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<td>77</td>
</tr>
<tr>
<td>15</td>
<td>Virtual pool changes</td>
<td>81</td>
</tr>
</tbody>
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CHAPTER 1

ViPR Controller Integration with VMAX and VNX Overview

This guide shows ViPR Controller System Administrators how to integrate VMAX and VNX functionality into the Virtual Data Center (VDC). It covers the ViPR Controller services that support FAST (fully automated storage tiering), TimeFinder operations, and Symmetrix Remote Data Facility (SRDF), and the creation and management of meta volumes on VMAX and VNX storage systems.

Related documents
The ViPR Controller Support Matrix provides the version requirements for the VMAX and VNX physical assets.

All ViPR Controller product documentation is available from the ViPR Controller Product Documentation Index.
CHAPTER 2

ViPR Controller Configuration Requirements and Information for VMAX storage systems

This chapter includes the following information.

- VMAX configuration requirements and information before creating your virtual data center ................................................................. 14
- SMI-S provider configuration requirements for VMAX ........................................ 14
- VMAX storage system .................................................................................. 16
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- Add aliases to VMAX storage system initiator names ...................................... 18
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VMAX configuration requirements and information before creating your virtual data center

This chapter provides the VMAX storage system configuration requirements and information required to add the storage systems to the ViPR Controller physical assets, and to configure the storage systems in the ViPR Controller virtual assets. The requirements and information should be reviewed prior to adding the storage systems to ViPR Controller.

SMI-S provider configuration requirements for VMAX

ViPR Controller management of VMAX systems is performed through the EMC SMI-S provider. Your SMI-S provider and the VMAX storage system must be configured as follows before the storage system is added to ViPR Controller.

Gather required information

You need specific information to validate that the SMI-S provider is correctly configured for ViPR Controller and to add storage systems to ViPR Controller:

- SMI-S provider host address
- SMI-S provider credentials (default is admin/#1Password)
- SMI-S provider port (default is 5989)

Enable properties

It is recommended, as a best practice, to set the Windows or UNIX, operating system variables for the SMI-S provider as follows:

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMCLI_CTL_ACCESS</td>
<td>PARALLEL</td>
<td>Specifies how to obtain a lock on the VMAX configuration database file before starting a VMAX control operation.</td>
</tr>
<tr>
<td>SYMCLI_WAIT_ON_DB</td>
<td>1</td>
<td>When set to 1, SYMCLI will wait to obtain a lock on the VMAX configuration database when locked by another user. By default, a busy database will return an error.</td>
</tr>
<tr>
<td>SYMCLI_WAIT_ON_GK</td>
<td>1</td>
<td>When set to 1, causes the SYMCLI to wait for the retrieval of VMAX information when all gatekeepers are busy. Otherwise, a busy gatekeeper will cause an error.</td>
</tr>
</tbody>
</table>

For details refer to the *EMC Solutions Enabler CLI Command Reference*, which is available from EMC Online Support.

When using SMI-S provider 8.1 or later, you must always enable these properties:

- SYMAPI_USE_GNS, SYMAPI_USE_RDFD under /var/symapi/config/options
- GNS_REMOTE_MIRROR under /var/symapi/config/daemon_options

Start the daemon service

Before you begin the configuration:
From the /opt/emc/SYMCLI/bin directory, start the daemon service:
```
stordaemon start storrdfd.
```

List the daemons: /opt/emc/SYMCLI/bin/stordaemon list

You can see which daemons are currently running:

```
Available Daemons ('[*]': Currently Running):
[*] storapid              EMC Solutions Enabler Base Daemon
    storgnsd              EMC Solutions Enabler GNS Daemon
    storrdfd              EMC Solutions Enabler RDF Daemon
[*] storwatchd            EMC Solutions Enabler Watchdog Daemon
    storsrmd64            EMC Solutions Enabler SRM Daemon, 64bit
    storstpd              EMC Solutions Enabler STP Daemon
    storsrvd              EMC Solutions Enabler SYMAPI Server Daemon
```

Note

The `storrdfd` daemon is mandatory for SRDF.

ViPR Controller configuration requirements for SMI-S providers with VMAX storage

- Review the SMI-S version requirements for VMAX storage systems in the ViPR Controller Support Matrix before taking any action to install or upgrade the SMI-S provider for use with ViPR Controller.
- In order to take advantage of the features provided with ViPR Controller 3.0 you must be running the latest version of the SMI-S provider. For specific version requirements see the ViPR Controller Support Matrix.
- SMI-S provider cannot be shared between ViPR Controller and any other application requiring an SMI-S provider to VMAX, such as EMC ViPR SRM.
- The host server running Solutions Enabler (SYMAPI Server) and SMI-S provider (ECOM) differs from the server where the VMAX service processors are running.
- The storage system is discovered in the SMI-S provider.
- When the storage provider is added to ViPR Controller, all the storage systems managed by the storage provider will be added to ViPR Controller. If you do not want all the storage systems on an SMI-S provider to be managed by ViPR Controller, configure the SMI-S provider to only manage the storage systems that will be added to ViPR Controller, before adding the SMI-S provider to ViPR Controller.

Note

Storage systems that will not be used in ViPR Controller, can also be deregistered, or deleted after the storage provider is added to ViPR Controller. For steps to deregister or delete storage from ViPR Controller see the ViPR Controller User Interface Virtual Data Center Configuration Guide, which is available from the ViPR Controller Product Documentation Index.

- The remote host, SMI-S provider (Solutions Enabler (SYMAPI Server) and EMC CIM Server (ECOM)) are configured to accept SSL connections.
- The EMC storsrvd daemon is installed and running.
- The SYMAPI Server and the ViPR Controller server hosts are configured in the local DNS server and that their names are resolvable by each other, for proper
communication between the two. If DNS is not used in the environment, be sure to use the hosts files for name resolution (/etc/hosts or c:/Windows/System32/drivers/etc/hosts).

- The EMC CIM Server (ECOM) default user login, password expiration option is set to "Password never expires."
- The SMI-S provider host is able to see the gatekeepers (six minimum).

Enable Preallocation for Volume Creation on VMAX2 Arrays
The following SMI-S Provider configuration is required to support preallocation when creating volumes on VMAX2:

1. On the SMI-S provider, edit the SYMAPI options file, located here:

<table>
<thead>
<tr>
<th>Provider Type</th>
<th>File Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux provider</td>
<td>/var/symapi/config/options</td>
</tr>
<tr>
<td>Windows provider</td>
<td>c:\program files\emc\symapi\config\options</td>
</tr>
</tbody>
</table>

2. Add the following line:

```
SYMAPI_ALLOW_PARTIAL_ALLOC_PRE_V3=TRUE
```

3. Restart the SMI-S provider for this configuration change to take effect. Use the CLI or, on Windows, services.msc.

ViPR Controller upgrade requirements for SMI-S provider
The ViPR Controller Support Matrix has the most recent version requirements for all systems supported, or required by ViPR Controller. For specific version requirements of the SMI-S provider, review the ViPR Controller Support Matrix before taking any action to upgrade or install the SMI-S provider for use with ViPR Controller.

VMAX storage system
You prepare the VMAX storage system before adding it to ViPR Controller as follows.

- Create a sufficient amount of storage pools for storage provisioning with ViPR Controller (for example, SSD, SAS, NL-SAS).
- Define FAST policies. Storage Tier and FAST Policy names must be consistent across all VMAX storage systems.
- It is not required to create any LUNs, storage groups, port groups, initiator groups, or masking views.
- If discovering eNAS file systems with VMAX3 storage systems, you must select VNX for File as the storage system type when adding the storage system to ViPR Controller.
- ViPR Controller supports FAST.X which allows you to connect an EMC XtremIO to the backend of a VMAX3. When ViPR Controller discovers the VMAX3, the XtremIO is displayed as a SRP or a SLO tier. All provisioning operations are done through the VMAX3.
- After a VMAX storage system has been added and discovered in ViPR Controller, the storage system must be rediscovered if administrative changes are made on the storage system using the storage system element manager.
For configuration requirements when working with meta volumes see *ViPR Controller Integration with VMAX and VNX Storage Systems Guide*.

**VMAX virtual pool configuration requirements and recommendations**

Review the following configuration requirements and recommendations before virtualizing your VMAX system in ViPR Controller.

When VMAX is configured with Storage Tiers and FAST Policies:

- Storage Tier and FAST Policy names must be consistent across all VMAX storage systems.
- Set these options when you build your virtual pool:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID Level</td>
<td>Select which RAID levels the volumes in the virtual pool will consist of.</td>
</tr>
<tr>
<td>Unique Auto-tiering Policy Names</td>
<td>VMAX only. When you build auto-tiering policies on a VMAX through Unisphere, you can assign names to the policies you build. These names are visible when you enable Unique Auto-tiering Policy Names. If you do not enable this option, the auto-tiering policy names displayed in the Auto-tiering Policy field are those built by ViPR.</td>
</tr>
<tr>
<td>Auto-tiering Policy</td>
<td>The Fully Automated Storage Tiering (FAST) policy for this virtual pool. FAST policies are supported on VMAX, VNX for Block, and VNXe. ViPR chooses physical storage pools to which the selected auto-tiering policy has been applied. If you create a volume in this virtual pool, the auto-tiering policy specified in this field is applied to that volume.</td>
</tr>
<tr>
<td>Fast Expansion</td>
<td>VMAX or VNX Block only. If you enable Fast Expansion, ViPR creates concatenated meta volumes in this virtual pool. If Fast Expansion is disabled, ViPR creates striped meta volumes.</td>
</tr>
<tr>
<td>Host Front End Bandwidth Limit</td>
<td>0 - set this value to 0 (unlimited). This field limits the amount of data that can be consumed by applications on the VMAX volume. Host front end bandwidth limits are measured in MB/S.</td>
</tr>
<tr>
<td>Host Front End I/O Limit</td>
<td>0 - set this value to 0 (unlimited). This field limits the amount of data that can be consumed by applications on the VMAX volume. Host front end I/O limits are measured in IOPS.</td>
</tr>
</tbody>
</table>

**VMAX3 virtual pool requirements and recommendations**

Review the following configuration requirements and recommendations before virtualizing your VMAX3 system in ViPR Controller.

Set these options when you build your virtual pool:
### Table 1 VMAX3 virtual pool settings

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisioning Type</td>
<td><strong>Thin.</strong> VMAX3 does not support thick volumes.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> ViPR Controller does not list thin pools on eNAS storage even when a</td>
</tr>
<tr>
<td></td>
<td>thin LUN is set on the virtual pool. ViPR Controller only lists these thin</td>
</tr>
<tr>
<td></td>
<td>pools as thick.</td>
</tr>
<tr>
<td>Protocols</td>
<td>FC</td>
</tr>
<tr>
<td>System Type</td>
<td>EMC VMAX</td>
</tr>
<tr>
<td>Thin Volume Preallocation</td>
<td>0 or <strong>100</strong>. Other values would filter out the VMAX3 SRP pools.</td>
</tr>
<tr>
<td></td>
<td>0 - Volumes allocated using this pool are fully-thin.</td>
</tr>
<tr>
<td></td>
<td><strong>100</strong> - Volumes allocated using this pool are full-allocated.</td>
</tr>
<tr>
<td>Unique Auto-tiering Policy Names</td>
<td>Enabled.</td>
</tr>
<tr>
<td>Auto-tiering Policy</td>
<td>VMAX3 is delivered with pre-defined Storage Level Objectives, and workflows.</td>
</tr>
<tr>
<td></td>
<td>You can specify the workflow and SLO you want applied to your volume during provisioning.</td>
</tr>
<tr>
<td>Enable Compression</td>
<td>When enabled, only the VMAX3 All Flash storage groups, which support compression will be available to add to the virtual pool. It is not required that compression is enabled on the VMAX3 storage groups, it is only required that compression is supported on the storage groups. When storage from this virtual pool is provisioned to the host, it will apply the compression settings defined on the storage system. For details see <a href="#">Support for compression on VMAX3 All Flash Arrays</a>.</td>
</tr>
<tr>
<td>Expandable</td>
<td>Enable to include storage pools containing volumes that can be expanded.</td>
</tr>
<tr>
<td>Host Front End Bandwidth Limit</td>
<td>0 - set this value to 0 (unlimited).</td>
</tr>
<tr>
<td></td>
<td>This field limits the amount of data that can be consumed by applications on the VMAX3 volume. Host front end bandwidth limits are measured in MB/S.</td>
</tr>
<tr>
<td>Host Front End I/O Limit</td>
<td>0 - set this value to 0 (unlimited).</td>
</tr>
<tr>
<td></td>
<td>This field limits the amount of data that can be consumed by applications on the VMAX3 volume. Host front end I/O limits are measured in IOPS.</td>
</tr>
</tbody>
</table>

## Add aliases to VMAX storage system initiator names

You can use the ViPR Controller CLI or REST API to add aliases to the initiator world wide port names (WWPNs) in masking views for VMAX storage systems.

