mapped is called a hypervolume or a hyper. A device may map to multiple hypers (containing identical copies of data) depending on its mirror configuration.

The array database file maintains device-level configuration and status information for each device on every array that is accessible from the host. Using SYMCLI, a list of all available devices can be displayed. The listed device data is used to obtain configuration and status information. This information identifies back-end information for the device's disk directors and corresponding hypervolumes, and their mappings to disk drives.

### Device types

SYMCLI defines and configures devices for numerous specialized roles defined as device types. Each device type has specialized characteristics that enables a device to participate in various SYMAPI operations.

<table>
<thead>
<tr>
<th>Device type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACLX devices</td>
<td>ACLX devices are device masking devices similar to VCM devices that are used for storage provisioning using auto-provisioning groups. VMAX3 arrays come pre-configured with one ACLX Device. The ACLX attribute will cannot be removed, and the ACLX devices cannot be created or deleted. The device will be visible to hosts at the LUN Address configured in the ACLX Device Lun address global configuration, and zero is the default value. The ACLX device is only visible on front end ports where the Show_ACLX_Device port attribute is enabled.</td>
</tr>
<tr>
<td>Data Domain devices</td>
<td>An encapsulated Data Domain device.</td>
</tr>
<tr>
<td>Gatekeeper devices</td>
<td>Gatekeeper devices are LUNs that act as the target of command requests to microcode-based functionality. For detailed information on gatekeeper management, refer to the EMC Solutions Enabler Installation Guide.</td>
</tr>
<tr>
<td>RDF devices</td>
<td>Devices configured as RDF1, RDF2, or RDF21 to support SRDF operations. SRDF is a business continuance solution that maintains a device-level mirror of array data on remotely attached arrays. These arrays also may be located in physically separate sites. SRDF provides a recovery solution for component or site failures using remotely mirrored devices. SRDF reduces backup and recovery costs and significantly reduces</td>
</tr>
</tbody>
</table>

Device types
### Device type

<table>
<thead>
<tr>
<th>Device type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin devices (TDEV)</td>
<td>Thin devices used for Thin Provisioning are devices that do not have storage allocated to them when they are created. To a host operating system, they look like regular devices with their configured capacity. The host treats them as regular devices and writes and reads from these devices like regular devices.</td>
</tr>
<tr>
<td>RecoverPoint Splitter devices</td>
<td>Devices that are in use by the RecoverPoint Splitter. With HYPERMAX OS 5977, indicates the specific RecoverPoint device type as production, replica or internal.</td>
</tr>
</tbody>
</table>

### List array device information

**Description**

Use the following two commands to list information about array devices:

- **sympd** — Lists array devices that are host-visible.
- **symdev** — Displays information about all array devices, host-visible or not.

**Syntax**

To list host-visible devices, use the following syntax:

```
sympd [-offline] [-sid <SymmID>] [-v]
    list [-resv]
    list [-DA <#|ALL>] [-interface <#|ALL>] [-hyper <#|ALL>] [-spindle]
    list [-DX <#|ALL] [-spindle]
    list [-vm]
```

**Options**

- **-sid**
  
  Limit the device output to a specific array.

- **-DA**
  
  List host-visible array devices that match a specific DA.

- **-DX**
  
  Lists host-visible array devices that match a specific DX.

- **-interface**
Lists host-visible array devices that match a specific interface.

-disk
Lists host-visible array devices that match a specific disk.

-hyper
Lists host-visible array devices that match a specific hyper-volume.

-spindle
Includes Spindle ID Information.

-vm
Displays valid virtual machine names on VMware ESX server environments.

-SA
List the host-visible array devices that match a specific front-end director number.

-P #
List the host-visible array devices that match a specific front-end director port number.

-scsi
List the host-visible array devices that are mapped to SCSI front-end directors.

-fibre
List the host-visible array devices that are mapped to Fibre front-end directors.

-ficon
List the host-visible array devices that are mapped to FICON front-end directors.

-escon
List the host-visible array devices that are mapped to ESCON front-end directors.

-gige
List the host-visible array devices that are mapped to Gig-E front-end directors.

---

**Note**
The `sympd` command only provides a limited amount of filter options. Use the `symdev list pd` command for additional filter options on physical devices. Refer to Filter list for device data on page 447 for more information.

---

**Examples**
To list host-visible array devices that match a front-end director 07E for array 064, enter:

```
sympd list -SA 7E -sid 064
```
Sample output
Array device names are listed in the Sym column.

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100064</th>
<th>Device Name</th>
<th>Dir</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sdt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/dev/sdu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/dev/sdv</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Report spindle ID information

The following commands report spindle ID information:

- sympd show
- sympd list -v
- symdev list
- symdev show

**sympd show**

- For all but unprotected devices, the spindle ID reports as part of the RAID Group Information section.
- For unprotected devices, the spindle ID reports in both the RAID Group Information section and the Back-end Disk Director Information section.
- For non-RAID devices (VAULT devices), spindle IDs report in the Back-end Disk Director Information section.

**sympd list -v**

Reports spindle ID information as part of both the back-end disk director Information section and the RAID group Information section.

**symdev list**

- Lists host-visible array devices for the following specified values:
  - DA (-da)
  - DX (-dx)
  - interface (-interface)
  - disk (-disk)
  - hyper-volume (-hyper)
- When specified along with the -spindle option, the reports Spindle ID information.

**symdev show**

- For all but unprotected devices, the spindle ID reports as part of the RAID Group Information section.
- For unprotected devices, the spindle ID reports in both the RAID Group Information and the Back-end Disk Director Information section.
For non-RAID devices (VAULT devices), spindle IDs report in the Back-end Disk Director Information section.

Provides similar output as the `sympd` command, but includes all array devices and lists them by array device names.

External spindle devices

FAST.X allows for an external disk to attach external storage to VMAX Family arrays. Adding an eDisk to an array makes the eDisk's capacity available to the array as an external spindle. For more information on FAST.X refer to FAST.X on page 343.

Use the `symdev list` command with the `-external` option to list information about eDisks (external spindles).

FAST.X is limited to the following:

- Virtual provisioning encapsulation of Data Domain eDisks for ProtectPoint.
  - The `symdev list` command includes a new Encapsulated Device Flags field to indicate when an encapsulated device is a Data Domain device.
  - A device status of Not Ready for a Data Domain device indicates that the device is Not Ready because it is specified as the target of an image refresh.
- External provisioning for XtremIO, VNX, VMAX and some third party arrays.

List external spindles

Syntax

To list external spindles, use the following syntax:

```
```

```
list [-FA <#|ALL> [-P <#>]]
    -SA <#|ALL> [-scsi] [-fibre] [-P <#>]]
     . . .
[-technology <EFD | FC | SATA>]
    [-internal | -external | -encapsulated [-limited]]
list pd [-FA <#|ALL> [-P <#>]]
    -SA <#|ALL> [-scsi] [-fibre] [-P <#>]]
     . . .
[-technology <EFD | FC | SATA>]
    [-internal | -external | -encapsulated [-limited]]
symdev [-sid SymmID] [-offline]
      list [-DA <#|ALL> | -DX <#|ALL>] -space [-cyl]
          [-spindle]
      list [-DA <#|ALL>] [-interface <#|ALL>]
          [-disk <#|ALL>] [-hyper <#|ALL>] [-firstport]
          [-spindle] [-internal]
      list [-DX <#|ALL>] [-hyper <#|ALL>]
          [-spindle] [-external]
```

Options

- **-DX**
  Lists devices on a specific external director (DX) or all DX directors. The existing DA option only shows devices on an internal DA director.

- **-internal**
Lists devices on internal spindles. TDEV, VDEV and DLDEV devices are not considered either internal or external and are not returned by this option, and is abbreviated as -int.

-external
Lists devices on external spindles. TDEV, VDEV and DLDEV devices are not considered either internal or external and are not returned by this option, and is abbreviated as -ext.

-encapsulated
Lists encapsulated devices, and abbreviated as -enc.

-limited
Lists devices that are geometry limited. These two options can also be used to report which TDEVs are considered encapsulated or geometry limited.

Note
The symdisk list command also provides options for listing external spindle information. For more information, also refer to External spindle information on page 459.

List RAID group information

Description
The symdev command indicates whether a rebuild or copy is in progress for a member of a device's RAID groups. The RAID Group Information section includes an additional indicator under the Status column, which displays when a specific member is undergoing one of the following:

- Rebuild — (R)
- Member copy — (C)
- Failed state — (F)

Examples
To list if a rebuild or copy is in progress for a member of the RAID groups for device 00050, enter:

```
symdev show 00050 -sid 123
```

Sample output

```
Device Service State          : Normal
RAID Group Information
RAID Group Service State      : Normal

Device : 00050
Spindle Disk Hyper Member Mir Attr
DA :IT Num Cap(MB) Num Status
-----------------------------------------------
```
Report PowerPath device status

Description
Use the -ppi option with the symdev list command to display PowerPath mount status of array devices.

Syntax
To display PowerPath mount status of array devices, use the following syntax:

```
symdev list -ppi [-sid SymmID]
```

Examples
To list PowerPath device status on array 789, enter:

```
symdev list -ppi -sid 789
```

Sample output

Symmextrix ID: 000198700789

**POWERPATH DEVICE STATUS**

<table>
<thead>
<tr>
<th>Device</th>
<th>Last Used</th>
<th>Mounted</th>
<th>Hostname</th>
<th>Process name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001F</td>
<td>06/29/17 08:46:51</td>
<td>Yes</td>
<td>Host_A</td>
<td>RedoLog</td>
</tr>
<tr>
<td>00341</td>
<td>06/29/17 08:47:52</td>
<td>No</td>
<td>Host_B</td>
<td>DBWrite</td>
</tr>
</tbody>
</table>

Report devices with non-native WWN

Description
Use the -wwn_non_native option with the symdev list command and symdev show command to list or show devices with Device External Identity set to non-native WWN.

Syntax
To list devices with Device External Identity set to non-native WWN, use the following syntax:

```
symdev [-sid SymmID] list -wwn_non_native
```

To show a device with Device External Identity set to non-native WWN, use the following syntax

**Syntax - symdev show**

To show a device with Device External Identity set to non-native WWN, use the following syntax:

```
symdev show -wwn_non_native <WWN>
```
Examples

To list all the devices on array 085 with a non-native WWN, enter:

```
symdev -sid 085 list -wwn_non_native
```

To show an external WWN for device 60000970000196801476533030314245, enter:

```
symdev show -wwn_non_native 60000970000196801476533030314245
```

Sample output

For symdev list:

```
Symmetrix ID: 000197100085

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sym   Physical</td>
<td>Config Attr Non-Native WWN</td>
</tr>
<tr>
<td>0003D Not Visible</td>
<td>RDF2+TDEV 60000970000196801476533030313831</td>
</tr>
<tr>
<td>0003E Not Visible</td>
<td>RDF2+TDEV 60000970000196801476533030313832</td>
</tr>
<tr>
<td>0005E Not Visible</td>
<td>RDF2+TDEV 60000970000196801476533030313833</td>
</tr>
</tbody>
</table>
```

For symdev show:

```
Symmetrix ID: 000194901137

  Device Physical Name     : Not Visible
  Device Symmetrix Name    : 01AD4
  Device Serial ID         : N/A
  Symmetrix ID             : 000194901137
  Product Revision         : 5977
  Device WWN               : 60000970000194901137533031414434
  Device Emulation Type    : FBA
  Device External Identity |
    Device WWN             : 60000970000196801476533030314245
```

Change the device state

Syntax

To change the device state, set or reset the hold bit on a device, or relabel a device, use the following syntax:

```
```
Change device state using filename

**Syntax**
To change the device state of multiple devices listed in a file, use the following syntax:

```
symdev -sid SymmID -file FileName
    [-noprompt] [-celerra] [-star]
  rw_enable [-SA <#|ALL> [-P <#>]
write_disable [-SA <#|ALL> [-P <#>]
ready
not_ready
relabel
hold
unhold [-symforce]
```

**View device service states**

**Description**
The `symdev list` and `symdev list pd` commands provide options that return data that is limited to a specific service state.

**Options**
- `-service_state`
  Returns list of devices one of the following states:
  - Normal
  - Failed
  - Degraded — Indicates if one or more mirror positions of the protected device are not ready.

  To list service states not in a particular state use "not" such as, `notfailed`.

**Examples**
To list all devices on array 097 that are in a `normal` state, enter:

```
symdev list -service_state normal -sid 097
```
to list all devices on array 097 that are not failed service state, enter:

```
symdev list pd -service_state notfailed -sid 097
```

**Device emulation**

All host I/O transactions with an array of disk devices are managed by the array operating system, which runs in the array I/O subsystem (channel directors and disk directors). Because each of the physical disks are indirectly seen as part of the I/O protocol, array devices are presented to the host with the following configuration or emulation attributes:

- Each device has N cylinders. The number is configurable (blocks ÷ 960).
- Each cylinder has 15 tracks (heads).
- Each device track in a fixed block architecture (FBA) has 64 blocks of 64K. (For non-FBA operating systems, the blocks are recognized without regard to the number of bytes.)

**List device emulation types**

**Examples**

To return a list of configured devices by emulation type for array 3139, enter:

```
symdev list -inventory -sid 3139
```

**Sample input**

<table>
<thead>
<tr>
<th>Symmetrix ID: 000192603139</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Config</td>
</tr>
<tr>
<td>Unprotected</td>
</tr>
<tr>
<td>2-Way Mir</td>
</tr>
<tr>
<td>RAID-5</td>
</tr>
<tr>
<td>RAID-6</td>
</tr>
<tr>
<td>TDEV</td>
</tr>
<tr>
<td>DLDEV</td>
</tr>
<tr>
<td>RDF1+Mir</td>
</tr>
<tr>
<td>RDF1+R-6</td>
</tr>
<tr>
<td>RDF1+DLDEV</td>
</tr>
<tr>
<td>RDF2+Mir</td>
</tr>
<tr>
<td>RDF2+R-5</td>
</tr>
<tr>
<td>RDF2+R-6</td>
</tr>
<tr>
<td>RDF21+R-5</td>
</tr>
<tr>
<td>RDF21+TDEV</td>
</tr>
<tr>
<td>BCV</td>
</tr>
<tr>
<td>2-Way BCV Mir</td>
</tr>
<tr>
<td>BCV+R-5</td>
</tr>
<tr>
<td>BCV+R-6</td>
</tr>
<tr>
<td>2-Way DRV Mir</td>
</tr>
<tr>
<td>VDEV</td>
</tr>
<tr>
<td>BCV+TDEV</td>
</tr>
</tbody>
</table>
Show device details

Examples
To details for device 8423 on array 584, enter:

```
symdev show 8423 -sid 584
```

Sample output

```
... Mirror Configuration Information
    { Mirror Number : 1
      Mirror Type : RAID-6
      Mirror Status : Ready (RW)
    }
RAID Group Information
    { Mirror Number : 1
      RAID Type : RAID-6
      Device Position : Primary
      Protection Level : 6+2
      Disk Group Number : 1
      Disk Group Name : DISK_GROUP_001
      Engine Number : Multiple
      RAID Group Service State : Normal
      Number of Failing Members : 0
      Member Information:
        { Device : 8423
          Spindle Disk Hyper Member Mir Attr
            DA :IT Num Cap(MB) Num Status
            --------------------------------------------------
            12FC 09C:D1 10 699 1 RW  1 N/A
            120C 07C:D1  9 699 2 RW  1 N/A
            111C 05C:D1  9 699 3 RW  1 N/A
            198C 07D:D0  9 699 4 RW  1 N/A
            1A7C 09D:D0  9 699 5 RW  1 N/A
            960  05B:C1 10 699 6 RW  1 N/A
            438  10A:C1 10 699 7 RW  1 N/A
            1914 06D:D1 10 699 8 RW  1 N/A
```

Show clone state flags

The following CLI list and show commands report the Clone State Flags:

- `symdev show`
- `symdev list -v`
- `sympd list -v`
- `sympd show`
- `symdg show ld`
- `symdg list ld -v`
- `symcg show ld`
Show disk geometry details

Examples
To show disk geometry for device 0016 on array 516, enter:

symdev show 0516 -geometry -sid 516

Sample output

Note
If the array-wide setting is turned on, the geometry at the individual device level can be defined which overrides the array-wide setting. In addition, for non-FBA devices, the output displays N/A with the -v and the -geometry options.

<table>
<thead>
<tr>
<th>Device Physical Name</th>
<th>/dev/sdd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Symmetrix Name</td>
<td>00516</td>
</tr>
<tr>
<td>Device Serial ID</td>
<td>1600016000</td>
</tr>
<tr>
<td>Symmetrix ID</td>
<td>000190300516</td>
</tr>
<tr>
<td>Attached BCV Device</td>
<td>N/A</td>
</tr>
<tr>
<td>Attached VDEV TGT Device</td>
<td>N/A</td>
</tr>
<tr>
<td>Vendor ID</td>
<td>EMC</td>
</tr>
<tr>
<td>Product ID</td>
<td>SYMMETRIX</td>
</tr>
<tr>
<td>Product Revision</td>
<td>5977</td>
</tr>
<tr>
<td>Device WWN</td>
<td>60060480000190305165330303136</td>
</tr>
<tr>
<td>Device Emulation Type</td>
<td>FBA</td>
</tr>
<tr>
<td>Device Defined Label Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Device Defined Label</td>
<td>N/A</td>
</tr>
<tr>
<td>Device Sub System Id</td>
<td>0x0001</td>
</tr>
<tr>
<td>Device Block Size</td>
<td>512</td>
</tr>
<tr>
<td>Device Capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cylinders: 4400</td>
</tr>
<tr>
<td></td>
<td>Tracks: 66000</td>
</tr>
<tr>
<td></td>
<td>512-byte Blocks: 4224000</td>
</tr>
<tr>
<td></td>
<td>MegaBytes: 2063</td>
</tr>
<tr>
<td></td>
<td>KiloBytes: 2112000</td>
</tr>
<tr>
<td>Effective Device Geometry: User Defined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sectors/Track: 128</td>
</tr>
<tr>
<td></td>
<td>Tracks/Cylinder: 15</td>
</tr>
<tr>
<td></td>
<td>Cylinders: 2000</td>
</tr>
<tr>
<td></td>
<td>512-byte Blocks: 3840000</td>
</tr>
<tr>
<td></td>
<td>MegaBytes: 1875</td>
</tr>
<tr>
<td></td>
<td>KiloBytes: 1920000</td>
</tr>
<tr>
<td>Device Configuration: RDF1 (Non-Exclusive Access)</td>
<td></td>
</tr>
<tr>
<td>Device is WORM Enabled</td>
<td>No</td>
</tr>
<tr>
<td>Device is WORM Protected</td>
<td>No</td>
</tr>
<tr>
<td>SCSI-3 Persistent Reserve: Disabled</td>
<td></td>
</tr>
<tr>
<td>Dynamic Spare Invoked</td>
<td>No</td>
</tr>
<tr>
<td>Dynamic RDF Capability</td>
<td>None</td>
</tr>
<tr>
<td>STAR Mode: No</td>
<td></td>
</tr>
<tr>
<td>STAR Recovery Capability: Sync_Tgt</td>
<td></td>
</tr>
<tr>
<td>STAR Recovery State: Inactive</td>
<td></td>
</tr>
<tr>
<td>Device Service State: Normal</td>
<td></td>
</tr>
<tr>
<td>Device Status: Not Ready (NR)</td>
<td></td>
</tr>
<tr>
<td>Device SA Status: Ready (RW)</td>
<td></td>
</tr>
<tr>
<td>Front Director Paths (2):</td>
<td></td>
</tr>
</tbody>
</table>
Output display

The **Effective Device Geometry** field has the following possible values:

- **User Defined** — Indicates the user has defined geometry for this device.
- **Native** — Indicates the current device geometry is the same as the native geometry for the array.
- **Array wide emulation** — Indicates that the array-wide flag for FBA geometry emulation is set to enabled and the effective geometry shown in the output is derived from this setting.

List DATA and SAVE devices

**Syntax**

To list DATA and SAVE pool device details, use the following syntax:

```
  symcfg [-sid SymmID] [-offline] [-mb | -gb]
  list [-savedevs [-fba] [-ckd3390] [-ckd3380] [-as400]
       [-nonpooled]
       [-devs [SymDevStart:SymDevEnd | SymDevName]
       [,SymDevStart:SymDevEnd | SymDevName...]]

  list [-datadev [-fba] [-nonpooled]
       [-devs [SymDevStart:SymDevEnd | SymDevName]
       [,SymDevStart:SymDevEnd | SymDevName...]]
```

**Note**

When the `symcfg list` command is used to return pool information, the returned data includes pools that are currently associated with the group, or pools that have been disassociated from the group but still have the group's data.

**Options**

- **-all**
  
  Includes both enabled and disabled devices in the calculations of **Free Tracks** and **Full %**, and the **Full %** is based on the **Usable Tracks**. Otherwise, only enabled devices are included. Without the **-all** option, the **Free Tracks** field includes free tracks from all enabled devices, and the **Full %** field is based on the enabled tracks.

- **-devs**
  
  Filters for specific devices or device range.

- **-nonpooled**
  
  Filters for nonpooled devices.

**Examples**

To return a list of DATA devices for array 237, enter:

```
symcfg list -sid 237 -datadev
```

List thin device information

**Description**

In addition to listing thin devices on an array, use the `symcfg list -dev` command to monitor the progress of space reclamation. The **Reclaiming status** indicates the
thin device is in the process of being reclaimed and the **Total Allocated Tracks (%)** adjusts as space is reclaimed.

**Syntax**
To list thin devices in an array, use the following syntax:

```bash
```

**Options**
- **-tdev**
  Lists the thin devices in the system.
- **-bound**
  Lists thin devices bound to a pool.
- **-unbound**
  Lists thin devices that are unbound.

**Examples**
To list the thin devices on array 341, enter:

```bash
symcfg list -tdev -sid 341
```

**Sample output**

**Note**
The columns **Total Allocated Tracks (%)** displays the percentage of the entire thin device allocated.
List thin device tier allocations

Examples

To list tier allocations for thin devices on array 341, enter:

```
symcfg list -tdev -sid 341 -tier
```

Sample output

Lists both technology and disk locations for the tiers.

```
Symmetrix ID: 000194900341

SYM METER Exiting Thin Devices

<table>
<thead>
<tr>
<th>Sym Emul</th>
<th>Total Tracks</th>
<th>Allocated Tracks (%)</th>
<th>Flag</th>
<th>LT Protection</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>01078 FBA</td>
<td>33000</td>
<td>0</td>
<td>IF</td>
<td>RAID-5(3+1)</td>
<td>FC_R5_VPTier</td>
</tr>
<tr>
<td>01079 FBA</td>
<td>33000</td>
<td>0</td>
<td>IF</td>
<td>RAID-6(6+2)</td>
<td>SATA_R6_VPTier</td>
</tr>
<tr>
<td>010EC FBA</td>
<td>33000</td>
<td>132</td>
<td>IF</td>
<td>RAID-6(14+2)</td>
<td>FC_R6_VPTier</td>
</tr>
<tr>
<td>010EE FBA</td>
<td>33000</td>
<td>0</td>
<td>IF</td>
<td>RAID-6(14+2)</td>
<td>Finance_VPTier</td>
</tr>
<tr>
<td>01128 FBA</td>
<td>8010</td>
<td>24</td>
<td>IF</td>
<td>RAID-6(14+2)</td>
<td>Finance_VPTier</td>
</tr>
<tr>
<td>011A2 FBA</td>
<td>33000</td>
<td>216</td>
<td>IF</td>
<td>RAID-6(14+2)</td>
<td>Finance_VPTier</td>
</tr>
</tbody>
</table>

Total Tracks: 240510 Allocated: 536

Legend:

- Disk (L)ocation: I = Internal, X = External, M = Mixed, - = N/A
- (T)echnology: S = SATA, F = Fibre Channel, E = Enterprise Flash Drive, M = Mixed, - = N/A

List thin devices in a pool

Examples

To display a list of thin devices in pool HR_THIN_R5, enter:

```
symcfg -sid 343 list -tdev -pool HR_THIN_R5
```

Show thin BCV devices with dynamic SRDF capability

Examples

To show device 15F9 on array 397, enter:

```
symdev show 15F9 -sid 397
```
Sample output

Device Configuration displays device 15F9 as BCV+TDEV and Dynamic RDF Capability as RDF1_OR_RDF2_Capable.

<table>
<thead>
<tr>
<th>Device Physical Name</th>
<th>Not Visible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Symmetrix Name</td>
<td>015F9</td>
</tr>
<tr>
<td>Device Serial ID</td>
<td>N/A</td>
</tr>
<tr>
<td>Symmetrix ID</td>
<td>000194900397</td>
</tr>
<tr>
<td>Number of RAID Groups</td>
<td>0</td>
</tr>
<tr>
<td>Attached VDEV TGT Device</td>
<td>N/A</td>
</tr>
<tr>
<td>Vendor ID</td>
<td>EMC</td>
</tr>
<tr>
<td>Product ID</td>
<td>SYMMETRIX</td>
</tr>
<tr>
<td>Product Revision</td>
<td>5977</td>
</tr>
<tr>
<td>Device WWN</td>
<td>6000097000019490039753031354639</td>
</tr>
<tr>
<td>Device Emulation Type</td>
<td>FBA</td>
</tr>
<tr>
<td>Device Defined Label Type</td>
<td>N/A</td>
</tr>
<tr>
<td>Device Defined Label</td>
<td>N/A</td>
</tr>
<tr>
<td>Device Sub System Id</td>
<td>0x0016</td>
</tr>
<tr>
<td>Cache Partition Name</td>
<td>DEFAULT_PARTITION</td>
</tr>
<tr>
<td>Bound Pool Name</td>
<td>N/A</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Device Configuration</td>
<td>BCV+TDEV</td>
</tr>
<tr>
<td>Device is WORM Enabled</td>
<td>No</td>
</tr>
<tr>
<td>Device is WORM Protected</td>
<td>No</td>
</tr>
<tr>
<td>SCSI-3 Persistent Reserve</td>
<td>Enabled</td>
</tr>
<tr>
<td>Dynamic Spare Invoked</td>
<td>No</td>
</tr>
<tr>
<td>Dynamic RDF Capability</td>
<td>RDF1_OR_RDF2_Capable</td>
</tr>
</tbody>
</table>

Note

Bound Pool Name will be reported as N/A for an encapsulated device.

List data allocations across multiple pools

Options

-detailed

Lists thin devices and all the pools where tracks are allocated to these devices.

Examples

```
symcfg -sid 397 -devs 1620:1630 list -tdev -detail
```

Sample output

```
Symmetrix ID: 000195700397
Enabled Capacity (Tracks) : 2884812
Bound Capacity (Tracks) : 20700

SYM M E T R I X  T H I N  D E V I C E S
-------------------------------------------------------------------------------------
Bound  Pool Name  Flgs  Total  Subs  Allocated  Size/Ratio
Sym Pool Name  ESPT  Tracks (%)  Tracks (%) Tracks (%)
---- ------------- ------ ---------- ----------- -----------
1623 testCust  F.B  14700  13  2400  16  1692  30
  test_pool    ---- - - - - - -
1625 - 8... 1500 0 0 0 0
1626 - 8... 1500 0 0 0 0
1627 - 8... 1500 0 0 0 0
```

Configuration Query Operations
Show details about thin pools

Options

- **detail**
  Shows details about a Thin Provisioning pool.

- **all**
  Shows the disabled devices in the pool.

Examples

To show details about thin pool DG1_FBA_PL on array 086, enter:

```
symcfg show -pool DG1_FBA_PL -thin -detail -sid 086
```

Sample output

The Pool State displays as **Enabled**, **Disabled**, or **Balancing**. If the Thin Provisioning pool is enabled and the write balancing feature is turned on, the Pool State displays as **Balancing**. A thin device status of **Reclaiming** indicates the thin devices are in the process space reclamation.

Any thin devices bound to a specified pool are listed along with thin devices that have allocated tracks within the pool but are not bound to that pool, displays in Other Thin Devices with Allocations in this Pool.