### Configuration requirements and information

- Listing and adding aliases is only supported on VMAX systems running SMI-S 8.2 and higher.
You can only use the get Method() to retrieve the alias name when the initiator is part of an initiator group.

If an alias is not set on the VMAX storage system, a "/" is returned.

Once an alias has been assigned, you can rename the alias, but you cannot reset the alias.

**ViPR Controller commands**

The following ViPR Controller CLI commands have been added to list and add aliases to VMAX storage system initiator names:

- `viprcli initiator aliasget`
- `viprcli initiator aliasset`

---

**Support for compression on VMAX3 All Flash Arrays**

You can use ViPR Controller to discover and manage VMAX3 All Flash Arrays, which support compression, and to enable, and disable compression on the storage group.

**Configuration requirements and information**

Be aware of the following when working with compression enabled storage:

- Compression is only identified by ViPR Controller for compression ready storage groups on VMAX3 All Flash Arrays. Refer to EMC VMAX3 All Flash Array documentation to determine which devices are compression ready on your VMAX3 storage system.

- If you are upgrading VMAX3 All Flash Arrays to support compression, and you want to use ViPR Controller to manage compression on the storage in those arrays, you must upgrade to ViPR Controller 3.5 to enable compression when exporting volumes from ViPR Controller. If you do not upgrade ViPR Controller, you will need to manually compress exported volumes outside of ViPR Controller.

- If you have upgraded to 3.5, or you have upgraded your VMAX3 All Flash Array to support compression, you will need to rediscover the storage system for ViPR Controller to identify that compression is supported on the VMAX3 All Flash Array.

- When ingesting VMAX3 All Flash Array volumes, you should validate that the compression properties of the compression enabled volumes being ingested match the compression properties of the volumes already included in the same virtual pool. ViPR Controller does not validate if the compression property on the volumes being ingested matches the compression properties of the volumes already included in the virtual pool.

  If you do ingest VMAX3 All Flash Array volumes into a virtual pool that does not have the same compression properties on the volumes, you can use the Catalog > Block Storage Services > Change Volume Virtual Pool > Change Auto-tiering Policy, Host IO Limits, or Compression option to move the volumes into the correct virtual pool.

- Enabling and disabling compression on virtual storage pools can be performed from the ViPR Controller UI, CLI or REST API.

**ViPR Controller UI**

The following ViPR Controller UI pages, and options provide the functionality to use the feature:
ViPR Controller UI Pages

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>When enabled, only the VMAX3 All Flash storage groups, which support compression will be available to add to the virtual pool. It is not required that compression is enabled on the VMAX3 storage groups, it is only required that compression is supported on the storage groups. When storage from this virtual pool is provisioned to the host, it will apply the compression settings defined on the storage system.</td>
</tr>
</tbody>
</table>

Catalog > Block Storage Services > Change Volume Virtual Pool > Change Autotiering Policy, Host IO Limits, or Compression

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows you to move volumes to a virtual pool where compression is enabled, or where compression is enabled, and the compression ratio set on the storage pools in the virtual pool matches the ratio set on the volume being moved.</td>
</tr>
</tbody>
</table>

Storage Systems > <storage system name > Storage Pools > Compression Enabled column

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies if compression is enabled on the VMAX3 storage pool.</td>
</tr>
</tbody>
</table>

Virtual Array > <virtual array name > Storage Pools > Compression Enabled column

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies if compression is enabled on the VMAX3 storage pool.</td>
</tr>
</tbody>
</table>

Resources > Volumes > <volume name > More Details > Compression Ratio

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays the compression ratio set on the volume.</td>
</tr>
</tbody>
</table>

ViPR Controller CLI

The -enablecompression option with the ViPR Controller CLI viprcli vpool create and viprcli vpool update commands is provided for this feature.

```
viprcli vpool create [-enablecompression <enable_compression>]
```
CHAPTER 3

ViPR Controller Configuration Requirements and Information for VNX for Block storage systems

This chapter includes the following information.

- VNX for Block configuration requirements and information before creating your virtual data center ................................................................. 22
- SMI-S provider configuration requirements for VNX for Block ........................................... 22
- VNX for Block storage system ........................................................................ 23
- EMC VNX for Block configuration requirements and recommendations ............. 24
- EMC VNX for Block virtual pool requirements and recommendations .............. 24
- EMC VNXe for Block export recommendations.................................................. 25
VNX for Block configuration requirements and information before creating your virtual data center

This chapter provides the VNX for Block storage system configuration requirements and information required to add the storage systems to the ViPR Controller physical assets, and to configure the storage systems in the ViPR Controller virtual assets.

The requirements and information should be reviewed prior to adding the storage systems to ViPR Controller.

SMI-S provider configuration requirements for VNX for Block

ViPR Controller management of VNX for Block systems is performed through the EMC SMI-S provider. SMI-S provider and VNX for Block must meet certain configuration requirements before you can add this storage system into ViPR Controller.

Gather the required information
You need specific information to validate that the SMI-S provider is correctly configured for ViPR Controller and to add storage systems to ViPR Controller.

- SMI-S provider host address
- SMI-S provider credentials (default is admin/#1Password)
- SMI-S provider port (default is 5989)

Configuration requirements

Set SMI-S provider variable
It is recommended, as a best practice, to set the Windows or UNIX, operating system variables for the SMI-S provider as follows.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYMCLI_WAIT_ON_DB</td>
<td>1</td>
<td>When set to 1, SYMCLI will wait to obtain a lock on the VNX for Block configuration database when locked by another user. By default, a busy database will return an error.</td>
</tr>
</tbody>
</table>

ViPR Controller configuration requirements for SMI-S providers with VNX for Block storage systems

- SMI-S provider cannot be shared between ViPR Controller and any other application requiring an SMI-S provider to VNX for Block, such as EMC ViPR SRM.
- The host server running Solutions Enabler (SYMAPI Server) and SMI-S provider (ECOM) differs from the server where the VNX for Block storage processors are running.
- The storage system is discovered in the SMI-S provider.
- When the storage provider is added to ViPR Controller, all the storage systems managed by the storage provider will be added to ViPR Controller. If you do not want all the storage systems on an SMI-S provider to be managed by ViPR.
Controller, configure the SMI-S provider to only manage the storage systems that will be added to ViPR Controller, before adding the SMI-S provider to ViPR Controller.

**Note**

Storage systems that will not be used in ViPR Controller, can also be deregistered, or deleted after the storage provider is added to ViPR Controller. For steps to deregister or delete storage from ViPR Controller see the *ViPR Controller User Interface Virtual Data Center Configuration Guide*, which is available from the *ViPR Controller Product Documentation Index*.

- The remote host, SMI-S provider (Solutions Enabler (SYMAPI Server) and EMC CIM Server (ECOM)) are configured to accept SSL connections.
- The EMC storsrvd daemon is installed and running.
- The SYMAPI Server and the ViPR Controller server hosts are configured in the local DNS server and that their names are resolvable by each other, for proper communication between the two. If DNS is not used in the environment, be sure to use the hosts files for name resolution (/etc/hosts or c:/Windows/System32/drivers/etc/hosts).
- The EMC CIM Server (ECOM) default user login, password expiration option is set to "Password never expires."
- The SMI-S provider host needs IP connectivity over the IP network with connections to both VNX for Block storage processors.

### VNX for Block storage system

You prepare the VNX for Block storage system before adding it to ViPR Controller as follows.

**Configuration requirements**

- Create a sufficient amount of storage pools or RAID groups for storage provisioning with ViPR Controller.
- If volume full copies are required, install SAN Copy enabler software on the storage system.
- If volume continuous-native copies are required, create clone private LUNs on the array.
- Fibre Channel networks for VNX for Block storage systems require an SP-A and SP-B port pair in each network, otherwise virtual pools cannot be created for the VNX for Block storage system.
- For configuration requirements when working with meta volumes see *ViPR Controller Integration with VMAX and VNX Storage Systems Guide*.

**Configuration requirements for ViPR Controller to collect HDS port metrics**

You must enable performance data logging in EMC Unisphere so that VNX for Block sends the required metrics to ViPR Controller before you can set up metrics-based port selection for VNX for Block. For steps to enable performance data logging in EMC Unisphere see: *Prerequisite configuration settings for VNX for Block*. 
Enable performance data logging for VNX for Block

You must enable performance data logging in EMC Unisphere so that VNX for Block sends the required metrics to ViPR Controller before you can set up metrics-based port selection for VNX for Block.

Procedure

1. Log into the EMC Unisphere.
2. Select System > Statistics for Block. Statistics for Block can be found in the Monitoring and Alerts section.
3. Click Performance Data Logging.
   The Data Logging dialog is displayed.
4. If data logging is not already started:
   a. Click Start to start data logging.
   b. Click Apply.
5. Click OK.

EMC VNX for Block configuration requirements and recommendations

ViPR Controller management of VNX for Block systems is performed through the EMC SMI-S provider. SMI-S provider and VNX for Block must meet certain configuration requirements before you can add this storage system into ViPR Controller.

EMC VNX for Block virtual pool requirements and recommendations

Review the following configuration consideration before adding VNX for Block storage to the ViPR Controller virtual pools.

- Fibre Channel networks for VNX for Block storage systems require an SP-A and SP-B port pair in each network, otherwise virtual pools cannot be created for the VNX for Block storage system.
- Prior to ViPR Controller version 2.2, if no auto-tiering policy was set on the virtual pool created from VNX for Block storage, ViPR Controller creates volumes from the virtual pools with auto-tiering enabled. Starting with ViPR Controller version 2.2, if no policy is set on the virtual pool created for VNX for Block storage, ViPR Controller will create volumes from the virtual pool with the "start high then auto-tier" enabled on the new volumes created in the same virtual pool.
EMC VNXe for Block export recommendations

It is recommended when exporting a VNXe for Block volume to a host using ViPR Controller that the host is configured with Fibre Channel only or iSCSI connectivity to the storage.
CHAPTER 4

ViPR Controller Support for FAST Policies

This chapter contains the following topics:

- ViPR Controller support for fully automated storage tiering for a volume .......... 28
- Change FAST policies on an unexported block volume .................................... 31
- Change the FAST policy for an exported volume ............................................ 31
- Duplicate a virtual pool ................................................................................... 36
- Add a FAST policy to a volume ......................................................................... 38
- Change the FAST policy for a volume ............................................................. 38
- Remove the FAST policy from a volume ......................................................... 39
ViPR Controller support for fully automated storage tiering for a volume

The ViPR Controller service **Change Virtual Pool** enables you to change the fully automated storage tiering (FAST) policy on a volume with the operation **Change Auto-tiering Policy or Host IO Limits**.

A VMAX array typically has several types of storage, and that storage supports a number of RAID types. Most VMAX arrays support the following drive types:

- Flash drives
- Enterprise hard disk drives (10K and 15K rpm)
- High-capacity SATA disk drives

The performance of your array partially depends on the placement of frequently-accessed data on high-speed disks such as Flash, and infrequently-accessed data on slower storage, such as SATA drives.

VMAX moves data among drive types in order to optimize your array performance. This feature is called VMAX FAST VP.

ViPR Controller supports Service Level Objectives on VMAX3 arrays, as explained in [Service Level Objectives (SLO) on VMAX3](page 29).

**Note**

ViPR Controller does not support FAST DP.

FAST settings in virtual pools

The following table describes the fields in the virtual pool configuration panels that relate to Fully Automated Storage Tiering (FAST) policies.

**Table 2 FAST settings in virtual pools**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique Auto-tiering Policy Names</td>
<td>Enable this option to display unique auto-tiering names in the Auto-tiering policy selection list. The array system administrator builds unique auto-tiering policy names through Unisphere or another client. Disable this option to display array-generated auto-tiering names. The array builds auto-tiering policy names from the array ID, the unique policy name, and the string <strong>FASTPOLICY</strong>. For example: <strong>SYMMETRIX+000196701972+FASTPOLICY+Green</strong></td>
</tr>
<tr>
<td>Auto-tiering Policy</td>
<td>This field contains the name of the auto-tiering policy. After you select this value, ViPR Controller displays only physical storage pools with that auto-tiering policy. If you create a volume in this virtual pool, ViPR Controller applies the auto-tiering policy specified in this field to that volume.</td>
</tr>
</tbody>
</table>
Notes on unique policy names

Some planning is required to use unique FAST policy names in your virtual pool.