```
Pool Name                        : DG1_FBA_PL
Pool Type                        : Thin

Enabled Devices(208):

<table>
<thead>
<tr>
<th>Sym</th>
<th>Usable</th>
<th>Alloc</th>
<th>Free Full</th>
<th>FLG</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>1FF30</td>
<td>274680</td>
<td>96</td>
<td>274680</td>
<td>3</td>
<td>.</td>
</tr>
<tr>
<td>1FF31</td>
<td>274680</td>
<td>96</td>
<td>274680</td>
<td>3</td>
<td>.</td>
</tr>
</tbody>
</table>

Tracks                                  | 1056000  | 40332   | 1054646  | 3   |
```

No Thin Devices Bound to Device Pool DG1_FBA_PL

Other Thin Devices with Allocations in this Pool (3):

Nothing listed.
### Verify thin and DATA device states

#### Description

More than one type of device state may be queried. All devices must be in any of the requested states for the verification to succeed. Normally, the command executes a single poll and exits with status 0 (all devices in requested state) or nonzero status indicating which devices were not ready. A message, such as, "One or more of the specified devices are not in the requested state", returns.

#### Syntax

To verify the state of thin or DATA devices, use the following syntax:

```bash
symcfg -sid SymmID [-i Interval] [-c Count]
[-pool PoolName] |
-g DgName | 
-sg SgName | 
-cg CgName | 
-devs SymDevStart:SymDevEnd | SymDevName[,SymDevStart:SymDevEnd | SymDevName...]symcfg verify -tdev
[-bound | -binding | -allocating | -deallocating | 
-unbound | -unbinding | -reclaiming]
    symcfg verify -datadev
[-draining | -drainwait | -disabled | -enabled | 
-deactivated | -nonpooled | -balancing]
```

#### Options

- **-devs**
  
  Specifies the status of single or multiple devices.

- **-pool**
  
  Returns all thin or DATA devices within a pool and must be in one of the requested states to pass verification.
-i
Specifies the polling rate. The default minimum interval value used for calculating the action is 15 seconds. A message displays at each poll. If the -i option is used without the -c option, the command loops infinitely, exiting only when all devices are in the correct state (or when manually interrupted).

-c
Specifies the numbers of polls to be executed. The command terminates at the end of the count or when all devices are in the correct state.

Verify device usage

Examples
To check once to see if all of the DATA devices in a pool (devpool) on array 1234 are disabled, enter:

    symcfg -sid 1234 verify -datadev -pool devpool -disabled

To continually check the status of a thin device (5AC) on array 1234 and exit the loop when it enters a bound state, enter:

    symcfg -sid 1234 verify -tdev -dev 5ac -bound -I 5

Migrated devices

Use the symdev list and symdev show commands to provide information about devices that are changed or virtualized during a migration.

List changed devices after migration

Options
-identity_set
    Displays the devices whose effective identity changed after a migrate operation.

Examples
To display the devices with identity change on array 207, enter:

    symdev -sid 207 -identity_set list

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000192600207</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Name</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Sym</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0477 /dev/sddv</td>
</tr>
</tbody>
</table>
List virtualized devices

Options

-identity

Displays the effective identity information of devices that are virtualized during a migrate operation.

Examples

To list identity information of migrated device 0477 on array 207, enter:

```
symdev -sid 207 -identity show 0477
```

Sample output

```
Device Physical Name     : Not Visible
Device Symmetrix Name    : 00477
Device Serial ID         : N/A
Symmetrix ID             : 000192600207
Number of RAID Groups    : 1
Attached BCV Device      : N/A
Attached VDEV TGT Device : N/A
Vendor ID                : EMC
Product ID               : SYMMETRIX
Product Revision         : 5825
Device WWN               : 60000970000192600207533030313732
Device Emulation Type    : FBA
Device Defined Label Type: N/A
Device Defined Label     : N/A
Device Sub System Id     : 0x0001
Cache Partition Name     : DEFAULT_PARTITION
Device Block Size        : 512
Device Capacity
Cylinders            :        960
Tracks               :      14400
512-byte Blocks      :    1843200
MegaBytes            :        900
KiloBytes            :     921600
Effective Device Information
Device WWN           : 60000970000192600306533030313732

Front Director Paths (12): (See note below)
-----------------------------------------------
DIRECTOR   PORT             LUN
----------  ---- -------- ---------
Type Num    Sts  VBUS TID SYMM Host
-----------------------------------------------
FA N/A  07E:3  RW   000  00  247  N/A
FA N/A  07F:3  RW   000  00  247  N/A

Geometry: User Defined
{
Sectors/Track   :    64
Tracks/Cylinder :      15
Cylinders       :       200
512-byte Blocks :    192000
MegaBytes       :       94
KiloBytes       :     96000
Device Configuration : Unprotected
Device is WORM Enabled: No
Device is WORM Protected: No
SCSI-3 Persistent Reserve: Disabled
Dynamic Spare Invoked : No
Dynamic RDF Capability : RDF1_OR_RDF2_Capable
```
**Filter list for device data**

**Description**

The `symdev list` and `symdev list pd` commands return a list of devices configured in one or more arrays connected to the controlling host. The `pd` qualifier returns only physical devices, and must appear after the list action on the command line, and is valid with all the `symdev list` options.

**Options**

- `all`
  
  Lists all configured devices.

**Syntax**

To list device information with filter options, use the following syntax:

```
  [-wwn | -wwn_encapsulated [-detail]] [-all]
  list [ -FA <#/ALL> [-p <#> ] |......
```

For more information on device list filter options, refer to the *EMC Solutions Enabler SYMCLI Command Reference.*
Configuration Query Operations

Filter device list by director

- **SA #**
  Lists devices by a specific front-end director number.

- **-p #**
  Lists devices by a specific front-end director port number.

- **-scsi**
  Lists devices mapped to SCSI front-end directors.

- **-fibre**
  Lists devices mapped to Fibre front-end directors.

Filter device list by director port mapping

- **-multiport**
  Lists devices mapped to more than one front-end director port.

- **-noport**
  Lists devices not mapped to any front-end director port.

- **-firstport**
  Lists first port information for devices with more than one port mapping schemas.

  If none of these options are specified, then devices with all director-port relationships return.
Filter device list by metadevice

- **meta**
  Lists meta member devices.

- **nonmember**
  Lists only meta head devices.

Filter device list by SRDF devices

- **R1**
  Lists all SRDF R1 devices.

- **R2**
  Lists all SRDF R2 devices.

- **R21**
  Lists all SRDF R21 devices. The -R21 option is not currently supported in conjunction with the -dynamic option.

- **rdfg**
  Lists only devices belonging to the specified SRDF group number (RdfGrpNum).

- **rdfa**
  Lists all SRDF/Asynchronous capable devices.

- **half_pair**
  List all devices that are not paired with an SRDF device. Existing half pair devices can result from an SRDF/Star failover scenario, a half_deletepair operation, or a configuration change.

- **dup_pair**
  Lists all devices that are paired with the same SRDF type. Existing duplicate pair devices can result from a SRDF/Star failover scenario or a configuration change.

- **notrdf**
  Lists all dynamic capable devices that are not SRDF devices. Use this option to identify non-SRDF devices that have dynamic SRDF capability. In addition, use this option with the -R1, -R2, and -R21 device options to include non-RDF devices in the list along with these specified devices.

---

**Note**

Refer to the *EMC Solutions Enabler SRDF Family CLI Product Guide* for detailed information on SRDF device types and failover configurations.

---

Filter device list by RAID information

- **raids**
  Lists RAID-S devices by by RAID group number. The RAID option lists the same information. When viewing device output for RAID-5 devices, the total device capacity (Device Capacity) is displaying the total logical capacity, and the
hyper capacity (Hyper Num Cap) is displaying, for each member, the physical capacity which includes all device space—available and unavailable.

Filter device list by technology type
-technology
Lists the drive technology (FC, EFD, and SATA) of the primary local back-end storage of the device.

Filtering device list by DA, interface, disk, or hypervolume
-da, -dx, -interface, -disk, -disk_group, -hyper
Lists specified DAs, DXs, interfaces, disks, disk groups or hypers. These options default to ALL if not specified.

Filtering by storage group
-sg
Lists devices by specified storage group. This option defaults to ALL if not specified.

Filtering by devices in data migration
-dm
Lists array devices that are in data migration session.

Filter device list by DIF1 attribute
-dif1
Lists device DIF1 attribute status. The Data Integrity Field (DIF) is a setting on a device that is relevant to an Oracle environment and all hosts that support the DIF protocol. If the DIF1 attribute is set on a device, it displays as TRUE or FALSE.

Restrictions
- DIF1 attribute can only be set on FBA devices.
- DIF1 attribute can be set on both standard provisioned (thick) and virtually provisioned (thin) host accessible devices, setting the DIF1 attribute request on any internal devices will be rejected.
- Devices must be unmapped while resetting the DIF1 attribute.
- Devices can be mapped to only fiber front end directors (no iSCSI or FCoE) while setting the DIF1 attribute.
- If a device has DIF1 attribute already set, it can be mapped only to fiber front end directors (no iSCSI or FCoE).
- If creating a meta device, both the head and members need to have the DIF1 attribute in the same state (either all set or all reset).
- DIF1 attribute needs to be set before requesting reset. If the reset request is for a device range and if any one of the device has the DIF1 attribute not set, then the request fails.
- DIF1 attribute can not be set on DATA and SAVE devices.
- Devices can only have the RDB_Checksum attribute or the DIF1 attribute set, but not both.
- The DIF1 flag cannot be set on a device having active DCS.
- Devices can only have the ACLX attribute or the DIF1 attribute set, but not both.
- There is no relationship between the DIF1 attribute and replication. Both source and target devices of any replication can have their own DIF1 setting.

**Device list capacity output options**

- **-cyl**
  Lists device capacity in cylinders rather than the default of megabytes (MB).
- **-pd**
  Lists only the host visible devices (pdevs).

**Device external locks**

Solutions Enabler uses *device external locks* in the array to lock pairs during replication operations (such as Open Replicator, TimeFinder, and SRDF operations).

**NOTICE**

Use the release lock action only if it is determined that the device lock was forgotten and there are NO other operations in progress to the specified devices (local or remote). Locks are typically of short duration (one second to an hour or so). However, it is critical to be able to recognize when a device lock held by certain applications (such as an SRDF action) are longer duration locks.

**List devices with external lock**

**Examples**

To list a range of devices (0000:000A) that have a device external lock, enter:

```
symdev list -sid 870 -devs 0000:000A -lock
```

**Release devices with external lock**

**Examples**

To release the locks held by the configuration server for device 204 on array 343, enter:

```
symdev release -sid 343 devs 204
```

Within Symmetrix unit 000190300343, release lock for device 204 (y/ [n]) ? y

Device lock is held by a migration session <654>. The session should be aborted to release the lock.

**Note**

Aborting the session, if successful, releases all locks held by the session including device locks.
Disk-level data

The configuration database file maintains low-level configuration and status information for each disk on every array that are accessible from the host, including external spindles (eDisks). Use the symdisk list and symdisk show commands, to list all the available disks, or specify individual disks to obtain configuration and status information.

List and show disk information

Syntax

To display disk details, use the following syntax:

```
symdisk [-sid <SymmID>] [-offline] [-cyl | -mb | -gb | -tb]
   [-disk_group <DskGrpNum | name:<DskGrpName> | ALL>]
   [-all] [-failed]
list [-spindle [-internal]] [-isspare] [-nospares]
   [-v [-hypers] [-spare_info] [-gaps]]
   [-DA <# | ALL> [-interface <# | ALL>]]
   [-tid <# | ALL>]
list [-spindle]
   [-external [-detail] [-encapsulated [-free]]]]
   [-v [-hypers] [-gaps]]
   [-DX <# | ALL>]
symdisk [-sid <SymmID>] -external -spindle -paths
   [-spid <SpindleID> |-DX <# | ALL> [-port <# | ALL>]]
list -detail
list [-offline]
symdisk [-sid <SymmID>] [-offline] [-cyl | -mb | -gb | -tb]
list -diskgrp_summary [-v]
   [-disk_group <DskGrpNum | name:<DskGrpName> | ALL>]
   [-internal | -external]
list -diskgrp_summary -by_engine [-v | -detail]
   [-disk_group <DskGrpNum | name:<DskGrpName> | ALL>]
   [-internal | -external]
show <DiskAddress> [-gaps_only]
symdisk -sid <SymmID> [-offline] [-cyl | -mb | -gb | -tb]
show -spid <SpindleID> [-gaps_only]
   show -wnn <ExternalWNN> [-gaps_only]
```

Options

- **-engine**
  Lists attributes, counts and capacities relevant to Internal Disk Group/Engine Spindle Groups.

- **-cyl | -mb | -gb | -tb**
  Indicates how to report disk capacity.

List SAS drives

Description

Serial Attached SCSI (SAS) disk drives in 300 GB, 450 GB and 600 GB capacity versions are supported. This includes the Cobra-D SAS 300, 450, and 600 GB disks drives (2.5'' drive using 3.5'' carrier and SAS/FC paddle card).
Note
For Disk Groups that contain internal spindles with different form factors (e.g. 2.5" and 3.5"), the Form Factor label displays as Mixed.

Options
-v
Lists the SAS technology type in the Technology field. The Form Factor field displays 2.5, 3.5, or N/A to indicate the Enterprise Flash Drive.

List disk gaps
Options
-gaps
Used with the symdisk list command, and lists any gaps found on the disk.

-spare_info
Used with the symdisk list command, and shows which disk the spare disk is substituting for, if it is invoked.

-gaps_only
Used with the symdisk show command, and lists any gaps found on the disk without listing all of the hyper information.

Reported actual disk capacity vs. rated disk capacity
The Actual Disk Capacity lists the physical disk capacities in MBs and GBs, where the MB is defined as (1024 x 1024) bytes and the GB is defined as 1024 MBs (or 1024 x 1024 x 1024 bytes).

The Rated Disk Capacity is based on the MB being defined as (1000 x 1000 bytes), the GB being defined as 1000 MBs (or 1000 x 1000 x 1000 bytes), and the TB defined as 1000 GBs.

List disk groups
Options
Used with the symdisk list command.

-by_diskgroup
Lists the disks by disk group number.

-disk_group
Limits disks that belong to a specified disk group. Disk groups can be specified by group number (DskGrpNum) or group name (name: DskGrpName). The ALL option returns disk information for all disk groups.

-dskgrp_summary
This option displays summary information for disk groups. Without the -v option the disk group summary information is displayed in a table format. With the -v option the disk group information in expanded format (one field per line) is displayed, information regarding spare disks is not included.
Note

The `-dskgrp_summary` option is not valid with the `-hypers`, `-spare_info`, `-gaps`, `-isspare` and `-failed` options.

List disk group summary

Examples

To list disk group summary for array 584, enter:

```bash
symdisk list -dskgrp_summary -sid 584
```

Note

The command line accepts `-dskgrp_summary` abbreviated as `dskg`.

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100584</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Group</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Flgs Speed Size Total Free</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>1 DISK_GROUP_001</td>
</tr>
<tr>
<td>2 DISK_GROUP_002</td>
</tr>
<tr>
<td>512 DISK_GROUP_512</td>
</tr>
<tr>
<td>513 DISK_GROUP_513</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Output with `symdisk list verbose (-v)` option:

```plaintext
Disk Group : 1
Disk Group Name : DISK_GROUP_001
Disks Selected : 67
Disk Location : Internal
Technology : SATA
Speed (RPM) : 7200
Form Factor : 3.5
Disk Size (MB) : 1823565
Rated Disk Size (GB) : 2000
Total Group Capacity (MB) : 122178855
Free Group Capacity (MB) : 23005664
Max Hypers Per Disk : 512
Hyper Size (MB) : 3561
....
```

List disk groups by engine

Options

`-by_engine`

Lists attributes, counts and capacities specific to internal disk group/engine spindle groups.

`-detail`
Expands the list to include the disk group name.

Examples
To list disk groups by engine for array 132, enter:

```
symdisk list -dskgrp_summary -by_engine -sid 132
```

Note
The command line accepts `-dskgrp_summary` abbreviated as `dskg`, and `-by_engine` abbreviated as `-by_eng`.

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197800132</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Group</td>
</tr>
<tr>
<td>Disk</td>
</tr>
<tr>
<td>Hyper</td>
</tr>
<tr>
<td>Usable Capacity</td>
</tr>
<tr>
<td>Spare Coverage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disk</th>
<th>Hyper</th>
<th>Usable Capacity</th>
<th>Spare Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp</td>
<td>Eng</td>
<td>Cnt  LT (RPM)</td>
<td>Size (MB)</td>
</tr>
<tr>
<td>----</td>
<td>---</td>
<td>---- ---- ------</td>
<td>---------</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>18  IE 0</td>
<td>28470</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>18  IE 0</td>
<td>28470</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>25  IE 0</td>
<td>14235</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>25  IE 0</td>
<td>14235</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>80 92 102035830</td>
</tr>
</tbody>
</table>

Legend:
Disk (L)ocation:
I = Internal, X = External, - = N/A
(T)echnology:
S = SATA, F = Fibre Channel, E = Enterprise Flash Drive, - = N/A

Output field description

- **Usable Capacity** — Reports in units of MB/GB/TB, based on `-mb/-gb/-tb` flag setting. The usable capacity is also reported in units of disks and percentage (relative to the total capacity for the internal disk group/engine spindle group) for internal disk groups.

- **Total Spare Coverage** — Reports in units of Disk and percent (%) for internal disk groups/engine spindle groups. The Disk-based units correspond to the `Disk Size` and `Max Hypers Per Disk` reported in the `-dskgrp_summary -v` output. The Total Spare Coverage values include all spare capacity, including unavailable capacity (i.e. failed disks), within each internal disk group/engine spindle group and the percentage is relative to the Usable capacity.

- **Available Spare Coverage** — Reports in units of Disk and percent (%) for internal disk groups/engine spindle groups. The Disk-based units correspond to the `Disk Size` and `Max Hypers Per Disk` reported in the `-dskgrp_summary -v` display. The Available Spare Coverage values are the amount of spare capacity currently available for sparing and this percent is relative to the Total Spare Coverage value.

Output with `symdisk list (-detail)` option:

<table>
<thead>
<tr>
<th>Symmetrix ID: 000197100584</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Group</td>
</tr>
<tr>
<td>Disk</td>
</tr>
<tr>
<td>Hyper</td>
</tr>
<tr>
<td>Usable Capacity</td>
</tr>
<tr>
<td>Spare Coverage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disk Group</th>
<th>Disk</th>
<th>Hyper</th>
<th>Usable Capacity</th>
<th>Spare Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List disk groups
List spare physical disks

Options
Use the following options with -DA, -interface, or -tid options to list spare disk information on specific directors, disk interfaces, or SCSI target IDs.

-isspare
Lists information about spare physical disks (spindles), if a spare disk is invoked against a failed disk.

-v -spare_info
Lists information about the failed disk that has been replaced. The -v option must be specified with this option. This display option is not applicable for permanent sparing.

-gaps
Lists gaps found between hypers on the disk, as the hypers are listed. To see a short list of only the gap information, do not specify the -hypers option on the symdisk list command, or specify the -gaps_only option on the symdisk show command.

Note
The gap sizes provided by this report are approximate values. The report can be used as a general guide to the location and size of free space gaps, but it may not be accurate down to the last cylinder.

-nospares
Lists only internal disks (spindles) that are capable of being covered by a spare, but currently are not. This option is not valid for external spindles (external spares do not exist) and no external spindles display when this option is specified.
Examples
To list information spare disk information about failed disk, enter:

    symdisk list -v -spare_info

Sample output
Lists a spare disk that is invoked against disk 16B:C0

List spindle information

Options
-spindle
Lists each disk by Spindle ID and includes the director number for each spindle.

-spid Spindle_ID
Lists physical disks by Spindle ID.

Examples
To list the spindle IDs for array 306, enter:

    symdisk list -spindle -sid 306

Sample output

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>Disks Selected</th>
<th>Capacity(MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Spindle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--------</td>
</tr>
<tr>
<td>Symmetrix ID</td>
<td>: 000194900306</td>
<td>Capacity</td>
</tr>
<tr>
<td>Spindle</td>
<td>Dir</td>
<td>Vendor</td>
</tr>
<tr>
<td>32E</td>
<td>08A</td>
<td>SEAGATE</td>
</tr>
<tr>
<td>16B35</td>
<td>08A</td>
<td>SEAGATE</td>
</tr>
<tr>
<td>1D83</td>
<td>08B</td>
<td>SEAGATE</td>
</tr>
<tr>
<td>22C34</td>
<td>08B</td>
<td>SEAGATE</td>
</tr>
<tr>
<td>. . .</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
List spindle information for physical disk

Syntax

```
-spid Spindle_ID
```

Specifies spindle ID.

Examples

To list spindle information for spindle 1B935 on array 306, enter:

```
symdisk show -spid 1B935 -sid 306
```

Note

The `sympd list` command with the `-spindle` option also provides spindle ID information. List array device information on page 428 provides more information.

Sample output

Note

This is the same output format as `symdisk list -v` (verbose).

```
Symmetrix ID                 : 000194900306
Director                   : DF-8A
Interface                  : C
Target ID                  : 1
Spindle ID                 : 1B935
External WWN               : 60000970000195700233533033132
External Array ID          : 0001957000233
External Device Name       : 031B
Disk Group Number          : 001
Disk Group Name            : DISK_GROUP_001
Technology                 : FC
Speed (RPM)                : 15000
Form Factor                : N/A
Vendor ID                  : EMC
Product ID                 : Symmetrix
...                         
```

Note

The `symdisk list` and `show` commands for spindles identifies remote Data Domain appliances when reporting on virtualized disks and LUNs on external arrays. If applicable, DataDomain displays in the Product ID field.

List spindle information for disk group

Options

```
-spindle
```

Lists each disk by Spindle ID and includes the director number for each spindle.
Examples
To list spindle IDs for disk group 004 for array 306, enter:

```
symdisk list -disk_group 004 -spindle -sid 306
```

Sample output

```
Symmetrix ID                 : 000194900306
Disks Selected               : 8
Disk Group                   : 4
Disk Group Name              : DISK_GROUP_004
Technology                   : FC
Speed (RPM)                  : 15000

Spindle | Dir | Vendor | Type | Hypr | Total | Free  | Actual |
-------- | ---  | ------ | ---- | ---- | ----- | ----- | ------ |
32A      | 07A  | SEAGATE| HUC4515 | 52   | 418710| 380208| 418710 |
B7       | 08A  | SEAGATE| HUC4515 | 52   | 418710| 380208| 418710 |
5C9      | 07B  | SEAGATE| HUC4515 | 53   | 418710| 379729| 418710 |
1D01     | 08B  | SEAGATE| HUC4515 | 53   | 418710| 364605| 418710 |
...      |      |        |       |      |       |       |        |
Total    |      |        |       |      | 3349684| 3009503| 3349684|
```

External spindle information

FAST.X attaches external disks (eDisks) to a VMAX arrays, and makes the eDisk's capacity available to the VMAX array as an external spindle.

Use the `symdisk show` command to list the spindle IDs for eDisks.

Note

For more information on eDisks, refer to FAST.X on page 343

View external spindle information

Syntax
To list external spindle information, use the following syntax:

```
symdisk show -wwn wwn
```

Output fields for external spindle information

- **Disk Location** — Shows Internal for internal disks, and External for external disks.
- **Disk Service State** — Shows the availability of the eDisk. The Failed Disk State is reported as part of the Disk Service State, showing states of Normal or Failed for internal disks. For external disks the Disk Service State is shown as Failed if there are no network paths available to the eDisk (neither active nor passive), Degraded if there are paths from only one of its supporting DX directors to the eDisk (either active or passive), and Normal if there is at least one active and one passive network path available from both supporting DX directors to the eDisk.
- **Technology** — Shows as N/A for external disks.
- Shows if an eDisk is encapsulated or not.
- Shows the number of external paths, available to the external LUN, to reach the eDisk.
CHAPTER 16

Events and Logs

This chapter describes how to configure, manage, and query VMAX events and logs.

- Events and logs overview ................................................................. 462
- Log option configuration ................................................................. 462
- Array event monitoring using SYMCLI .......................................... 465
- Common audit log ........................................................................... 466
- Daemon log files ............................................................................ 470
Events and logs overview

SYMCLI and SYMAPI normally log significant events and actions to a daily log file. On UNIX, the log file has the following pathname:
/var/symapi/log/symapi-yyyymmdd.log

On Windows, the log file has the following pathname:
C:\Program Files\EMC\Symapi\log\symapi-yyyymmdd.log

File name date format:
- *yyyy* — year
- *mm* — month
- *dd* — day

The log displays the following items about each event:
- Time tag of the event occurrence
- Process ID (PID)
- Source of the event (application name)
- Related (internal) API function call
- Name of the specific operation or event
- Variable event field that describes the event or error in detail

Note

By default, SYMAPI log files are retained forever. You can change this to automatically remove the files after a set amount of time by modifying the SYMAPI_LOGFILE_RETENTION option in the options file. It is recommended that you configure a log file retention time to conserve disk space.

The format for the retention option is SYMAPI_LOGFILE_RETENTION = *NN*. Where *NN* is the number of days to retain the SYMAPI log file.

Default value: 0 (retain forever)

Valid values: 5 (5 days) - 1825 (5 years)

Log option configuration

The following table lists the options to customize how and where events are logged in your VMAX environment.

<table>
<thead>
<tr>
<th>Logging option</th>
<th>Configuration description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable/disable logging</td>
<td>You can disable logging by setting the environment variable SYMCLI_NOLOGGING to 1. For example, to disable</td>
</tr>
<tr>
<td>Logging option</td>
<td>Configuration description</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Logging on UNIX (C shell), enter:</td>
<td>setenv SYMCLI_NOLOGGING 1&lt;br&gt;To turn logging back on, enter:&lt;br&gt; unsetenv SYMCLI_NOLOGGING</td>
</tr>
<tr>
<td>Log file name</td>
<td>You can change the name and path of the default log file.</td>
</tr>
<tr>
<td></td>
<td>For example, to change the log file name on UNIX (C shell), use the following form:</td>
</tr>
<tr>
<td></td>
<td>setenv SYMCLI_LOG filename</td>
</tr>
<tr>
<td></td>
<td>To turn daily log files back on, enter:&lt;br&gt; unsetenv SYMCLI_LOG</td>
</tr>
<tr>
<td>Allow undated SYMAPI log file names</td>
<td>You can allow the creation of undated SYMAPI log files by setting the environment variable&lt;br&gt; SYMAPI_DATED_LOGFILE_NAME in the options file to disable.</td>
</tr>
<tr>
<td></td>
<td>To allow undated log file names, set:&lt;br&gt; SYMAPI_DATED_LOGFILE_NAME=DISABLE</td>
</tr>
<tr>
<td></td>
<td>To reenable dates, set:&lt;br&gt; SYMAPI_DATED_LOGFILE_NAME=ENABLE</td>
</tr>
<tr>
<td>Change date formats</td>
<td>You can change date formats in the log entries by setting the environment variable&lt;br&gt; SYMAPI_LOGFILE_DATE_FORMAT in the options file to FORMAT2. This formats the date as yyyy-mm-dd.</td>
</tr>
<tr>
<td></td>
<td>To change the date format, set:&lt;br&gt; SYMAPI_LOGFILE_DATE_FORMAT=FORMAT2</td>
</tr>
</tbody>
</table>
Table 23 Log file configuration options (continued)

<table>
<thead>
<tr>
<th>Logging option</th>
<th>Configuration description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To change the date format back to the default (mm/dd/yyyy), set: SYMAPI_LOGFILE_DATE_FORMAT=FORMAT1</td>
</tr>
<tr>
<td>Log file configuration options</td>
<td>You can change the format of optional fields within each log record by setting the environment variable SYMAPI_LOGFILE_FORMAT in the options file. Zero or more of the following optional fields can be included:</td>
</tr>
<tr>
<td></td>
<td>• pid — include the process ID.</td>
</tr>
<tr>
<td></td>
<td>• tid — include the thread ID.</td>
</tr>
<tr>
<td></td>
<td>• userid — include the user ID (useful with User Authorization is enabled).</td>
</tr>
<tr>
<td></td>
<td>• activityid — include the activity ID.</td>
</tr>
<tr>
<td></td>
<td>The default value is pid tid. To see the log file format, create an entry in the options file with values separated by spaces. For example: SYMAPI_LOGFILE_FORMAT = userid pid tid activityid</td>
</tr>
<tr>
<td>Log file retention</td>
<td>Log file retention is an option set in the options file to specify the number of days to retain the log files:</td>
</tr>
<tr>
<td></td>
<td>• Maximum value: 1825 (or 5 years)</td>
</tr>
<tr>
<td></td>
<td>• Minimum value: 6</td>
</tr>
<tr>
<td></td>
<td>• Alternative value: 0 (setting it to zero maintains the log file forever. This is the default for everything except the service)</td>
</tr>
</tbody>
</table>
### Table 23 Log file configuration options (continued)

<table>
<thead>
<tr>
<th>Logging option</th>
<th>Configuration description</th>
</tr>
</thead>
<tbody>
<tr>
<td>processor whose default is 30.) For example, to change the log file Retention to 60 days, enter: SYMAPI_LOGFILE_RETENTION=60</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

When the log file retention option is set, it overrides all existing log file Retention values including those set for the service processor during initialization. The default for the service processor is 30 days. Setting this options file value will override that default. In addition, if you have accumulated many years of log files prior to setting this option, when the option is set, it deletes those log files that do not meet the specified criteria.

---

### Array event monitoring using SYMCLI

The `symevent` command allows an administrator to monitor or track events within a VMAX array that may affect its operation. In some cases, reported events represent conditions that have already been repaired. This command allows monitoring of the array for all reported events.

Use `symevent` to:

- **monitor** — This action runs the command in the foreground, polling the array for new events every interval in seconds, either until the iteration count is satisfied or the program is stopped. Monitoring can be restricted to report events of certain severity (warnings, errors, or fatal events).

- **list** — This action examines the history of events stored on the array, for those events that meet the requested criteria, such as events recorded during a certain time period, or based upon the reporting director.
Monitoring events

Examples

To poll for and report on all events, on all locally-connected arrays, every 15 seconds, continuously, enter:

```
symevent monitor
```

To poll for and display events with a severity of `warning` or greater every 15 seconds for a 50-second period, enter:

```
symevent monitor -sid 0207 -i 15 -c 50 -warn
```

Sample output

For array 0207:

```
Symmetrix ID: 000192600207
Detection time           Dir    Src  Category     Severity     Error Num
------------------------ ------ ---- ------------ ------------ ----------
Mon Dec 29 21:26:04 2015 DF-7A  Symm Communication Warning      0x001a
The Symmetrix Service Processor could not complete a Call Home for service
```

List events

Options

- `-start` / `-end`

Lists events occurring during a certain time period.

- `-DIR`

Limits reporting to specific director activity.

Examples

To retrieve a verbose list of the events which have occurred on the specified array between 12 p.m. and 3 p.m. today, enter:

```
symevent list -sid 0207 -start 12:00 -end 15:00 -v
```

Common audit log

Data is written to a common audit file during VMAX control operations. The common audit log correlates activity from all hosts into one file that is stored in the Symmetrix File System (SFS).

The `symaudit` command enables the filtering of the common audit log file for a specified VMAX array. The audit log resides on the array with a capacity of 40 MB. Once the 40 MB limit is reached, the log starts to overwrite itself. There is no maintenance for this file, unless records need to be captured before the circular 40 MB space recycles.
For details on filtering parameter values refer to the `symaudit` command in the Dell EMC Solutions Enabler CLI Reference Guide.

Use the following actions to parse or monitor the audit log contents:

**show**

Displays details about the audit log itself for a specific array, including the total range of records, the date/time range, and the starting record number.

**list**

Lists details about the requested records in either a brief or verbose format. The range of records to extract can be filtered by one or all of the following:

- record number
- record count
- date/time
- functional area
- control action
- vendor ID
- application ID
- hostname
- username
- device acted upon

**monitor**

Monitors the array for new audit log data in realtime.

---

**Note**

If Embedded Management is configured on the VMAX array, when running the `symaudit list` and `symaudit show` commands the host name listed in the output is the nodename identified by the NAT gateway, and not the internal identity of the eManagement Guest. For more information on eManagement refer to the EMC VMAX3 Family Product Guide for VMAX 100K, VMAX 200K, VMAX 400K with HYPERMAX OS.

---

### Show audit log for single array

**Examples**

```
symaudit show -sid 0207
```

**Sample output**

<table>
<thead>
<tr>
<th>Audit Log Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrix ID            : 000192600207</td>
</tr>
<tr>
<td>Starting date           : 12/17/2008 21:42:57</td>
</tr>
<tr>
<td>Ending date             : 01/02/2009 15:30:35</td>
</tr>
</tbody>
</table>

---
List audit log for specified time period

Examples

symaudit list -sid 0207 -start_date 01/02/2009:12:00:00 -end_date 01/02/2009:12:15:00 -v

Sample output

AUDIT LOG DATA
Symmetrix ID : 000192600207
Record Number : 1663
Records in Seq : 2
Offset in Seq : 1
Time : 01/02/16 12:11:50
Vendor ID : EMC Corp
Application ID : SYMCONFIGURE
Application Version : 8.2.0.302
API Library : SDK
API Version : T8.2.302.2 (Edit Level: 907)
Host Name : api1051.lss.
OS Name : LINUX
OS Revision : 2.6.9-11.E
Client Host :
Process ID : 00027021
Task ID : 00000002
Function Class : CfgChg
Action Code : Release
Text : STARTING a Device Reservation 'RELEASE'. Owner=m; ReserveID=1;
Comment="t";
Username : H:api1051\root
Activity ID : SE69f82805ea
Record Number : 1664
Records in Seq : 2
Offset in Seq : 2
Time : 01/02/16 12:11:50
Vendor ID : EMC Corp
Application ID : SYMCONFIGURE
Application Version : 8.2.0.302
API Library : SDK
API Version : T8.2.302.2 (Edit Level: 907)
Host Name : api1051.lss.
OS Name : LINUX
OS Revision : 2.6.9-11.E
Client Host :
Process ID : 00027021
Task ID : 00000002
Function Class : CfgChg
Action Code : Release
Text : Devices: [ 0020 ]
Username : H:api1051\root
Activity ID : SE69f82805ea
Record Number : 1665
Records in Seq : 1
Offset in Seq : 1
Time : 01/02/16 12:11:51
Vendor ID : EMC Corp
Application ID : SYMCONFIGURE
Application Version : 8.2.0.302
Output field descriptions:

- Record Number — The current record number.
- Records in Seq — Total number of records requested.
- Offset in Seq — Offset number from the first record requested.
- Time — Date and time the record was entered.
- Vendor ID — ID of the vendor whose application logged the record.
- Application ID — ID of the application that logged the record.
- Application Version — Application version number.
- API Library — Name of the SYMAPI library the application ran against.
- API Version — Version of the SYMAPI.
- Host Name — Name of the host that logged the record.
- OS Name — Operating system on which the host is running.
- OS Revision — Operating system revision number.
- Client Host — Any SYMCLI client communicating with the SYMAPI server.
- Process ID — ID of the process that logged the record.
- Task ID — ID of the task.
- Function Class — Class name of the SYMAPI functional area.
- Action Code — Name of the SYMAPI control action associated with an audit log entry.
- Text — Details of the given entry.
- Username — Identifies the user that generated the log entry.
- Activity ID — A randomly generated ID that uniquely identifies this action.

Custom audit log activity ID

By default, Solutions Enabler generates a random activity ID to identify each session. This ID appears in the audit log entries for that session. Since the default ID is random, filtering audit log entries based on the ID is difficult.

You can specify a custom activity ID, making it easier to filter audit log entries.

An optional argument `-actid <Activity ID>`, allows you to set a custom activity ID on all operations performed as part of that CLI command.
When you use the `-actid <Activity ID>` argument, entries in the audit log for that command are tagged with the specified activity ID prefixed with "U_".

User-defined activity IDs must meet the following requirements:

- Maximum of 14 characters (not including the automatic prefix).
- Include only alphanumeric characters.
- Underscore (_), and hyphen (-) characters are allowed.

If you try to define an Activity ID with more than 14 characters, the operation fails, and an error is displayed.

All active SYMCLI commands, with the exception of `symaudit` command, accept the `-actid` argument. For example:

```
symqos -sid 237 -cp -name cptest -devs 410:411,1170 addall -actid CPTest1
```

Output of `symaudit` queries in verbose mode report the user-defined activity ID. For example:

```
symaudit list -sid 237 -v -activity_id U_CPTest1
```

### Daemon log files

Each Solutions Enabler daemon has two log files to record daemon errors and other significant conditions.

Daemon log files are stored in:

```
<SYMAPI_HOME>/log/storXXXX.log0
<SYMAPI_HOME>/log/storXXXX.log1
```

where `storXXXX` is the name of the daemon. The daemons are:

- `storsrvd` (SYMAPI Server Daemon)
- `storevntd` (Event Daemon)
- `storgnsd` (GNS Daemon)
- `storrdfd` (RDF Daemon)
- `storapid` (Base Daemon)
- `storstpd` (STP Daemon)
- `storwatchd` (Watchdog Daemon, UNIX only)

Logging alternates between the two files, switching to the other file each time the maximum size specified by the daemon’s `LOGFILE_SIZE` parameter is reached. Each daemon writes to the `.log0` file until its size exceeds that specified in the
The `daemon_options` file includes options that allow you to customize logging for a particular daemon, including the type of log file (wrap or dated), the maximum size for wrap files, the amount of time to retain dated log files, and log file permissions.

**Defaults**

- The `LOGFILE_SIZE` parameter is 1 MB.
- Daemon log files use wrap mode. To change the log files to dated mode, use the `LOGFILE_TYPE` option in the `daemon_options` file. In dated mode, the daemon log file format is `daemon_name-yyyy-mm-dd.log`. A new dated log file is started every day on the first write after 12:00 a.m.
- Dated log files are retained for three days. You can change this to automatically remove the files after a set amount of time by modifying the `LOGFILE_RETENTION` option in the `daemon_options` file.

The `daemon_options` file includes options that allow you to further customize logging for a particular daemon.

The following table shows the general logging configuration options you can use to customize the Solutions Enabler daemon log files. For details on the syntax and values, refer to the `<SYMAPI_HOME>/config/daemon_options` file.

**Table 24 Options for managing daemon log files**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOGFILE_TYPE</strong></td>
<td>Specifies the style of logging for the daemon. Possible values: WRAP (default) - Two log files are maintained: storxxxx.log0 and storxxxx.log1. Logging switches to the other file each time the maximum size specified by the <code>LOGFILE_SIZE</code> parameter is reached. DATED - A separate log file is used for each day: storxxxx-yyyy-mm-dd.log. There are no size limits on these files. Dated log files are retained for the number of days specified by the <code>LOGFILE_RETENTION</code> parameter.</td>
</tr>
<tr>
<td><strong>LOGFILE_SIZE</strong></td>
<td>Used for wrapping log files. Specifies the maximum number of KBs to write before switching to the other file of the pair. Default: 1000 (KB)</td>
</tr>
<tr>
<td><strong>LOGFILE_RETENTION</strong></td>
<td>Used for dated log files. How many days to retain old log files. Default: 3 (days) Valid values: A number of days greater than 0.</td>
</tr>
<tr>
<td><strong>LOGFILE_PERM</strong></td>
<td>Specifies the permissions on any newly created log files. Possible values:</td>
</tr>
</tbody>
</table>

Events and Logs

Daemon log files
Table 24 Options for managing daemon log files (continued)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rw (default)</td>
<td>Anyone can read or write (UNIX mode of rwxrwxrwx).</td>
</tr>
<tr>
<td>r</td>
<td>The owner (root) can read/write.</td>
</tr>
</tbody>
</table>

Event daemon

Solutions Enabler also provides an asynchronous event daemon that can be used to monitor and manage VMAX events. The event daemon (storevntd) provides the services required to monitor the status of VMAX storage environments from third-party enterprise management frameworks. The following targets are supported:

- SNMP
- File on disk
- System logger on the host
- Unix syslog service
- Windows event log
- The syslog listener across the network (bypasses the syslog service (calls) on the local host and directly sends events/traps to this remote listener).

For more information on enabling and configuring the event daemon, refer to the *EMC Solutions Enabler Installation Guide*. 
CHAPTER 17
XML Structured Output

This chapter describes the XML output option of the SYMCLI.

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- XSLT: XML data transformations ................................................................. 474
- Element-based XML ................................................................................... 474
- Set XML mode with SYMCLI ................................................................. 475
XML structured output overview

The XML (Extensible Markup Language) output option provides a mechanism to facilitate the automated processing of SYMCLI output data. XML is a deterministic parsing tool that eases parsing of output data, providing a functional advantage over screen-scraping tools like awk or Perl. The XML industry standard is based on the experience of SGML and is endorsed by the World Wide Web Consortium. Detailed information on XML may be found at: http://w3.org/XML/.

XML has the look and feel of HTML, as it employs the same tag-based syntax. However, XML uses tags to delimit data—as opposed to defining the data as with HTML—allowing the document author to specify the tags most applicable to the given application. For the SYMCLI, tags represent the physical and logical structures within the VMAX array and its environments.

When XML mode is utilized, the data returned is identical to that of the standard output, but "marked-up" with tags. These tags enable individual pieces of data to be readily called upon by name. In addition, they provide a definitive way to express the relationship between different objects, an advantage over the standard CLI display output.

XSLT: XML data transformations

Many tools are available to query, filter, retrieve, and format specific information stored in complex XML files. Among these, eXtensible Stylesheet Language Transforms (XSLT) is a particularly useful and widely available technology. While using XML will result in less ambiguous, more robust scripts, XSLT will make the information presented in XML accessible to the more familiar plain text-based scripting techniques. To introduce you to XSLT, a directory containing several examples of the types of queries that can be performed on XML data using XSLT is provided. The examples are designed only to provide a brief introduction to the power and usefulness of XSLT, and can help ease the transition to XML.

Element-based XML

Solutions Enabler provides element-based XML that describes data in a hierarchical manner by using the notion of parent and children. An element can have several different content types. It can have element content (child element), a mixed content containing both text and child element, a simple content containing text only, or an empty content carrying no information. An element can also have attributes. These additional content types would allow users to modify the data structures in a fairly flexible manner. On the other hand, an attribute is used to provide additional information about an element. An attribute is, in general, used to store the metadata describing the data that stored in XML. Although data can be stored in attributes, it is best practice to store data in child elements.
Set XML mode with SYMCLI

To use XML mode with SYMCLI, an environment variable or a command line option can be used. To use the environment variable to globally set the command output to XML or standard use the following syntax:

```
SYMCLI_OUTPUT_MODE = xml_element|standard
```

**Note**
When the environment variable output mode is set to `xml` or `xml_element`, commands that do not support XML output generate a runtime error message. To override this behavior set the command line `-output` option to a value of `standard`. This allows execution of a given command in standard mode.

XML output using SYMCLI

**Syntax**
To override the current environment variable setting and set the output style for a single command, use the following syntax:

```
<SymcliCommand> -output <xml|xml_element|standard>
```

**Note**
The `-output` flag is not found in `-help` or man pages because of its wide scope and usage.

**Options**
- `xml_element`
  - Returns the output of all commands in element-based XML tags.

- `standard`
  - Returns the output of all commands in the default output format.

**Examples**

```
symcfg list -out xml or symcfg list -out xml_element
```

**Sample output**
Note that a new element tag `<Symm_Info>` is added to the XML data shown below to store general VMAX data.

```
<?xml version="1.0" standalone="yes" ?>
<SymCLI_ML>
  <Symmetrix>
    <Symm_Info>
      <symid>000190102055</symid>
      <attachment>Local</attachment>
```

```
To maintain consistent element names in all SYMCLI commands, some tag names are redefined. For example, in current SYMCLI command, different names exist to describe Symmetrix identification number, such as id, symmetrix, or symid. A new consistent tag name is defined across all SYMCLI commands in the element-based XML output.
This section describes:

- how to use Non-Disruptive Migration (symdm) to migrate data
  - from VMAX arrays running Enginuity 5876 to VMAX3 Family and VMAX All Flash arrays running HYPERMAX OS 5977 Q3 2016 SR and higher
  - from VMAX3 Family and VMAX All Flash arrays running HYPERMAX OS 5977 Q3 2016 SR and higher to PowerMax arrays running PowerMaxOS
- how to use Open Replicator (symrcopy) to migrate data between EMC arrays or third-party arrays.

Chapters include:

Chapter 18, "Non-Disruptive Migration"

Chapter 19, "Open Replicator"
Migrating Data
This chapter describes the Non-Disruptive Migration (NDM) feature and the SYMCLI command `symdm` command used to migrate data:

- from Enginuity 5876 to VMAX3 Family and VMAX All Flash arrays running HYPERMAX OS 5977 Q4 2016 SR and higher.
- from Enginuity 5876 to PowerMax arrays running PowerMaxOS 5978.
- from HYPERMAX OS 5977 Q4 2016 SR or higher to PowerMax arrays running PowerMaxOS 5978.

For details on supported releases, please consult the *Dell EMC SRDF Interfamily Connectivity Guide*.

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Non-Disruptive Migration overview

Non-Disruptive Migration (NDM) provides a method for migrating data from a source array to a target array without application host downtime across a metro distance, typically within a data center. For NDM array operating system version support, please consult the NDM support matrix, or the SRDF Interfamily Connectivity Guide.

If regulatory or business requirements for DR (disaster recovery) dictate the use of SRDF/S during migration, contact Dell EMC for required ePacks for SRDF/S configuration.

The NDM operations involved in a typical migration are:

- Environment setup – Configures source and target array infrastructure for the migration process.
- Create – Duplicates the application storage environment from source array to target array.
- Cutover – Switches the application data access form the source array to the target array and duplicates the application data on the source array to the target array.
- Commit – Removes application resources from the source array and releases the resources used for migration. Application permanently runs on the target array.
- Environment remove – Removes the migration infrastructure created by the environmental setup.

Some key features of NDM are:

- Simple process for migration:
  1. Select storage group to migrate.
  2. Create the migration session.
  3. Discover paths to the host.
  4. Cutover or readytgt storage group to VMAX3 or VMAX All Flash array.
  5. Monitor for synchronization to complete.
  6. Commit the migration.
- Allows for inline compression on VMAX All Flash array during migration.
- Maintains snapshot and disaster recovery relationships on source array, but are not migrated.
- Allows for non-disruptive revert to source array.
- Allows up to 50 concurrent migration sessions.
- Requires no license since it is part of HYPERMAX OS.
- Requires no additional hardware in the data path.

The following graphic shows the connections required between the host (single or cluster) and the source and target array, and the SRDF connection between the two arrays.

Figure 12 Non-Disruptive Migration zoning
The App host connection to both arrays uses FC, and the SRDF connection between arrays uses FC or GigE.

The migration controls should be run from a control host and not from the application host. The control host should have visibility to both the source array and target array.

The following devices and components are not supported with NDM:

- CKD devices, IBM i devices
- eNAS data
- ProtectPoint, FAST.X relationships and associated data

Environmental requirements for Non-Disruptive Migration

The following configurations are required for a successful data migration:

**Array configuration**

- The target array must be running HYPERMAX OS 5977.811.784 or higher. This includes VMAX3 Family arrays and VMAX All Flash arrays.
- The source array must be a VMAX array running Enginuity 5876 with required ePack (contact Dell EMC for required ePack).
- SRDF is used for data migration, so zoning of SRDF ports between the source and target arrays is required. Note that an SRDF license is not required, as there is no charge for NDM.
- The NDM RDF group is configured with a minimum of two paths on different directors for redundancy and fault tolerance. If more paths are found up to eight paths will be configured.
- If SRDF is not normally used in the migration environment, it may be necessary to install and configure RDF directors and ports on both the source and target arrays and physically configure SAN connectivity.

**Host configuration**

- The migration controls should be run from a control host and not from the application host.
Both the source and the target array have be visible to the controlling host that runs the migration commands.

**Pre-migration rules and restrictions for Non-Disruptive Migration**

In addition to general configuration requirements of the migration environment, the following conditions are evaluated by Solutions Enabler prior to starting a migration.

- A Storage Group is the data container that is migrated, and the following requirements apply to a storage group and its devices:
  - Storage groups must have masking views. All devices within the storage group on the source array must be visible only through a masking view. The device must only be mapped to a port that is part of the masking view.
  - Multiple masking views on the storage group using the same initiator group are only allowed if port groups on the target array already exist for each masking view, and the ports in the port groups are selected.
  - Storage groups must be parent or standalone storage groups. A child storage group with a masking view on the child storage group is not supported.
  - Gatekeeper devices in the storage group are not migrated to the target array.
  - Devices must not be masked or mapped as FCoE ports, iSCSI ports, or non-ACLX enabled ports.
  - The devices in the storage group cannot be protected using RecoverPoint.
  - Devices may not be in multiple storage groups.

- For objects that may already exist on the target array, the following restrictions apply:
  - The names of the storage groups (parent and/or children) to be migrated must not exist on the target array.
  - The names of masking views to be migrated must not exist on the target array.
  - The names of the initiator groups (IG) to be migrated may exist on the target array. However, the aggregate set of host initiators in the initiator groups used by the masking views must be the same. Additionally the effective ports flags on the host initiators must be the same for both source and target arrays.
  - The names of the port groups to be migrated may exist on the target array, provided that the groups on the target array appear in the logging history table for at least one port.

- The status of the target array must be as follows:
  - If a target-side Storage Resource Pool (SRP) is specified for the migration that SRP must exist on the target array.
  - The SRP to be used for target-side storage must have enough free capacity to support the migration.
  - The target side must be able to support the additional devices required to receive the source-side data.
  - All initiators provisioned to an application on the source array must also be logged into ports on the target array.

- Only FBA devices are supported (Celerra and D910 are not supported) and the following restrictions apply:
  - Cannot have user geometry set, mobility ID, or the BCV attribute.
- Cannot be encapsulated, a Data Domain device, or a striped meta device with different size members.
- Must be dynamic SRDF R1 and SRDF R2 (DRX) capable and be R1 or non-RDF devices, but cannot be R2 or concurrent RDF devices, or part of a Star Consistency Group.
- Devices in the storage group to be migrated can have TimeFinder sessions and/or they can be R1 devices. The migration controls evaluates the state of these devices to determine if the control operation can proceed.
- The devices in the storage group cannot be part of another migration session.

Unsupported devices

The following list provides an overview of unsupported devices, and device restrictions:

- Only IBM i devices are supported (CKD is not supported) with the following restrictions:
  - Cannot have user geometry set, mobility ID, or the BCV attribute.
  - Cannot be encapsulated, a Data Domain device, or a striped meta device with different size members.
  - Must be dynamic SRDF R1 and SRDF R2 (DRX) capable and be R1 or non-RDF devices, but cannot be R2 or concurrent RDF devices, or part of a Star Consistency Group.
- Devices in the storage group to be migrated can have TimeFinder sessions and/or they can be R1 devices. The migration controls evaluates the state of these devices to determine if the control operation can proceed.
- The devices in the storage group cannot be part of another migration session.

Geometry Compatible Mode flag set with Non-Disruptive Migration

Track size for FBA devices increased from 64K in Enginuity 5876 to 128K in HYPERMAX OS. Geometry Compatibility Mode (GCM) 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. With HYPERMAX OS, the device size difference is automatically managed 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.

Because Non-Disruptive Migration uses SRDF technology for data migration (which requires that R1 and R2 devices be the same size), the GCM flag can get automatically set on the target device during migration.

Non-Disruptive Migration for PowerMaxOS 5978 overview

Non-Disruptive Migration (NDM) is a method for migrating data without application downtime. The migration takes place over a metro distance, typically within a data center.

Starting with PowerMaxOS there are two implementations of NDM each for different types of source array:

- VMAX3 or VMAX All Flash array running HYPERMAX OS 5977.1125.1125 or later with an ePack
Migration from a VMAX array

Migrating from a VMAX array uses SRDF technology. For NDM purposes, the source is a VMAX array running Enginuity 5876, with an ePack. The target is a PowerMax array running PowerMaxOS 5978. The following picture shows the logical structure of a migration from VMAX including the connections required:

**Figure 13** Configuration of a VMAX migration

![Migration Diagram]

**Process**

The steps in the migration process are:

1. Set up the environment – configure the infrastructure of the source and target array, in preparation for data migration.

2. On the source array, select a storage group to migrate.

3. Create the migration session – copy the content of the storage group to the target array using SRDF.
4. Cutover the storage group to the PowerMax array.
   From now on the application server accesses the storage group on the target array only.

5. Commit the migration session – remove resources from the source array and those used in the migration itself. The application now uses the target array only.

6. To migrate further storage groups, repeat steps 2 to 5.

7. After migrating all the required storage groups, remove the migration environment.

Other features

Other features of migrating from VMAX to PowerMax are:

- Data can be compressed during migration to the PowerMax array
- Allows for non-disruptive revert to the source array
- There can be up to 50 migration sessions in progress simultaneously
- NDM does not require an additional license as it is part of PowerMaxOS
- The connections between the application host and the arrays use FC; the SRDF connection between the arrays uses FC or GigE

Devices and components that cannot be part of a NDM system are:

- CKD devices, IBMi devices
- eNAS data
- ProtectPoint and FAST.X relationships along with their associated data

Migration from a VMAX3 or VMAX All Flash array

Migrating from VMAX3 or VMAX All Flash uses a modified form of SRDF/Metro. This means that in the normal workflow, both the source and target arrays are visible to the application host while the migration takes place. Indeed, both arrays are read/write accessible to the host. The following picture shows the logical structure of a migration from VMAX3 or VMAX All Flash including the connections required.
Normal flow

The steps in the migration process that is normally followed are:

1. Set up the migration environment – configure the infrastructure of the source and target array, in preparation for data migration.
2. On the source array, select a storage group to migrate.
3. Create the migration session – copy the content of the storage group to the target array using SRDF/Metro. During this time the source and target arrays are both accessible to the application host.
4. Commit the migration session – remove resources from the source array and those used in the migration itself. The application now uses the target array only.
5. To migrate further storage groups, repeat steps 2 to 4.
6. After migrating all the required storage groups, remove the migration environment.

Alternate flow

There is an alternative process that pre-copies the data to the target array before making it available to the application host. The steps in this process are:

1. Set up the migration environment – configure the infrastructure of the source and target array, in preparation for data migration.
2. On the source array, select a storage group to migrate.
3. Use the precopy facility of NDM to copy the selected data to the target array. During this time the source array is available to the application host, but the target array is unavailable.
4. When the copying of the data is complete, use the Ready Target facility in NDM to make the target array available to the application host also.
5. Commit the migration session – remove resources from the source array and those used in the migration itself. The application now uses the target array only.
6. To migrate further storage groups, repeat steps 2 to 5.
7. After migrating all the required storage groups, remove the migration environment.

Other functions
Other NDM facilities that are available for exceptional circumstances are:

- **Cancel** – to cancel a migration that has not yet been committed.
- **Sync** – to stop or start the synchronization of writes to the target array back to source array. When stopped, the application runs on the target array only. Used for testing.
- **Recover** – to recover a migration process following an error.

Other features
Other features of migrating from VMAX3 or VMAX All Flash to PowerMax are:

- Data can be compressed during migration to the PowerMax array
- Allows for non-disruptive revert to the source array
- There can be up to 50 migration sessions in progress simultaneously
- Does not require an additional license as NDM is part of PowerMaxOS
- The connections between the application host and the arrays use FC; the SRDF connection between the arrays uses FC or GigE

Devices and components that cannot be part of a NDM system are:

- CKD devices, IBMi devices
- eNAS data
- ProtectPoint and FAST.X relationships along with their associated data

Environmental requirements for non-disruptive migration
There are requirements associated with both the arrays involved in a migration and the host system.

Storage arrays

- The target array runs PowerMaxOS 5978.
- The source array is either:
  - A VMAX3 or VMAX All Flash array running HYPERMAX OS 5977.1125.1125
  - A VMAX array running Enginuity 5876

  The source array requires an ePack. Contact Dell EMC to obtain that ePack.
- SRDF is used for data migration, so zoning of SRDF ports between the source and target arrays is required. Note that an SRDF license is not required, as there is no charge for NDM.
- The NDM RDF group requires a minimum of two paths on different directors for redundancy and fault tolerance. If more paths are found up to eight paths are configured.
- If SRDF is not normally used in the migration environment, it may be necessary to install and configure RDF directors and ports on both the source and target arrays and physically configure SAN connectivity.
Non-Disruptive Migration

**Host**

- Wherever possible, use a host system separate from the application host to initiate and control the migration (the control host).
- The control host requires visibility of and access to both the source and target arrays.

**Non-Disruptive Migration operational restrictions and state reference**

This section details Non-Disruptive Migration states, valid migration states required for migration actions, and migration actions with other replication (TimeFinder and SRDF).

**Non-Disruptive Migration session states**

The following table lists the possible states for a migration session.

<table>
<thead>
<tr>
<th>Migration state</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No migration</td>
<td>No migration in progress.</td>
</tr>
<tr>
<td>CreateInProg</td>
<td>Migration session is being created. The create command has not run to completion with either a success or a failed status.</td>
</tr>
<tr>
<td>Created</td>
<td>The create command has run to completion with a success status. [On VMAX to VMAX3 or VMAX AF]</td>
</tr>
<tr>
<td>CreateFailed</td>
<td>The create command has run to completion with a failed status.</td>
</tr>
<tr>
<td>CutoverReady</td>
<td>The create command has run to completion with a success status. A Host Discovery was performed, either automatically or manually. The devices on the target array are in pass-through mode and I/O's can be serviced by devices on the source and target arrays; a cutover may be performed. [On VMAX to VMAX3 or VMAX AF]</td>
</tr>
<tr>
<td>CutoverInProg</td>
<td>The cutover command is in progress and the application is being moved to the target array. The cutover command has not run to completion with either a success or a failed status. [On VMAX to VMAX3 or VMAX AF]</td>
</tr>
<tr>
<td>CutoverFailed</td>
<td>The cutover command has run to completion with a failed status. [On VMAX to VMAX3 or VMAX AF]</td>
</tr>
<tr>
<td>Precopy</td>
<td>The create command with the ‘precopy’ flag succeeded. The replication pathway has been created and is currently synchronizing data from the Source to the Target array. The Target devices are not masked to the host. A ReadyTgt may be performed. [On VMAX3 to VMAX AF].</td>
</tr>
<tr>
<td>ReadyTgtInProg</td>
<td>The ReadyTgt command is in progress and the application is being made host visible to the target array. The ReadyTgt command has not run to completion with either a success or a failed status. [On VMAX3 to VMAX AF].</td>
</tr>
<tr>
<td>ReadyTgtFailed</td>
<td>The ReadyTgt command has run to completion with a failed status. [On VMAX3 to VMAX AF].</td>
</tr>
</tbody>
</table>
### Migration state

<table>
<thead>
<tr>
<th>Migration state</th>
<th>Description</th>
</tr>
</thead>
</table>
| Migrating       | VMAX to VMAX3 or VMAX AF: The Cutover command succeeded and data is being migrated from the source to the target array. I/O's can only be serviced by devices on the target array.  
VMAX3 to VMAX AF: The Create or ReadyTgt command succeeded and data is being migrated from the source to the target array. I/O's can be serviced by devices on the source and target arrays. |
| MigrateFailed   | This state occurs when a Migrating state is interrupted, as might occur with a loss of the required DM connectivity between the source and target arrays. |
| CutoverNoSync   | The sync -stop command completed successfully. The application is running on the target array, all data was migrated from the source to the target array but data updates are not being replicated back to the source. |
| CutoverSync     | The cutover or sync -start command completed successfully. The application is running on the target array, and all data has been synchronized between the target and source arrays. |
| CutoverSyncing  | VMAX to VMAX3 or VMAX AF: The sync -start command completed successfully. The application is running on the target array, and data is being replicated back to the source.  
VMAX3 to VMAX AF: The sync -start command completed successfully. The application is running on both the source and target arrays and data is being synchronized between the source and target arrays. |
| Synchronized    | The application is running on both the source and target arrays, a Host Discovery has being performed either automatically or manually and all data has been synchronized between the source and target arrays. [On VMAX3 to VMAX AF]. |
| CommitInProg    | Commit command is in progress. The commit command has not run to completion with either a success or a failed status. |
| CommitFailed    | Commit command has run to completion with a failed status. |
| CancellInProg   | Cancel command is in progress. The cancel command has not run to completion with either a success or a failed status. |
| CancelFailed    | Cancel command has run to completion with a failed status. |
| Partitioned     | The migration session has been successfully created but the DM replication pathway is not available. |

## Non-Disruptive Migration control actions and dependent migration states

### Migration controls

Each migration action is dependent on the following and determines whether a migration action can proceed or fail:

- Migration state.
- Rules based on other replication states.
- Changes in the application storage configuration.
- Changes to the migration session outside the NDM feature.
Migration control actions and states

The following table lists the migration state that is a valid state prior to running a specific migration action. This table does not include the environment setup and remove actions as the environment -setup action must be completed successfully before any of the actions shown in the table can be performed. The environment -remove action removes the migration infrastructure, and all migration actions must be completed before performing the environment -remove action.

Table 25  Migration control actions and applicable migration states

<table>
<thead>
<tr>
<th>Migration states</th>
<th>Nomigration</th>
<th>CreateInProg</th>
<th>Create</th>
<th>CreateReady</th>
<th>CutoverInProg</th>
<th>Cutover</th>
<th>Precopy</th>
<th>ReadyTgtInProg</th>
<th>ReadyTgt</th>
<th>CutoverTgt</th>
<th>Migrating</th>
<th>MigrateFailed</th>
<th>Synchronized</th>
<th>CutoverSync</th>
<th>CommitInProg</th>
<th>CancelFailed</th>
<th>Cancel</th>
<th>CancelFailed</th>
<th>Partitioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>create</td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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a.  VMAX to VMAX3 or VMAX All Flash only.
b. Revert flag required on VMAX to VMAX3 or VMAX All Flash only.
c. VMAX3 to VMAX All Flash only.

Non-Disruptive Migration compatibility with other replication technologies

SRDF

SRDF relationships can exist on the migration source or target devices, however the following rules and restrictions apply.

- For the migration source device:
  - Can be a R1 device prior to the migration create action. After the create action, this device is seen as an R21 device, with the R2 device mirror used for the migration session.
  - Existing R1 device can be in Adaptive Copy, Asynchronous mode, or Synchronous mode prior to the migration create action.
  - RDF set mode action can be used to change to Adaptive Copy, Asynchronous mode, or Synchronous mode during the life cycle of the migration session.
  - Cannot be a R2 device prior to the create action, or at any time during the migration session.
- Multi-session Consistency (MSC) cannot be enabled for the existing R1 device.
- Existing R1 device cannot be part of a Star Consistency Group.
- Data synchronization from the existing R2 to R1 device is not allowed at any time during the migration session.
- Cannot add an R1 RDF mirror to the migration once it has started, therefore the NDM source device cannot be made an R21 device when the migration is in progress.
- Existing R1 device cannot be enabled for Synchronous RDF Consistency (RDF-ECA).
- Cannot change RDF mode from Asynchronous to Synchronous mode or Synchronous to Asynchronous on the existing R1 device.

For the migration target device:
- An additional R1 mirror can be added after the migration session is in the CutoverSync state. At this point in the migration session the device is seen as a R11 device with one mirror used for the migration session.
- Added R1 device can be in Adaptive Copy, Asynchronous mode, or Synchronous mode.
- Cannot add an additional R2 mirror (makes it a R21 device) at any time during the migration session.
- RDF set mode action can be used to change to Adaptive Copy, Asynchronous mode, or Synchronous mode during the life cycle of the migration session.
- Added R1 device cannot be part of an RDF Metro configuration.
- Multi-session Consistency (MSC) cannot be enabled for the added R1 device.
- Added R1 device cannot be part of a Star Consistency Group.
- Data synchronization from the added R2 to R1 device is not allowed at any time during the migration session.
- Added R1 device cannot be enabled for Synchronous RDF Consistency (RDF-ECA).
- Cannot change RDF mode from Asynchronous to Synchronous mode or Synchronous to Asynchronous on the existing R1 device.

**TimeFinder**

TimeFinder relationships can exist on the migration source or target devices, however the following rules and restrictions apply.

For the migration source device:
- Can be a TimeFinder source device.
- Cannot be a TimeFinder target device.
- The TimeFinder session cannot be restoring data back to the migration source device at any time during the migration session.

For the migration target device:
- Can be a TimeFinder source device after the migration is in a CutoverSync state.
- The TimeFinder session cannot be restored back to the migration target device at any time during the migration session.
- The TimeFinder session on the target device must be removed prior to a cancel operation.
ORS
The source and target devices cannot be part of an ORS relationship.

Non-Disruptive Migration restrictions with other SYMCLI commands

**Base commands**
For the base commands, - symdev, symdg, symcg, symsg the following command options cannot be issued when the device is involved in a migration operation:

- write_disable
- not_ready
- free -all

For base commands listed above, the `ready` command option can be used to clear the host_inactive state which may have been placed on a device during a migration operation. This command should only be used to manually recover from a migration failure that cannot be resolved using the migration functionality. If the device is mapped to a host, the `symforce` flag is required.

---

**Note**
The `ready` command option only works on a device in the host_inactive state. For any other device state it will not clear the inactive state.

---

**SRDF commands (symrdf)**
The following actions are allowed for the `symrdf` set and control commands when an RDF pair is part of the a NDM RDF group:

- Setting link limbo
- Setting hardware compression
- Setting software compression
- Modifying a NDM RDF group

The following actions are not allowed for the `symrdf` set and control commands when an RDF pair is part of the a NDM RDF group:

- Creating RDF pairs in a NDM RDF group
- All RDF control actions
- All RDF set actions, except for link limbo
- Removing a NDM RDF group

**TimeFinder commands (symmir, symclone, symsnapvx)**
There are no changes to the syntax of these commands. However, these commands are enhanced to block all control actions that copy data to a NDM device, this includes not allowing the restore action if the NDM device is a source of a symmir, symclone, or symsnapvx session.

**ORS commands (symrcopy)**
There are no changes to the syntax of this command. However, this command is enhanced to block all control actions that copy data to a NDM device.

---

**Non-Disruptive Migration control operations**

The migration process is managed by the `symdm` CLI command and includes the following operations:
- Environment setup — Configures source and target array infrastructure for the migration process.
- Create — Replicates the application storage environment from source array to target array.
  - Create -precopy — (Only for HYPERMAX OS 5977 to PowerMaxOS) Starts copying the source data to the target array but does not make the target devices host visible. This allows the application to continue running only on the source array while allowing the data to be copied to the target. It requires a readytgt command to continue the migration.
- Readytgt — (Only for HYPERMAX OS 5977 to PowerMaxOS) Makes the target devices visible to the host, configures the DM replication so the I/Os are replicated to the other array and allows the I/Os to be serviced from both the source and target devices. This operation is only used after the create -precopy operation.
- Cutover — (Only for Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS) Switches the application data access from the source array to the target array and duplicates the application data on the source array to the target array.
- Commit — Removes application resources from the source array and releases the resources used for migration. Application permanently runs on the target array.

Migration sessions can also be reverted, recovered, or cancelled.

Environment setup for Non-Disruptive Migration

The environment configuration for NDM provides the following operations:

- Verify — Validates source and target array infrastructure for the migration process.
- Setup — Configures source and target array infrastructure (replication pathway) for the migration process.
- Remove — Once migration is committed or NDM environment no longer needed, removes the replication pathway configured for the migration.

Migration infrastructure - migration replication pathway creation

The environment setup operation creates an RDF (DM RDF) group to serve as a replication pathway between the source and target arrays. For Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS migrations this single replication group is used for moving the data between the source and target arrays. For HYPERMAX OS 5977 to PowerMaxOS migrations, this RDF group is used as a template; another RDF group is created for each migration to move the data between the source and target arrays.