On a VMAX array, you build unique FAST policy names with Unisphere. If you enable the Unique Auto-tiering Policy Names check box, ViPR Controller displays the FAST policy names that you built on the VMAX array.

Unisphere enforces uniqueness in auto-tiering policy names on the VMAX array, but ViPR Controller can include more than one VMAX in a virtual pool. This situation presents a complication for the ViPR Controller administrator, because if two policies on two VMAX arrays have the same name, the FAST policies may not be identical. In this scenario, the ViPR Controller user interface displays only one instance of the name, and ViPR Controller chooses which FAST policy to apply to volumes in that virtual pool.

If you build a virtual pool that includes multiple VMAX arrays, and you want to use unique auto-tiering policy names, verify that the FAST policy names on the VMAX arrays are unique to all VMAX arrays in the virtual pool. If you are not sure of this, do not enable unique auto-tiering policy names.

Unique auto-tiering policy names are required for many Change Virtual Pool service operations, such as changing a virtual volume from VPLEX Local to VPLEX Distributed.

Service Level Objectives (SLO) on VMAX3

ViPR Controller supports Service Level Objectives on VMAX3 arrays.

Service Level Objectives are similar to VMAX FAST policies. They are pre-defined at the factory, and are displayed in ViPR through the Auto-tiering Policy field. The following figure shows the Auto-tiering Policy field in the Hardware panel of the virtual pool.

Figure 1 SLOs with no unique naming

![Auto-tiering Policy](image)

The name of the SLO in the ViPR Controller virtual pool configuration shows the Symmetrix ID, the policy, the workload and the average response time of the SLO. None indicates that the Optimized SLO is selected for the volumes created with this virtual pool.

Enable Unique Auto-tiering Policy Names to display SLOs with unique names that match those displayed in Unisphere:
ViPR Controller and FAST policies: Notes and limitations

ViPR Controller handles FAST policy management according to certain guidelines that are explained in this discussion.

Here are the guidelines to follow:

- You can only change the SLO value for stand-alone VMAX3 volumes.
- You cannot change the SLO value for a VPLEX virtual volume with back-end physical storage on VMAX3.
- You cannot build FAST policies in ViPR Controller. Storage array administrators build FAST policies with Unisphere or another interface.
- When you change a FAST policy for a volume, ViPR Controller changes the FAST policy for the entire storage group. Therefore, all volumes part of a VMAX storage group must be specified for the operation to be successful.
- To determine the storage groups in which your volumes reside, run Unisphere or use the Solutions Enabler CLI.
- You cannot change the FAST policy of a VPLEX virtual volume that has back-end physical storage on a VMAX.
- In Unisphere, you apply FAST policies to volumes when you add the volume to a storage group on the array. In ViPR Controller, you can add a volume to a storage group by exporting the volume to a host. ViPR Controller adds the volume to a storage group on the VMAX, and applies the FAST policy.
- An unexported volume can reside in a virtual pool that has a FAST policy defined. However, the FAST policy is not in effect for that volume until you export the volume to a host or cluster.
- When adding a new node to a one node cluster with a FAST policy or exporting an already exported FAST volume to a different host, ViPR Controller creates a new masking view in a cascaded fashion with the same volume dropped into the storage group that is associated with the new masking view. Since the volume was originally in a storage group with a FAST policy, no other FAST policies are applied to this volume. The storage group in the new masking view is named `<storage_group_name>_NonFast`.
- For VMAX, you cannot migrate a volume spanning across disks in the same storage pool to another storage pool using a FAST policy.
- ViPR Controller supports phantom storage groups in VMAX but not in VMAX3.
- If you want to use existing masking views without ingesting them, you cannot change the FAST policy on the phantom storage groups. To be able to change the
FAST policy on phantom storage groups, ingest the masking views into ViPR Controller. This ensures that ViPR Controller can manage all volumes in this group.

**ViPR Controller and FAST Policies on VNX**

VNX storage systems also support FAST policies. The VMAX and VNX arrays handle FAST policies differently.

With VNX, you can change the FAST policies for exported and un-exported volumes. On a VNX, a FAST policy is directly associated with the volume.

All volumes provisioned on a VNX are assigned to the **Auto Tier**. If you set the virtual pool auto-tiering field to **None**, VNX assigns volumes provisioned using that virtual pool to the **Start High then Autotier** policy, which is the recommended option on VNX.

You can change the FAST policy of a VNX volume to one of the other tiering options that VNX offers.

VNX does not have the storage group limitation. The storage group limitation is exclusively on VMAX arrays.

The physical storage pool in which the volume resides must be available in both the original and target virtual pools. Check both the source and target virtual pools to ensure that the physical storage pool in which your volume resides matches both virtual pools.

**Change FAST policies on an unexported block volume**

You can use ViPR Controller to change the FAST policy on any volume in ViPR Controller. Changing the FAST policy on an exported block volume is more complicated than changing the FAST policy on an unexported volume.

The reason for this is that an unexported volume is not assigned to a storage group. If the volume has no storage group assignment, you can build the target virtual pool, then change the FAST policy for the volume using Change Virtual Pool. Building a target pool is explained in Duplicate a virtual pool.

Choose the appropriate procedure for your environment:

- Add a FAST policy to a volume
- Change a FAST policy of a volume
- Remove a FAST policy from a volume

**Change the FAST policy for an exported volume**

ViPR Controller has a limitation on changing the FAST policy on a VMAX volume that has been exported to a host.

When you use a ViPR Controller service to export a volume to a host, the VMAX array adds that volume to a storage group as part of the service orchestration. To apply (or change) the FAST policy for a volume in a storage group, change the FAST policy for all volumes in the storage group, or the ViPR Change Virtual Pool service will fail.

You need the following information to run Change Virtual Pool on an exported VMAX volume.

- The storage groups to which your volume belongs.
- The names of the other volumes that share a storage group with your volume.
The name of the physical storage pool that contains your volume.

This information is available in Unisphere.

Has my volume been exported?

Each volume created in ViPR Controller has a list of exports. The following procedure shows how to determine if a volume has been exported.

Before you begin

Create the volume from ViPR Controller using the Block Storage Services > Create Block Volume service, or an equivalent service.

Procedure

1. Log in to ViPR Controller as a system administrator.
2. Select Resources > Volumes.
3. Click the volume that you want to examine.

Results

If the volume has been exported, the exports are listed below the volume description, as shown in the following figure.

Figure 3 Volume with Exports

If your volume has been exported, you must identify the other volumes in the storage group on the VMAX, as described in Get the list of volumes that share a storage group with your volume.

If the volume has not been exported, the exports list is empty.
If your volume has not been exported, you can run the Change Virtual Pool service to change the FAST policy. See Change FAST policies on an unexported block volume.

Get list of volumes that share a storage group with your volume

Once you determine that your volume was exported, you know that your volume resides in a storage group on your VMAX. To change the FAST policy, you must compile a list of all volumes in the storage group. This list is required when you run the Change Virtual Pool service.

Before you begin
- You must have a volume that was created by ViPR Controller.
- The volume must have exports.

Procedure
1. Log in to Unisphere.
2. Click the array on which you built your volume.
3. Select Storage > Volumes.
4. Open the Virtual Volume list, and then double-click TDEV.

The Thin Volumes list opens.

<table>
<thead>
<tr>
<th>All Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Volumes …</td>
</tr>
<tr>
<td>Regular Volume</td>
</tr>
<tr>
<td>Virtual Volume</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
5. Find the volume you created by using the Advanced Filtering feature of Unisphere. Enter the name of the volume that you created in the **Volume Identifier Name** field, and then click **OK**.

The volume list displays your volume.

6. Double-click the volume to view the volume properties.

   The **Volume** properties provide a **Storage Groups** link in the **Related Objects** box.

7. Click **Storage Groups**.

   Unisphere displays the Storage Groups to which your volume belongs.
8. Double-click the parent storage group.

Unisphere displays the storage group properties. This screen includes a Related Objects list.

9. Click Volumes in the Related Objects list.

Unisphere displays the complete list of storage groups to which the volume belongs. You can use this list of volumes to run Change Virtual Pool to change a FAST policy.

Figure 5 Storage Groups List
Get the physical storage pool for your volume

Learn how to identify the physical storage pool that contains your volume.

Before you begin

Create the volume from ViPR Controller by using the service Block Storage Services > Create Block Volume or an equivalent service.

Procedure

1. To log in to Unisphere and migrate to the Volume Properties page for your volume, follow steps 1 through 6 in Get the list of volumes that share a storage group with your volume.

   The Volume Properties provide a Bound Pool Info link in the Related Objects box.

2. Click the Bound Pool Info link.

   Unisphere displays the storage pool in which your volume resides.

3. Record the pool name. Make sure that your source and target virtual pools support the Change Auto-tiering operation.

Duplicate a virtual pool

To change the FAST policy of a volume from ViPR Controller, move the volume from its current virtual pool to another virtual pool that has the new FAST policy applied.

Before you begin

The virtual pool that contains the volume and the virtual pool into which you move the volume must be identical, except for the FAST policies. If any other virtual pool settings differ between the source and target virtual pools, the Change Virtual Pool operation fails.

This procedure shows how to create the target virtual pool.

Procedure

1. Log in to ViPR Controller as a system administrator.

2. Choose Virtual > Block Virtual Pools.

3. Select the virtual pool to duplicate by clicking the check box next to the virtual pool.

4. Click Duplicate.

   ViPR Controller creates a new virtual pool from the name of your source virtual pool. For example, if your virtual pool is called MyPool1, ViPR Controller creates a virtual pool called MyPool_copy and then opens the Create Virtual Pool panel so that you can edit its parameters.

5. Change the Hardware > Auto-tiering policy setting.

6. Click Save.
Check the duplicate virtual pool for your physical storage pool

To run Change Virtual Pool to change the FAST policy for a volume, the volume must reside in a physical storage pool that matches both the source and target virtual pools.

**Before you begin**

To see which physical storage pool contains your volume, see Get the physical storage pool for your volume.

After you determine which physical storage pool contains your volume, check both the source and target virtual pools for your physical storage pool. This is to assure that the FAST policy change in the target virtual pool did not filter out the physical storage pool that contains your volume.

**Procedure**

1. Log in to ViPR as an administrator.
2. Select Virtual > Block Virtual Pools.
3. Click the target virtual pool in the Block Virtual Pools list.
4. Expand the Storage Pools list.

**Results**

The physical storage pool that contains your volume must appear on this list. If it does not, you cannot assign your volume to this virtual pool.
Add a FAST policy to a volume

This procedure describes how to apply a FAST policy to a volume by moving that volume to a virtual pool that has an auto-tiering policy.

Before you begin

Build a volume from ViPR Controller by running the service Block Storage Services > Create Block Volume or an equivalent service.

When you create the volume, the virtual pool that you specify must have the auto-tiering policy field set to None.

Procedure

1. To duplicate the virtual pool to which the volume currently belongs, follow the instructions in Duplicate a virtual pool. In the target virtual pool, set the Auto-Tiering policy field to the name of the FAST policy that you want to apply to the volume. The source and target virtual pools must differ only in the auto-tiering policy field. If there are other differences, the Change Virtual Pool service will fail.

2. Run Block Storage Services > Change Virtual Pool.

3. Set the fields in the Change Virtual Pool dialog as shown in the following table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Choose the project that contains the volume.</td>
</tr>
<tr>
<td>Virtual Pool</td>
<td>Choose the virtual pool in which the volume currently resides.</td>
</tr>
<tr>
<td></td>
<td>This virtual pool has the auto-tiering policy set to None.</td>
</tr>
<tr>
<td>Operation</td>
<td>Choose Change Auto-tiering Policy or Host IO Limits.</td>
</tr>
<tr>
<td>Target Virtual Pool</td>
<td>Specify the duplicate virtual pool you created in step 1.</td>
</tr>
<tr>
<td>Volume</td>
<td>Select the volume you want to add to the virtual pool, and any other volumes that share a storage group with that volume on the array.</td>
</tr>
</tbody>
</table>

4. Click Order.

Change the FAST policy for a volume

This procedure explains how to change the volume's FAST policy by moving that volume to a virtual pool that has another auto-tiering policy.

Before you begin

Build a volume from ViPR Controller by running the service Block Storage Services > Create Block Volume or an equivalent service.