The following configuration rules apply:

- The DM RDF group is configured with a minimum of two paths on different directors for redundancy and fault tolerance. If more paths are found up to eight paths will be configured.
- RF and RE ports are supported. If both are available the RF ports are selected.
- A single DM RDF group can be used for concurrent migrations between two arrays.
For Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS migrations, changing or deleting the DM RDF group will cause any subsequent migration command to fail.

A single target array can have multiple DM RDF groups, each connected to a different source array, with the target array setup as the migration target from multiple source arrays.

A single source array can have multiple DM RDF groups each connected to a different target array, with the source array setup as the migration source to multiple target arrays.

The source and target array must not be more than one hop away from the control host.

Validate environment for Non-Disruptive Migration

Description
The symdm environment –validate command validates that the environment is set up and meets the requirements for the migration process.

Syntax
To validate the environment for NDM, use the following syntax:

Note
The source and target array IDs must be specified.

```
symdm environment -src_sid <SymID> -tgt_sid <SymID> -validate -noprompt
```

Options

-noprompt (-nop)
If included in command, user confirmation is required for command execution.

Examples
To verify the migration environment between source array 124 and target array 643, enter:

```
symdm environment -src_sid 124 -tgt_sid 643 -validate
```

A DM 'Validate Create' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration........................................Validated.
Initialize Replication Environment........................Validated.
Create Storage Group(s) on Target............................Validated.
Duplicate Device(s) on Target................................Validated.
Create Initiator Group(s) on Target............................Validated.
Create Port Group(s) on Target.................................Failed.
Create Masking View(s) on Target.............................Validated.

The Validation failed. Please see the SYMAPI log file for more information.
Expected response when running `environment -validate` command on an environment that is not setup for migration:

```bash
symdm environment -src_sid 124 -tgt_sid 643 -validate
```

A DM 'Environment Validate' operation is in progress. Please wait...

Analyze Configuration.................................Failed.

The Validation failed. Please see the SYMAPI log file for more information.

Setup environment for Non-Disruptive Migration

Description
The `symdm environment -setup` command configures the source and target array infrastructure (replication pathway) for the migration process.

Syntax
To configure the environment for NDM, use the following syntax:

```bash
symdm environment -src_sid <SymID> -tgt_sid <SymID> -setup
```

Examples
To setup the migration path between source array 124 and target array 643, enter:

```bash
symdm environment -src_sid 124 -tgt_sid 643 -setup
```

A DM 'Environment Setup' operation is in progress. Please wait...

Analyze Configuration...........................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration...........................................Done.
SetupConfiguration............................................Started.
Setup Configuration............................................Done.

Expected response when running `environment-setup` command and the migration environment is already setup:

```bash
symdm environment -src_sid 124 -tgt_sid 643 -setup
```

A DM 'Environment Setup' operation is in progress. Please wait...

The migration environment is already configured.

Migration session creation for Non-Disruptive Migration

The migration session creation for NDM provides the following operations:

- **Validate** — Checks that the requirements and restrictions are met for the source array and the target array to ensure that a specific migration (storage group) can proceed. This command does not actually start the migration process.
- **Create** — performs several actions:
  - Provisions the target array with the equivalent storage used on the source array for the application.
Non-Disruptive Migration

- Configures the target array devices to have the same identity as the source array devices.
- Duplicates the application storage environment, of the specified storage group, on the source array to the target array.

**Note**
Once the migration operation starts, do not reboot hosts or modify storage groups.

**Validate create session for Non-Disruptive Migration**

**Description**
The `symdm create -validate` command validates that a specific migration (storage group) can proceed and replicates the application storage environment, of the specified storage group, on the source array to the target array.

**Syntax**
To validate the create action for NDM, use the following syntax:

```
symdm create –src_sid <SymID> –tgt_sid <SymID> -sg<sgName> -validate -noprompt
```

**Options**

-noprompt (-nop)
If included in command, user confirmation is not required for command execution.

**Examples**
To validate migration of storage group DM_APP1 between source array 124 and target array 643, enter:

```
symdm create -src_sid 124 -tgt_sid 643 -sg DM_APP1 -validate
```

A DM 'Validate Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration....................................................Validated.
- Create Storage Group(s) on Target.....................................Validated.
- Duplicate Device(s) on Target.........................................Validated.
- Create Initiator Group(s) on Target....................................Validated.
- Create Port Group(s) on Target........................................Validated.
- Create Masking View(s) on Target....................................Validated.

The DM 'Validate Create' operation successfully executed for storage group 'DM_APP1'

**Expected response when running create -validate that fails:**

```
symdm create -src_sid 124 -tgt_sid 643 -sg DM_APP1 -validate
```

A DM 'Validate Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration....................................................Validated.
- Create Storage Group(s) on Target.....................................Validated.
- Duplicate Device(s) on Target.........................................Validated.
- Create Initiator Group(s) on Target....................................Validated.
- Create Port Group(s) on Target........................................Validated.
- Create Masking View(s) on Target....................................Validated.
Create Port Group(s) on Target...........................................Failed.
Create Masking View(s) on Target.........................................Validated

The Validation failed. Please see the SYMAPI log file for more information.

The above create -validate command indicates a problem with the port-create action. This must be corrected before the migration is allowed.

Create session for Non-Disruptive Migration

Description
The symdm create command duplicates the application data, of the specified storage group, on the source array to the target array.

Syntax
To create a NDM session, use the following syntax:

```
symdm create -src_sid <SymID> -tgt_sid <SymID> -sg <sgName> -noprompt
-tgt_srp <SRPName> -tgt_pg <PgName> -nocompression -precopy
```

Options

- **-noprompt (-nop)**
  If included in command, user confirmation is not required for command execution.

- **-tgt_srp**
  Specifies the SRP name to use on the target array during the NDM create operation.

- **-tgt_pg**
  Specifies the PG name to use on the target array during the NDM create operation.

- **-nocompression**
  If included in command, the compression attribute is removed.

- **-precopy**
  If included in command, NDM starts copying the source data to the target array but does not make the target devices host visible. This is only available for HYPERMAX OS 5977 to PowerMaxOS migration.

Examples
To create a NDM session between source array 124 and target array 643 for storage group DM-APP1, enter:

```
symdm create -src_sid 124 -tgt_sid 643 -sg DM_APP1
```

A DM 'Create' operation is in progress for storage group 'DM_APP1'. Please wait...

```
Analyze Configuration......................................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration......................................................Done.
Set Dynamic RDF attribute on Source Device(s)............................Started.
```

Migration session creation for Non-Disruptive Migration
Set Dynamic RDF attribute on Source Device(s)..............................Done.
Create Storage Group(s) on Target..............................................Started.
Create Storage Group(s) on Target..............................................Done.
Duplicate Device(s) on Target....................................................Started.
Duplicate Device(s) on Target....................................................In Progress.
Duplicate Device(s) on Target....................................................Done.
Create Initiator Group(s) on Target.................................Started.
Create Initiator Group(s) on Target.................................Done.
Create Port Group(s) on Target..............................................Started.
Create Port Group(s) on Target..............................................Done.
Setup Data Replication.........................................................Started.
Setup Data Replication.........................................................Done.
Create Masking View(s) on Target............................Started.
Create Masking View(s) on Target............................Done.
Update Device State.........................................................Started.
Update Device State.........................................................Done.
The DM 'Create' operation successfully executed for storage group 'DM_APP1'

Expected response when issuing a create command for a migration that already in progress:

```bash
symdm create -src_sid 124 -tgt_sid 643 -sg DM_APP1
```
A DM 'Create' operation is in progress for storage group 'DM_APP1'. Please wait...
The migration session is already in the requested state.

Expected response when issuing a create command for a migration and the storage group is not in a masking view:

```bash
symdm create -src_sid 124 -tgt_sid 643 -sg DM_APP1
```
A DM 'Create' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..................................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration..................................................Failed.
The storage group is not in a masking view

Create precopy session for Non-Disruptive Migration (only for HYPERMAX OS 5977 to PowerMaxOS migration)

**Description**
The `symdm create -precopy` command configures the replication to start copying the source data to the target array after provisioning storage on the target array but does not make the target devices host visible. This allows the application to continue running only on the source array while allowing the data to be copied to the target.

**Note**
If the `--precopy` option is used, then the `readytgt` command is required to continue the migration process.
To create a precopy session, use the following syntax:

```
symdm create -precopy -src_sid <SymID> -tgt_sid <SymID> -sg <sgName> -noprompt
```

Options

- **-noprompt (-nop)**
  If included in command, user confirmation is not required for command execution.

Examples

To create a precopy session between source array 124 and target array 643 for storage group DM-APP1, enter:

```
symdm create -precopy -src_sid 124 -tgt_sid 643 -sg DM_APP1
```

A DM 'Precopy Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration..........................................Started.
- Source SID:000197100643
- Target SID:000197100644
- Analyze Configuration..........................................Done.
- Initialize Replication Environment..............................Started.
- Initialize Replication Environment..............................Done.
- Create Storage Group(s) on Target..............................Started.
- Create Storage Group(s) on Target..............................Done.
- Duplicate Device(s) on Target.................................Started.
- Preparing for device create on Target..........................Started.
- Preparing for device create on Target..........................Done.
- Duplicate Device(s) on Target.................................In Progress.
- Duplicate Device(s) on Target.................................Done.
- Create Initiator Group(s) on Target............................Started.
- Create Initiator Group(s) on Target............................Done.
- Create Port Group(s) on Target.................................Started.
- Create Port Group(s) on Target.................................Done.
- Start Data Replication..........................................Started.
- Start Data Replication..........................................Done.

The DM 'Precopy Create' operation successfully executed for storage group 'DM_APP1'.

Cutover Non-Disruptive Migration session (only for Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS migration)

Description

The `symdm cutover` command switches the application data access from the source array to the target array. After a successful cutover, the application will be running against newly-configured storage on the target array, with updates to its data replicating back to the source array.

Note

Prior to running the cutover action, a host rescan must be performed to verify that new paths to the application’s devices are discovered.
Syntax
To cutover a migration session, use the following syntax:

```
Note
The source or target array ID and the migrated storage group must be specified.
```

```
symdm cutover -sid <SymID> -sg <sgName> -noprompt
```

Options
- `noprompt`
  If included in command, user confirmation is required for command execution.

Examples
To cutover the migration session for storage group DM_APP1 on target array 643, enter:

```
symdm cutover -sid 643 -sg DM_APP1
```

A DM 'Cutover' operation is in progress for storage group 'DM_APP1'. Please wait...

```
Analyze Configuration..........................................Started.
  Source SID:000198700124
  Target_SID:000197100643
Analyze Configuration..........................................Done.
Cutover........................................................Started.
Cutover........................................................Done.
```

The DM 'Cutover' operation successfully executed for storage group 'DM_APP1'

Expected response when issuing a cutover command for a migration that is in process:

```
symdm cutover sid 643 -sg DM_APP1
```

A DM 'Cutover' operation is in progress for storage group 'DM_APP1'. Please wait...

The migration session is already in the requested state.

Readytgt Non-Disruptive Migration session (only for HYPERMAX OS 5977 to PowerMaxOS migration)

Description
The `symdm readytgt` command reconfigures the DM replication so the I/Os are replicated to the other array and makes the target devices visible to the host allowing the I/Os to be serviced from both the source and target devices.

Note
This operation is only used if the `-precopy` option was used with the create operation. After successfully completing the readytgt operation, a host rescan must be performed to ensure that the application host can use the target-side devices for I/O.
At this point both the target-side and source-side devices are host_active, I/O's can be serviced by either array and are replicated to the other array.

Syntax
To reconfigure the replication, use the following syntax:

```
Note
The source or target array ID and the migrated storage group must be specified.
```

```
symdm readytgt -sid <SymID> -sg <sgName> -i <Interval> -c <Count> -noprompt
```

Options
- `-c <#>, -i <#>`
  Executes list command for the specified number of times and the specified interval.
- `-noprompt`
  If included in command, user confirmation is not required for command execution.

Examples
To reconfigure the migration session for storage group DM_APP1 on target array 643, enter:

```
symdm readytgt -sid 643 -sg DM_APP1
```

A DM 'ReadyTgt' operation is in progress for storage group 'DM_APP1'. Please wait...

```
Analyze Configuration..........................................Started.
  Source SID:000197100643
  Target SID:000197100644
Analyze Configuration..........................................Done.
Preparing Devices for Host discovery...........................Started.
Preparing Devices for Host discovery...........................Done.
Create Masking View(s) on Target...............................Started.
Create Masking View(s) on Target...............................Done.
The DM 'ReadyTgt' operation successfully executed for storage group 'DM_APP1'.
```

Expected response when issuing a `readytgt` command for a migration that is in process:

```
symdm readytg sid 643 -sg DM_APP1
```

A DM 'ReadyTgt' operation is in progress for storage group 'DM_APP1'. Please wait...

```
The migration session is already in the requested state.
```

Commit Non-Disruptive Migration session

Description
The `symdm commit` command completes the migration by removing application resources from the source array and releasing resources used for the migration.
After the commit operation is complete, a host rescan that includes the -r option should be run to remove the dead paths to the target array. This should be followed by a multipath reload command.

**Syntax**

To commit a migration, use the following syntax:

```bash
symdm commit -sid <SymID> -sg <sgName> -noprompt
```

**Options**

- **-noprompt**
  
  If included in command, user confirmation is required for command execution.

**Examples**

To commit the migration for storage group DM_APP1 on target array 643, enter:

```
symdm commit -sid 643 -sg DM_APP1
```

A DM 'Commit' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration..........................................Started.
  
  Source SID:000198700124
  Target SID:000197100643
  
  Analyze Configuration..........................................Done.
  
  Remove Masking View(s) on Source...............................Started.
  Remove Masking View(s) on Source...............................Done.
  Remove Data Replication........................................Started.
  Remove Data Replication........................................In Progress.
  Remove Data Replication........................................Done.

The DM 'Commit' operation successfully executed for storage group 'DM_APP1'

If a commit operation fails, correct the cause of the failure and run a recover operation.

**Post-commit infrastructure actions**

After a commit operation is performed, following infrastructure changes take place:

- RDF device relationships used for migrating data via the DM RDF group are deleted, however the DM RDF group remains in place.
- Masking views on the source array are removed if there are no dedicated gatekeepers in the storage group.
- Source-side devices are assigned the device ID of the target-side device to ensure that the device is no longer used by the application that was moved to the target.
- If a migrated storage group had dedicated gatekeepers, a new storage group with the name of the migrated storage group and a suffix _SAVE_# is created on the source array, and all migrated devices on the source array are moved to this storage group.
Cancel Non-Disruptive Migration session

Description
The `symdm cancel` command halts a migration that has not been committed. The cancel operation applies only to the migration of the specified storage group. Other migrations running in parallel will continue, and new migrations can be created at any time during or after the cancel operation. A cancel action is blocked if the target-side devices are configured for local or remote replication. Replication must be removed prior to running the cancel operation.

Note
After the cancel operation is complete, a host rescan that includes the option to remove the dead paths to the target array. This should be followed by a multipath reload command.

For Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS migrations, if a cutover command has been issued, the cancel action must use the `-revert` flag. This forces all data to be replicated back to the source side devices before the cancel can complete.

Syntax
To cancel a migration, use the following syntax:

```
Note
The source or target array ID and the migrated storage group must be specified.
```

```
symdm cancel -sid <SymID> -sg <sgName> -noprompt
```

Options
- **-noprompt**
  If included in command, user confirmation is not required for command execution.

Examples
To cancel the migration for storage group `DM_APP1` on target array 643 prior to cutover, enter:

```
symdm cancel -sid 643 -sg DM_APP1
```

A DM 'Cancel' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration...............Started.
  - Source SID:000198700124
  - Target SID:000197100643
  Analyze Configuration...............Done.
- Remove Masking View(s) on Target.............Started.
- Remove Data Replication.....................Started.
- Remove Port Group(s) on Target...............Started.
- Remove Duplicate Device(s) on Target.........Started.
- Wait for deallocation to complete ...........Started.
Wait for deallocation to complete ............................................Done.
Remove Duplicate Device(s) on Target.................................Done.
Remove Storage Group(s) on Target.................................Started.
Remove Storage Group(s) on Target.................................Done.
The DM 'Cancel' operation successfully executed for storage group 'DM_APP1'

To cancel the migration, that has been cutover, for storage group DM_APP1 on target array 643, enter:

```
symdm cancel -revert -sid 643 -sg DM_APP1
```

A DM 'Cancel Revert' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration..........................................Done.
Revert Data Replication...........................................Started.
Revert Data Replication...........................................In Progress.
Revert Data Replication...........................................Done.
Remove Masking View(s) on Target..............................Started.

.......The DM 'Cancel Revert' operation successfully executed for storage group 'DM_APP1'

Upon successful completion of a cancel operation, the storage environment reverts to the pre-migration state:

- Migration replication pathway connections are severed.
- Any target-side resources configured for the application that are not shared with other applications are removed.
- Application is running on the source only.

**Synchronizing devices for Non-Disruptive Migration session**

The sync operation controls target to source replication after all of the data is on the target array.

If the target-to-source device replication needs to be controlled, the following sync control actions are available:

- **sync -stop** — Suspends target-to-source device replication and puts the migration in a *CutoverNoSync* state.
- **sync -start** — Establishes target-to-source device replication and puts the migration in a *CutoverSyncing* or *CutoverSync* state.

**Stop device synchronization for Non-Disruptive Migration session**

**Description**

The `symdm sync -stop` command suspends target-to-source replication.

**Syntax**

To stop target-to-source replication, use the following syntax:
Synchronizing devices for Non-Disruptive Migration session

**Note**
The source or target array ID, and the migrating storage group must be specified.

```bash
symdm sync -sid <SymID> -sg <sgName> -stop
```

**Examples**
To stop target-to-source replication for storage group DM-APP1 from target array 643, enter:

```
symdm sync -sid 643 -sg DM_APP1 -stop
```

A DM 'Sync Stop' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration............................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration............................................Done.
Stop Data Replication............................................Started.
Stop Data Replication............................................Done.

The DM 'Sync Stop' operation successfully executed for storage group 'DM_APP1'

---

**Start device synchronization for Non-Disruptive Migration session**

**Description**
The `symdm sync -start` command establishes target-to-source replication.

**Syntax**
To start target-to-source replication, use the following syntax:

```bash
symdm sync -sid <SymID> -sg <sgName> -start
```

**Note**
The source or target array ID, and the migrating storage group must be specified.

```bash
symdm sync -sid <SymID> -sg <sgName> -start
```

**Examples**
To start target-to-source replication for storage group DM-APP1 from target array 643, enter:

```
symdm sync -sid 643 -sg DM_APP1 -start
```

A DM 'Sync Start' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration............................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration............................................Done.
Start Data Replication..........................................Started.
Start Data Replication..........................................Done.

The DM 'Sync Start' operation successfully executed for storage group 'DM_APP1'
Recover a failed Non-Disruptive Migration session

Description
The `symdm recover` command recovers the last action performed and puts the migration in a state that allows the failed action (create, cutover, commit, or cancel) to complete. The recover operation is only used after a migration step results in a *Failed* state.

A recover operation performs the following actions:

- Determines which migration step failed.
- Puts the migration session's resources (connections, devices, etc.) into the appropriate state to allow the failed action to complete.
- Repeats or resumes (depending on the cause of the failure) the failed action.

Syntax
To recover from a failed migration, use the following syntax:

```
Note
The source or target array ID and the migrated storage group must be specified.
```

```
symdm recover -sid <SymID> -sg <sgName>
```

Examples
To recover from a failed create migration of storage group `DM_APP1` on target array 643, enter:

```
symdm recover -sid 643 -sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...  

- Analyze Configuration..........................................Started.  
  Source SID:000198700124  
  Target SID:000197100643  
- Analyze Configuration..........................................Done.  
- Create Storage Group(s) on Target..............................Not Needed.  
- Duplicate Device(s) on Target....................................Not Needed.  
- Create Initiator Group(s) on Target...............................Not Needed.  
- Create Port Group(s) on Target....................................Not Needed.  
- Setup Data Replication.........................................Started.  
- Setup Data Replication.........................................Done.  
- Create Masking View(s) on Target...............................Started.  
- Create Masking View(s) on Target...............................Done.  
- Update Device State............................................Started.  
- Update Device State............................................Done.

The DM 'Recover' operation successfully executed for storage group 'DM_APP1'

To recover from a failed cutover of storage group `DM_APP1` on target array 643, enter:

```
symdm recover -sid 643 -sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...
Analyze Configuration..........................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration..........................................Done.
Recover Data Replication.......................................Started.
Recover Data Replication.......................................Done.
Cutover..................................................................Started.
Cutover..................................................................In Progress.
Cutover..................................................................In Progress.
Cutover..................................................................Done.
The DM 'Recover' operation successfully executed for storage group 'DM_APP1'

To recover from a failed commit of storage group DM_APP1 on target array 643, enter:

\texttt{symdm recover --sid } 643 \texttt{--sg DM_APP1}

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration..........................................Done.
Remove Masking View(s) on Source...............................Started.
Remove Masking View(s) on Source...............................Done.
Remove Data Replication........................................Started.
Remove Data Replication........................................Done.
The DM 'Recover' operation successfully executed for storage group 'DM_APP1'

To recover from a failed cancel for the migration session of storage group DM_APP1 on target array 643, enter:

\texttt{symdm recover --sid } 643 \texttt{--sg DM_APP1}

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
Source SID:000198700124
Target SID:000197100643
Analyze Configuration..........................................Done.
Remove Data Replication........................................Not Needed.
Remove Port Group(s) on Target.................................Started.
Remove Port Group(s) on Target.................................Done.
Remove Initiator Group(s) on Target............................Started.
Remove Initiator Group(s) on Target............................Done.
Remove Duplicate Device(s) on Target..........................Started.
Wait for deallocation to complete..............................Started.
Wait for deallocation to complete..............................Done.
Remove Storage Group(s) on Target............................Started.
Remove Storage Group(s) on Target............................Done.
The DM 'Recover' operation successfully executed for storage group 'DM_APP1'
To recover from a failed revert for the migration session of storage group DM_APP1 on target array 643, enter:

```bash
symdm recover –sid 643 –sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

```
Analyze Configuration.................................Started.
    Source SID:000198700124
    Target SID:000197100643
Analyze Configuration.................................Done.
Revert Data Replication...............................Started.
Revert Data Replication...............................In Progress.
Revert Data Replication...............................Done.
Remove Masking View(s) on Target.....................Started.
Remove Masking View(s) on Target.....................Done.
Remove Data Replication...............................Started.
Remove Data Replication...............................Done.
Remove Port Group(s) on Target........................Started.
Remove Port Group(s) on Target........................Done.
Remove Initiator Group(s) on Target...................Started.
Remove Initiator Group(s) on Target...................Done.
Remove Duplicate Device(s) on Target...............Started.
Wait for deallocation to complete. ..................0
Wait for deallocation to complete. ..................0
Wait for deallocation to complete. ..................Done.
Remove Duplicate Device(s) on Target...............Done.
Remove Storage Group(s) on Target....................Started.
Remove Storage Group(s) on Target....................Done.
```

The DM 'Recover' operation successfully executed for storage group 'DM_APP1'

### Remove environment for Non-Disruptive Migration session

**Description**

The `symdm environment -remove` command removes the migration infrastructure created by the `-setup` option after all necessary application migrations have been completed. The migration must be cancelled or committed before this command is allowed.

**Note**

Separate remove operations are required for each source and target array pair. The environment remove operation removes the DM RDF group between the two arrays, provided there are no migration sessions in progress.

**Syntax**

To remove the environment for NDM, use the following syntax:

```bash
symdm environment -src_sid <SymID> -tgt_sid <SymID> -remove
```

**Note**

The source and target array IDs must be specified.
Examples
To remove the migration path between source array 124 and target array 643, enter:

```
symdm environment -src_sid 124 -tgt_sid 643 -remove
```

A DM 'Environment Remove' operation is in progress. Please wait...

- Analyze Configuration..................................................Started.
  Source SID:000198700124
  Target SID:000197100643
- Analyze Configuration..............................................Done.
- Remove Configuration..................................................Started.
- Remove Configuration..............................................Done.

The DM 'Environment Remove' operation successfully executed.

List Non-Disruptive Migration session status

Syntax
To monitor migration session status, use the following syntax:

```
symdm list
```

Options
- `-sg <SgName>`
  Lists migration status for specified storage group only.

- `-c <#>, -i <#>`
  Executes list command for the specified number of times and the specified interval.

- `-v`
  Lists summary information about each of the current migration sessions and will display where the migration session failed.

- `-detail`
  Lists detailed information on the state of a single migration session. Displays a detailed list of all objects used in the migration session of a specified storage group (`-sg`). Using these options can help to isolate the cause of a failed migration.

- `-environment [-offline]`
  Reports summary information for configured migration environments. All local and remote arrays are queried. The `-offline` option sets this operation to run in offline mode using only the host configuration database.

- `-sg_info | -pg_info | -ig_info | -view_info | -pairs_info`
  Filters the `symdm list -sg -v - detail` command to list the detail for only storage groups, port groups, initiator groups, masking views, or device pairs.
Examples
To list the migrations sessions and the status, for array 084, enter:

```
symdm list -sid 084
```

To list the migration session and status for storage group storgrp_a, enter:

```
symdm list -sid 084 -sg storgrp_a
```

To list the summary information for each of the currently configured migration environments, enter:

```
symdm list -environment
```

Sample output
For all sessions in a specified array:

```
Symmetrix ID: 000197100084

<table>
<thead>
<tr>
<th>Storage Group</th>
<th>Source</th>
<th>Target</th>
<th>Capacity</th>
<th>Done</th>
</tr>
</thead>
</table>
| storgrp_a     | 000198700084 | 000197100085 | 500.0 | 90%
| storgrp_b     | 000198700084 | 000197100085 | 1000.0 | N/A
```

For specific storage group:

```
Symmetrix ID : 000197100084
Storage Group: storgrp_a

<table>
<thead>
<tr>
<th>Source</th>
<th>Target</th>
<th>Capacity</th>
<th>Done</th>
</tr>
</thead>
</table>
| 000197100084 | 000197100085 | Migrating | 500.0 | 90%
```

For migration environment status:

```
Symmetrix ID: 000194901137

<table>
<thead>
<tr>
<th>Remote SymmID</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>000196801476</td>
<td>OK</td>
</tr>
<tr>
<td>000197100084</td>
<td>Failed</td>
</tr>
</tbody>
</table>
```

Symmetrix ID: 000196801476
Remote SymmID  Status
----------  ------
000194901137   OK
000198700030   Failed

Using list command to troubleshoot migration failure
Refer to Example: Troubleshoot migration failure (device moved between storage groups) on page 521 and Example: Troubleshoot migration failure (masking view added) on page 523 for using the symdm list command for troubleshooting a migration failure.

Non-Disruptive Migration examples

This section provides the following examples for using Non-Disruptive Migration to migrate an application to a newly acquired VMAX All Flash array (ID 000197300015)

Example: Non-Disruptive Migration environment setup on page 511
Example: Typical Non-Disruptive Migration process (from Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS) on page 512
Example: Typical Non-Disruptive Migration process (from HYPERMAX OS 5977 to PowerMaxOS 5978) on page 514
Example: Suspending, restarting and recovering the Non-Disruptive Migration session on page 517
Example: Cancelling the Non-Disruptive Migration session on page 520
Example: Troubleshoot migration failure (device moved between storage groups) on page 521
Example: Troubleshoot migration failure (masking view added) on page 523

Example: Non-Disruptive Migration environment setup

The following example shows how to use the symdm environment -setup command to prepare to migrate two applications each from a different source VMAX array to the same target VMAX3 array:

- HR2 currently uses VMAX array 000194902222 for data storage.
- PAYROLL4 currently uses VMAX array 000194904444 for data storage.
- Both applications will be migrated to VMAX All Flash array 000197300015.

Both migrations can be performed concurrently, but the migration infrastructure requires that concurrent migration setup and create operations are constructed separately. Therefore, the environment setup commands are run separately.

Note

When either environment setup completes, the migration for the completed setup can be started.

The environment setup operation is run for source array 222 and target array 015.

symdm environment --src_sid 222 --tgt_sid 015 --setup

A DM 'Environment Setup' operation is in progress. Please wait...
The environment setup operation is run for source array 444 and target array 015.

```
symdm environment -src_sid 444 -tgt_sid 015 -setup
```

A DM 'Environment Setup' operation is in progress. Please wait...

```
Analyze Configuration..........................................Started.
  Source SID:000194904444
  Target SID:000197300015
Analyze Configuration..........................................Done.
Setup Configuration............................................Started.
Setup Configuration............................................Done.
The DM 'Environment Setup' operation successfully executed.
```

Example: Typical Non-Disruptive Migration process (from Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS)

The HR2 application is storing data on the source VMAX array 000194902222. The following example shows how to use the symdm create, symdm cutover and symdm commit commands to move the HR2 data target VMAX3 array 000197300015 and run the application from this array.

1. The create operation is run specifying the source array 222, target array 015, and the storage group HR2 as application data to be migrated.

```
symdm create -src_sid 222 -tgt_sid 015 -sg HR2.
```

A DM 'Create' operation is in progress for storage group 'HR2'. Please wait...

```
Analyze Configuration..........................................Started.
  Source SID:000194902222
  Target SID:000197300015
Analyze Configuration..........................................Done.
Create Storage Group(s) on Target............................Started.
Create Storage Group(s) on Target............................Done.
Duplicate Device(s) on Target.................................Started.
Duplicate Device(s) on Target.................................Done.
Create Initiator Group(s) on Target..........................Started.
Create Initiator Group(s) on Target..........................Done.
Create Port Group(s) on Target...............................Started.
Create Port Group(s) on Target...............................Done.
Setup Data Replication........................................Started.
Setup Data Replication........................................Done.
Create Masking View(s) on Target.............................Started.
Create Masking View(s) on Target.............................Done.
Update Device State...........................................Started.
Update Device State...........................................Done.
The DM 'Create' operation successfully executed for storage group 'HR2'.
2. A host rescan is run. After the host rescan:
   - The application can issue I/Os to both the source and target devices.
   - The host multi-pathing software discovers that HR2's storage accessible using a path to the target array.
   - The migration session is in CutoverReady state which indicates that the array has a minimum of one path from an initiator in a masking view.

3. A cutover operation is run.

   **Note**
   Either the source or the target array participating in the migration session can be specified in the `symdm cutover` command.

   During the cutover operation the NDM process:
   - Moves HR2 I/O processing to only the target array devices.
   - Makes source array devices `host_inactive`.
   - The host multi-pathing software discovers that HR2's storage is not accessible using the path to the source array.
   - Writes issued to HR2's storage on the target array replicate back to the source array, in the event that the migration is cancelled and the HR2 processing reverts to the source array.

```
symdm cutover -sid 015 -sg HR2
A DM 'Cutover' operation is in progress for storage group 'HR2'. Please wait...
   Analyze Configuration..........................................Started.
       Source SID:000194902222
       Target SID:000197300015
    Analyze Configuration..........................................Done.
   Cutover........................................................Started.
    Cutover........................................................Done.
The DM 'Cutover' operation successfully executed for storage group 'HR2'
```

HR2 application is now running on the target array.

4. A list operation is run to check for the CutoverSync state for the migration session.

   **Note**
   Either the source or the target array participating in the migration session can be specified in the `symdm list` command.

```
symdm list -sid 222 -sg HR2
Symmetrix ID : 000194902222
Storage Group: storgrp_a

Total Source       Target       Capacity
Done Array        Array        State         (GB)      (%)
-------------- -------------- ----------- --------- ----
000194902222 000197300015 Migrating              500.0   90
```

Example: Typical Non-Disruptive Migration process (from Enginuity 5876 to HYPERMAX OS 5977, or to PowerMaxOS)
All HR2 data has been synchronized between the source and target arrays.

5. A commit operation is run to complete the migration of HR2.

**Note**

Either the source or the target array participating in the migration session can be specified in the `symdm commit` command.

```bash
symdm commit -sid 015 -sg HR2
```

A DM 'Commit' operation is in progress for storage group 'HR2'. Please wait...