When you create the volume, the virtual pool that you specify must have the auto-tiering policy field set.

Procedure

1. Follow the instructions in Duplicate a virtual pool to duplicate the virtual pool to which the volume currently belongs. In the target virtual pool, change the Auto-
**Tiering policy** field to the name of the FAST policy that you want to apply to the volume. The source and target virtual pools must differ only in the auto-tiering policy field. If there are other differences, the Change Virtual Pool service will fail.

2. Run **Block Storage Services > Change Virtual Pool**

3. Set the fields in the Change Virtual Pool dialog box as shown in the following table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Choose the project that contains the volume.</td>
</tr>
<tr>
<td>Virtual Pool</td>
<td>Choose the virtual pool in which the volume currently resides. This virtual pool has the auto-tiering policy set.</td>
</tr>
<tr>
<td>Operation</td>
<td>Choose <strong>Change Auto-tiering Policy or Host IO Limits</strong>.</td>
</tr>
<tr>
<td>Target Virtual Pool</td>
<td>Specify the duplicate virtual pool you created in step 1.</td>
</tr>
<tr>
<td>Volume</td>
<td>Select the volume you want to add to the virtual pool, and any other volumes that share a storage group with that volume on the array.</td>
</tr>
</tbody>
</table>

4. Click **Order**.

## Remove the FAST policy from a volume

This procedure explains how to remove the FAST policy from the volume by moving that volume to a virtual pool that has no auto-tiering policy.

**Before you begin**

Build a volume from ViPR Controller by running the service **Block Storage Services > Create Block Volume** or an equivalent service.

When you create the volume, the virtual pool that you specify must have the auto-tiering policy field set.

**Procedure**

1. To duplicate the virtual pool to which the volume currently belongs, follow the instructions in **Duplicate a virtual pool**. In the target virtual pool, set the **Auto-Tiering policy** field to **None**. The source and target virtual pools must differ only in the auto-tiering policy field. If there are other differences, the Change Virtual Pool service will fail.

2. Run **Block Storage Services > Change Virtual Pool**.

3. Set the fields in the Change Virtual Pool dialog box as shown in the following table.

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Choose the project that contains the volume.</td>
</tr>
</tbody>
</table>
### Table 5  Remove virtual pool service settings (continued)

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Pool</td>
<td>Choose the virtual pool in which the volume currently resides. This virtual pool has the auto-tiering policy set.</td>
</tr>
<tr>
<td>Operation</td>
<td>Choose <strong>Change Auto-tiering Policy or Host IO Limits</strong>.</td>
</tr>
<tr>
<td>Target Virtual Pool</td>
<td>Specify the duplicate virtual pool that you created in step 1.</td>
</tr>
<tr>
<td>Volume</td>
<td>Select the volume you want to add to the virtual pool, and any other volumes that share a storage group with that volume on the array.</td>
</tr>
</tbody>
</table>

4. Click **Order**.
CHAPTER 5

ViPR Controller Support for Meta Volumes on VMAX Arrays

This chapter contains the following topics:

- ViPR Controller support for meta volumes on VMAX ........................................ 42
- Concatenated vs. striped meta volumes on VMAX arrays .................................... 42
- ViPR Controller striped volume creation in a VMAX thin pool .............................. 43
- ViPR Controller concatenated volume creation on VMAX ................................. 44
- ViPR Controller striped volume creation in a VMAX thick pool ......................... 46
- ViPR Controller volume expansion on VMAX ..................................................... 47
ViPR Controller support for meta volumes on VMAX

ViPR Controller manages, creates, and modifies VMAX meta volumes when it creates and expands volumes on an VMAX array.

ViPR Controller provides a number of services that create volumes on block storage:

- Block Storage Services > Create Block Volume
- Block Storage Services > Create Block Volume for a Host
- Block Services for Windows > Create and Mount Volume
- Block Services for Linux > Create and Mount Volume

ViPR Controller also provides services that expand block storage volumes.

- Block Storage Services > Expand Block Volume
- Block Services for Windows > Expand Volume on Windows
- Block Services for Linux > Expand Linux Mount

Note

VMAX3 arrays do not use meta volumes of any kind. This discussion does not pertain to ViPR Controller integration with VMAX3 arrays.

Concatenated vs. striped meta volumes on VMAX arrays

VMAX supports both striped and concatenated meta volumes. ViPR Controller enables you to control the type of meta volume it creates.

By default, ViPR Controller creates striped meta volumes. However, you control the type of meta volume that ViPR Controller creates.

VMAX supports both striped and concatenated meta volumes.
If you enable Fast Expansion, ViPR Controller creates concatenated meta volumes in this virtual pool. If Fast Expansion is disabled, ViPR Controller creates striped meta volumes.

**Note**

The Fast Expansion option is available in the virtual pool configuration screens only if you select a system type of EMC VMAX or EMC VNX Block.

**ViPR Controller striped volume creation in a VMAX thin pool**

When a ViPR Controller user submits a request to create a striped volume in a thin storage pool, ViPR Controller determines whether to create a regular volume or a meta volume.

The following list describes the process and policies that ViPR Controller uses to determine when and how to build striped volumes in a thin pool.

- During VMAX array discovery, ViPR Controller adds physical storage pools.
- Each storage pool has an associated maximum volume size.
- You can retrieve the maximum volume size for a storage pool by performing a GET against that storage pool using the ViPR Controller REST API.
- The default maximum volume size of a storage pool on a VMAX is 240 GB. You can explicitly set the maximum volume size for a VMAX storage pool through the auto meta feature.
- If the VMAX auto meta feature is enabled, the maximum volume size is the `min_auto_meta_size` setting of the array.
If you modify the `min_auto_meta_size` setting of any array under ViPR Controller management from Unisphere, the best practice is to immediately rediscover the array in order to synchronize the array settings with ViPR. If you do not rediscover the array, any volume creation or expansion could yield unpredictable results.

- ViPR Controller chooses one physical storage pool where it will create the volume. (ViPR Controller volumes do not span across physical storage pools.)
- ViPR Controller checks the maximum volume size of the storage pool and compares it to the size of the request that the user submitted through the service dialog box.
- If the requested volume size exceeds the maximum volume size of the storage pool, ViPR Controller creates a meta volume. If the requested volume size is smaller than the maximum volume size of the storage pool, ViPR Controller creates a standard volume.

### Striped thin pool provisioning: Determine the number of meta members in a meta volume

When ViPR Controller creates a striped meta volume in a virtual pool that has thin provisioning, it calculates how many meta members to build according to the following rules:

- ViPR Controller retrieves the maximum meta member size from the storage pool object that ViPR Controller returned from an array discovery. The default is 240GB.
- If the requested volume size exceeds the maximum thin volume meta member size limit, build a meta volume. For requests smaller than the maximum thin volume meta member size limit, create a regular volume.
- Use 8 members total (including the head) until you reach the maximum capacity possible of 8 members. An eight member meta volume includes a meta head and seven meta members.
- If an 8 member meta volume is too small to fulfill the request, use a 16-member meta volume. If the 16-member meta volume is too small, use a 32-member meta volume.
- When requested capacity exceeds 32 meta members, add more members individually, for example, 33, 34, 35, until you achieve sufficient capacity.

### ViPR Controller concatenated volume creation on VMAX

When a ViPR Controller user submits a request to create a concatenated volume, ViPR Controller determines whether to create a regular volume or a meta volume.

The following list describes the process and policies that ViPR Controller uses to determine when and how to build concatenated meta volumes.

- During VMAX array discovery, ViPR Controller adds physical storage pools.
- Each storage pool has an associated maximum volume size.
- You can retrieve the maximum volume size for a storage pool by performing a GET against that storage pool using the ViPR Controller REST API.
- The default maximum volume size of a storage pool on a VMAX is 240 GB. You can explicitly set the maximum volume size for a VMAX storage pool through the auto meta feature.
- If the VMAX auto meta feature is enabled, the maximum volume size is the `min_auto_meta_size` setting of the array.

**Note**

If you modify the `min_auto_meta_size` setting of any array under ViPR Controller management from Unisphere, the best practice is to immediately rediscover the array in order to synchronize the array settings with ViPR. If you do not rediscover the array, any volume creation or expansion could yield unpredictable results.

- ViPR Controller chooses one physical storage pool where it will create the volume. (ViPR Controller volumes do not span across physical storage pools.)
- ViPR Controller checks the maximum volume size of the storage pool and compares it to the size of the request that the user submitted through the service dialog box.
- If the requested volume size exceeds the maximum volume size of the storage pool, ViPR Controller creates a meta volume. If the requested volume size is smaller than the maximum volume size of the storage pool, ViPR Controller creates a standard volume.

After ViPR Controller chooses a storage pool, it creates the volume.

### Concatenated meta volume: Determine the number of meta members in a meta volume

When ViPR Controller creates a concatenated meta volume, it sets the number of meta members according to the following process:

- Determines the maximum volume size. The ViPR Controller API GET on the storage pool returns this information.
- Creates the number of meta members that ViPR Controller needs to fulfill the request.
- Ensures that all created meta members are the same size.

**Example 1**

Suppose VMAX returns a maximum volume size of 240 GB.

The user asks ViPR Controller to create a 400 GB volume.

ViPR Controller creates 2 meta members of 200 GB apiece.

**Example 2**

Suppose VMAX returns a maximum volume size of 240 GB.

The user asks ViPR Controller to create a 900 GB volume.

ViPR Controller creates 4 meta members of 225 GB apiece.
ViPR Controller striped volume creation in a VMAX thick pool

When a ViPR Controller user submits a request to create a striped volume in a thick storage pool, ViPR Controller determines whether to create a regular volume or a meta volume.

ViPR Controller uses the following process and policies to determine when and how to build striped volumes in a thick pool.

- During VMAX array discovery, ViPR Controller adds physical storage pools.
- Each storage pool has an associated maximum volume size.
- You can retrieve the maximum volume size for a storage pool by performing a GET against that storage pool using the ViPR Controller REST API.
- The default maximum volume size of a storage pool on a VMAX is 240 GB. You can explicitly set the maximum volume size for a VMAX storage pool through the auto meta feature.
- If the VMAX auto meta feature is enabled, the maximum volume size is the `min_auto_meta_size` setting of the array.

Note

If you modify the `min_auto_meta_size` setting of any array under ViPR Controller management from Unisphere, the best practice is to immediately rediscover the array in order to synchronize the array settings with ViPR Controller. If you do not rediscover the array, any volume creation or expansion could yield unpredictable results.

- ViPR Controller chooses one physical storage pool where it will create the volume. (ViPR Controller volumes do not span across physical storage pools.)

Striped thick pool provisioning: Determine the number of meta members in a meta volume

When ViPR Controller creates a striped meta volume in a storage pool that has thick provisioning, it calculates how many meta members to build according to the following rules:

- If the request is between 32GB and 500GB, use a 4-member meta volume.
- If the request is between 500GB to 1024GB, use an 8-member meta volume.
- More than 1024GB, use a 16-member meta volume or a 32-member meta volume, according to requested capacity.
- When requested capacity is larger than 32 meta members, add more members individually. For example, add a 33rd meta member, then a 34th, until you reach sufficient capacity.
ViPR Controller volume expansion on VMAX

You can expand a volume on a VMAX if the volume was created in a virtual pool that has the Expandable option enabled. When a ViPR Controller user submits a request to expand a VMAX volume, ViPR Controller applies the following rules:

- Any volume expansion on VMAX results in a meta volume. This is a VMAX feature. Therefore, if you expand a volume that resides on a VMAX with ViPR Controller, the resulting volume will be a meta volume, even if the original volume was a regular volume and the expansion was small.

- If you expand a meta volume with a ViPR Controller service, ViPR Controller adds meta members until the total size of the volume meets or exceeds the size that the user specified in the service request.

- If the meta volume is a striped meta, striped data is redistributed to use new member volumes. This process can take some time. VMAX backs up the volume data to a BCV (Business Continuity Volume). Then it creates a striped meta volume of the requested size and copies the data to it.

- All meta members in a meta volume have the same size. For example:
  - When ViPR Controller expands a 256GB meta volume with 8 members to 320GB, it adds two new members, each of 32GB.
  - When ViPR Controller expands a 16GB regular volume to 256GB, ViPR Controller adds 15 new members, each of 16GB.

- When ViPR expands a regular VMAX volume into a meta volume, the result is a concatenated meta volume of the requested size.

- Expect some delays in accessing the data while expansion service processing is under way.
CHAPTER 6
ViPR Controller Support for Meta Volumes on VNX Arrays

This chapter contains the following topics:

- ViPR Controller meta volume creation on VNX: notes and guidelines.................50
- ViPR Controller provisioning on VNX: regular vs. meta volumes..........................50
- ViPR Controller provisioning on VNX: Determine the number of meta members in a volume............................................................................................................. 51
- Expand a volume on a VNX array ........................................................................ 51
ViPR Controller meta volume creation on VNX: notes and guidelines

When ViPR Controller creates volumes in a VNX storage pool, it applies the following guidelines:

- During VNX array discovery, ViPR Controller adds physical storage pools.
- Each storage pool has an associated maximum volume size.
- You can retrieve the maximum volume size for a storage pool by performing a GET against that storage pool using the ViPR Controller REST API.
- VNX supports meta volumes only for RAID groups (volumes created in concrete pools). They are always thick volumes.
- ViPR Controller creates meta volumes for all VNX volumes larger than the maximum meta member size that the VNX array returns. The default volume size limit for a thick volume in a concrete storage pool on a VNX is 1.7TB.
- On a VNX, unified storage pools support only regular volumes.
- When ViPR Controller creates meta members in meta volumes, those meta members are the same size.
- ViPR Controller creates striped meta volumes on VNX. ViPR Controller does not create concatenated meta volumes on a VNX array.
- If a concatenated meta volume resides on the VNX outside of ViPR Controller, ViPR Controller can ingest it. Subsequently, ViPR Controller can expand that concatenated meta volume.

ViPR Controller provisioning on VNX: regular vs. meta volumes

When ViPR Controller receives a request to create a volume on a VNX array, it uses the certain criteria to determine the type of volume to create.

To determine the type of volume to create on VNX, ViPR Controller completes the following processes:

- ViPR Controller chooses one physical storage pool where it will create the volume. ViPR Controller volumes do not span across physical storage pools.
- If you specify a thin virtual storage pool in the service dialog box, ViPR Controller provisions a regular volume up to the maximum volume size for the physical storage pool.
- If you specify a thick virtual storage pool in the service dialog, ViPR Controller checks the maximum volume size of the storage pool and compares it to the size of the request that the user requested through the service dialog box.
- If the requested volume size exceeds the maximum volume size of the storage pool, ViPR Controller creates a meta volume. If the requested volume size is less than the maximum volume size of the storage pool, ViPR Controller creates a standard volume.
ViPR Controller provisioning on VNX: Determine the number of meta members in a volume

During storage provisioning, ViPR Controller uses the following processes to determine the number of members to create in the meta volume:

- ViPR Controller builds the minimum number of meta members to fulfill the request.
- ViPR Controller creates meta members that are all the same size.
- No meta member exceeds the maximum meta member size. The value of the maximum meta member size resides in the storage pool object that ViPR Controller returns from a VNX array discovery.

ViPR Controller meta volume creation on VNX: examples

The following examples assume that the maximum volume size in the concrete storage pools is 1.7TB.

The user requests a volume of 6 TB. ViPR Controller creates a meta volume that has 4 meta members of 1.5 TB.

The user requests a volume of 10 TB. ViPR Controller creates a meta volume that has 6 1.7 TB meta members.

Expand a volume on a VNX array

You can expand a volume on a VNX if the volume was created in a virtual pool that has the Expandable option enabled. When you expand a VNX volume, ViPR Controller applies these policies:

- Thin Pool Volumes. Either thick or thin LUNs created in VNX Unified pools. ViPR Controller expands these volumes as regular volumes up to the regular volume size limit in the storage pool. ViPR Controller does not support meta volume expansion of these volumes. The volume size limit for thick volumes in a Unified CLARiiON storage pool is 11TB. The size limit for thin volumes is 17TB.
- Thick pool volumes. RAID group volumes that are thick LUNs provisioned from VNX concrete pools. ViPR Controller expands them as meta volumes.
ViPR Controller Support for Meta Volumes on VNX Arrays
CHAPTER 7

ViPR Controller Support for TimeFinder Operations on VMAX arrays

This chapter contains the following information.

- ViPR Controller Support for TimeFinder Operations on VMAX Arrays........54
- TimeFinder Clone operations.................................................................54
- TimeFinder Snap (VDEV) operations......................................................56
- TimeFinder VP Snap operations...............................................................57
- TimeFinder Mirror operations.................................................................58
- TimeFinder SnapVX operations...............................................................60
ViPR Controller Support for TimeFinder Operations on VMAX Arrays

ViPR Controller uses snapshot technology to perform TimeFinder operations on VMAX storage systems.

The following sections list the TimeFinder operations which are supported, and not supported in ViPR Controller and lists the ViPR Controller services used to perform the supported operations.

- TimeFinder Clone
- TimeFinder Snap (VDEV)
- TimeFinder VP Snap
- TimeFinder Mirror
- TimeFinder SnapVX

TimeFinder Clone operations

The following sections list the TimeFinder Clone operations which are supported, and not supported in ViPR Controller and lists the ViPR Controller services used to perform the supported operations.

TimeFinder Clone supported operations

The following TimeFinder Clone operations are supported by ViPR Controller on VMAX3 and VMAX2 storage systems.

Table 6 TimeFinder Clone operations supported by ViPR Controller

<table>
<thead>
<tr>
<th>TimeFinder Clone operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Differential Clone (precopy)</td>
<td>Creates a differential clone in precopy mode.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Full Copy (performs both create and activate operations)</td>
<td>POST /block/volumes/{id}/protection/full-copies</td>
</tr>
<tr>
<td></td>
<td>Creates a differential clone in precopy mode for multiple volumes in a consistency group.</td>
<td>POST /block/consistency-groups/{id}/protection/full-copies</td>
<td></td>
</tr>
<tr>
<td>Activate Differential Clone (precopy)</td>
<td>Activates a differential clone in precopy mode.</td>
<td>POST /block/full-copies/{id}/activate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activates a differential clone in</td>
<td>POST /block/consistency-groups/</td>
<td></td>
</tr>
</tbody>
</table>
Table 6 TimeFinder Clone operations supported by ViPR Controller (continued)

<table>
<thead>
<tr>
<th>TimeFinder Clone operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>precopy mode</strong> <strong>for multiple volumes in a consistency group.</strong></td>
<td></td>
<td>{id}/protection/full-copies/{fcid}/activate</td>
<td></td>
</tr>
<tr>
<td><strong>Terminate</strong></td>
<td>Severs the relationship with the source and target devices. Detached clone is considered a standard volume.</td>
<td>Catalog&gt;Block Protection Services&gt;Detach Full Copies</td>
<td>POST /block/full-copies/{id}/detach POST /block/consistency-groups/{id}/protection/full-copies/{fcid}/detach</td>
</tr>
<tr>
<td><strong>Delete Clone</strong></td>
<td>Deletes the clone. Severs the relationship with source and target devices.</td>
<td>Catalog&gt;Block Protection Services&gt;Remove Full Copies</td>
<td>POST /block/volumes/{id}/deactivate POST /block/full-copies/{id}/detach POST /block/consistency-groups/{id}/protection/full-copies/{fcid}/detach POST /block/consistency-groups/{id}/protection/full-copies/{fcid}/deactivate</td>
</tr>
<tr>
<td><strong>Full Restore</strong></td>
<td>Full restore can use the target as the source for a new session with a new target.</td>
<td>Catalog&gt;Block Protection Services&gt;Restore from Full Copies</td>
<td>POST /block/full-copies/{id}/restore</td>
</tr>
<tr>
<td><strong>Resynchronize</strong></td>
<td>Performs recreate and establish. Incremental copy of all subsequent changes made to the source device to the target device.</td>
<td>Catalog&gt;Block Protection Services&gt;Resynchronize Full Copies</td>
<td>POST /block/full-copies/{id}/resynchronize</td>
</tr>
</tbody>
</table>
TimeFinder Clone operations not supported in ViPR Controller

The following TimeFinder Clone operations are not supported by ViPR Controller:

- Copy Mode
- Clone to larger device
- Clone thick to thin
- Clone thin to thick

TimeFinder Snap (VDEV) operations

The following sections list the TimeFinder Snap (VDEV) operations which are supported, and not supported in ViPR Controller and lists the ViPR Controller services used to perform the supported operations.

TimeFinder Snap (VDEV) supported operations

The following TimeFinder Snap (VDEV) operations are supported by ViPR Controller on VMAX2 storage systems.

Table 7 TimeFinder Snap (VDEV) operations supported by ViPR Controller

<table>
<thead>
<tr>
<th>TimeFinder Snap (VDEV) operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create and Activate Differential Snapshot with Copy on First Write (Thick Source Only)</td>
<td>Creates and activates snap copy session. Target VDEV becomes accessible to the host.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Block Snapshot (for a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/activate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots/{sid}/activate</td>
</tr>
<tr>
<td>Terminate</td>
<td>Severs the relationship with source and target devices. Deletes the target device.</td>
<td>Catalog&gt;Block Protection Services&gt;Remove Block Snapshot (of a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/deactivate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots/{sid}/deactivate</td>
</tr>
<tr>
<td>Incremental Restore</td>
<td>Incremental restore to the source device. Only the differences between source and target devices in SAVE pool will be copied back to the source.</td>
<td>Catalog&gt;Block Protection Services&gt;Restore Block Snapshot (to a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/restore</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots/{sid}/restore</td>
</tr>
</tbody>
</table>
Table 7 TimeFinder Snap (VDEV) operations supported by ViPR Controller (continued)

<table>
<thead>
<tr>
<th>TimeFinder Snap (VDEV) operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Differential Clone</td>
<td>Create and activates a differential clone of a snapshot in pre-copy mode.</td>
<td>UI operation not available.</td>
<td>POST /block/snapshots/{id}/protection/full-copies</td>
</tr>
<tr>
<td>Resynchronize</td>
<td>Performs recreate and establish. Incremental copy of all subsequent changes made to the source device to the target device</td>
<td>UI operation not available.</td>
<td>POST /block/snapshots/{id}/resynchronize</td>
</tr>
<tr>
<td>Export</td>
<td>Presents snapshot of a volume to another host.</td>
<td>Catalog&gt;Block Protection Services&gt;Export a Snapshot to a host</td>
<td>POST /block/exports</td>
</tr>
</tbody>
</table>

TimeFinder SNAP (VDEV) unsupported operations
The following TimeFinder SNAP (VDEV) operations are not supported by ViPR Controller:
- Thin Source Volume
- Asynchronous Copy on First Write
- Selecting a target SAVE pool
- Cannot create inactive Snap

TimeFinder VP Snap operations

The following TimeFinder VP Snap operations are supported by ViPR Controller on VMAX2 storage systems.

Table 8 TimeFinder VP Snap operations supported by ViPR Controller

<table>
<thead>
<tr>
<th>TimeFinder VP Operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create and Activate Snapshot (Thin source only)</td>
<td>Creates and activates snap copy session Target is bound to the pool of the source volume.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Block Snapshot (for a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/activate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/</td>
</tr>
</tbody>
</table>
### TimeFinder VP Snap operations supported by ViPR Controller (continued)

<table>
<thead>
<tr>
<th>TimeFinder VP Operation</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terminate</strong></td>
<td>Deletes target device. Target device is removed from any shared allocations that were part of the session, and any non-shared allocations for that device are deallocated.</td>
<td>Catalog&gt;Block Protection Services&gt;Remove Block Snapshot (of a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/deactivate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots/{sid}/deactivate</td>
</tr>
<tr>
<td><strong>Incremental Restore</strong></td>
<td>Incremental restore to the source device</td>
<td>Catalog&gt;Block Protection Services&gt;Restore Block Snapshot (to a volume or consistency group)</td>
<td>POST /block/snapshots/{id}/restore</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>POST /block/consistency-groups/{id}/protection/snapshots/{sid}/restore</td>
</tr>
<tr>
<td><strong>Create Differential Clone</strong></td>
<td>Creates and activates a differential clone of snapshot in pre-copy mode.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Snapshot Full Copy</td>
<td>POST /block/snapshots/{id}/protection/full-copies</td>
</tr>
<tr>
<td><strong>Resynchronize</strong></td>
<td>Performs recreate, and establish. Incremental copies of all subsequent changes made to the source device to the target device.</td>
<td>UI operation not available.</td>
<td>POST /block/snapshots/{id}/resynchronize</td>
</tr>
<tr>
<td><strong>Export</strong></td>
<td>Presents snapshot of a volume to another host.</td>
<td>Catalog&gt;Block Protection Services&gt;Export Snapshot (block volume) to a Host</td>
<td>POST /block/exports</td>
</tr>
</tbody>
</table>

## TimeFinder Mirror operations

The following sections list the TimeFinder Mirror operations which are supported, and not supported in ViPR Controller and lists the ViPR Controller services used to perform the supported operations.