- Analyze Configuration............................................Started.
  - Source SID:000194902222
  - Target SID:000197300015
- Analyze Configuration............................................Done.
- Remove Masking View(s) on Source.................................Started.
- Remove Masking View(s) on Source.................................Done.
- Remove Data Replication.........................................Started.
- Remove Data Replication.........................................Done.

The DM 'Commit' operation successfully executed for storage group 'HR2'

HR2 application now permanently runs on the target array and no longer runs on the source array.

**Note**

Run a host rescan using `-r` option, followed by a multipath reload command.

**Example: Typical Non-Disruptive Migration process (from HYPERMAX OS 5977 to PowerMaxOS 5978)**

The DM_APP1 application is storing data on the source VMAX array 000194902643. The following example shows how to use the `symdm create`, `symdm cutover` and `symdm commit` commands to move the DM_APP1 data target VMAX3 array 000197300644 and run the application from this array.

1. The `create -validate` operation is run to check if the requirements and restrictions are met to ensure that the specified migration can proceed.

```bash
symdm create -src_sid 643 -tgt_sid 644 -sg DM_APP1 -validate
```

A DM 'Validate Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration............................................Validated
  - Initialize Replication Environment..........................Validated.
  - Create Storage Group(s) on Target..........................Validated.
  - Duplicate Device(s) on Target..............................Validated.
  - Create Initiator Group(s) on Target.........................Validated.
  - Create Port Group(s) on Target..............................Validated.
2. The create operation is run specifying the source array 643, target array 644, and the storage group DM_APP1 as application data to be migrated.

```
sydm create -src_sid 643 -tgt_sid 644 -sg DM_APP1
```

A DM 'Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration..............................Started.
  - Source SID:000197100643
  - Target SID:000197100644
- Analyze Configuration..............................Done.
- Initialize Replication Environment.....................Started.
- Initialize Replication Environment.....................Done.
- Create Storage Group(s) on Target......................Started.
- Create Storage Group(s) on Target......................Done.
- Duplicate Device(s) on Target..........................Started.
- Duplicate Device(s) on Target..........................In Progress.
- Duplicate Device(s) on Target..........................Done.
- Create Initiator Group(s) on Target....................Started.
- Create Initiator Group(s) on Target....................Done.
- Create Port Group(s) on Target........................Started.
- Create Port Group(s) on Target........................Done.
- Start Data Replication...............................Started.
- Start Data Replication...............................Done.
- Create Masking View(s) on Target.......................Started.
- Create Masking View(s) on Target.......................Done.

The DM 'Create' operation successfully executed for storage group 'DM_APP1'.

3. OPTIONAL Precopy: Using the -precopy option duplicates the DM_APP1 application's storage on the target array 644 and configures data replication from the source array 643 to the target array.

```
sydm create -precopy -src_sid 643 -tgt_sid 644 -sg DM_APP1
```

A DM 'Precopy Create' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration..............................Started.
  - Source SID:000197100643
  - Target SID:000197100644
- Analyze Configuration..............................Done.
- Initialize Replication Environment.....................Started.
- Initialize Replication Environment.....................Done.
- Create Storage Group(s) on Target......................Started.
- Create Storage Group(s) on Target......................Done.

Note

The target array devices are not made host visible when the command completes. After the precopy operation, you
Create Storage Group(s) on Target..............................Done.
Duplicate Device(s) on Target..............................Started.
  Preparing for device create on Target..............................Done.
Duplicate Device(s) on Target..............................In Progress.
  Preparing for device create on Target..............................Done.
Create Initiator Group(s) on Target..............................Started.
Create Initiator Group(s) on Target..............................Done.
Create Port Group(s) on Target..............................Started.
Create Port Group(s) on Target..............................Done.
Start Data Replication.........................................Started.
Start Data Replication.........................................Done.
The DM 'Precopy Create' operation successfully executed for storage group 'DM_APP1'.

4. OPTIONAL Ready tgt:

Note

Readytgt can only be used after –precopy was successfully executed.

This reconfigures the replication so the I/Os are replicated to the source array 643 and will make the target devices visible to the host.

```
symdm readytgt -sid 643 -sg DM_APP1
```

A DM 'ReadyTgt' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
  Source SID:000197100643
  Target SID:000197100644
Analyze Configuration..........................................Done.
Preparing Devices for Host discovery..............................................Started.
Preparing Devices for Host discovery..............................................Done.
Create Masking View(s) on Target..............................Started.
Create Masking View(s) on Target..............................Done.
The DM 'ReadyTgt' operation successfully executed for storage group 'DM_APP1'.
5. Use the commit operation to complete the migration process by removing application resources from the source array 643 and releasing resources used for the migration.

```bash
symdm commit -sid 643 -sg DM_APP1
```

A DM 'Commit' operation is in progress for storage group 'DM_APP1'. Please wait...

```
<table>
<thead>
<tr>
<th>Step</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze Configuration</td>
<td>Started</td>
</tr>
<tr>
<td>Source SID: 000197100643</td>
<td></td>
</tr>
<tr>
<td>Target SID: 000197100644</td>
<td></td>
</tr>
<tr>
<td>Analyze Configuration</td>
<td>Done</td>
</tr>
<tr>
<td>Stop Data</td>
<td></td>
</tr>
<tr>
<td>Replication</td>
<td>Started</td>
</tr>
<tr>
<td>Stop Data</td>
<td></td>
</tr>
<tr>
<td>Remove Masking View(s) on Source</td>
<td>Started</td>
</tr>
<tr>
<td>Remove Masking View(s) on Source</td>
<td>Done</td>
</tr>
<tr>
<td>Remove Data</td>
<td></td>
</tr>
<tr>
<td>Replication</td>
<td>Started</td>
</tr>
<tr>
<td>Remove Data</td>
<td></td>
</tr>
<tr>
<td>Replication</td>
<td>In Progress</td>
</tr>
<tr>
<td>Remove Data</td>
<td></td>
</tr>
<tr>
<td>Replication</td>
<td>Done</td>
</tr>
<tr>
<td>Remove Replication Environment</td>
<td></td>
</tr>
<tr>
<td>Remove Replication Environment</td>
<td>Started</td>
</tr>
<tr>
<td>Remove Replication</td>
<td></td>
</tr>
<tr>
<td>Remove Replication Environment</td>
<td>Done</td>
</tr>
</tbody>
</table>
```

The DM 'Commit' operation successfully executed for storage group 'DM_APP1'.

---

**Example: Suspending, restarting and recovering the Non-Disruptive Migration session**

The following example shows how to suspend, restart or recover a migration. The `symdm sync -stop` command suspends the source-target replication to remove the overhead of synchronizing writes back to the source array. This overhead could interfere when testing the performance of the application on the new array. Removing this overhead is also beneficial when it is unlikely that a `symdm cancel` action will be issued to migrate the application's storage back to the source array. The `symdm sync -start` command re-establishes the source-target replication. It can be used to reverse the effect of a `symdm sync -stop` action, or after replication has been halted by a link failure. The `symdm recover` command can be used after correcting the cause of a failed `symdm` action (create, readytgt, commit, or cancel) to put the migration into the appropriate state and then repeat or resume the failed action.

1. The `symdm sync -stop` operation suspends the replication from the source array 643.

```bash
symdm sync -sid 643 -sg DM_APP1 -stop
```
A DM 'Sync Stop' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
  Source SID:000197100643
  Target SID:000197100644
Analyze Configuration..........................................Done.
Stop Data Replication..........................................Started.
Stop Data Replication..........................................Done.

The DM 'Sync Stop' operation successfully executed for storage group 'DM_APP1'.

2. The `symdm sync -start` operation re-establishes replication from the source array 643.

`symdm sync -sid 643 -sg DM_APP1 -start`

A DM 'Sync Start' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
  Source SID:000197100643
  Target SID:000197100644
Analyze Configuration..........................................Done.
Start Data Replication.........................................Started.
Start Data Replication.........................................Done.

The DM 'Sync Start' operation successfully executed for storage group 'DM_APP1'.

3. The `symdm recover` operation fixes the migration state and attempts to repeat or resume a failed action:
   - Recovering a failed create action:

`symdm recover -sid 643 -sg DM_APP1`

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

Analyze Configuration..........................................Started.
  Source SID:000197100643
  Target SID:000197100644
Analyze Configuration..........................................Done.
Initialize Replication Environment.............................Not Needed.
Create Storage Group(s) on Target.............................Not Needed.
Duplicate Device(s) on Target.................................Not Needed.
Create Initiator Group(s) on Target............................Not Needed.
Create Port Group(s) on Target.................................Not Needed.
Start Data Replication.........................................Started.
Start Data Replication.........................................Done.
Create Masking View(s) on Target...............................Started.
Create Masking View(s) on Target...............................Done.

The DM 'Recover' operation successfully executed for storage group 'DM_APP1'.
• Recovering a failed precopy action:

```
symdm recover -sid 643 -sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration.................................................Started.
  Source SID:000197100643
  Target SID:000197100644
- Analyze Configuration.................................................Done.
- Initialize Replication Environment............................Not Needed.
- Create Storage Group(s) on Target..............................Not Needed.
- Duplicate Device(s) on Target....................................Not Needed.
- Create Initiator Group(s) on Target............................Not Needed.
- Create Port Group(s) on Target.................................Not Needed.
- Start Data Replication..............................................Started.
- Start Data Replication..............................................Done.

The DM 'Recover' operation successfully executed for storage group 'DM_APP1'.

• Recovering a failed commit action:

```
symdm recover -sid 643 -sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration.................................................Started.
  Source SID:000197100643
  Target SID:000197100644
- Analyze Configuration.................................................Done.
- Stop Data Replication................................................Not Needed.
- Remove Masking View(s) on Source...............................Not Needed.
- Remove Data Replication.............................................Started.
- Remove Data Replication.............................................Done.
- Remove Replication Environment...............................Started.
- Remove Replication Environment...............................Done.

The DM 'Recover' operation successfully executed for storage group 'DM_APP1'.

• Recovering a failed cancel action:

```
symdm recover -sid 643 -sg DM_APP1
```

A DM 'Recover' operation is in progress for storage group 'DM_APP1'. Please wait...

- Analyze Configuration.................................................Started.
  Source SID:000197100643
  Target SID:000197100644
- Analyze Configuration.................................................Done.
- Stop Data Replication................................................Not Needed.
- Remove Masking View(s) on Target...............................Not Needed.
- Remove Data Replication.............................................Started.
Example: Cancelling the Non-Disruptive Migration session

The following example shows how to use the `symdm cancel` to cancel a migration after it is created but prior to cutover, and how to use the `symdm cancel -revert` command to cancel a migration after it is created and cutover, but before it is committed. Refer to Non-Disruptive Migration control actions and dependent migration states on page 489 for migration states that allow the cancel operation.

- Cancel operation prior to cutover. HR2 migration is currently in the Created state and a decision is made not to complete the migration.

1. A cancel operation is run specifying target array 015 and storage group HR2. During the cancel operation the NDM process:
   - Severs the replication pathway connection between the source and target devices.
   - Removes the storage provisioned on the target array for HR2 by the create operation.

   ```
   symdm cancel –sid 015 –sg HR2
   ```

   A DM 'Cancel' operation is in progress for storage group 'HR2'. Please wait...

   - Analyze Configuration
   - Source SID:000194902222
   - Target SID:000197300015
   - Analyze Configuration
   - Remove Masking View(s) on Target
   - Remove Masking View(s) on Target
   - Remove Data Replication
   - Remove Data Replication
   - Remove Port Group(s) on Target
   - Remove Port Group(s) on Target
   - Remove Initiator Group(s) on Target
   - Remove Initiator Group(s) on Target
   - Remove Duplicate Device(s) on Target
   - Remove Duplicate Device(s) on Target
   - Wait for deallocation to complete
   - Wait for deallocation to complete
   - Remove Storage Group(s) on Target
   - Remove Storage Group(s) on Target
   - Remove Storage Group(s) on Target
   - Remove Storage Group(s) on Target

   The DM 'Cancel' operation successfully executed for storage group 'HR2'.

2. After the cancel operation is complete, a host rescan that includes the option to remove the dead paths to the target array. This is followed by a multipath reload command.
Cancel operation after cutover. HR2 migration has been created, and a host rescan and cutover operation have been run. HR2 is currently in the CutoverSync state and a decision is made not to complete the migration.

1. A cancel operation, with the -revert flag, is run specifying target array 015 and storage group HR2. During the cancel and revert operation the NDM process:
   - Checks that all HR2 data is available on the source array and moves HR2 processing back to the source array.
   - Removes the replication pathway connection between the source and target devices.
   - Removes the storage provisioned on the target array for HR2 by the create operation.

   ```
   symdm cancel -sid 015 -sg HR2 -revert
   ```

   A DM 'Cancel Revert' operation is in progress for storage group 'DM_APP1'. Please wait...

   Analyze Configuration..........................................Started.
   Source SID:000194902222
   Target SID:000197300015
   Analyze Configuration..........................................Done.
   Revert Data Replication........................................Started.
   Revert Data Replication........................................In Progress.
   Revert Data Replication........................................Done.
   Remove Masking View(s) on Target....................................Started.
   ......

   The DM 'Cancel' operation successfully executed for storage group 'HR2'

2. After the cancel operation is complete, a host rescan that includes the option to remove the dead paths to the target array. This is followed by a multipath reload command.

Application environment following the migration cancellation.

- HR2 continues to run uninterrupted on the source array as the migration process cancels the migration.
- At the completion of the cancel operation, the HR2 environment is the same as it was prior to running the migration create operation. No resources remain allocated for HR2 on the target array, and HR2 is processing only on the source array.

Example: Troubleshoot migration failure (device moved between storage groups)

The following example shows how to use the `symdm list -v` command to help troubleshoot a failed migration session. The failure is a result of a device being moved, in the target configuration, from one child storage group to another after the migration was started.

The following output from the `symdm list -v` command displays the migration status of the application HR2 from array 137 to array 084. The application contains a cascaded storage group (two child storage groups) with three masking views to the application hosts. These masking views are configured with different port groups and a combination of cascaded and standalone initiator groups.
1. Run the `symdm list -v` command to display summary information for the storage group HR2 migration session:

```
symdm list -sid 084 -sg HR2 -v
```

```
Storage Group : HR2
Source Array  : 000194901137
Target Array  : 000197100084
Migration State : CutoverReady
Total Capacity (GB) : 500.0
Done (%) : N/A

Source Configuration: OK
{ Storage Groups (3) : OK
  Masking Views (3) : OK
  Initiator Groups (5): OK
  Port Groups (3) : OK
}

Target Configuration: Failed
{ Storage Groups (3) : Failed
  Masking Views (3) : OK
  Initiator Groups (5): OK
  Port Group (3) : OK
}

Device Pairs (9): OK
```

The output shows a migration failure for the storage group objects in the target configuration. The migration has reached *CutoverReady* state.

2. Run the `symdm list -sg -v -detail` with the `-sg_info` option. This filters the display to list only the storage groups used in the migration session with storage group HR2, and the current state of each groups.

```
symdm list –sid 084 –sg HR2 –v –detail
```

```
Storage Group : HR2
Source Array  : 000194901137
Target Array  : 000197100084
Migration State : CutoverReady
Total Capacity (GB) : 500.0
Done (%) : N/A

Source Configuration: OK
{ Storage Groups (3): OK
  { Name : HR2
    Status : OK
    { Group Name
      Hint
      HR2_sga
      HR2_sgb
    }
    Name : HR2_sga
    Status : OK
  }

```
The child storage groups in the target configuration are in a Failed state because they no longer contain the same devices as the storage groups in the target array (device was moved).

3. Identify the moved device by running the `symsg show` command on the target array, then compare the these devices with the expected set of devices shown in the display. Once the device discrepancy is corrected, a `symdm cutover` command can be run to repeat the failed action.

Example: Troubleshoot migration failure (masking view added)

The following example shows how to use the `symdm list -v` command to help troubleshoot a failed migration session. The failure is a result of a masking view being added, in the source configuration, after the migration was started. The following output from the `symdm list -v` command displays the migration status of the application HR2 from array 137 to array 084. The application contains a cascaded storage group (two child storage groups) with three masking views to the application hosts. These masking views are configured with different port groups and a combination of cascaded and standalone initiator groups.
1. Run the `symdm list -v` command to display summary information for the storage group HR2 migration session:

```
symdm list -sid 084 -sg HR2 -v
Storage Group : HR2
Source Array  : 000194901137
Target Array  : 000197100084

Migration State : CutoverSync
Total Capacity (GB) : 500.0
Done (%) : N/A

Source Configuration: Failed
{  Storage Groups (3) : OK
   Masking Views (3) : Failed
    Initiator Groups (5): OK
     Port Groups (3) : OK
}

Target Configuration: Failed
{  Storage Groups (3) : OK
   Masking Views (3) : OK
    Initiator Groups (5): OK
     Port Group (3) : OK
}
Device Pairs (9): OK
```

The output shows a migration failure for the masking view objects in the source configuration. The migration has reached `CutoverSync` state.

2. Run the `symdm list -sg -v -detail` command to display a detailed list of all the objects used in the migration session with storage group HR2, and the current state of each object.

**Note**

Output is abbreviated. Also, the `-view_info` option can be used to display only the masking view info.

```
symdm list -sid 084 -sg HR2 -v -detail
Storage Group : HR2
Source Array  : 000194901137
Target Array  : 000197100084

Migration State : CutoverSync
Total Capacity (GB) : 500.0
Done (%) : 100

Source Configuration: Failed
{  Storage Groups (3): OK
    {  Name : HR2
       Status : OK
       {  Group Name
          ----------------------------------------
          HR2_sga
        }
  }
}
Masking Views (3): Failed
{
  Masking View Name     Initiator Group       Port Group            Status
  --------------------- --------------------- --------------------- ---------
  HR2_hosta_view        HR2_hosts             HR_pg1                OK
  HR2_hostb_view        HR2_hostx_ig          HR_pg2                OK
  HR2_hostc_view        HR2_hosty_ig          HR_pg3                OK
}

Initiator Groups (5): OK
{
  Name : HR2_hosts
  Status : OK
  {
    Group Name
    ---------------------
    HR2_hostx_child_ig
    HR2_hosty_child_ig
  }
}

Port Groups (3): OK
{
  Name : HR2_pg1
  Status : OK
  {
    Dirport Status
    -------- --------
    02E:000 OK
    03F:000 OK
    02F:000 OK
    03G:000 OK
  }
}

Target Configuration: OK
{
  Storage Groups (3): OK
  {
    Name : HR2
    Status : OK
    {
      Group Name
      ---------------------
      HR2_sga
      HR2_sgb
    }
  }
  Masking Views (3): OK
  {
    Masking View Name     Initiator Group       Port Group            Status
    --------------------- --------------------- --------------------- ---------
    HR2_hosta_view        HR2_hosts             HR_pg1                OK
    HR2_hostb_view        HR2_hostx_ig          HR_pg2                OK
    HR2_hostc_view        HR2_hosty_ig          HR_pg3                OK
  }
}

Initiator Groups (5): OK
{
  Name : HR2_hosts
  Status : OK
  {
    Group Name
  }
}
The masking views in the source configuration are in a Failed state because the source array no longer contains the same list of masking views as the target array (a masking view was added).

3. Identify the added masking view by running the symaccess show HR2 -type storage command, then compare the current list of masking views on the storage group with the list of masking views shown in the display. Once the masking view discrepancy is corrected, a symdm commit command can be run to repeat the failed action.
CHAPTER 19

Open Replicator

This chapter summarizes the Open Replicator feature which can be used to migrate data from older arrays and some third party arrays to arrays running HYPERMAX OS 5977 and higher.

The Open Replicator feature and symrcopy command used to migrate data is documented in theDell EMC Solutions Enabler Array Controls and Management CLI User Guide version 8.3 and higher.

- Open Replicator and arrays running HYPERMAX OS ........................................ 528
- ORS and host interaction ................................................................................ 528
- ORS rcopy concepts ...................................................................................... 528
- ORS operational rules and limitations ............................................................. 530
- ORS copying limitations ................................................................................ 530
- ORS device guidelines ................................................................................... 530
- ORS SAN setup requirements ....................................................................... 531
- ORS SYMCLI symsan support ...................................................................... 532
- Open Replicator session options .................................................................. 532
- Open Replicator control operations .............................................................. 534
- Open Replicator examples ........................................................................... 556
- Open Replicator operational restrictions and state reference ...................... 576
Open Replicator and arrays running HYPERMAX OS

The Open Replicator (ORS) `symrcopy` command provides a method for copying data to or from various types of arrays within a storage area network (SAN) infrastructure. For example, Open Replicator provides a tool used to migrate data from older arrays, and some third-party storage arrays to VMAX arrays including arrays running HYPERMAX OS 5977.

The ORS feature and `symrcopy` command, used to migrate data, is documented in the Dell EMC Solutions Enabler Array Controls and Management CLI User Guide version 8.3 and higher.

The following ORS rules and limitations apply to control arrays running HYPERMAX OS 5977 or higher:

- ORS push sessions are not supported, along with differential copying, precopy option, recreate, restore, and remove command.
- The maximum number of active sessions allowed is 512 when running HYPERMAX OS 5977 or higher.
- Only one remote array is supported.
- Creating ORS sessions on control devices that are involved in a TimeFinder session or a SRDF operation is not supported.
- Any VMAX3 array FA port, connected to the remote array and granted access to the remote devices, can be used for Open Replicator sessions.
- Requires at least one zoned remote port for cold sessions, and it is recommended that there are at least two zoned remote ports for hot sessions, although this recommendation is not enforced.
- Set ceiling can be set to DISABLE.
- Dynamically finds directors and ports that can access an ORS session's remote devices, and uses these directors and ports for data transfer.
- Setting session pace is not supported.

ORS and host interaction

Open Replicator copy (Rcopy) operations are controlled from a local host attached to the DMX or VMAX Family array. Data copying is accomplished as part of the storage system process and does not require host resources. The data can be copied online between DMX and VMAX arrays allowing host applications, such as a database or file server, to remain operational (function normally) during the copy process.

ORS rcopy concepts

The following Rcopy concepts and terminology are used throughout the Open Replicator Migration section of this product guide:

- The VMAX and DMX arrays and its devices are referred to as the control side of the copy operation. Older DMX or VMAX arrays, or third-party arrays on the SAN are referred to as the remote array/devices.
- The copy direction is from the perspective of the control side. There are two types of copy operations, push and pull. A push operation copies data from the control device to the remote device(s). A pull operation copies data to the control device from the remote device(s).
Copy operations are either *hot* (online) or *cold* (offline).

Use the `-name` option to give the session a name. Use the `-session_name` option when specifying the session name for control operations.

There can be only one control device per active session.

Open Replicator can be used to migrate data into a VMAX Family array from older DMX and VMAX arrays, or other third-party arrays. Figure 15 on page 529 shows two Open Replicator copy sessions performing a pull operation, where data is copied through the SAN infrastructure from remote devices to the control array.

**Figure 15 Control array device pull operation**

---

**Note**

Since data is copied through the SAN infrastructure, Open Replicator may require updating the zoning configuration before copying data between arrays is allowed. For zoning requirements and suggestions, refer to ORS SAN setup requirements on page 531.

Open Replicator can be used to copy data from a control array to older array. **ORS rcopy concepts** on page 528 shows two Open Replicator copy sessions performing a push operation, where data is copied from the control array to remote devices within the SAN infrastructure.

**Note**

For arrays running HYPERMAX OS 5977, push operations are not supported.
ORS operational rules and limitations

The following general rules apply to Open Replicator sessions:

- Remote devices do not have to be the same RAID type or meta-configuration.
- On pull operations, the remote devices should not be updated by array hosts for the duration of the copy process.
- For pull operations from devices with SCSI reservations, if the remote devices have a cluster running against them or the devices are AIX LVM devices, the cluster, AIX host, or other software that is creating the SCSI reservations must be shutdown before creating the Open Replicator session.
- Data corruption to devices is possible during a copy operation if another host on the SAN has write access to the remote device. EMC recommends that the remote device be unmounted or marked as Not Ready to any other hosts on the SAN to guarantee that the device cannot change while copying is in process.
- Accumulated I/O errors between the control device and remote device will cause a session to fail if the copy operation is a hot push. The failed session may be activated again as long as no new data has been written to the control device since the session failed. The session will temporarily stall and restart on any other type of copy operation.
- Open Replicator fully supports copy operations for thin devices. For information on Virtual Provisioning and creating thin devices, refer to Thin Device Management on page 89.

ORS copying limitations

Copying is device-based; extent copying is not supported. Device configuration changes cannot be made during an Open Replicator session, as making device changes may lead to inconsistent data on the local device if pulling, or on the remote device if pushing data.

Open Replicator cannot detect changes to a remote device during, or between incremental copies. Before each session, make sure that there are no changes being made to the remote device.

ORS device guidelines

<table>
<thead>
<tr>
<th>Action</th>
<th>Control device</th>
<th>Remote device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating the device file</td>
<td>DMX or VMAX Family arrays</td>
<td>DMX or older VMAX array, or third-party array</td>
</tr>
<tr>
<td></td>
<td>Always listed on left</td>
<td>Always listed on right</td>
</tr>
<tr>
<td></td>
<td>Format: symdev=arrayid:device</td>
<td>Format: symdev=array:device or wwn=WWN</td>
</tr>
<tr>
<td></td>
<td>Example: symdev=7098:E9</td>
<td>Example: wwn=6006048000000000314353594d303737</td>
</tr>
</tbody>
</table>

Table 26 Control and remote device guidelines
### Table 26 Control and remote device guidelines (continued)

<table>
<thead>
<tr>
<th>Action</th>
<th>Control device</th>
<th>Remote device</th>
</tr>
</thead>
</table>
| Hot push (not supported on HYPERMAX OS 5977) | One device per session  
  All directors must see remote device | One device per session  
  Device not accessible to host  
  Can use -consistent, -nodifferential, and -precopy  
  **Note**  
  Differential copying is the default for copy sessions and does not need to be specified in the symrcopy create command. | Refer to ORS and creating a device file on page 535 for device format rules |

| Cold push (not supported on HYPERMAX OS 5977) | One device per session  
  Device Not Ready to host  
  At least one director must see remote device(s) | Can use -nodifferential  
  **Note**  
  Differential copying is the default for copy sessions and does not need to be specified in the symrcopy create command. |  |

| Hot pull                      | One device per session  
  Device online to the host  
  All directors must see the remote device a | One device per active session  
  Can use -donor_update, -frontend_zero |  |

| Cold pull                    | One device per session  
  At least one director must see the remote device and the devices is not ready to host | One device per session  
  Can use -frontend_zero |  |

---

a. Applies only to devices running on arrays Enginuity 5876 or lower. This is not a requirement for HYPERMAX OS 5977 or higher.

### ORS SAN setup requirements

Since data is copied through the SAN infrastructure, Open Replicator may require a SAN configuration update before copying data between storage arrays is allowed. Because of the various types of cabling, zoning, and masking that can exist within a SAN configuration, the following requirements are provided as a generic reference for setting up a data migration with Open Replicator through a SAN:

---

ORS SAN setup requirements 531
A Fibre Channel switch is required for Open Replicator. Direct connections (such as arbitrated loop) are not supported.

For arrays running Enginuity 5773 and 5876:
- The SAN for the remote storage array must have connectivity to the control array SAN. Open Replicator requires that at least one port on the remote array, that allows access to the remote device, have access to the control device through at least one port for a cold copy and all ports for a hot copy on the control array.
- Zoning must be set up on the Fibre Channel switch to zone the control array fibre adapters (FAs) to the remote storage array front-end adapter(s).
- If the storage port for the source devices is running volume configuration management (VCM) software such as Volume Logix for Symmetrix or a similar software product, setup may require granting permission to access the target device(s) from the target storage port. For instance, on a VMAX array, the control FA(s) must be enabled to have access to the remote storage array device(s).
- Specific instructions for granting access to target devices vary depending on the selected target storage array and VCM software.

For arrays running HYPERMAX OS 5977:
- Any VMAX3 array FA port, connected to the remote array and granted access to the remote devices, can be used for Open Replicator sessions. This is a change from earlier versions of ORS where the ports involved in Open Replicator sessions had to be FA ports where the volumes were mapped.
- Requires at least one zoned remote port for cold sessions, and it is recommended that there are at least two zoned remote ports for hot sessions. The recommendation for hot sessions is not enforced.

**ORS SYMCLI symsan support**

The SYMCLI command `symsan` lists port and LUN WWNs as seen from a specific array director and port. This is used to validate that the zoning between the port and target is correct. It does not require a created Open Replicator session. Use this command to display remote port WWNs, and LUN WWNs seen behind a remote port WWN.

The `symsan` command allows for:
- Listing all ports or LUNS in the SAN that are seen by a specific DX director or all DX directors.
- Listing all ports or LUNS in the SAN that are seen by a specific FA director or all FA directors.
- Listing all ports or LUNS in the SAN that are seen by a specific FA/DX director or all FA/DX directors, using the `-dir` option.

Refer to SYMCLI help options on page 28 for information on how to access `symsan` manpage or command help.

**Open Replicator session options**

Open Replicator copies data in sessions across the SAN infrastructure. A device file is used to specify the device pairs to be used in the copy session. These devices are referred to as the control and remote devices. The control device always resides on the locally-attached DMX or VMAX Family array, and is responsible for controlling
data copying to or from its partner remote device. Devices listed in the device file are identified by either logical unit number (LUN), World Wide Name (WWN), or by a combination of the storage array ID and device name (use symdev for arrays). Refer to **ORS and creating a device file** on page 535 for instructions on how to obtain device information and create the device file.

A copy session is first defined by using the `symrcopy create` command. A session name can be specified for later use in control operations. The push/pull options (`-push|-pull`) define the direction of the copy operation for device pairs listed in the device file, and the hot/cold options (`-hot|-cold`) define online or offline copying.

### symropy session options

- **-pull**
  
Pulls data through the SAN to the control device(s) from the remote device(s).

- **-push**
  
Pushes data across the SAN from the control device(s) to the remote device(s)

- **-hot**
  
Control device is available as read/write online to the host while the copy operation is in progress. With hot copying, all directors that have the local devices mapped are required to participate in the session. A hot copy session cannot be created unless all directors can discover the remote device.

- **-cold**
  
Control device is unavailable to the host while the copy operation is in progress. A cold copy session can be created as long as one or more directors discovers the remote device.

**Note**

Arrays running HYPERMAX OS 5977 dynamically find directors and ports that can access an ORS session's remote devices, and uses these directors and ports for data transfer.

If a control device is pushing data to a remote device and that control device is currently online for host write I/O operations, a consistent point-in-time copy can be made across multiple control devices using the Enginuity Consistency Assist (ECA) feature (`-consistent`). This will temporarily prevent any host write I/Os while the Open Replicator copy session begins.

### ORS hot pull copy session example

**Figure 16** on page 534 shows Open Replicator copy sessions created and activated for a hot pull copy operation. A device file `-file filename` contains the pairing information for the control and remote devices. Each line in the device file is a copy session. The file specifies control devices by "Symmetrix ID: device number" and remote devices by "LUN WWN" as follows:

<table>
<thead>
<tr>
<th>symdev</th>
<th>wwn</th>
</tr>
</thead>
<tbody>
<tr>
<td>000187900041:0102</td>
<td>123456781234567820000000c920b484</td>
</tr>
<tr>
<td>000187900041:0103</td>
<td>123456781234567820000000c9274156</td>
</tr>
</tbody>
</table>
Refer to ORS and creating a device file on page 535 for instructions on how to obtain device information and create the device file.

Figure 16 Control array hot pull using the symrcopy command

```
symrcopy create -name copy_session_1 -pull -hot -file pairs
symrcopy activate -file pairs
```

Open Replicator control operations

SYMCLI Open Replicator performs control operations from a local host attached to the DMX or VMAX Family array and implements these operations in sessions across the SAN infrastructure. Open Replicator copy sessions are first created using a device file, which lists the device pairs (control and remote) for the operation.

Note

For arrays running HYPERMAX OS 5977, only one remote target is supported.

Open Replicator SYMCLI symrcopy command performs the copy sessions. The main control operations, required to successfully complete a copy session, are as follows:

- Create the session.
- Activate the session.
- Terminate the session.

**HYPERMAX OS 5977 settings and actions**

- Data protection and recovery options for hot and cold pulls.
- Enable or disable front-end zero detection for pull operations to thin control devices.
- Background copying mode of a session.
- Ceiling value for bandwidth.

**Note**

Ceiling value is set using the `symqos -rcopy` command.

- List, query, and verify copy sessions to display the current session status.
- Export the run information to an output file.

**Enginuity 5876 or lower settings and actions**

- Data protection and recovery options for hot pulls.
- Enable or disable front-end zero detection for pull operations to thin control devices.
- Background copying mode of a session.
- Ceiling value for bandwidth.

**Note**

Ceiling value is set using the `symqos -rcopy` command.

- Session pace for copying, recreating, and restoring.
- Differential copying.
- List, query, and verify copy sessions to display the current session status.
- Remove a remote device from a session.
- Recreate a differential copy session.
- Rename a differential copy session.
- Restore data from a remote device of a copy session.
- Export the run information to an output file.

**Note**

For detailed syntax of the `symrcopy` command, refer to the *EMC Solutions Enabler CLI Command Reference*.

---

**ORS and creating a device file**

Before an Open Replicator copy session can be created, a device file must be created that lists the control and remote device pairs for the copy operation. The device file syntax contains two columns (one for control devices and one for remote devices). Devices in the file are specified either by their unique LUN WWN, or by the storage array ID and device number (Storage ID:device#).

Use the following rules to determine the correct device ID format in the device file:

- If the array for the remote device is visible to the host where the `symrcopy` command is run (locally or by a remote RDF connection), either the storage array
ID and device number or the LUN WWN can be used for the remote device ID in the device file.

- If the array for the remote device is only visible using the `symsan` command, only the LUN WWN can be used for the remote device ID in the device file.

### Obtain device information

**Description**
The Solutions Enabler (SYMCLI) uses several commands to obtain device information, including device number, director information, WWN, and capacity. This information is helpful in determining and identifying devices for use in a device file. Some of these commands include: `symdev`, `syminq`, `sympd`, `symsan`.

**Examples**
To list of devices on array 041, enter:

```
symdev list -sid 0041
```

To list devices by device wwn (a SCSI inquiry), enter:

```
syminq -sym -wwn
```

**Sample output**

For array 041 devices:

<table>
<thead>
<tr>
<th>Symmetrix ID: 000187900041</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device ID: 00168</td>
</tr>
<tr>
<td>Device Name: /dev/vx/rdmp/c5t0d2s2</td>
</tr>
<tr>
<td>Directors: 03A:0 01A:C2 2-Way Mir</td>
</tr>
<tr>
<td>Config: Grp'd (M) RW 17261</td>
</tr>
<tr>
<td>Cap: (MB)</td>
</tr>
</tbody>
</table>

For device wwn list:

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d2s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 00168</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303238</td>
</tr>
</tbody>
</table>

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d3s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 001F8</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303239</td>
</tr>
</tbody>
</table>

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d4s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 001F9</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303241</td>
</tr>
</tbody>
</table>

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d5s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 00170</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303242</td>
</tr>
</tbody>
</table>

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d6s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 00172</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303243</td>
</tr>
</tbody>
</table>

```
syminq -sym -wwn
```

<table>
<thead>
<tr>
<th>Name: /dev/vx/rdmp/c5t0d7s2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Num: 001B2</td>
</tr>
<tr>
<td>Array ID: 00000000006190</td>
</tr>
<tr>
<td>WWN: 60060480000190300016533030303244</td>
</tr>
</tbody>
</table>
Note

For details about the `symdev` and `syminq` commands syntax, refer to the Dell EMC Solutions Enabler CLI Command Reference.

Create ORS device file

The control device is always listed in the first column of the device file. Lines in the device file that begin with a pound symbol (#) will be ignored. The device filename `-file Filename` is inserted into the command line for control operations.

This example shows a device file with multiple copy sessions. Each line in the device file is a separate copy session.