### Supported TimeFinder Mirror operations

The following TimeFinder Mirror operations are supported by ViPR Controller on VMAX3 and VMAX2 storage systems.
Table 9 TimeFinder Mirror operations supported by ViPR Controller

<table>
<thead>
<tr>
<th>TimeFinder Mirror operations</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Mirror</td>
<td>Create relationship of source to target.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Continuous Copy</td>
<td>POST /block/volumes/{id}/protection/continuous-copies/start</td>
</tr>
<tr>
<td>Terminate</td>
<td>Deletes mirror.</td>
<td>Catalog&gt;Block Protection Services&gt;Remove Continuous Copy</td>
<td>POST /block/volumes/{id}/protection/continuous-copies/deactivate</td>
</tr>
<tr>
<td>Stop</td>
<td>Dissolves pair. Promotes mirror as regular volume.</td>
<td>Resources&gt;Block Snapshots&gt;Actions</td>
<td>POST /block/volumes/{id}/protection/continuous-copies/stop</td>
</tr>
<tr>
<td>Pause</td>
<td>Fracture the mirror.</td>
<td>Resources&gt;Block Snapshots&gt;Actions</td>
<td>POST /block/volumes/{id}/protection/continuous-copies/pause</td>
</tr>
<tr>
<td>Resume</td>
<td>Incremental establish</td>
<td>Resources&gt;Block Snapshots&gt;Actions</td>
<td>POST /block/volumes/{id}/protection/continuous-copies/resume</td>
</tr>
</tbody>
</table>

Unsupported TimeFinder Mirror operations
The following TimeFinder Mirror operations are not supported by ViPR Controller.

- Mirror Protected Restore
- Mirror Protected Establish
- Mirror Reverse Split
- Mirror Concurrent BCV
# TimeFinder SnapVX operations

The following sections list the TimeFinder SnapVX operations which are supported, and not supported in ViPR Controller and lists the ViPR Controller services used to perform the supported operations.

## Supported TimeFinder SnapVX operations

The following TimeFinder SnapVX operations are supported by ViPR Controller on VMAX3 storage systems, as well as following storage systems, and configurations when VMAX3 is used for the backend:

- VPLEX Local
- VPLEX Metro
- VPLEX + RecoverPoint

<table>
<thead>
<tr>
<th>TimeFinder SnapVX operations</th>
<th>Description</th>
<th>ViPR Controller UI</th>
<th>ViPR Controller REST API</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create</td>
<td>Create SnapVX snapshot session for the volume or consistency group, and define whether to link to one or multiple targets in copy or no copy mode.</td>
<td>Catalog&gt;Block Protection Services&gt;Create Block Snapshot (for a volume or consistency group)</td>
<td>POST /block/volumes/{id}/protection/snapshot-sessions&lt;br&gt;POST /block/consistency-groups/{id}/protection/snapshot-sessions&lt;br&gt;POST /block/snapshots/{id}/protection/snapshot-sessions</td>
</tr>
<tr>
<td>Deactivate</td>
<td>Delete the snapshot session. You cannot delete a snapshot session, which is linked to any targets.</td>
<td>Catalog&gt;Block Protection Services&gt;Remove Snapshot Session (of a volume or consistency group)&lt;br&gt;Resources&gt;Snap Sessions&gt;Delete</td>
<td>POST /block/snapshot-session/{id}/deactivate&lt;br&gt;POST /block/consistency-groups/{id}/protection/snapshot-sessions/{sid}/deactivate</td>
</tr>
<tr>
<td>Link</td>
<td>Link the snapshot session to the target volume. You can use an existing target, or create a new target to link to the snapshot session.</td>
<td>Catalog&gt;Block Protection Services&gt;Link Block Snapshot (of a volume or consistency group)</td>
<td>POST /block//snapshot-sessions/{id}/link-targets&lt;br&gt;POST /block/consistency-groups/{id}/protection/snapshot-sessions/{sid}/link-targets</td>
</tr>
<tr>
<td>Unlink</td>
<td>Unlink the target volume from the snapshot session and</td>
<td>Resources&gt;Snap Sessions&gt;Delete</td>
<td>POST /block/snapshot-sessions/{id}/unlink-targets</td>
</tr>
<tr>
<td>TimeFinder SnapVX operations</td>
<td>Description</td>
<td>ViPR Controller UI</td>
<td>ViPR Controller REST API</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>---------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>also delete the target volume.</td>
<td>session details&gt;Unlink with delete Catalog&gt;Block Protection Services&gt;Remove Snapshot Session (Also deletes the snapshot session) (for a volume or consistency group)</td>
<td>Resources&gt;Snap Sessions&gt;Snapshot session details&gt;Unlink without delete (for a volume or consistency group)</td>
<td>POST /block//consistency-groups/{id}/protection/snapshot-sessions/{sid}/unlink-targets</td>
</tr>
<tr>
<td>Unlink the target volume from the snapshot session, while allowing you to continue to use ViPR Controller to manage the target volume as an individual volume.</td>
<td>Resources&gt;Snap Sessions&gt;Snapshot session details&gt;Unlink without delete (for a volume or consistency group)</td>
<td>POST /block//consistency-groups/{id}/protection/snapshot-sessions/{sid}/unlink-targets</td>
<td>POST /block/consistency-groups/{id}/protection/snapshot-sessions/{sid}/unlink-targets</td>
</tr>
<tr>
<td>Relink</td>
<td>Catalog&gt;Block Protection Services&gt;Link Block Snapshot (for a volume or consistency group) Resources&gt;Snapshot Sessions&gt;Snapshot session details&gt;Relink</td>
<td>POST /block//snapshot-sessions/{id}/relink-targets</td>
<td>POST /block/consistency-groups/{id}/protection/snapshot-sessions/{sid}/relink-targets</td>
</tr>
<tr>
<td>Restore</td>
<td>Catalog&gt;Block Protection Services&gt;Restore Block Snapshot in Type, select Snapshot Session</td>
<td>POST /block//snapshot-sessions/{id}/restore</td>
<td>POST /block/consistency-groups/{id}/protection/snapshot-sessions/{sid}/restore</td>
</tr>
<tr>
<td>Restore from linked target — to restore the linked target data to the source volume.</td>
<td>Catalog&gt;Block Protection Services&gt;Restore Block Snapshot (to a volume or consistency group), in Type, select Local or Remote.</td>
<td>POST /block//snapshots/{id}/restore</td>
<td>POST /block//consistency-groups/{id}/protection/snapshots/{sid}/restore</td>
</tr>
</tbody>
</table>

**Unsupported TimeFinder SnapVX operations**
The following TimeFinder SnapVX operations are not supported by ViPR Controller.
ViPR Controller Support for TimeFinder Operations on VMAX arrays

- Create Differential Clone, BCVs
- Time-to-Live (TTL)
- Generation Numbers
CHAPTER 8

ViPR Controller Support for SRDF Remote Replication

This chapter contains the following topics:

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- ViPR Controller support for SRDF/A and SRDF/S operations ..................................... 68
- ViPR Controller support for SRDF-Metro operations ................................................. 80
ViPR Controller support for Symmetrix Remote Data Facility

ViPR Controller enables you to use the Symmetrix Remote Data Facility (SRDF) to replicate volumes automatically to a remote data center. ViPR Controller supports the following SRDF modes.

<table>
<thead>
<tr>
<th>VMAX or VMAX3 storage system mode</th>
<th>ViPR Controller mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRDF synchronous or SRDF/S</td>
<td>Synchronous</td>
</tr>
<tr>
<td>SRDF asynchronous or SRDF/A</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>SRDF Metro</td>
<td>Active</td>
</tr>
</tbody>
</table>

Note
Active mode is only available for VMAX3 storage systems enabled with a SRDF/Metro license.

ViPR Controller operations for SRDF automate these processes:
- Volume creation
- Zone and mask creation for volumes
- Initiation of SRDF connections
- Monitoring of SRDF connections

ViPR Controller and SRDF: limitations
ViPR Controller does not support certain SRDF configurations. ViPR Controller does not support the following:
- SRDF/Star and SRDF/CG.
- Static RDF groups. A dynamic RDF group must use synchronous, asynchronous, or active mode.
- Adaptive copy mode.
- Multiple SRDF copies
- Ingestion of SRDF Metro volumes
- Ingestion of VPLEX + SRDF volumes

Support summary: SRDF operations
Review the following sections to determine the SRDF operations that are supported and unsupported by ViPR Controller.

Common SRDF operations
The following are common SRDF operations that you can perform in ViPR Controller. For a complete list of supported SRDF operations, see:
- SRDF operations supported for SRDF/S and SRDF/A replication
- SRDF operations supported and unsupported for SRDF Metro replication
### Table 10 Common SRDF operations

<table>
<thead>
<tr>
<th>SRDF operation</th>
<th>Description</th>
<th>Supported through ViPR Controller?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SRDF Pairs operations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Createpair</td>
<td>Creates dynamic SRDF pairs based on devices specified in a device file. By default, the Symmetrix ID specified in this operation is the R1 device. If you use the -R2 option, the R2 device becomes the default.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Deletpair</td>
<td>Deletes dynamic SRDF pairing in the specified device group.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Suspend</td>
<td>Suspends I/O traffic on the SRDF links for the remotely mirrored pairs in the group.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>SRDF Pair, Link operations</strong></td>
<td></td>
<td>Any SRDF link operations are applied to all volumes in the RDF group.</td>
<td></td>
</tr>
<tr>
<td>Split</td>
<td>Splits an SRDF pair. This stops mirroring for the SRDF pairs in a device group.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore</td>
<td>Restores remote mirroring and initiates a data copy from the target (R2) side to the source (R1) side. This operation can be a full or incremental restore.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Establish</td>
<td>Establishes an SRDF pair by initiating a data copy from the source (R1) side to the target (R2) side. This operation can be a full or incremental establish</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Resume</td>
<td>Resumes I/O traffic on the SRDF links for the remotely-mirrored pairs in the group.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Failover and Failback operations</strong></td>
<td></td>
<td>Failover and Failback functions are not supported for SRDF Metro.</td>
<td></td>
</tr>
<tr>
<td>Failover</td>
<td>Switches data processing from the source (R1) to the target (R2) side. If the source (R1) is operational, ViPR Controller suspends I/O traffic on the SRDF links and write-disables the devices on the source (R1) side to their local hosts. Then, ViPR Controller</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 10 Common SRDF operations (continued)

<table>
<thead>
<tr>
<th>SRDF operation</th>
<th>Description</th>
<th>Supported through ViPR Controller?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>UI</td>
<td>API</td>
</tr>
<tr>
<td>suspend traffic on the SRDF links, and write enables the devices on the target side to their local hosts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failback</td>
<td>Switches data processing from the (R2) side back to the source (R1) side. If the target (R2) is operational, ViPR Controller does the following: 1. Write-disables the devices on the target side to their local hosts. 2. Resumes I/O traffic on the SRDF links. 3. Write-enables the devices on the source (R1) side to their local hosts.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Swap</td>
<td>Swaps the SRDF personality of the designated SRDF devices. Source R1 devices become target R2 devices, and target R2 devices become source R1 devices.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create Snapshot</td>
<td>Creates a point-in-time copy of a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete Snapshot</td>
<td>Deletes a point-in-time copy of a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore Snapshot</td>
<td>Restores snapshot data to a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create clone</td>
<td>Creates a full copy of a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete Clone</td>
<td>Deletes a full copy of a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mirror operations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 10 Common SRDF operations (continued)

<table>
<thead>
<tr>
<th>SRDF operation</th>
<th>Description</th>
<th>Supported through ViPR Controller?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delete Mirror</td>
<td>Delete a continuous copy of a volume.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Note</td>
<td>Perform the pause operation before deleting a mirror.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RDF groups
When using ViPR Controller to perform operations on RDF groups:

- You can create regular SRDF volumes with or without Consistency Groups.
- When you perform an operation on a device in an RDF group, the operation is performed on all volumes in the project when the volumes are in a consistency group. When volumes are not in a consistency group, some operations, such as failovers, might affect only the indicated volume.
- You can only create one Consistency Group in an RDF group or ViPR Controller Project. (This ensures consistency is maintained between volumes when performing actions on the Consistency Group and allows snapshots/clones on all volumes of the Consistency Group.)

R1/R2 with R2 gold copies
If an SRDF/S or SRDF/A R1/R2 consistency group has an existing mirror or BCV relationship in ViPR Controller, the following occurs when provisioning the new R1/R2 pair:

- Creates R1/R2 pair.
- Adds R1/R2 pair to the existing CG.
- Creates mirrors or BCVs to the R1/R2 pair.
- Adds mirrors or BCVs to the existing mirror CG.

The added Gold Copies are in Synchronized State. To make the CG consistent, invoke Consistent Split above the Gold Copy CG.

SRDF operations not provided by ViPR Controller
You cannot perform the following operations through ViPR Controller. However, you can run these operations through VMAX interfaces (such as Unisphere) on volumes that ViPR Controller manages. ViPR Controller recognizes the changes made through those interfaces.

- Swapping one half of an SRDF pair
- Explicitly flushing data from a source SRDF volume to a target SRDF volume
- Switching to adaptive copy mode
- Expand in the following configurations:
  - Expanding R1 and R2 volumes with snapshots
  - Expanding an SRDF volume in a VMAX to VMAX3 configuration where the R1 device is a meta volume on a VMAX storage system.
Although ViPR Controller does not support the native expansion of volumes in an SRDF relationship, it does support this workflow to expand VMAX3 volumes: SRDF links broken > volume natively expanded > SRDF links re-established

Note
You can expand the SRDF source and target volumes when the source and targets are both on VMAX3 storage systems, however, the expand operation is disruptive.

SRDF target volumes (When the source volume is expanded, the target volume is automatically expanded as well.)

SRDF operations not supported by ViPR Controller
ViPR Controller does not support any of the following SRDF operations
- addgrp
- disable
- half_movepair
- merge
- movepair
- removegrp
- update
- checkpoint
- enable
- half_swap
- migrate
- ready
- rw_enable
- verify
- deactivate
- half_deletpair
- label
- modifygrp
- refresh
- set
- write_disable

ViPR Controller support for SRDF/A and SRDF/S operations

ViPR Controller supports various SRDF/A and SRDF/S configurations and operations. ViPR Controller supports the following:
- R1 to R2 (point-to-point) configurations.
- On volumes using SRDF/A mode:
You can delete an SRDF/A volume from the group without disturbing the active asynchronous session.

If you delete the last volume from an SRDF/A group, ViPR Controller removes the consistency group from the array.

You can perform SRDF operations for SRDF/S and SRDF/A protected volumes that are part of a ViPR Controller consistency group. These operations are performed on all volumes within that consistency group.

For a complete list of supported SRDF operations, see: SRDF operations supported for SRDF/S and SRDF/A replication.

Prerequisites for setting up SRDF/A and SRDF/S with ViPR Controller

Review this section before setting up SRDF/S and SRDF/A configurations with ViPR Controller.

These are prerequisites for setting up SRDF/S and SRDF/A configurations with ViPR Controller:

- The source and target VMAX arrays must be physically connected through proper RDF front-end directors.

- Before creating SRDF-protected volumes in ViPR Controller, you must configure an RDF group containing the source and target VMAX arrays. ViPR Controller cannot discover SRDF-protected volumes without at least one RDF group set on the array. The RDF group must:
  - Be a dynamic RDF group using synchronous or asynchronous mode.
  - Not contain any volumes. It must be an empty group that you manually create on VMAX.
  - Have the same name as the ViPR Controller project. Once a project is associated with an RDF group (that has the same name as the project), all SRDF-protected volumes that you subsequently create for that project use the same RDF group.

SRDF/A and SRDF/S support summary: virtual pool changes and array features

ViPR Controller offers various support for changing virtual pools for SRDF/A or SRDF/S-protected volumes and array functionality, such as FAST for SRDF.

Change virtual pools for SRDF-protected volumes

The following table lists support for virtual pool changes.

Table 11 Virtual pool changes

<table>
<thead>
<tr>
<th>Moving...</th>
<th>To...</th>
<th>Is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A non-SRDF volume</td>
<td>An SRDF-protected virtual pool (SRDF/S or SRDF/A)</td>
<td>Supported Create the target volume on the target virtual array specified in the SRDF-protected virtual pool.</td>
</tr>
<tr>
<td>An SRDF-protected volume (SRDF/S or SRDF/A)</td>
<td>Another SRDF-protected virtual pool (SRDF/S or SRDF/A)</td>
<td>Not Supported</td>
</tr>
</tbody>
</table>
Table 11 Virtual pool changes (continued)

<table>
<thead>
<tr>
<th>Moving...</th>
<th>To...</th>
<th>Is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A non-SRDF protected virtual pool</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Supported array features
The following table shows support for array features with ViPR Controller and SRDF.

Table 12 Array feature support

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST with SRDF</td>
<td>Yes</td>
<td>Select the FAST policy when you create the SRDF-protected virtual pool. Source and target volumes have the same FAST policy. If you move a non-SRDF volume with FAST protection to a target SRDF-protected pool, ViPR Controller applies the same FAST policy to the target.</td>
</tr>
<tr>
<td>Meta volumes with SRDF</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

SRDF operations supported for SRDF/S and SRDF/A replication
Review this section to determine the valid SRDF operations that ViPR Controller can perform on VMAX storage systems that are protected by SRDF/S and SRDF/A remote replication.

Unless noted, the SRDF operations can be performed on both volumes with and without consistency groups.

Table 13 Supported operations for SRDF replication

<table>
<thead>
<tr>
<th>Operation</th>
<th>VMAX3 to VMAX</th>
<th>VMAX3 to VMAX3</th>
<th>VMAX to VMAX3</th>
<th>VMAX to VMAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create SRDF Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Failover SRDF Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Failback SRDF Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Swap SRDF Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Split SRDF link</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Establish SRDF link</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Resync from R1 to R2</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Restore from R2 to R1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SRDF stop</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete SRDF Volumes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 13 Supported operations for SRDF replication (continued)

<table>
<thead>
<tr>
<th>Operation</th>
<th>VMAX3 to VMAX</th>
<th>VMAX3 to VMAX3</th>
<th>VMAX to VMAX3</th>
<th>VMAX to VMAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change volume from non-SRDF Vpool to SRDF Vpool</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Expand SRDF Volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Create local Mirror from SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete local Mirror of SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create Snapshot from SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore Snapshot to SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Resync Snapshot from SRDF R1 Volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Delete Snapshot of SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create Clone from SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore Clone to SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Resync Clone from SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete Clone of SRDF R1 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create local Mirror from SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete local Mirror of SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create Snapshot from SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore Snapshot to SRDF R2 Volume</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Resync Snapshot from SRDF R2 Volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Delete Snapshot of SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Create Clone from SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Restore Clone to SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Resync Clone from SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Delete Clone of SRDF R2 Volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Additional notes for SRDF/S and SRDF/A operations**

**Restore:** When using ViPR Controller to restore a consistency group snapshot for the R2 device, the SRDF link between the R1, and R2 is split. After attempting to restore, the link remains in a split state. You must perform one of the following operations to the link in either direction: failback, restore (again), establish, or resume.

**Support for SRDF operations between VMAX meta volumes, and VMAX3 non-meta volumes**

You can use ViPR controller to create and manage SRDF relationships between VMAX and VMAX3 storage systems when the R1 device is a meta device.

You can use ViPR Controller to work with SRDF configurations with R1 meta devices in the following configurations:
• Creation and management of SRDF relationships where a VMAX meta volume is the source, and a VMAX3 thin device is the target.
• Creation and management of SRDF relationships where a VMAX meta volume is the target, and a VMAX3 think device is the source.
• Using the Change Virtual Pool > Add SRDF protection option on existing SRDF devices to swap the target to a:
  - VMAX3 thin device, where a VMAX meta is the source.
  - VMAX meta volume, where a VMAX3 think device is the source.

Note
Swap may not work if the VMAX meta is comprised of 2 times more cylinders than the VMAX3 device.

Examples of ViPR Controller operations for SRDF/S and SRDF/A volumes and CGs
This section provides examples of the ViPR Controller operations you can use to manage your SRDF/S and SRDF/A-protected volumes and consistency groups.
• Setup SRDF/A or SRDF/S protection between two sites with of ViPR Controller
• Use ViPR Controller to add SRDF/S or SRDF/A protection to a volume in a consistency group
• Ingest volumes with SRDF/A or SRDF/S protection
• Failover a block volume with SRDF/S or SRDF/A protection

Example: Setup SRDF/A or SRDF/S protection between two sites with of ViPR Controller
You can set up SRDF/S and SRDF/A protection between a source and target VMAX array in ViPR Controller.

Procedure
1. Verify that the following physical assets are discovered and managed by ViPR Controller:
   • Any hosts connected to the source and target VMAX arrays.
   • The source and target VMAX arrays. These arrays must have the required RDF connections. The following figure shows a Symmetrix system (VMAX) ending in 985 (source) with an SRDF connection to a Symmetrix system ending in 999 (target).
2. Create a virtual array for the source VMAX array and a virtual array for the target array.

The following figure shows information about the source virtual array (varray 985) and the target virtual array (varray999).

Figure 8 Virtual arrays with SRDF protection

You can view a list of virtual arrays by selecting Virtual > Virtual Arrays.
3. Create the target virtual pool. This virtual pool represents the target storage for SRDF disaster recovery. Select **Virtual > Block Virtual Pools**, and then click **Add** to enter this information:
   a. A name and description.
   b. In the **Virtual Arrays** field, select the target VMAX array.
   c. In **Hardware > System Type**, select **EMC VMAX**.
   d. In **Storage Pools**, select **Automatic** or **Manual** as appropriate for your environment.
   e. Enable **Hardware > Multi-Volume Consistency**.
   
   **Note**
   
   Do not add a copy. You add a copy when you create the source virtual pool.

   f. Click **Save**.

4. Create the source virtual pool. This is the virtual pool from which storage is provisioned. Select **Assets > Block Virtual Pools**, and then click **Add** to enter this information:
   a. A name and description.
   b. In the **Virtual Arrays** field, select the source VMAX array.
   c. In **Hardware > System Type**, select **EMC VMAX**.
   d. Enable **Hardware > Multi-Volume Consistency**.
   e. In **Data Protection > Protection System**, select **VMAX SRDF**.
   f. In **Data Protection > SRDF Copy Mode**, select **Synchronous (SRDF/S)** or **Asynchronous (SRDF/A)**.
   g. In **SRDF Copies**, click **Add Copy**.
   h. In the **SRDF Copy** dialog box, select the target virtual array you created in step 2 and the target virtual pool you created in step 3, and then click **Done**. **Figure 9** SRDF Copy dialog box

   **Note**
   
   ViPR Controller supports adding one SRDF copy per source.
i. In Storage Pools > Pool Assignment, select Automatic or Manual as appropriate for your environment.

j. Click Save.

5. Create a project to which you can add SRDF-protected volumes.

Note
For SRDF with CG, enable the Multi-consistency field.

a. Select Tenant > Projects.

b. Click Add and then enter a project name with these properties:
   - Must be the same name as the RDF group name on VMAX.
   - Must be 10 characters or less, per Symmetrix RDF-naming restrictions.

c. Enter the AD/LDAP name of a user. This user becomes the project owner. If you do not enter a name, you become the project owner.

d. (Optional) Select the Enable Quota box to assign a quota to the project. This limits the amount of storage provisioned for the project.

e. Click Save.

6. Create a block volume in the project that you previously created.

a. Select Catalog > Block Storage Services, and then click Create Block Volume for a Host.

b. From the Host drop-down list, select the production server.

c. From the Virtual Array drop-down list, select the source virtual array that you created in step 2.

d. From the Virtual Pool drop-down list, select the source virtual pool to associate with the project.

e. Specify a name and size for the volume.

f. Open the Advanced panel, and choose a ViPR Controller consistency group for your volume.

g. Click Order.

For an SRDF-protected volume, ViPR Controller executes these steps in the background:
   - Creates the volume on the source virtual array
   - Creates a target volume of the same size on the target virtual array
   - Creates the SRDF connections and synchronizes the source and target volumes
   - Exports volumes to the host

7. (Optional) To verify that Unisphere displays the volumes that you created, open Data Protection > Replication Groups and Pools > SRDF groups.
Example: Use ViPR Controller to add SRDF/S or SRDF/A protection to a volume in a consistency group

You can add SRDF/S and SRDF/A protection to a volume in ViPR Controller by running the Change Virtual Pool service in the Service Catalog.

**Before you begin**

- The volume must exist on a VMAX array.
- The volume must be part of a ViPR Controller consistency group.
- The VMAX array must be part of an SRDF configuration.