```plaintext
# dev_file_1
## column1:control column2:remote
# Symmetrix and StorageID:device always listed first
symdev=000000006190:0168 wwn=600604800000000619053594D314638
symdev=000000006190:01F8 wwn=600604800000000619053594D314640
symdev=000000006190:01F9 wwn=600604800000000619053594D314641
symdev=000000006190:0170 wwn=600604800000000619053594D314642
symdev=000000006190:0172 wwn=600604800000000619053594D314646
symdev=000000006190:01B2 wwn=600604800000000619053594D314649
# End
```

This example shows a device file with one control device (01) and multiple remote devices (41 and 42). This is only used with cold push sessions:

```plaintext
symdev=000000001234:01 symdev=000000005678:41
symdev=000000001234:01 symdev=000000005678:42
```

This example shows a device file with a mix of symdev and wwn device IDs.

```plaintext
symdev=000000001234:01 symdev=000000005678:42
symdev=000000001234:02 symdev=000000005678:43
symdev=000000001234:03 wwn=600604800000000567853594D303434
```

Export ORS device list to text file

**Examples**

To export session device list to text file `dev_file_1.txt`, enter:

```plaintext
symrcopy export -session_name rcopy_1 -file dev_file_1.txt
```

**Sample output**

The output file (`dev_file_1.txt`) contains the session device list.

```plaintext
symdev=000000006190:0168 wwn=600604800000000619053594D314638
symdev=000000006190:01F8 wwn=600604800000000619053594D314640
symdev=000000006190:01F9 wwn=600604800000000619053594D314641
symdev=000000006190:0170 wwn=600604800000000619053594D314642
symdev=000000006190:0172 wwn=600604800000000619053594D314646
symdev=000000006190:01B2 wwn=600604800000000619053594D314649
```
Create ORS copy session

Description
The `symrcopy create` defines a new ORS copy session. Other mandatory syntax session controls included in the `symrcopy create` command line are the copy direction parameter (`-pull`), the online/offline parameter (`-hot`), and the device text filename (`-file Filename`). See Open Replicator session options on page 532 for more information on the mandatory parameters.

Syntax

```
symrcopy create -name <SessionName> <-pull> <-hot> -file <FileName>
```

Options

- **-name**
  
  Session name — used for control operations.

Examples

To define a hot, pull Open Replicator copy session named `rcopy_1`, enter:

```
symrcopy create -name rcopy_1 -pull -hot -file dev_file_1
```

Note

Arrays running HYPERMAX OS 5977 dynamically find directors and ports that can access an ORS session's remote devices, and uses these directors and ports for data transfer.

ORS front-end zero detection

Front-end zero detection is an option used with thin control devices. Front-end zero detection looks for incoming zero patterns from the remote device, and instead of writing the incoming data of all zeros to the thin control device, the group on the thin device is de-allocated. Front-end zero detection is allowed for pull operations only and is indicated by the `frontend_zero` option. This option is ignored for any standard (thick) control devices.

Note

With front-end zero detection enabled, "persistent" allocations are treated as regular allocations, and track group is de-allocated.

Enable front-end zero detection

Example

By default pull sessions are disabled for the `frontend_zero` detection option. To create a hot pull session and enable front-end zero detection, enter:

```
symrcopy create -session_name rcopy_1 -pull -hot -frontend_zero -file dev_file_1
```
Disable front-end zero detection

Examples
The `set frontend_zero off` option disables zero detection for the session, and is only allowed during active -pull operations. To disable front-end zero detection for the active session `rcopy_1`, enter:

```bash
symrcopy -session_name rcopy_1 set frontend_zero off
```

Note
Once front-end zero detection is disabled during an active session, it cannot be enabled again during the session.

ORS donor update

To protect against potential data loss due to a SAN failure or other connectivity issue during a hot pull operation, use the `-donor_update` option. With this option, all writes to the control device from the host are immediately copied to the remote device as well. Because the data is fully copied to both the remote device and the control device, if a failure occurs, the session can be safely terminated and created again to fully recover from any mid-copy failure.

Enable ORS donor update

Examples
To create and activate an Open Replicator copy session for a hot pull operation using the `donor_update` option:

```bash
symrcopy create -name rcopy_1 -pull -hot -donor_update -file dev_file_1
symrcopy activate -session_name rcopy_1
```

Note
For information on the `activate` command, refer to Activate ORS session on page 541.

Terminate and restart ORS hot pull session

Examples
If during an activated hot pull operation, a SAN failure or other connectivity issue is detected, then terminate the Open Replicator sessions. To terminate an Open Replicator sessions associated with the control device:

```bash
symrcopy terminate -file dev_file_1 -symforce
```

To start the copy session again after the problem is resolved, and restart the copy process from the point of failure:
Note

The **donor_update** option must be included in the original `symrcopy create` command to fully recover all writes made to the devices prior to the failure.

```plaintext
symrcopy create -name rcopy_1 -pull -hot -donor_update -file dev_file
symrcopy activate -session_name rcopy_1
```

Note

The above example restarts the copy process from where it left off at the time of failure.

Disable ORS donor update

Description

The `set donor_update off` option disables the **donor_update** option. This command stops the copying of data to the remote devices, and stops all new writes to the control device from immediately being copying to remote device. The donor update option may also be used on an incremental restore session. Refer to Restoring an ORS session on page 555 for more information.

Note

The **donor_update** option may also be turned off while the session is in the CopyInProg (copy in progress) state by including the -force option in the command line. The session will continue to copy in its current mode without donor update.

Options

- **-consistent**
  
  Maintains consistency of the data on the remote device. Without this option, donor update is still deactivated, but consistency on the remote devices is not maintained. This option is useful for a hot pull session, with donor update enabled, where the session has finished copying and maintaining a consistent image on the remote devices is desired. By using the set donor_update off command with the -consistent option after the session has fully copied, the donor update portion of the session is disabled, but data consistency on the remote devices is maintained.

Examples

To set the donor update option to off and maintain consistency on the remote devices for session rcopy1, enter:

```plaintext
symrcopy set donor_update off -session_name rcopy_1 -consistent
```

Restrictions:

If the session is terminated, renamed, restored, recreated, a device is removed, or another session is created using the same control device, the donor update portion of the session is automatically deactivated and consistency on the remote devices is lost. To maintain the consistency on the remote devices, issue the `set donor_update off -consistent` command prior to any of these actions.
Activate ORS session

Description
The `symrcopy activate` command activates the copy sessions for device pairs listed in the device file and begins copying data to (pushing) or from (pulling) the remote devices.

If control devices are pushing data to remote devices and the control devices are currently online for host I/O operations, include the Enginuity Consistency Assist (ECA) option (`-consistent`) in the command line to temporarily prevent host I/O while the Open Replicator copy session begins. This begins a consistent point-in-time copy to the remote devices using an ECA window, which temporarily freezes host I/O to the control devices.

Syntax
To begin the copying process for an Open Replicator copy session, use the following syntax:

```
 symrcopy activate -file Filename -session_name SessionName
```

**Note**
Any other Open Replicator copy sessions that were previously created using the specified device file (and session name) will also be started.

Options
- `-file Filename`
  The device file.
- `-session_name SessionName`
  The session name.

Example
To activate an Open Replicator copy session, enter:

```
 symrcopy activate -session_name rcopy_1
```

**Note**
Under certain circumstances, failed sessions may be reactivated. Refer to Recover from failed ORS session on page 553.

ORS background copying
Open Replicator copy sessions that are actively background copying to devices are in the `CopyInProg` state. This is the default state for copy sessions. This state can be changed to the `CopyOnAccess` state for a pull operation, the `CopyOnWrite` state for a push operation, or the `Precopy` state for a hot push operation by using the `symrcopy set mode [-copy|-nocopy|-precopy]` options. An activated session in the `CopyOnAccess` state copies data to the control device only when those tracks have been accessed on the control device. An activated session in the `CopyOnWrite` state copies data to the remote device only when those tracks are accessed on the control device.
A hot push session that is in the **Precopy** state immediately begins copying data in the background before the session is activated. Session data will continue copying to the remote device until either the mode is changed to nocopy, copy, or the session is activated, at which time a point-in-time copy of the control device is made. After the session has been activated, copying will continue in the **CopyOnWrite** (nocopy) or **CopyInProg** (copy) state. The **Precopy** feature is available only for hot push operations. Hot push sessions can also be set to **Precopy** mode by including the `-precopy` option with either the `create` or `recreate` command.

The background copy status for a session is designated by a flag in the output of `symrcopy list` command. Refer to Monitor ORS session status on page 544 for more detail.

---

**Note**

The `-precopy` option requires Enginuity version 5773 or 5876.

---

### Stop and restart ORS background copying

**Examples**

To temporarily stop the background copying for a session by changing the state to **CopyOnAccess** or **CopyOnWrite** from **CopyInProg** using the `symrcopy` command, enter:

```
  symrcopy set mode nocopy -file dev_file_1
```

To resume background copying for a session and change to the **CopyInProg** state, enter:

```
  symrcopy set mode copy -file dev_file_1
```

---

**Note**

The `-precopy` option requires Enginuity version 5773 or 5876.

---

### ORS background copying (hot) without point-in-time copy

**Examples**

The following are examples of how to immediately begin background copying on a hot push session without making a point-in-time copy:

```
  symrcopy set mode precopy -file dev_file_1

  symrcopy create dev_file_1 -precopy
```

---

**Note**

To see the `-precopy` option used with the `recreate` command, refer to Recreate an ORS session on page 553.
Restrictions:
- The `-precopy` option requires Enginuity version 5773 or 5876.
- Precopy mode can only be set when the session is not activated.

ORS ceiling value

Ceiling values can be adjusted to optimize the performance of the specific SAN environment.

The `symqos -rcopy set ceiling` command sets the maximum allowed bandwidth percentage for a given director, port, director/port pair, or all directors and ports. Valid values are 0 - 100 (%), DISABLE or NONE (shuts off the ceiling function).

For example, setting the ceiling value to 100% causes Open Replicator to consume as much bandwidth as possible, typically:
- 80 MB/s for a 1 GB SAN
- 150 MB/s for a 2 GB SAN
- 180 MB/s for a 4 GB SAN (for DMX - 4 systems)
- 300 MB/s for a 4 GB SAN (for VMAX Family arrays)
- 300 MB/s for an 8 GB SAN (for VMAX Family arrays)

Setting the ceiling to a value (other than NONE) renders the session pace value ineffective to the copy. If the ceiling value is set to NONE, the session pace is in effect for the copy.

When using ORS with SRDF/A, users should monitor and adjust the ORS ceiling/session pace or turn on SRDF/A pacing to prevent ORS I/O from causing SRDF/A to drop. Refer to Primus case emc292509 for guidelines on setting these values.

Note

The DISABLE setting is only allowed for HYPERMAX OS 5977 or higher.

Set ORS ceiling

Examples
To set a bandwidth ceiling of 100% for all directors on array 6190, enter:

```
symqos -rcopy set ceiling 100 -dir all -sid 6190
```

To view the ceiling setting, enter:

```
symqos -rcopy list ceiling -dir all -sid 6190
```

Set the ORS session pace

Description
If the ceiling value is set to NONE, the session pace can be set for devices being copied, recreated, or restored to manage the speed of the replication process. The session pace designates how fast data copies between devices. Values can range from 0 to 9, with 0 being the fastest pace, and 9 being the slowest pace. If set to 0, there is no inserted delay time and the replication will proceed as fast as possible.
Values of 1 - 9 add delays, which takes longer to complete copying but conserves system resources. The default for both online (hot) replication and offline (cold) replication is 5.

**Example**
The following example shows how to set the session copy pace:

```
symrcopy set pace 0 -file dev_file_1
```

**Restrictions:**
- The session pace is ineffective to the copy if the ceiling is set to a value other than NONE.
- For arrays running HYPERMAX OS 5977 or higher, setting session pace is not supported.

**Monitor ORS session status**

Open Replicator session status is checked using the `symrcopy query`, `symrcopy list`, or `symrcopy verify` command.

**List all ORS sessions**

**Description**
To list the Open Replicator copy sessions for a local array, use the `symrcopy list` command. This command returns status information for all created sessions. To list session information for a specific Symmetrix array, include the array ID (`-sid SymmID`) option in the command line.

**Options**
The following options are available for the `symrcopy list` command:

- **-offline**
  - It only displays information held in the database and does not query the array for updated session information.

- **-detail**
  - It displays additional device information for modified tracks, session pace, and session name.

- **-wwn**
  - It displays the full device world wide name.

**Note**
Using the `-detail` and `-wwn` options expands the width of the character display, which may not view properly for some displays.

**Example**
The following is a list example of all Open Replicator sessions for array ID 0766:

```
symrcopy list -sid 0766
```
### Sample output

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sym</td>
<td>Tracks</td>
<td>RI</td>
<td>CDSHUTZ</td>
<td>CTL &lt;=&gt; REM (%)</td>
</tr>
<tr>
<td>002FF</td>
<td>0 6001248000DF0DC47E0044E36089EFE</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>0030D</td>
<td>0 60012480001A6EF92F00DFCDB2408DABC</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>00311</td>
<td>0 60012480001A6EF92F00B7E4AC5C1408W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>00314</td>
<td>0 60012480001A6EF92F008F23962A6686W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>00316</td>
<td>0 6001248000DF0DC47E00CC0824867CB</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>00317</td>
<td>0 6001248000DF0DC47E004D6586E5C423W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>00318</td>
<td>0 6001248000DF0DC47E0004F0A43FAF17W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>00319</td>
<td>0 6001248000DF0DC47E003F69C56748B</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>0039F</td>
<td>0 6001248000DF0DC47E005CC2D44B6D1C</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>003A7</td>
<td>0 6001248000DF0DC47E005F24EB2D64W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>003AF</td>
<td>0 6001248000DF0DC47E00D31A2E8B989W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>003B7</td>
<td>0 6001248000DF0DC47E008719DEEB8DEW</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Synchronized</td>
</tr>
<tr>
<td>003BF</td>
<td>0 6001248000DF0DC47E006409B754B0E</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
<tr>
<td>003C7</td>
<td>0 6001248000DF0DC47E004C9C0ECAD8A9W</td>
<td>.W</td>
<td>XXXX.R.</td>
<td>Stopped</td>
</tr>
</tbody>
</table>

Total ------

<table>
<thead>
<tr>
<th>Tracks</th>
<th>MB(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Legend:

R: (Remote Device Vendor Identification)
- S = Symmetrix, C = Clariion, . = Unknown.

I: (Remote Device Specification Identifier)
- D = Device Name, W = LUN WWN, World Wide Name.

Flags:

(C): X = The background copy setting is active for this pair.
- . = The background copy setting is not active for this pair.

(D): X = The session is a differential copy session.
- . = The session is not a differential copy session.

(S): X = The session is pushing data to the remote device(s).
- . = The session is pulling data from the remote device(s).

(H): X = The session is a hot copy session.
- . = The session is a cold copy session.

(U): X = The session has donor update enabled.
- . = The session does not have donor update enabled.

(T): C = The session is a continuous session.
- M = The session is a migration session.
- R = The session is a RecoverPoint session.
- S = The session is a standard ORS session.

(Z): X = The session has front-end zero detection enabled.
- . = The session does not have front-end zero detection enabled.

(*): The failed session can be reactivated.

### List filtered ORS session types

**Description**

The list `symrcopy list` command provides the `-type` option that lists either standard ORS sessions or RecoverPoint sessions.

---

**Note**

For listing Federated Live Migration (FLM) sessions, refer to `#unique_759`. 

---

Monitor ORS session status 545
Examples
To list standard sessions only, enter:

```bash
symrcopy list -sid 6190 -type standard
```

To list RecoverPoint sessions only, enter:

```bash
symrcopy list -sid 90 -type recoverpoint
```

Note
If the `symrcopy list` command is run without the `-type` option, the default behavior is to include all sessions in the list, as shown in List all ORS sessions on page 544.

Sample output
For standard session:

```
Symmetrix ID: 00000000006190
Control Device              Remote Device                   Flags    Status      Done
----------------------- --------------------------------   -------   --------    ----- 
 Protected
Sym          Tracks      Identification                   RI CDSHUTZ CTL <=> REM  (%)
----------- --------- --------------------------------   --- ------- ------------ ----
001F8        33000  6006048000000000619053594D314640      .W X..XXS. CreateInProg N/A
001F9        33000  6006048000000000619053594D314637      .W X..XXS. CreateInProg N/A
00170        20000  6006048000000000619053594D314642      .W X..XXSX CopyInProg   50
00172        30000  6006048000000000619053594D314646      .W X..XXSX CopyInProg   75
Total       152000
Tracks      152000
MB(s)           12062.5

Legend:
R (Remote Device Vendor Identification)
S = Symmetrix, . = Unknown.
I: (Remote Device Specification Identifier)
D = Device Name, W = LUN WWN, World Wide Name.
Flags:
(C): X = The background copy setting is active for this pair.
. = The background copy setting is not active for this pair.
(D): X = The session is a differential copy session.
. = The session is not a differential copy session.
(S): X = The session is pushing data to the remote device(s).
. = The session is pulling data from the remote device(s).
(H): X = The session is a hot copy session.
. = The session is a cold copy session.
(U): X = The session has donor update enabled.
. = The session does not have donor update enabled.
(T): M = The session is a migration session.
R = The session is a RecoverPoint session.
S = The session is a standard ORS session.
(Z): X = The session has front-end zero detection enabled.
. = The session does not have front-end zero detection enabled.
(*) : The failed session can be reactivated.
```
For RecoverPoint session:

<table>
<thead>
<tr>
<th>Symmetrical ID: 0000000006190</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Device</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Protected</td>
</tr>
<tr>
<td>Sym</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Query ORS session status

**Description**

Open Replicator session status is checked using the `symrcopy query` or `symrcopy verify` command.

The `symrcopy query` command is used to display details for remote copy sessions defined in a device file. The query command provides current status information for control/remote device pairs. If the device pair state is CopyInProg, the query command displays the percentage of copying that has completed.

**Options**

The following options are available for the `symrcopy query` command:

- `-i`
  
  This (interval) is used to execute the query command in repeated intervals (in seconds). The default for interval is 30 seconds if the count option is used, and 15 seconds is the minimum interval that can be specified.

- `-c`
  
  This (count) is used with the `-i` option and specifies the duration of the query intervals.

**Note**

Estimated time to copy completion is shown in the query output when the `-c` and `-i` options are used or if the protected track count has changed since the last interval.

- `-offline`
  
  This option displays only information held in the database and does not query the array for updated session information.

- `-detail`
  
  This option displays additional device information for modified tracks, session pace, and session name. This option expands the width of the character display, which may not view properly for some displays.

- `-wwn`
  
  This option displays the full device world wide name. This option expands the width of the character display, which may not view properly for some displays.

- `-summary`
This shows all possible session states and the number of sessions that are in each state. The -wnn and the -detail options cannot be used with the -summary option.

Examples
To query copy session status using a file, enter:

```bash
symrcopy query -file dev_file_1
```

To query for copy session status that will run every 30 seconds for 1 hour, enter:

```bash
symrcopy query -file dev_file_1 -i 30 -c 120
```

To query copy session status using a session name, enter:

```bash
symrcopy query -session_name rcopy_2
```

To query copy session status using the -summary option, enter:

```bash
symrcopy -file dev_file_1 query -summary
```

Sample output
This output shows a copy session status:

```bash
symrcopy query -file dev_file_1
```

<table>
<thead>
<tr>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Done</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------</td>
<td>-----</td>
<td>-------------</td>
</tr>
<tr>
<td>Protected</td>
<td>SID:symdev</td>
<td>Tracks</td>
<td>Identification</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CDSHUTZ SRC =&gt; TGT (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| SID:0000006190:00168   | 33000 6006048000000000619053594D314638 .W X.XXM. Copied |
| 100                    | 33000 6006048000000000619053594D314640 .W X.XXS. CreateInProg |
| 0000006190:001F8       | 33000 6006048000000000619053594D314637 .W X.XXS. CreateInProg |
| N/A                   | 20000 6006048000000000619053594D314642 .W X.XXSX CopyInProg |
| 50                     | 30000 6006048000000000619053594D314646 .W X.XXSX CopyInProg |
| 00000006190:00172      | 33000 6006048000000000619053594D314649 .W X.XXRX CopyInProg |
| 75                     | 33000 6006048000000000619053594D314649 .W X.XXRX CopyInProg |

Total Tracks: 152000
MB: 12062.5

Legend:
R (Remote Device Vendor Identification)
S = Symmetrix, . = Unknown.
I: (Remote Device Specification Identifier)
D = Device Name, W = LUN WWN, World Wide Name.
Flags:
Verify ORS session state

Syntax
To verify session status, use the following syntax:

```
```

Options

- **-createinprog**
  Verifies that the copy session is in the process of being created.

- **-created**
  Verifies that the copy session has been created.

- **-recreateinprog**
  Verifies that the copy session is in the process of being recreated (incrementally updating the targets).

- **-recreated**
  Verifies that the copy session has been recreated. Device pairs in the session have finished incrementally updating.

- **-copyinprog**
  Verifies which device pairs in the copy session are currently in the CopyInProg state (actively background copying).

- **-copyonaccess**
  Verifies which device pairs in the copy session are currently in the CopyOnAccess state (only copying the device tracks to the control device as they are being accessed on the remote device for a pull operation).

- **-copyonwrite**
  Verifies which device pairs in the copy session are currently in the CopyOnWrite state (only copying the device tracks to the remote device as they are being written to on the remote device for a push operation).
-copied
Verifies which device pairs in the copy session have finished copying data. This is the default if no option is provided.

-terminateinprog
Verifies that the copy session is in the process of terminating.

-failed
Verifies if any of the device pairs in the copy session have failed to copy.

-failedback
Verifies if a FLM session has failed back.

-verifyinprog
Verifies that all active directors for the copy session have completed copy operations.

-precopy
Verifies that the device pair is currently in the Precopy state (copying device tracks in the background without activation). Adding the -cycled option verifies all precopy sessions that have completed one cycle.

-restinprog
Verifies that the copy session is in the process of being restored.

-restored
Verifies that the copy session has been fully restored.

-syncinprog
Verifies which device pairs in the copy session are currently in the SyncInProg state (actively background copying).

-synchronized
Verifies which device pairs in the copy session are in the Synchronized state.

Examples
To verify copy session states for a list of devices specified in `dev_file_1`, enter:

```
symrcopy -file dev_file_1 verify
```

To verify copy session states for a list of devices specified in `dev_file_1`, enter:

```
symrcopy -file dev_file_1 verify -summary
```

Sample output
Using the `verify` command:

```
One of the device(s) in the list are in "Copied" state.
```

Using the `verify` command with the `-summary` option:
**Note**

The one-line `verify` command output displays after the `--summary` output.

```plaintext
<table>
<thead>
<tr>
<th>Device File Name : dev_file_1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCopy Session State</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>CreateInProg</td>
</tr>
<tr>
<td>Created</td>
</tr>
<tr>
<td>RecreateInProg</td>
</tr>
<tr>
<td>Recreated</td>
</tr>
<tr>
<td>CopyInProg</td>
</tr>
<tr>
<td>SyncInProg</td>
</tr>
<tr>
<td>Synchronized</td>
</tr>
<tr>
<td>Restored</td>
</tr>
<tr>
<td>RestoreInProg</td>
</tr>
<tr>
<td>Precopy</td>
</tr>
<tr>
<td>TerminateInProg</td>
</tr>
<tr>
<td>Failed</td>
</tr>
<tr>
<td>Stopped</td>
</tr>
<tr>
<td>FailedBack</td>
</tr>
<tr>
<td>VerifyInProg</td>
</tr>
<tr>
<td>Invalid</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total Protected</td>
</tr>
</tbody>
</table>

One of the device(s) in the list are in 'Copied' state.
```

**Note**

If no verify option is provided, then "copied" is the default state that is verified.

**Terminate an ORS session**

**Syntax**

To terminate an ORS copy session and remove it from the array, use the following syntax:

```
symrcopy terminate
```

**Options**

- `-symforce`

  This option is mandatory when terminating a session in the `CopyInProg`, `CopyOnAccess`, or `CopyOnWrite` state.

  **NOTICE**

  Use care when applying the `-symforce` option to terminate an active session. At termination, the receiving devices contain an incomplete data copy and should be considered invalid.
-file
Use this with FileName to specify the control device associated with the session. Remote devices in the file are ignored.

-session name
Use this with SessionName to specify the session to terminate.

-all sessions
Terminates all sessions.

Examples
To terminate a copy session associated with control device in file dev_file_1, enter:

```
symrcopy terminate -file dev_file_1
```

To terminate a copy session named rcopy_1, enter:

```
symrcopy terminate -session_name rcopy_1
```

To terminate an activated copy session that has not finished copying:

```
symrcopy terminate -file dev_file_1 -symforce
```

To terminate all sessions associated with the control device in file dev_file_1, enter:

```
symrcopy terminate -all_sessions -symforce -file dev_file_1
```

Terminate ORS RecoverPoint session

Description
The symrcopy command does not support control of Open Replicator RecoverPoint sessions, however for cleanup purposes RecoverPoint sessions can be terminated and removed.

Example
To terminate a RecoverPoint session associated with the control device in the file dev_file_1, enter:

```
symrcopy terminate -file dev_file_1 -rp
```

Remove an ORS remote device from a session

Example
When removing a remote device from a session, it must be put in a device file. To remove a remote device associated with device in the file dev_file_1, enter:

```
symrcopy remove -file dev_file_1
```
Recreate an ORS session

Description
Recreating a session creates a new point-in-time copy of the data. For differential push operations only, the copy session is recreated using the `symrcopy recreate` command. The session must have been originally created with differential copying. Activating a recreated session begins an incremental update of the devices to copy any device tracks that changed since the last time the session actively finished copying. Up to 15 sessions are allowed for incremental updates per logical volume. Open Replicator uses the Symmetrix Differential Data Facility (SDDF) to set the track protection bitmaps and monitor track differences between the control and remote devices.

Options
- **-name**
  Use this option to rename a recreated session.

- **-precopy**
  Use the option to recreate a copy session to pre-copy the incremental track updates in the background without activating the session. This option is for hot push ORS operations.

Examples
To recreate and activate a copy session for incremental track updates for session name `rcopy_2`, enter:

```bash
symrcopy recreate -name rcopy_2 -file dev_file_3
symrcopy activate -session_name rcopy_2
```

To recreate and rename a session to `rcopy_2`, enter:

```bash
symrcopy recreate -name rcopy_2 -file dev_file_3 -precopy
```

Note
The `-pace` option can be included in the command line to manage the speed of the replication process. See Set the ORS session pace on page 543.

Recover from failed ORS session

Description
For a **Failed** session, when no new data is indicated on the devices in the session, it is eligible to be reactivated. Use the `symrcopy query` command to check the status of a failed session. An asterisk (*) symbol next to the Failed status indicates the session is available for reactivation. Use the `activate` command to reactivate the failed sessions.

Examples
To query session status, enter:
The Failed sessions shown are eligible for reactivation.