**Procedure**

1. Set the virtual pool with these characteristics:
   - SRDF/S or SRDF/A protection
   - Multi-volume consistency
   - With the same settings as the associated volume's physical storage pool

2. Run **Block Storage Services > Change Virtual Pool**.
3. Select the project that contains the unprotected volume.
4. Select the virtual pool of the unprotected volume.
5. Select the operation **Add SRDF Protection**.
6. Select the target virtual pool that has SRDF protection enabled.
7. Select the volume you want to protect.
8. Click **Order**.

Example: Ingest volumes with SRDF/A or SRDF/S protection

You can ingest volumes that are in an SRDF/S or SRDF/S relationship into ViPR Controller.

**Before you begin**

When ingesting volumes in an SRDF relationship:

- Both the source volume (R1) and the target volume (R2) are ingested using a project whose name matches its RDF group.
- The source virtual pool must contain physical storage pools on the source storage array.
- The target virtual pool must contain physical storage pools on the target storage array.
- You perform two ingest operations because the source and target volumes are ingested using different virtual pools.

Before you ingest volumes in an SRDF relationship, verify the following:

- You are a system administrator in ViPR Controller.
- The source and target arrays are configured for SRDF protection.
- The source and target arrays are discovered by ViPR Controller.
- The source and target arrays are added to different ViPR Controller virtual arrays.
- Volumes being ingested are not part of a ViPR Controller consistency group.
Both the source and target virtual pools can belong to the same virtual array. However, it is recommended that you configure them into different arrays to ensure the disaster recovery relationship is clear.

For volumes protected by SRDF, you ingest both the source volume (R1) and the target volume (R2) into different virtual pools. The source virtual pool must contain physical storage pools on the source VMAX array. The target virtual pool must contain physical storage pools on the target VMAX array. You perform two ingest operations because the source and target volumes are ingested into different virtual pools.

Ingested SRDF pairs must be in a consistent state when adding R1 and R2 devices. The operation fails if the SRDF pair is in a synchronized, failover, split, suspended, invalid, or partitioned state.

Perform these steps before ingesting the source and target volumes into ViPR Controller:

**Procedure**

1. Verify that a virtual array with a virtual pool is set with SRDF protection. This is for ingesting the source volume.
2. Verify that a virtual array with a virtual pool is NOT SRDF protected. This is for ingesting the target volume.
3. Run the discovery process for both the source and target arrays. After discovery is completed on both arrays, see the discussion on Ingest unmanaged block volumes into ViPR Controller in the *ViPR Controller Ingest Services for Existing Environments Guide*.

**Ingest SRDF/A or SRDF/S-protected volumes**

To ingest an SRDF-protected volume, do the following:

1. Check the name of the RDF group for the SRDF pair you want to ingest. The ViPR Controller project you create for the ingest operation must have the same name as the RDF group. To check the RDF group name, you can use an element manager such as SMC, or use the following SYMCLI command:

   ```bash
   # symcfg -sid <id> list -rdfg all
   ```

2. Ensure that you have set up a virtual array with a virtual pool that has SRDF protection configured. This virtual pool is used to ingest the source volume. You set the source virtual pool with the following SRDF settings, which you can find at the Virtual > Block Virtual Pools > Data Protection.

**Table 14 SRDF data protection settings**

<table>
<thead>
<tr>
<th>Data Protection Field</th>
<th>Data Protection Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection System</td>
<td>VMAX SRDF. Only use this setting in the virtual pool during ingestion of the source volume.</td>
</tr>
<tr>
<td>SRDF Copy Mode</td>
<td>Synchronous or asynchronous mode.</td>
</tr>
</tbody>
</table>
Table 14 SRDF data protection settings (continued)

<table>
<thead>
<tr>
<th>Data Protection Field</th>
<th>Data Protection Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRDF Copies</td>
<td>Set the virtual array and virtual pool to host the target volume.</td>
</tr>
</tbody>
</table>

The following shows the virtual pool Data Protection panel with the appropriate selections.

Figure 10 SRDF protection on source virtual pool

When you select Add Copy, specify the target virtual array and target virtual pool. Only virtual arrays and their associated pools that can act as the target for the source VMAX appear in this screen.
3. Ensure that you set up a virtual array with a virtual pool for ingesting the target volume. The virtual pool must not be SRDF protected.

4. Run the discovery process and specify both the source and target arrays.
   a. Select Catalog > View Catalog > Block Storage Services > Discover Unmanaged Volumes.
   b. Select the both the source and target arrays to discover the unmanaged SRDF-protected volumes.
   c. Select Order.

5. After successful discovery on the source and target arrays, run either of the following the ingestion services on both the source and target arrays:
   a. Select Catalog > View Catalog > Block Storage Services and select either:
      - Ingest UnExported Unmanaged Volumes
      - Ingest Exported Unmanaged Volumes
      
      For a VMAX3 replica volume, repeat step 2 to ingest this volume

      For further details, and general information about discovery, and ingestion of unmanaged volumes refer to the ViPR Controller Ingest Services for Existing Environments, which is available from the ViPR Controller Product Documentation Index.

Example: Failover a block volume with SRDF/S or SRDF/A protection

You can failover a block volume using the Failover Block Volume service in the ViPR Controller Service Catalog.

Before you begin

You must have access to the block volume's project in ViPR Controller.

For ViPR Controller managed SRDF volumes in the event of a datacenter disaster: if for any reason the failover/swap of these SRDF volumes is performed outside of ViPR Controller, perform rediscovery of the underlying storage arrays before performing any actions on these resources in ViPR Controller.
Procedure

1. Select the Catalog > Block Protection Services > Failover block volume service.
2. Select the project, volume, and failover target.
3. Click Order.
4. After the failover completes, return to the ViPR Controller Catalog to mount the volume to the disaster recovery server.
5. (Optional) You can swap the source and target destinations by selecting Block Protection Services > Swap Continuous Copies.

ViPR Controller support for SRDF-Metro operations

ViPR Controller supports SRDF Metro for VMAX3 storage systems. SRDF Metro is established on the block virtual pool by setting the SRDF copy mode to Active. The Active mode is then used by ViPR Controller to select only the storage pools that are SRDF Metro enabled to add to the block virtual pool.

Requirements and information for setting up SRDF-Metro for ViPR Controller

Your SRDF-Metro configuration must meet the following configuration requirements to be supported by ViPR Controller.

For SMI-S version requirements refer to the ViPR Controller Support Matrix.

- ViPR Controller only supports SRDF Metro between two VMAX3 storage systems.
- VMAX3 storage systems must be enabled with an SRDF Metro licenses.
- ViPR Controller does not support ingestion of SRDF Metro devices.
- You do not need to discover the “witness,” storage system in ViPR Controller with the SRDF Metro-enabled storage systems.
- SRDF Metro operations are supported with volumes in a consistency group.
- ViPR Controller does not support Swap and Failover operations.
- When SRDF pairs need to be added to a non-empty ViPR Controller project (SRDF Group), two scenarios are possible:

  Create new SRDF pairs. The new RDF volume pairs will not have any data on them.

  In this case, use the ViPR Controller Create Volume operation to add the new volume pairs. If the associated virtual pool contains Asynchronous, Synchronous, Active (METRO) SRDF protection, the Create Volume operation adds the new volume pairs without suspending other active pairs using that SRDF Group.

  Note

  The Create Volume operation, in the case of a non-empty SRDF Active (METRO) group, uses the `format` option (`createpair -format`) when adding the new pairs. The `format` option removes any existing data on the new pairs. ViPR-Controller does not check for the existence of data on the new pairs. In the case of an empty SRDF Metro group, the Create Volume operation does not use the `format` option.
Convert to SRDF protection. The RDF pairs created will have existing data on the volumes. This existing data needs to be preserved.

In this case, use the ViPR Controller Change Virtual Pool operation on existing volumes to add SRDF protection. As part of the Change Virtual Pool operation, ViPR Controller suspends all the pairs belonging to the SRDF Group before proceeding with the required task. This operation preserves data on the existing volumes being upgraded to SRDF protection. This is true for SRDF Active (METRO) protection as well.

- When an existing pair needs to be removed from a ViPR Controller project (SRDF Group), ViPR Controller will need to suspend all the pairs belonging to the SRDF Group before proceeding with the required task.

**SRDF-Metro support summary: changing virtual pools and array features**

ViPR Controller offers various support for changing virtual pools for SRDF-Metro protected volumes and array functionality, such as FAST for SRDF.

### Change virtual pools for SRDF Metro-protected volumes

**Table 15 Virtual pool changes**

<table>
<thead>
<tr>
<th>Moving...</th>
<th>To...</th>
<th>Is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A non-SRDF metro volume</td>
<td>An SRDF-Metro protected virtual pool</td>
<td>Supported Create the target volume on the target virtual array specified in the SRDF-protected virtual pool.</td>
</tr>
<tr>
<td>An SRDF Metro-protected volume</td>
<td>Another type of SRDF-protected virtual pool (SRDF/S or SRDF/A)</td>
<td>Not Supported</td>
</tr>
<tr>
<td></td>
<td>A non-SRDF protected virtual pool</td>
<td></td>
</tr>
</tbody>
</table>

**Support for SRDF Metro-protected volumes and FAST**

FAST with SRDF is supported by ViPR Controller. When creating the SRDF-protected virtual pool:

- The source and target volumes should have the same FAST policy.
- If you move a non-SRDF volume with FAST protection to a target SRDF-protected pool, ViPR Controller applies the same FAST policy to the target.

**SRDF operations supported and unsupported for SRDF Metro replication**

Review this section to determine the valid SRDF operations that ViPR Controller can perform on VMAX3 storage systems that are protected by SRDF Metro remote replication.

**Supported SRDF operations**

Unless noted, the SRDF operations can be performed on both volumes with and without consistency groups.

SRDF Metro operations are only supported in VMAX3 to VMAX3 configurations.

- Create SRDF Volume
- Split SRDF link
- Establish SRDF link
- Restore from R2 to R1
- SRDF stop
- Delete SRDF Volumes
- Change volume from non-SRDF virtual pool to an SRDF virtual pool
- Create local Mirror from SRDF R1 Volume
- Delete local Mirror of SRDF R1 Volume
- Create Snapshot from SRDF R1 Volume
- Restore Snapshot to SRDF R1 Volume
- Delete Snapshot of SRDF R1 Volume
- Create Clone from SRDF R1 Volume
- Restore Clone to SRDF R1 Volume
- Resync Clone from SRDF R1 Volume
- Delete Clone of SRDF R1 Volume
- Create local Mirror from SRDF R2 Volume
- Delete local Mirror of SRDF R2 Volume
- Create Snapshot from SRDF R2 Volume
- Delete Snapshot of SRDF R2 Volume
- Create Clone from SRDF R2 Volume
- Restore Clone to SRDF R2 Volume
- Resync Clone from SRDF R2 Volume
- Delete Clone of SRDF R2 Volume

**Unsupported SRDF Metro operations**
The following SRDF Metro operations are not supported by ViPR Controller

- Resync from R1 to R2
- Resync Snapshot from SRDF R1 Volume
- Resync Snapshot from SRDF R2 Volume
- Restore Snapshot to SRDF R2 Volume
- Expand SRDF Metro Volume
CHAPTER 9

ViPR Controller Ingest Support for VMAX Storage Systems

This chapter includes the following sections.

- Ingesting VMAX volumes into a consistency group ........................................... 84
Ingesting VMAX volumes into a consistency group

The Ingest VMAX Block Volumes into Consistency Groups service imports the source VMAX volumes, including snapshots, continuous copies, and full copies, into a ViPR Controller consistency group. These volumes cannot belong to other consistency groups. Use this service for native or VPLEX-protected volumes on VMAX only. Do not use for RecoverPoint-protected volumes.

This allows you to use the ViPR Controller consistency group to take snapshots and clones of your virtual volumes at the consistency group level. All of the virtual volumes in the consistency group must come from the same storage array.

Ingestion of SRDF Metro volumes is not supported.

Note

If you already have consistency groups for backend volumes, clones and snaps, and would like to continue using those existing manually created consistency groups, you will need to manage those consistency groups outside of ViPR Controller. However, it is recommended that you create and start using the backend consistency groups created by ViPR Controller once the backend volumes, clones and snapshots are ingested in to ViPR Controller.

Procedure

1. Select Service Catalog > Block Storage Services > Ingest VMAX Block Volumes into Consistency Groups.
2. Select the Project to which the consistency group belongs.
3. Select the Consistency Group.
4. Select the source Volumes to add to the consistency group.