```
symrcopy -file dev_file_1 query -detail
```

Sample output

<table>
<thead>
<tr>
<th>Symmetry ID: 000190300237</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done Pace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Device</td>
<td>Remote Device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
<td>-------</td>
<td>--------</td>
<td>-----------</td>
</tr>
<tr>
<td>Sym</td>
<td>Protected</td>
<td>Modified</td>
<td>Identification</td>
<td>RI</td>
</tr>
<tr>
<td>001F8</td>
<td>33000</td>
<td>0</td>
<td>00604800000000619053594D314640</td>
<td>SD</td>
</tr>
<tr>
<td>N/A</td>
<td>33000</td>
<td>0</td>
<td>00604800000000619053594D314637</td>
<td>SD</td>
</tr>
<tr>
<td>Total</td>
<td>Tracks 66000</td>
<td>MB(s) 4062.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **R** (Remote Device Vendor Identification)
- **S** = Symmetry, **.** = Unknown.
- **I**: (Remote Device Specification Identifier)
  - **D** = Device Name, **W** = LUN WWN, World Wide Name.
- Flags:
  - (C): X = The background copy setting is active for this pair.
    - **.** = The background copy setting is not active for this pair.
  - (D): X = The session is a differential copy session.
    - **.** = The session is not a differential copy session.
  - (S): X = The session is pushing data to the remote device(s).
    - **.** = The session is pulling data from the remote device(s).
  - (H): X = The session is a hot copy session.
    - **.** = The session is a cold copy session.
  - (U): X = The session has donor update enabled.
    - **.** = The session does not have donor update enabled.
  - (T): C = The session is a continuous session.
  - M = The session is a migration session.
  - R = The session is a RecoverPoint session.
  - S = The session is a standard ORS session.
  - (Z): X = The session has front-end zero detection enabled.
    - **.** = The session does not have front-end zero detection enabled.
- (*) = The failed session can be reactivated.

Restrictions

- Reactivating failed sessions requires Enginuity version 5773 or higher.
- If there is new data on devices that are part of the session, session activation is blocked. If session activation is blocked and it is a non-differential session, terminate the session and re-issue the create and activate commands. This starts the copy from the beginning.
- If session activation is blocked and it is a differential session, recreate the session to create a new point-in-time copy.
Restoring an ORS session

Description
Restoring a session if only allowed for differential push operations. The copy session restores back to the control device by pulling back only the changed tracks from the remote device. The session must have been created with differential copying, and must be in the copied state. Hot or cold differential push sessions can be restored.

For example, if all data is copied from the control device to the remote device(s) and then changes are made to the control device, use the `symrcopy restore` command to recover the original data from the remote device. When the command is issued, the session is recreated in restore mode and automatically activated. At the start of the restore operation, all control devices are set to Not Ready status. If running a hot session, control devices are returned to Ready status at the end of the operation (as the data begins copying). If running a cold session, the control devices remain in Not Ready status.

Note
Refer to the EMC Solutions Enabler Installation Guide for license information required for restore functionality.

Options

- **-file**
  Use this with `FileName` to specify the devices associated with the session.

- **-session name**
  Use this with `SessionName` to specify the session to restore

- **-pace**
  Sets the speed of the session. See Set the ORS session pace on page 543

Example
To restore original data from a differential push session back to the control device, enter:

```
symrcopy restore -file dev_file_3
```

Restore ORS data using donor update

Description
Differential push operations are restored using the `-donor_update` option. Using this option with the `symrcopy restore` command, a copy is maintained, on the remote device, of any new data that has been written to the control device while the session is in the process of restoring.

Options

- **-force**
  Terminates a session that has `-donor_update` enabled.
  Turns off the `-donor_update` option while session is in RestInProg. The session will continue to restore in its current mode without donor update.
  Use to create a new session(using the same control device), recreate, or restore sessions that are in the Restored state when `-donor_update` is enabled.
donor_update off -consistent
Maintains consistency on the remote devices after the restore session is complete. Must be set before restore action.

Examples
To restore data back to the control device using the -donor_update option, enter:

```bash
symrcopy restore -file dev_file_3 -donor_update
```

Note
The control device will be set to not ready before the operation and then set back to its previous state after the restore has begun.

To set the donor_update option to off and maintain consistency on the remote devices:

```bash
symrcopy set donor_update off -file dev_file_3 -consistent
```

Restrictions:
- If -donor_update option is used, a session cannot be renamed or devices cannot be removed from a session in the Restored state.
- If the session is terminated, renamed, recreated, a device is removed, or another session is created using the same control device, the donor update portion of the session will automatically be deactivated and consistency on the remote devices will be lost.

Open Replicator examples
This section provides the following examples of using Open Replicator:

Example: Perform an ORS hot pull operation on page 556
Example: Pull data online from IBM F20 to VMAX array on page 561
Example: Pushing online data from VMAX array to HDS 9960 array on page 569

Example: Perform an ORS hot pull operation
This example shows how to migrate data from an older array to a VMAX array. The hardware setup consists of the control array with array ID 000187900041 (abbreviated as 41) connected to a controlling host. The remote array on the SAN is an older array (DMX). Three remote devices are each identified by their LUN WWN. Three control devices are E9, EA, and EB. The control device capacity should be equal to or larger than the remote device extents that are being copied.

Note
If a copy needs to be forced from a larger device to a smaller device (for example, data was initially copied to a larger device and now the same data needs to be copied back to the smaller device), this is done by including the -force_copy option with the symrcopy create command.
For online (-hot) copying, the control devices may be Read/Write enabled. The remote devices should not be receiving any updates from their local host.

The steps for performing a hot pull operation are:

- Example 1 Hot pull step 1 – create device file on page 557
- Example 1 hot pull step 2 – create migration session with donor update on page 557
- Example 1 hot pull step 3 – query migration session on page 557
- Example 1 hot pull step 4 – activate migration session on page 558
- Example 1 hot pull step 5 – verify session status on page 559
- Example 1 hot pull step 6 – terminate migration session on page 561

Example 1 Hot pull step 1 – create device file

The first step in an ORS copy operation is to define the control/remote device pairings in a text file. A control device or remote device is specified by either its unique LUN WWN or by a combination of the array ID and the device name (array ID:device).

Enter the control devices in the left-hand column, and the remote devices in the right-hand column, as shown below in the filename tango:

```
vi tango
symdev=000187900041:E9  wwn=600604800000000314353594D303737
symdev=000187900041:EA  wwn=600604800000000314353594D303738
symdev=000187900041:EB  wwn=600604800000000314353594D303739
```

Example 1 hot pull step 2 – create migration session with donor update

The symrcopy create command creates three online copy sessions so that data on the remote devices specified in file tango can be copied to the control devices when the copy operation is activated. The -pull parameter specifies that the control array is pulling the data to it. The -hot parameter indicates that the control array remains online during the operation. The -name option gives these sessions the label name Monday. The -donor_update parameter indicates that all writes to the control device from the host will also be copied to the remote device.

```
symrcopy create -name Monday -pull -hot -donor_update -file tango -noprompt
```

'Create' operation execution is in progress for the device list in device file 'tango'. Please wait...
'Create' operation successfully executed for the device list in device file 'tango'.

Example 1 hot pull step 3 – query migration session

The symrcopy query command indicates that the sessions for the control/remote device pairs in the file tango are in the Created state and are considered to be active sessions. When the control host can "see" the remote devices (in this case, a remote
Open Replicator converts the remote device LUN WWN identifier (specified in file `tango`) to the "array ID:device" format (for example, `000000003143:0077`).

```
symrcopy query -file tango
```

<table>
<thead>
<tr>
<th>Device File Name</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>: tango</td>
<td>: tango</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- `R` (Remote Device Vendor Identification)
- `S` = Symmetrix, `. = Unknown.
- `I:` (Remote Device Specification Identifier)
- `D` = Device Name, `W` = LUN WWN, World Wide Name.

**Flags:**
- `(C): X` = The background copy setting is active for this pair.
- `. = The background copy setting is not active for this pair.
- `(D): X` = The session is a differential copy session.
- `. = The session is not a differential copy session.
- `(S): X` = The session is pushing data to the remote device(s).
- `. = The session is pulling data from the remote device(s).
- `(H): X` = The session is a hot copy session.
- `. = The session is a cold copy session.
- `(U): X` = The session has donor update enabled.
- `. = The session does not have donor update enabled.
- `(T): C` = The session is a continuous session.
- `M` = The session is a migration session.
- `R` = The session is a RecoverPoint session.
- `S` = The session is a standard ORS session.
- `(Z): X` = The session has front-end zero detection enabled.
- `. = The session does not have front-end zero detection enabled.
- `(*)` = The failed session can be reactivated.

The `symrcopy query` command activates the copy sessions for the pairings in the file `tango`. Copying from the remote array to the control array begins. At this point, migrated data on the on the control array can be accessed without waiting for the copy operation to complete.

**Example 1 hot pull step 4 – activate migration session**

```
symrcopy activate -file tango -noprompt
```

'Activate' operation execution is in progress for the device list in device file 'tango'. Please wait...

'Activate' operation successfully executed for the device list in device file 'tango'.

The `symrcopy query` command with the `-detail` option indicates that the sessions for the device pairs defined in the file `tango` are in the CopyInProg state and the percent (%) completion. The display also contains other details such as the pace.
The default pace value of 5 provides relatively fast copy time with only a moderate impact on the application.

```
symrcopy query -file tango -detail
```

<table>
<thead>
<tr>
<th>Device File Name</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done Pace Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>: tango</td>
<td>Remote Device</td>
<td>Remote Device</td>
<td>Flags</td>
<td>Status</td>
<td>Done Pace Name</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------</td>
<td>-------</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------</td>
<td>-------</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td>SID:symdev</td>
<td>Tracks</td>
<td>Tracks</td>
<td>Identification</td>
<td>RI  CDSHUTZ CTL &lt;=&gt; REM (%)</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------</td>
<td>---------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>000187900041:000E9</td>
<td>128083</td>
<td>0</td>
<td>000000003143:0077</td>
<td>SD X..XXS. CopyInProg 7 5 Monday</td>
<td></td>
</tr>
<tr>
<td>000187900041:000EA</td>
<td>123742</td>
<td>0</td>
<td>000000003143:0078</td>
<td>SD X..XXS. CopyInProg 10 5 Monday</td>
<td></td>
</tr>
<tr>
<td>000187900041:000EB</td>
<td>127455</td>
<td>0</td>
<td>000000003143:0079</td>
<td>SD X..XXS. CopyInProg 7 5 Monday</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>379280</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MB(s)</td>
<td>11852.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **R** (Remote Device Vendor Identification)
- **S** = Symmetrix, . = Unknown.
- **I**: (Remote Device Specification Identifier)
- **D** = Device Name, W = LUN WWN, World Wide Name.

Flags:
- **(C)**: X = The background copy setting is active for this pair.
  . = The background copy setting is not active for this pair.
- **(D)**: X = The session is a differential copy session.
  . = The session is not a differential copy session.
- **(S)**: X = The session is pushing data to the remote device(s).
  . = The session is pulling data from the remote device(s).
- **(H)**: X = The session is a hot copy session.
  . = The session is a cold copy session.
- **(U)**: X = The session has donor update enabled.
  . = The session does not have donor update enabled.
- **(T)**: C = The session is a continuous session.
  M = The session is a migration session.
  S = The session is a standard ORS session.
- **(Z)**: X = The session has front-end zero detection enabled.
  . = The session does not have front-end zero detection enabled.
- **(*)**: The failed session can be reactivated.

The `symrcopy query` command checks at 60-second intervals (-i) to verify whether the control/remote device pairs are in the Copied state.

**Note**

The Pace column will report N/A for sessions where the control device is on an array running HYPERMAX OS 5977 or higher.

**Example 1 hot pull step 5 – verify session status**

```
symrcopy verify -i 60 -file tango
```

NONE of the devices are in the 'Copied' state.
NONE of the devices are in the 'Copied' state.
NOT ALL of the devices are in the 'Copied' state.
ALL of the devices are in the 'Copied' state.

Example: Perform an ORS hot pull operation 559
A subsequent `symrcopy query` command indicates that the sessions for the device pairs defined in the file `tango` are now in the `Copied` state and that copying is 100% complete.

```
symrcopy query -file tango
```

```
<table>
<thead>
<tr>
<th>Device File Name</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

```
<table>
<thead>
<tr>
<th>SID:symdev (%)</th>
<th>Protected Tracks</th>
<th>Identification</th>
<th>RI</th>
<th>CDSHUTZ</th>
<th>CTL &lt;=&gt; REM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

```
| Sym | Tracks | Identification | RI | CDSHUTZ | CTL <=> REM | (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

The `symrcopy list` command displays the three inactive copy sessions on the control array whose `sid` is `000187900041` (abbreviated as `41`).

```
symrcopy list -sid 41
```

```
<table>
<thead>
<tr>
<th>Symmetrix ID: 000187900041</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

```
| Sym | Tracks | Identification | RI | CDSHUTZ | CTL <=> REM | (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

The `symrcopy list` command displays the three inactive copy sessions on the control array whose `sid` is `000187900041` (abbreviated as `41`).

```
symrcopy list -sid 41
```

```
<table>
<thead>
<tr>
<th>Symmetrix ID: 000187900041</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

```
| Sym | Tracks | Identification | RI | CDSHUTZ | CTL <=> REM | (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

```

The `symrcopy list` command displays the three inactive copy sessions on the control array whose `sid` is `000187900041` (abbreviated as `41`).
Example 1 hot pull step 6 – terminate migration session

The `symrcopy terminate` command ends all copy sessions defined in the file `tango`.

```
symrcopy terminate -file tango -noprompt
```

'Terminate' operation execution is in progress for the device list in device file 'tango'. Please wait...
'Terminate' operation successfully executed for the device list in device file 'tango'.

Another `symrcopy list` command verifies that there are no longer any copy sessions on the control array.

```
symrcopy list -sid 41
```

Symmetrix ID: 000187900041
No Devices with RCopy sessions were found.

With the copy operation complete, the remote application on the remote host can be started. However, any changes to remote data at this point are not migrated to the control array unless another full Open Replicator pull operation is performed.

Example: Pull data online from IBM F20 to VMAX array

This example shows how to migrate using a hot pull from an IBM F20 array to a VMAX array. Oracle is part of the environment, as is the Veritas volume manager and file system. The example shows how to perform Open Replicator operations on the
controlling host connected to the VMAX array, and how to perform operations on the remote host connected to the F20 array.

Steps for pulling online data from IBM F20 to VMAX array are:

1. Example 3 pull data online from IBM F20 to VMAX array step 1 – identify IBM devices on page 562 — gets WWNs of the IBM array devices.
2. Example 3 pull data online from IBM F20 to VMAX array step 2 – create device file on page 563
3. Example 3 pull data online from IBM F20 to VMAX array step 3 – create migration session on page 563
4. Example 3 pull data online from IBM F20 to VMAX array step 4 – shutdown remote application running on IBM F20 devices on page 564
5. Example 3 pull data online from IBM F20 to VMAX array step 5 – activate migration session on page 564
6. Example 3 pull data online from IBM F20 to VMAX array step 6 – query migration session on page 564
7. Example 3 pull data online from IBM F20 to VMAX array step 7 – set ceiling value on page 565
8. Example 3 pull data online from IBM F20 to VMAX array step 8 – adjusting ceiling value on page 566

**NOTICE**

An application on the control devices can be run while Open Replicator is pulling remote data to those devices. The "copy-on-first-access" mechanism is used if the array host reads or writes data on tracks that have not been copied yet from the remote devices. In the case of write I/O, the I/O is temporarily suspended, the track is copied, and then the write is applied to the track. These changed tracks are not reflected back to the remote array.

---

Example 3 pull data online from IBM F20 to VMAX array – prerequisite tasks

Prior to running Open Replicator in this environment, the following tasks must be performed:

- The Fibre Channel switch needs a zone from the array's FA(s) to the IBM F20 host adapter(s).
- "Hosts" on the IBM F20, that represent the FA(s) on the array need to be configured, and the IBM devices need to be assigned access to those hosts.

Example 3 pull data online from IBM F20 to VMAX array step 1 – identify IBM devices

The remote IBM devices that will be migrated to the control-side array must be identified. The EMC Inquiry Utility (version 7.3) can accomplish this when run on the remote host connected to the IBM array. If the Inquiry Utility is not available, use IBM tools. The following inq command identifies the IBM storage devices. Open Replicator needs to know the WWN of each IBM device:

```bash
inq -shark_wwn
For help type inq -h.
==================================================================
<table>
<thead>
<tr>
<th>IBM Device</th>
<th>Unit Serial</th>
<th>WWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/rdsk/c3t10d0s2</td>
<td>02720499</td>
<td></td>
</tr>
</tbody>
</table>
```

---
Example 3 pull data online from IBM F20 to VMAX array step 2 – create device file

After identifying the control devices (1C4 – 1CD) that will receive the data, define the control/remote device pairings in a text file. The following command uses the `vi` text editor to create a text file named `devfile.pull`. The first pairing entered in this file is control device 1C4 on control array 000187990125 (abbreviated as 25), paired with the IBM device whose WWN is 49424d2020202020323130352020202020202020202020203032373230343939. The next control device is paired with the next remote IBM device, and so forth:

```
vi devfile.pull
```
Example 3 pull data online from IBM F20 to VMAX array step 4 – shutdown remote application running on IBM F20 devices

Although not shown here, on the remote host, shut down the remote application that uses the F20 array devices, unmount the remote file system(s), and deport volume group(s). By performing these steps after creating the Open Replicator session, this ensures that the create operation is successful and the setup is correct before incurring application down time.

Example 3 pull data online from IBM F20 to VMAX array step 5 – activate migration session

The symrcopy activate command activates the copy sessions for the pairings in the file devfile.pull. Copying from the remote IBM array to the control-side array begins. At this point the migrated data can be accessed on the control-side array. The copy operation does need to be complete:

```
symrcopy activate -file devfile.pull -noprompt
'Activate' operation execution is in progress for the device list in
device file 'devfile.pull'. Please wait...
'Activate' operation successfully executed for the device list
in device file 'devfile.pull'.
```

Immediately after a successful activate operation and before copy operations are complete, volume group(s) can be imported, file system(s) mounted on the control host, and the application can be run on the VMAX Family array.

Example 3 pull data online from IBM F20 to VMAX array step 6 – query migration session

The symrcopy query command with the -detail option indicates that the sessions for the device pairs defined in the file devfile.pull are in the CopyInProg state and the percent (0%) completion. The display also contains other details such as the pace. The default pace value of 5 provides relatively fast copy time with only a moderate impact on the application:

```
symrcopy query -file devfile.pull -detail
Device File Name : devfile.pull  
Control Device              Remote Device                  Flags
Status  Done Pace Name                              
-----------------------------------------------
---- ---- -------                                  
--- --- -------                                  
Protected                                          
Modified
SID:symdev (%) TracksTracks IdentificationRI CDSHUTZ CTL <=> REM
---- ---- ------- ------ -------------- ---------- --- ----- --------------
--- --- ---- --- ---- --- ---- ---- ---- ---- ----
000187990125:001C4 304380    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001C5 304382    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001C6 304383    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001C7 304384    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001C8 304387    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001C9 304387    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
000187990125:001CA 304389    0 49424D20202020323130352020202* .W X..X.S. CopyInProg
0  5 IBM
```
### Legend:

- **R** (Remote Device Vendor Identification)
- **S** = Symmetrix, . = Unknown.
- **I:** (Remote Device Specification Identifier)
- **D** = Device Name, **W** = LUN WWN, World Wide Name.
- **Flags:**
  - (C): X = The background copy setting is active for this pair.
    . = The background copy setting is not active for this pair.
  - (D): X = The session is a differential copy session.
    . = The session is not a differential copy session.
  - (S): X = The session is pushing data to the remote device(s).
    . = The session is pulling data from the remote device(s).
  - (H): X = The session is a hot copy session.
    . = The session is a cold copy session.
  - (U): X = The session has donor update enabled.
    . = The session does not have donor update enabled.
  - (T): M = The session is a migration session.
    R = The session is a RecoverPoint session.
    S = The session is a standard ORS session.
  - (Z): X = The session has front-end zero detection enabled.
    . = The session does not have front-end zero detection enabled.
  - (*): The failed session can be reactivated.

---

**Note**

The Pace column will report N/A for sessions where the control device is on an array running HYPERMAX OS 5977 or higher.

---

**Example 3 pull data online from IBM F20 to VMAX array step 7– set ceiling value**

The ceiling value is the percentage of the bandwidth available for Open Replicator background copy transfers. This value can be set but should only be done after understanding the bandwidth being used by all other applications. There may be other applications using the same Fibre Channel director(s) as Open Replicator. Setting the Open Replicator ceiling too high for a director/port can have an adverse impact on these other applications. The ceiling settings that this example uses are for demonstration purposes only.

By default, the ceiling is undefined (as indicated by NONE in the display). The "Max" value is the estimated maximum bandwidth (MB/second) for each director/port of the control-side array. A bandwidth ceiling can be set that balances application performance against Open Replicator copy time. Because the ceiling is not set, the speed of the copy operation is currently controlled by the default pace setting (5) displayed earlier. The following `list ceiling` command can be used to list the current ceiling setting.

```bash
symqos -rcopy list ceiling -dir all -sid 25
Symmetrix ID: 000187990125
Symmetrix Remote Copy Bandwidth Ceiling
          Max    Set Actual
```
The `symqos -rcopy set ceiling` command sets a bandwidth ceiling of 10% for all director/ports in the VMAX array (sid 25). This means that Open Replicator's ceiling will be 10% of the estimated 130 MB/second FA bandwidth:

```
symqos -rcopy set ceiling 10 -dir all -sid 25 -noprompt
'Set Ceiling' operation execution is in progress
'Set Ceiling' operation successfully executed
```

Example 3 pull data online from IBM F20 to VMAX array step 8 – adjusting ceiling value

The `symqos -rcopy list ceiling` command shows that the ceiling settings for all director/ports in the VMAX array are now at 10%. Because the control devices are mapped only to director/port 16C:1, copying occurs only through this director/port.

Note that the "Actual" bandwidth being used by Open Replicator for this operation is 13 MB/second, which is 10% of the estimated maximum. The pace value that controlled copy speed earlier is now ignored for any copy session that uses an FA where the ceiling is set:

```
symqos -rcopy list ceiling - dir all -sid 25
Symmetrix ID: 000187990125
Symmetrix Remote Copy Bandwidth Ceiling

<table>
<thead>
<tr>
<th>Dir:P</th>
<th>Max (MB)</th>
<th>Set (%)</th>
<th>Actual (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01C:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>01C:1</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>02C:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>02C:1</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15C:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15C:1</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>16C:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>16C:1</td>
<td>130</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>02D:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>02D:1</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>16D:0</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>16D:1</td>
<td>130</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>
Another `symrcopy query` command displays the status of the copy operation at 30-second intervals:

```
symrcopy query -file devfile.pull -detail -i 30
```

<table>
<thead>
<tr>
<th>Device File Name</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>: devfile.pull</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modified SID: symdev REM</th>
<th>Protected Tracks</th>
<th>Tracks Identification</th>
<th>RI CDSHUTZ CTL &lt;=</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>________________________</td>
<td>________________</td>
<td>____________________</td>
<td>-----------------</td>
<td>---</td>
</tr>
<tr>
<td>000187990125:001C4</td>
<td>299935</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001C5</td>
<td>299415</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001C6</td>
<td>299500</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001C7</td>
<td>299584</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001C8</td>
<td>299692</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001C9</td>
<td>299772</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001CA</td>
<td>299774</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001CB</td>
<td>299989</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001CC</td>
<td>300146</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000187990125:001CD</td>
<td>301044</td>
<td>0 49424D2020202032313035202020202* .W X..X.S. CopyInProg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 5 IBM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2998851</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MB(s)</td>
<td>93714.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Copy rate: 13.0 MB/S
Estimated time to completion: 02:00:11

Legend:
- **R** (Remote Device Vendor Identification)
- **S** = Symmetrix, . = Unknown.
- **I**: (Remote Device Specification Identifier)
- **D** = Device Name, **W** = LUN WWN, World Wide Name.

**Flags:**
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- . = The background copy setting is not active for this pair.
- (D): **X** = The session is a differential copy session.
- . = The session is not a differential copy session.
- (S): **X** = The session is pushing data to the remote device(s).
- . = The session is pulling data from the remote device(s).
- (H): **X** = The session is a hot copy session.
- . = The session is a cold copy session.
- (U): **X** = The session has donor update enabled.
- . = The session does not have donor update enabled.
- (T): **M** = The session is a migration session.
- **R** = The session is a RecoverPoint session.
- **S** = The session is a standard ORS session.
- (**Z**): **X** = The session has front-end zero detection enabled.
- . = The session does not have front-end zero detection enabled.
- (***): The failed session can be reactivated.
**Note**

The Pace column will report N/A for sessions where the control device is on an array running HYPERMAX OS 5977 or higher.

Another `symqos -rcopy set ceiling` command sets a new bandwidth ceiling of 80% for director 16c, port 1, giving Open Replicator most of the possible FA bandwidth. Most likely this setting would impact any applications using director/port FA 16C:1:

```
symqos -rcopy set ceiling 80 -dir 16c -port 1 -sid 25 -noprompt
'Set Ceiling' operation execution is in progress
'Set Ceiling' operation successfully executed
```

The following `symqos -rcopy list ceiling` command displays the ceiling setting for all directors, including director 16c, port 1. Although the actual bandwidth being used (currently 37 MB/second) is not at 80% of the maximum, it may approach that value as the copy operation progresses. However, the "Actual" value is affected by the SAN and the remote storage, which may keep this value below the percentage allowed for Open Replicator. If the ceiling is never reached, then the ceiling does not affect the copy rate.

```
symqos -rcopy list ceiling -dir all -sid 25
```

<table>
<thead>
<tr>
<th>Symmetrix ID: 000187990125</th>
<th>Symmetrix Remote Copy Bandwidth Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dir:P</td>
<td>Max</td>
</tr>
<tr>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>01C:0</td>
<td>130</td>
</tr>
<tr>
<td>01C:1</td>
<td>130</td>
</tr>
<tr>
<td>02C:0</td>
<td>130</td>
</tr>
<tr>
<td>02C:1</td>
<td>130</td>
</tr>
<tr>
<td>15C:0</td>
<td>130</td>
</tr>
<tr>
<td>15C:1</td>
<td>130</td>
</tr>
<tr>
<td>16C:0</td>
<td>130</td>
</tr>
<tr>
<td>16C:1</td>
<td>130</td>
</tr>
<tr>
<td>02D:0</td>
<td>130</td>
</tr>
<tr>
<td>02D:1</td>
<td>130</td>
</tr>
<tr>
<td>16D:0</td>
<td>130</td>
</tr>
<tr>
<td>16D:1</td>
<td>130</td>
</tr>
</tbody>
</table>

The `symrcopy verify` command checks at 60-second intervals (-i) whether the control/remote device pairs are in the *Copied* state. The Open Replicator copy operation is now complete:

```
symrcopy verify -copied -file devfile.pull -i 60
```

NONE of the devices are in the 'Copied' state.
NONE of the devices are in the 'Copied' state.
....
ALL of the devices are in the 'Copied' state.
The `symrcopy terminate` command ends all copy sessions defined in the file `devfile.pull`:

```
symrcopy terminate -file devfile.pull -noprompt
```

'Terminate' operation execution is in progress for the device list in `devfile.pull`. Please wait...
'Terminate' operation successfully executed for the device list in `devfile.pull`.

With the copy operation complete, the remote application on the remote host can be restarted (if necessary). However, any changes to remote data at this point are not migrated to the VMAX array unless another full Open Replicator pull operation is performed.

**Example: Pushing online data from VMAX array to HDS 9960 array**

This example shows how to perform a hot push of data from a Symmetrix VMAX family array to a Hitachi HDS 9960 array. The example shows how to perform Open Replicator operations on the controlling host connected to the VMAX Family array, and how to perform operations on the remote host connected to the HDS array.

The steps for pushing online data from VMAX array to HDS 9960 array:

1. **Example 4 push online data from VMAX array to HDS 9960 array step 1** — identify HDS devices on page 570 — gets WWNs of the HDS array devices.
2. **Example 4 push online data from VMAX array to HDS 9960 array step 2** — create device file on page 570
3. **Example 4 push online data from VMAX array to HDS 9960 array step 3** — create migration session on page 570
4. **Example 4 push online data from VMAX array to HDS 9960 array step 4** — set ceiling value on page 572
5. **Example 4 push online data from VMAX array to HDS 9960 array step 5** — activate migration session on page 573
6. **Example 4 push online data from VMAX array to HDS 9960 array step 6** — adjust ceiling value on page 573

**Note**

For arrays running HYPERMAX OS 5977, push operations are not supported.

**NOTICE**

Applications against remote HDS devices cannot be run at any time during the copy operation.

**Example 4 push online data from VMAX array to HDS 9960 array — prerequisite tasks**

Prior to running Open Replicator in this environment, the following tasks must be performed:

1. Configure the Fibre Channel switch to zone the VMAX array to the HDS array.
2. Configure the HDS array to assign devices to the VMAX array.

Example 4 push online data from VMAX array to HDS 9960 array step 1 – identify HDS devices

The example needs to identify the remote HDS devices that will receive data from the control-side array. EMC's Inquiry Utility version 7.3 (SIL version 6.0.2) can accomplish this when run on the remote host connected to the HDS array. If the Inquiry Utility is not available, use HDS tools. The following inq command identifies the HDS storage devices. Open Replicator needs to know the WWN of each HDS device:

```
inq -hds_wwn
```

<table>
<thead>
<tr>
<th>HDS Device</th>
<th>Array Serial #</th>
<th>WWN</th>
<th>Array Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/rdsk/c3t10d0s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303030</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d1s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303032</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d2s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303034</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d3s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303036</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d4s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303038</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d5s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303041</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d6s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303043</td>
<td>R400</td>
</tr>
<tr>
<td>/dev/rdsk/c3t10d7s2</td>
<td>65535</td>
<td>4849544143484920523430303943424430303045</td>
<td>R400</td>
</tr>
</tbody>
</table>

Example 4 push online data from VMAX array to HDS 9960 array step 2 – create device file

After identifying the control devices (1C4 - 1CD) that will send the data, define the control/remote device pairings in a text file. The following command uses the `vi` text editor to create a text file named `devfile.push`. The first pairing entered in this file is control device 1C4 on array 000187990125 (abbreviated as 25), paired with the HDS device whose WWN is 4849544143484920523430303943424430303030. The next control device is paired with the next remote HDS device, and so forth:

```
vi devfile.push
```

Example 4 push online data from VMAX array to HDS 9960 array step 3– create migration session

A `symrcopy create` command from the control host now sets up the Open Replicator hot push operation. The command creates ten online copy sessions so that data on the control devices specified in file `devfile.push` can be copied to the remote HDS devices when the copy operation is started. The `-push` parameter specifies that the control array is pushing the data to the remote array. The `-hot`
The **symrcopy** command indicates that the sessions for the device pairs defined in the file **devfile.push** are in the Created state. To display more detail, include the `-detail` option. To see the full WWN identifier of each remote device, include the `-wwn` option:

```bash
symrcopy query -file devfile.push
```

### symrcopy query -file devfile.push

<table>
<thead>
<tr>
<th>Device File Name: devfile.push</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Device</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Legend:**

- **R**: Remote Device Vendor Identification
- **S**: Symmetrix, . = Unknown.
- **I**: (Remote Device Specification Identifier)
- **D**: Device Name, W = LUN WWN, World Wide Name.
- **F**: Flags:
  - **(C): X** = The background copy setting is active for this pair.
  - **(D): X** = The session is a differential copy session.
  - **(S): X** = The session is pushing data to the remote device(s).
  - **(H): X** = The session is a hot copy session.
  - **(T): M** = The session is a migration session.

---

Example: Pushing online data from VMAX array to HDS 9960 array

---

```
symrcopy create -name HDS -push -hot -file devfile.push -noprompt

'Create' operation execution is in progress for the device list in device file 'devfile.push'. Please wait...

'Create' operation successfully executed for the device list in device file 'devfile.push'.
```

---

Subsequent copying during these copy sessions will perform incremental copies, capturing only new writes to the control devices. The `-name` option gives these sessions the label name HDS:
Example 4 push online data from VMAX array to HDS 9960 array step 4 – set ceiling value

The ceiling value is the percentage of the bandwidth available for Open Replicator background copy transfers. This value can be set but should only be done after understanding the bandwidth being used by all other applications. There may be other applications using the same Fibre Channel director(s) as Open Replicator. Setting the Open Replicator ceiling too high for a director/port can have an adverse impact on these other applications. The ceiling settings that this example uses are for demonstration purposes only.

By default, the ceiling is undefined (as indicated by NONE in the display). The "Max" value is the estimated maximum bandwidth (MB/second) for each director/port of the control-side array. A bandwidth ceiling can be set that balances application performance against Open Replicator copy time:

```
symqos -rcopy list ceiling -dir all -sid 25
Symmetrix ID: 000187990125
Symmetrix Remote Copy Bandwidth Ceiling
          Max   Set   Actual
       Dir:P  (MB)  (%)    (MB)
            -----  ----  -----
            01C:0   130  NONE       0
            01C:1   130  NONE       0
            02C:0   130  NONE       0
            02C:1   130  NONE       0
            15C:0   130  NONE       0
            15C:1   130  NONE       0
            16C:0   130  NONE       0
            16C:1   130  NONE       0
            02D:0   130  NONE       0
            02D:1   130  NONE       0
            16D:0   130  NONE       0
            16D:1   130  NONE       0
```

The `symqos -rcopy set ceiling` command sets a bandwidth ceiling of 10% for all director/ports in the control-side array (sid 25). This means that Open Replicator's ceiling will be 10% of the estimated 130 MB/second FA bandwidth:

```
symqos -rcopy set ceiling 10 -dir all -sid 25 -noprompt
'Set Ceiling' operation execution is in progress
'Set Ceiling' operation successfully executed
```

The `symqos -rcopy list ceiling` command displays that the ceiling settings for all director/ports in the control-side array are now at 10%. Once the Open Replicator session is activated, the ceiling can be displayed again to show its "Actual" value. Note that the pace value (including the default) is ignored for any copy session that uses an FA where the ceiling is set:

```
symqos -rcopy list ceiling -dir all -sid 25
Symmetrix ID: 000187990125
Symmetrix Remote Copy Bandwidth Ceiling
          Max   Set   Actual
       Dir:P  (MB)  (%)    (MB)
            -----  ----  -----
            01C:0   130  10%    13
            01C:1   130  10%    13
            02C:0   130  10%    13
            02C:1   130  10%    13
            15C:0   130  10%    13
            15C:1   130  10%    13
            16C:0   130  10%    13
            16C:1   130  10%    13
            02D:0   130  10%    13
            02D:1   130  10%    13
            16D:0   130  10%    13
            16D:1   130  10%    13
```
Example 4 push online data from VMAX array to HDS 9960 array step 5 – activate migration session

The `symrcopy activate` command starts the copy operation for the device pairs defined in the file `devfile.push`. Copying from the control devices to the remote devices begins. Using the `-consistent` option creates a consistent point-in-time copy:

```
symrcopy activate -file devfile.push -consistent -noprompt
'Activate' operation execution is in progress for the device list in device file 'devfile.push'. Please wait...
'Activate' operation successfully executed for the device list in device file 'devfile.push'.
```

Example 4 push online data from VMAX array to HDS 9960 array step 6– adjust ceiling value

The `symqos -rcopy list ceiling` command shows that the ceiling settings for all director/ports in the control-side array are now at 10%. Because the control devices are mapped only to director/port 16C:1, copying occurs only through this director/port. Note that the "Actual" bandwidth being used by Open Replicator for this operation is 13 MB/second, which is 10% of the estimated maximum:

```
symqos -rcopy list ceiling -dir all -sid 25
Symmetrix ID: 000187990125
Symmetrix Remote Copy Bandwidth Ceiling

<table>
<thead>
<tr>
<th>Dir:P (MB)</th>
<th>(%)</th>
<th>Actual (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01C:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>01C:1</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>02C:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>02C:1</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>15C:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>15C:1</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>16C:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>16C:1</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>02D:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>02D:1</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>16D:0</td>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>16D:1</td>
<td>130</td>
<td>10</td>
</tr>
</tbody>
</table>
```

Example: Pushing online data from VMAX array to HDS 9960 array
**Note**

The `symrcopy query` command displays the status of the copy operation at 30-second intervals:

```
symrcopy query -file devfile.push -i 30
```

<table>
<thead>
<tr>
<th>Device File Name</th>
<th>Control Device</th>
<th>Remote Device</th>
<th>Flags</th>
<th>Status</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>devfile.push</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SID:symdev Tracks Identification</th>
<th>RI CDSHUTZ CTL &lt;=&gt; REM</th>
</tr>
</thead>
<tbody>
<tr>
<td>000187990125:001C4 416645 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001C5 416888 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001C6 416691 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001C7 416632 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001C8 416799 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001C9 417123 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001CA 416876 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001CB 417092 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001CC 417009 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
<tr>
<td>000187990125:001CD 416717 4849544143484920523430303943424*</td>
<td>.W XXXX.S. CopyInProg 4</td>
</tr>
</tbody>
</table>

Total Track(s) 4168472
MB(s) 130265

Legend:
R (Remote Device Vendor Identification)
S = Symmetrix, C = Clarion, . = Unknown.
I: (Remote Device Specification Identifier)
D = Device Name, W = LUN WWN, World Wide Name.
Flags:
(C): X = The background copy setting is active for this pair.
      . = The background copy setting is not active for this pair.
(D): X = The session is a differential copy session.
      . = The session is not a differential copy session.
(S): X = The session is pushing data to the remote device(s).
      . = The session is pulling data from the remote device(s).
(H): X = The session is a hot copy session.
      . = The session is a cold copy session.
(U): X = The session has donor update enabled.
      . = The session does not have donor update enabled.
(T): M = The session is a migration session.
      R = The session is a RecoverPoint session.
      S = The session is a standard ORS session.
(Z): X = The session has front-end zero detection enabled.
      . = The session does not have front-end zero detection enabled.
(*): The failed session can be reactivated.

The `symqos -rcopy set ceiling` command sets a bandwidth ceiling of 100% for all director/ports in the control-side array (sid 25), giving Open Replicator all of the possible FA bandwidth. Most likely this setting would impact any applications using director/port FA 16C:1:

```
symqos -rcopy set ceiling 100 -dir all -sid 25 -noprompt
'Set Ceiling' operation execution is in progress.
'Set Ceiling' operation successfully executed.
```

The following `symqos -rcopy` command displays the new ceiling setting for all directors, including director 16c, port 1. Although the actual bandwidth being used (currently 47 MB/second) is not at 100% of the maximum, it may approach that value.
as the copy operation progresses. However, the "Actual" value is affected by the SAN and the remote storage, which may keep this value below the estimated maximum of the control-side array director/port. If the ceiling is never reached, then the ceiling does not affect the copy rate:

```
symqos -rcopy list ceiling -dir all -sid 25
```

Symmetry Remote Copy Bandwidth Ceiling

<table>
<thead>
<tr>
<th>Dir:</th>
<th>Max (MB)</th>
<th>Set (%)</th>
<th>Actual (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01C:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>01C:1</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>02C:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>02C:1</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15C:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>15C:1</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>16C:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>16C:1</td>
<td>130</td>
<td>100</td>
<td>47</td>
</tr>
<tr>
<td>02D:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>02D:1</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>16D:0</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>16D:1</td>
<td>130</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Another `symrcopy query` command displays an updated status of the copy operation at 30-second intervals:

```
symrcopy query -file devfile.push -i 30
```

Example: Pushing online data from VMAX array to HDS 9960 array
The `symrcopy verify` command checks at 60-second intervals (-i) to verify whether the control/remote device pairs are in the Copied state. The Open Replicator copy operation is now complete:

```
 symrcopy verify -Copied -i 60 -file devfile.push
NONE of the devices are in the 'Copied' state.
NONE of the devices are in the 'Copied' state.
...
NOT ALL of the devices are in the 'Copied' state.
ALL of the devices are in the 'Copied' state.
```

Open Replicator operational restrictions and state reference

This section details which ORS operations are permissible for certain control device states, devices in various states of a replication (TimeFinder or SRDF) operation, and certain device types.

Device control operations allowed for ORS control devices on page 576
ORS operations allowed for replication session states on page 577
ORS operations allowed for device types on page 587

Device control operations allowed for ORS control devices

**Table 27** on page 576 details if a device control operation is permissible, for the ORS control device, in various states with the controlling host (such as, ready, not ready).

**Table 27** Device control operations allowed for ORS control device states with host

<table>
<thead>
<tr>
<th>Action</th>
<th>Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td></td>
</tr>
<tr>
<td>Online RCopy control device pushing out</td>
<td>Yes</td>
</tr>
<tr>
<td>Online RCopy control device pulling in</td>
<td>Yes</td>
</tr>
<tr>
<td>Offline RCopy control device pushing out</td>
<td>No</td>
</tr>
</tbody>
</table>
### Table 27 Device control operations allowed for ORS control device states with host (continued)

<table>
<thead>
<tr>
<th>Offline RCopy control device</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Ready</td>
<td></td>
</tr>
<tr>
<td>Online RCopy control device</td>
<td>Yes</td>
</tr>
<tr>
<td>pushing out</td>
<td></td>
</tr>
<tr>
<td>Online RCopy control device</td>
<td>Yes</td>
</tr>
<tr>
<td>pulling in</td>
<td></td>
</tr>
<tr>
<td>Offline RCopy control device</td>
<td>N/A</td>
</tr>
<tr>
<td>pushing out</td>
<td></td>
</tr>
<tr>
<td>Offline RCopy control device</td>
<td>N/A</td>
</tr>
<tr>
<td>pulling in</td>
<td></td>
</tr>
<tr>
<td>RW Enable</td>
<td></td>
</tr>
<tr>
<td>Online RCopy control device</td>
<td>Yes</td>
</tr>
<tr>
<td>pushing out</td>
<td></td>
</tr>
<tr>
<td>Online RCopy control device</td>
<td>Yes</td>
</tr>
<tr>
<td>pulling in</td>
<td></td>
</tr>
<tr>
<td>Offline RCopy control device</td>
<td>No</td>
</tr>
<tr>
<td>pushing out</td>
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<tr>
<td>Offline RCopy control device</td>
<td>No</td>
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<tr>
<td>pulling in</td>
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<tr>
<td>Write Disable</td>
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<td>Online RCopy control device</td>
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<tr>
<td>pushing out</td>
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<tr>
<td>Online RCopy control device</td>
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</tr>
<tr>
<td>pulling in</td>
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<tr>
<td>Offline RCopy control device</td>
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<tr>
<td>pushing out</td>
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</tr>
<tr>
<td>Offline RCopy control device</td>
<td>No</td>
</tr>
<tr>
<td>pulling in</td>
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</tbody>
</table>

### ORS operations allowed for replication session states

Use the state tables to determine if an ORS operation is permissible on devices in various states of a replication (TimeFinder or SRDF) session:

- **TimeFinder/Mirror and TimeFinder/Clone sessions** — Details if an ORS operation is supported on devices in various states of a TimeFinder session.
- **TimeFinder/SnapVX sessions (HYPERMAX OS 5977)** — Details if an ORS operation is supported on devices in various states of a TimeFinder/SnapVX session.
- **SRDF sessions** — Details if an ORS operation is supported on devices (such as R1 and R2) in various states of SRDF sessions.
TimeFinder/Mirror and TimeFinder/Clone sessions

The following tables detail which ORS (rcopy) operations allowed when the control device is in use as a source or target for TimeFinder/Mirror, or as a source or target for TimeFinder/Clone:

**Table 28** Allowable rcopy operations when the control device for PUSH session is in use as a TimeFinder/Mirror SOURCE

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>BCV Pair State</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Never Established</td>
<td>Sync in prog</td>
<td>Syncronized</td>
<td>Split in prog</td>
<td>Background split in progress</td>
<td>Split before sync</td>
<td>Split</td>
<td>Split no incremental</td>
<td>Restore in prog</td>
<td>Restored</td>
</tr>
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<tr>
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<td>Y</td>
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<tr>
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*Not supported for arrays running HYPERMAX OS 5977 or higher.*
Table 29 Allowable rcopy operations when the control device for PUSH session is in use as a TimeFinder/Mirror TARGET

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<tr>
<th>rcopy Operation</th>
<th>BCV Pair State</th>
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<tr>
<td>Create</td>
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<td>Recreate</td>
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<td>Set Copy</td>
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<td>Set Pace</td>
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<td>Set Nocopy</td>
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<tr>
<td>Set Precopy</td>
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<tr>
<td>Terminate</td>
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</tr>
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</table>

a. Not supported for arrays running HYPERMAX OS 5977 or higher.

Table 30 Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Mirror SOURCE

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>BCV Pair State</th>
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<tbody>
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<td>Activate</td>
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<tr>
<td>Create</td>
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<tr>
<td>Donor Update Off</td>
<td>Y</td>
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</table>
**Table 30** Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Mirror SOURCE (continued)

<table>
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<tr>
<th>rcopy Operation</th>
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<td>FrontEnd Zero Off</td>
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<tr>
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<tr>
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</table>

a. Not supported for arrays running HYPERMAX OS 5977 or higher.

**Table 31** Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Mirror TARGET

<table>
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<tr>
<th>rcopy Operation</th>
<th>BCV Pair State</th>
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<tr>
<td>Remove</td>
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</table>
### Table 31: Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Mirror TARGET (continued)

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>BCV Pair State</th>
<th>Never Established</th>
<th>Sync in prog</th>
<th>Synchronized</th>
<th>Split in progress</th>
<th>Background split in progress</th>
<th>Split before sync</th>
<th>Split</th>
<th>Split no incremental</th>
<th>Restore in prog</th>
<th>Restored</th>
<th>Terminate</th>
<th>Split before restore</th>
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</table>

*Not supported for arrays running HYPERMAX OS 5977 or higher.*

### Table 32: Allowable rcopy operations when the control device for PUSH session is in use as a TimeFinder/Clone SOURCE

<table>
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<th>rcopy Operation</th>
<th>Pair State</th>
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<th>Create in prog</th>
<th>Created</th>
<th>Recreated</th>
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<th>Copy in progress</th>
<th>Copied</th>
<th>Copy on write</th>
<th>Copy on access</th>
<th>Split</th>
<th>Restore in prog</th>
<th>Restored</th>
<th>Terminate in prog</th>
<th>Invalid</th>
<th>Failed</th>
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<tbody>
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</tbody>
</table>
Table 32 Allowable rcopy operations when the control device for PUSH session is in use as a TimeFinder/Clone SOURCE (continued)

a. Not supported if device is held.
b. Not supported if device is the source of an extent-level Clone session.
c. Not supported for arrays running HYPERMAX OS 5977 or higher.
d. Not supported if device is the source of a Snap or VP Snap session.

Table 33 Allowable rcopy operations when the control device for PUSH session is in use as a TimeFinder/Clone TARGET

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>No session</th>
<th>Create in prog</th>
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<th>Copy on write</th>
<th>Copy on access</th>
<th>Split</th>
<th>Restore in prog</th>
<th>Restored</th>
<th>Terminate in prog</th>
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<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
</tr>
<tr>
<td>SetPrecopy</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
</tr>
<tr>
<td>Terminate</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
</tr>
</tbody>
</table>

Table 34 Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Clone TARGET

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>No session</th>
<th>Create in prog</th>
<th>Created</th>
<th>Recreated</th>
<th>Precopy</th>
<th>Copy in progress</th>
<th>Copied</th>
<th>Copy on write</th>
<th>Copy on access</th>
<th>Split</th>
<th>Restore in prog</th>
<th>Restored</th>
<th>Terminate in prog</th>
<th>Invalid</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activate</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
<td>γ</td>
</tr>
</tbody>
</table>
Table 34 Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Clone TARGET (continued)

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>Pair State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No session</td>
</tr>
<tr>
<td>Create</td>
<td>Y</td>
</tr>
<tr>
<td>Donor Update Off</td>
<td>Y</td>
</tr>
<tr>
<td>Failback</td>
<td>Y</td>
</tr>
<tr>
<td>FrontEnd Zero Off</td>
<td>Y</td>
</tr>
<tr>
<td>Remove</td>
<td>Y</td>
</tr>
<tr>
<td>Rename</td>
<td>Y</td>
</tr>
<tr>
<td>Set Copy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Nocopy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Pace</td>
<td>Y</td>
</tr>
<tr>
<td>Terminate</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Not supported if device is held.
b. Not supported if device is the source of an extent-level Clone session.
c. Not supported for arrays running HYPERMAX OS 5977 or higher.
d. Not supported if device is the source of a Snap or VP Snap session.

Table 35 Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Clone SOURCE

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>Pair State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No session</td>
</tr>
<tr>
<td>Activate</td>
<td>Y</td>
</tr>
<tr>
<td>Create</td>
<td>Y</td>
</tr>
<tr>
<td>Donor Update Off</td>
<td>Y</td>
</tr>
<tr>
<td>Failback</td>
<td>Y</td>
</tr>
<tr>
<td>FrontEnd Zero Off</td>
<td>Y</td>
</tr>
<tr>
<td>Remove</td>
<td>Y</td>
</tr>
</tbody>
</table>
Table 35 Allowable rcopy operations when the control device for PULL session is in use as a TimeFinder/Clone SOURCE (continued)

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>No session</th>
<th>Create in prog</th>
<th>Created</th>
<th>Recreated</th>
<th>Precopy</th>
<th>Copy in progress</th>
<th>Copied</th>
<th>Copy on write</th>
<th>Copy on access</th>
<th>Split</th>
<th>Restore in prog</th>
<th>Restored</th>
<th>Terminate in prog</th>
<th>Invalid</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Copy</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Nocopy</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Pace</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Terminate</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Not supported if device is held.
b. Not supported if device is the source of an extent-level Clone session.
c. Not supported for arrays running HYPERMAX OS 5977 or higher.
d. Not supported if device is the source of a Snap or VP Snap session.

Snap VX sessions

Only the `rcopy terminate` command is allowed when the rcopy control device for a PUSH or PULL session is also in use as a Snap VX source device. The SnapVX operation can only be in the following states:

- No session
- Establish in progress
- Established
- Restore in prog
- Restored
- Terminate in prog
- Failed

Only the `rcopy terminate` command is allowed when the rcopy control device for a PUSH or PULL session is also in use as a Snap VX target device. The SnapVX operation can only be in the following states:

- No session
- Failed
- Link copy in progress
- Link Copied

SRDF sessions

The following tables detail which ORS (rcopy) operations are allowed when the rcopy control device is in use as a SRDF R1 or R2 mirror:
Table 36 Allowable rcopy operations when the control device for PUSH session is in use as an SRDF R1 mirror

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>SRDF State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sync in prog</td>
</tr>
<tr>
<td>Activate</td>
<td>Y</td>
</tr>
<tr>
<td>Create</td>
<td>Yab</td>
</tr>
<tr>
<td>Incremental Restore</td>
<td>Ybc</td>
</tr>
<tr>
<td>Recreate</td>
<td>Y</td>
</tr>
<tr>
<td>Remove</td>
<td>Y</td>
</tr>
<tr>
<td>Rename</td>
<td>Y</td>
</tr>
<tr>
<td>Set Copy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Nocopy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Pace</td>
<td>Y</td>
</tr>
<tr>
<td>Set Precopy</td>
<td>Yb</td>
</tr>
<tr>
<td>Terminate</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Not supported for arrays running HYPERMAX OS 5977 or higher.
b. Must have no local invalids on R1 or remote invalids on R2.
c. Array must be running Enginuity 5876 or higher.

Table 37 Allowable rcopy operations when the control device for PUSH session is in use as an SRDF R2 mirror

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>SRDF State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sync in prog</td>
</tr>
<tr>
<td>Activate</td>
<td></td>
</tr>
<tr>
<td>Create</td>
<td></td>
</tr>
<tr>
<td>Incremental Restore</td>
<td>Ybc</td>
</tr>
<tr>
<td>Recreate</td>
<td></td>
</tr>
<tr>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Rename</td>
<td></td>
</tr>
<tr>
<td>Set Copy</td>
<td></td>
</tr>
<tr>
<td>Set Nocopy</td>
<td></td>
</tr>
<tr>
<td>Set Pace</td>
<td></td>
</tr>
<tr>
<td>Set Precopy</td>
<td></td>
</tr>
<tr>
<td>Terminate</td>
<td></td>
</tr>
</tbody>
</table>

ORS operations allowed for replication session states 585
### Table 37 Allowable rcopy operations when the control device for PUSH session is in use as an SRDF R2 mirror (continued)

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>SRDF State</th>
<th>Sync in prog</th>
<th>Synchronized</th>
<th>Split</th>
<th>Suspended</th>
<th>Failed over</th>
<th>Partitioned1</th>
<th>Partitioned2</th>
<th>R1 updated</th>
<th>R1 updinprog</th>
<th>Invalid</th>
<th>Consistent</th>
<th>TransmitIdle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Pace</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Precopy</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Terminate</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Not supported for arrays running HYPERMAX OS 5977 or higher.

b. R2 must be write enabled.

### Table 38 Allowable rcopy operations when the control device for PULL session is in use as an SRDF R1 mirror

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>SRDF State</th>
<th>Sync in prog</th>
<th>Synchronized</th>
<th>Split</th>
<th>Suspended</th>
<th>Failed over</th>
<th>Partitioned1</th>
<th>Partitioned2</th>
<th>R1 updated</th>
<th>R1 updinprog</th>
<th>Invalid</th>
<th>Consistent</th>
<th>TransmitIdle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activate</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Create</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Donor Update Off</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Failback</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Frontend Zero Off</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Remove</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Rename</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Copy</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Nocopy</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Set Pace</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Terminate</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Array must be running 5876 or higher.
b. Must have no local invalids on R1 or remote invalids on R2.
c. Frontend zero must be in Off state.
d. Force flag must be set.
e. Not supported for arrays running HYPERMAX OS 5977 or higher.
Table 39 Allowable rcopy operations when the control device for PULL session is in use as an SRDF R2 mirror

<table>
<thead>
<tr>
<th>rcopy Operation</th>
<th>SRDF State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sync in prog</td>
</tr>
<tr>
<td>Activate</td>
<td>Y</td>
</tr>
<tr>
<td>Create</td>
<td>Y&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Frontend Zero Off</td>
<td>Y</td>
</tr>
<tr>
<td>Failback</td>
<td>Y</td>
</tr>
<tr>
<td>Donor Update Off</td>
<td>Y</td>
</tr>
<tr>
<td>Set Nocopy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Copy</td>
<td>Y</td>
</tr>
<tr>
<td>Set Pace</td>
<td>Y</td>
</tr>
<tr>
<td>Terminate</td>
<td>Y</td>
</tr>
<tr>
<td>Remove</td>
<td>Y</td>
</tr>
<tr>
<td>Rename</td>
<td>Y</td>
</tr>
</tbody>
</table>

a. Not supported for arrays running HYPERMAX OS 5977 or higher.

b. R2 must be write enabled.

c. Frontend zero detect must be in Off state.

ORS operations allowed for device types

The following table details if an ORS operation is permissible for certain device types.

**Note**

Open Replicator fully supports copy operations for thin devices.

Table 40 ORS operations allowed by device type

<table>
<thead>
<tr>
<th>Action</th>
<th>Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rcopy Create push where local device type is:</td>
<td></td>
</tr>
<tr>
<td>Gatekeeper</td>
<td>Yes, as long as it is not the gatekeeper for the syscall.</td>
</tr>
<tr>
<td>WORM</td>
<td>No</td>
</tr>
<tr>
<td>CKD_3380 and CKD_3390</td>
<td>No</td>
</tr>
<tr>
<td>AS400</td>
<td>No</td>
</tr>
<tr>
<td>Rcopy Create pull, where local device type is:</td>
<td></td>
</tr>
<tr>
<td>Device Type</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gatekeeper</td>
<td>Yes, as long as it is not the gatekeeper for the syscall.</td>
</tr>
<tr>
<td>WORM</td>
<td>No</td>
</tr>
<tr>
<td>CKD_3380 and CKD_3390</td>
<td>No</td>
</tr>
<tr>
<td>AS400</td>
<td>Yes on DMX arrays running Enginuity 5773.150 or higher, and VMAX Family arrays running Enginuity 5876.</td>
</tr>
<tr>
<td>Rcopy Create push or pull, where local device type is:</td>
<td>thal</td>
</tr>
<tr>
<td>Virtual device (VDEV)</td>
<td>Yes, as long as the following conditional are met:</td>
</tr>
<tr>
<td></td>
<td>• Session is a cold push ONLY</td>
</tr>
<tr>
<td></td>
<td>• VMAX Family arrays are running Enginuity 5876.</td>
</tr>
<tr>
<td>SFS device</td>
<td>No</td>
</tr>
<tr>
<td>STAR</td>
<td>Yes</td>
</tr>
<tr>
<td>Unconfigured device</td>
<td>No</td>
</tr>
<tr>
<td>Meta member</td>
<td>No</td>
</tr>
</tbody>
</table>
This section includes settings and procedures related to Solutions Enabler security that is not included in the chapters covering host-based or user based control access.

Chapters include:

Chapter 20, "Log files and settings"

Chapter 21, "Port Usage"

Chapter 22, "Lockbox"
Security related settings and procedures
This chapter describes the various log files that record array-based software and hardware changes, software-based SYMAPI conditions and errors, and daemon conditions and errors.

- Secure audit log
- SYMAPI log files
- Daemon log files
Secure audit log

Information from the secure audit log is retrieved using the Solutions Enabler `symaudit` command. The audit log records configuration changes, security alarms, service operations, and security-relevant actions on each array. Records are written to the audit log by:

- Solutions Enabler
- Software running on the service processor
- The HYPERMAX OS environment.

The audit log is maintained on the storage array itself. Event contents in the audit log cannot be altered. User access is restricted to the Auditor role that allows a user to view, but not modify, the log.

Solutions Enabler associates a unique Activity ID with each command that is executed. This Activity ID is stored within audit log records, and can be used to correlate records that belong together, such as records generated during execution of the same command.

You can configure the Solutions Enabler event daemon, `storevntd`, to automatically stream audit entries as they appear to an external log service, such as syslog, Simple Network Management Protocol (SNMP), or the Windows Event Service.

For more detail on the audit log refer to Common audit log on page 466.

SYMAPI log files

One log file is created per day, using the dated format to record SYMAPI errors and other significant conditions. A new log file is started every day on the first write after 12:00 a.m.

For more details about the log files refer to Events and logs overview on page 462.

Daemon log files

Each Solutions Enabler daemon has two log files to record daemon errors and other significant conditions.

Logging alternates between the two files, switching to the other file each time the maximum size specified by the daemon’s LOGFILE_SIZE parameter is reached. Each daemon writes to the `.log0` file until its size exceeds that specified in the LOGFILE_SIZE option, at which point it switches to the `.log1` file. It switches back to `.log0` under the same conditions.

For more details on daemon log files refer to Daemon log files on page 470.
CHAPTER 21

Port Usage

This chapter describes the ports used by the Solutions Enabler server and the event daemon, and how to modify port settings.

- Port usage

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Port usage

This section describes the ports Solutions Enabler uses to communicate between server and client hosts.

If a firewall or network address translator is present, these ports must be open. Typically, this is a firewall between the Solutions Enabler client and the server hosts.

Server ports

In client/server mode, the Solutions Enabler server (storsrvd daemon) listens by default at TCP/IP port 2707 for client connections.

You can configure a port by adding an entry to `<SYMAPI_HOME>/config/daemon_options` file. If you change the default port at the server, you must modify the `<SYMAPI_HOME>/config/netcnfg` configuration file at client hosts to reflect the use of the non-default port.

To change the server port the server must be down. To use a different port, specify it in the `daemon_options` file, then restart the storsrvd daemon.

Event daemon ports

When using the asynchronous events in client/server mode, the event daemon at the client host listens at a TCP/IP port for events being forwarded from the event daemon at the server. By default, the client event daemon asks the operating system to pick an unused port for it to use.

You can configure a specific port to use by adding an entry to the `<SYMAPI_HOME>/config/daemon_options` file on the client host. The event daemon uses the following ports by default:

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamically assigned</td>
<td>In client/server mode, the event daemon (storevntd) on a client host listens on this port for asynchronous events sent to it from a server host. By default, this is picked at random by the client host event daemon.</td>
</tr>
<tr>
<td>1024 - 65535</td>
<td></td>
</tr>
<tr>
<td>514</td>
<td>Port the server listens on for events.</td>
</tr>
<tr>
<td>162</td>
<td>Port the application listens on for traps.</td>
</tr>
</tbody>
</table>

Configure Solutions Enabler server and event daemon ports

Server port

In client/server mode, the Solutions Enabler server (the storsrvd daemon) listens by default at TCP/IP port 2707 for client connections. To add an entry and configure a port for the server, add the following entry to the `daemon_options` file:

`storsrvd:port = nnnn`

Event daemon

When using the asynchronous events in client/server mode, the event daemon at the client host listens at a TCP/IP port for events being forwarded from the event daemon at the server. By default, the client event daemon asks the operating system to pick an unused port for it to use. To configure a port for the event daemon, add the following entry to the `daemon_options` file:

`storevntd:event_listen_port = nnnn`
This chapter describes the Solutions Enabler encrypted lockbox and the Stable System Values (SSVs), and the procedures to change the lockbox password and SSVs.

- **Lockbox**.................................................................................................................. 596
Lockbox

Solutions Enabler uses a Lockbox to store and protect sensitive information. The Lockbox is associated with a particular host. This association prevents the Lockbox from being copied to a second host and used to obtain access.

The Lockbox is created at installation. During installation, the installer is prompted to provide a password for the Lockbox. If no password is provided at installation, a default password: nodename@SELockbox1 is generated and stored in the Lockbox along with Stable System values (SSVs, a fingerprint that uniquely identifies the host system). The host_name is the same value as returned by the hostname command.

Stable System Values (SSVs)

Stable System values (SSVs) validate access to the Lockbox. When data is written to or retrieved from the Lockbox, the SSVs in the Lockbox are compared against the SSVs generated from the host. If the SSVs match, the operation is permitted. If the SSVs do not match, the operation fails.

When Solutions Enabler is upgraded, product information in the existing Lockbox is automatically copied into the Lockbox when the Lockbox is first accessed.

When any of the following occur, the host fingerprint may no longer match, and the SSVs inside of the Lockbox must be reset:

- The host is upgraded (either hardware or software)
- The Lockbox file is moved to another host
- User clones a virtual machine

**NOTICE**

To improve security, change the Lockbox password after resetting the SSVs.

Verify Stable System Values

**Description**
If a host is upgraded or reconfigured host SSVs can change. Use the `symcfg -lockbox verify -ssv` command to verify the current SSVs stored in SE lockbox against the current host SSVs.

**Examples**
An SSV match success:

```
symcfg verify -lockbox -ssv
```

The Lockbox SSVs are consistent with the host System Stable Values.

An SSV match failure:

```
symcfg verify -lockbox -ssv
```

The host System Stable Values do not match the current system configuration.
Lockbox passwords

If you create the Lockbox using the default password during installation, change the password immediately after installation to best protect the contents in the Lockbox.

For maximum security, select a password that is hard to guess. It is very important to remember the password.

**WARNING**

Loss of this password can lead to situations where the data stored in the Lockbox is unrecoverable.

Passwords must meet the following requirements:

- 8 - 256 characters in length
- Include at least one numeric character
- Include at least one uppercase and one lowercase character
- Include at least one of the following non-alphanumeric characters: ! @ # % &
- Lockbox passwords may include any character that can be typed in from US standard keyboard.
- The new password must not be the same as the previous password.

Default Lockbox password

When you install Solutions Enabler, you are asked whether you want to use the default password for the Lockbox. If you choose to use the default, the installation process establishes the default Lockbox password in the following format:

`nodename@SELockbox1`

where: `nodename` is the hostname of the computer on which you are installing.

Operating systems have different methods of determining the node name:

- Unix: The installation program uses the `hostname` command to determine the node name. Normally, the node name is set in the `/etc/hosts` file.
- Windows: The value of the `COMPUTERNAME` system environment variable, converted to lower case.
- z/OS: The `gethostname()` function is used to get the node name of the machine.

If the value of `nodename` is stored in upper case letters, it is converted to lower case for the default password.

**NOTICE**

It is strongly recommended that you change the default password. If you allow the installation program to use the default password, note it for future use. You will need the password if you need to reset the Lockbox Stable System values or generate certificates for client/server operations.

Password and SSV management

SSVs are platform-dependent. Changes to hardware or software on a host may require you to reset the SSVs stored in the Lockbox.

Lockbox administrative interactions include:
• Changing the password used to protect the Lockbox.
• Resetting the saved SSVs in the Lockbox after attributes on the host change, making the Lockbox inaccessible to user-initiated SYMAPI and SYMCLI calls.

Note
You must restart all Solutions Enabler daemons after changing or resetting the Lockbox password.

Two symcfg commands allow administrative interactions with the Lockbox:

```
symcfg -lockbox [-password <Password>]
  reset -ssv
  setpw [-new_password <NewPassword>]
```

Note
Both commands require the existing password.
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