

ViPR Controller 2.4 Block Volume Ingestion with EMC VMAX, VMAX3 and VNX

ABSTRACT

This white paper describes how to ingest exported and unexported volumes created outside of ViPR Controller. Using native host, array, and SAN element manager tools is the first step toward building properly designed ViPR Controller Virtual Assets for the purpose of ingestion. The ViPR Controller services for discovery and ingestion require advanced planning and knowledge of the SAN infrastructure.

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EXECUTIVE SUMMARY

ViPR Controller enables storage arrays to be added to a virtual data center and for their storage pools to be used as the target for block and file storage provisioning operations. ViPR Controller provides a mechanism to manage volumes or file systems that were created outside of ViPR Controller.

The mechanism for bringing storage under ViPR Controller control is referred to as ingestion.

In addition to file systems and basic block volumes, ViPR Controller also provides the ability to ingest volumes that use the Symmetrix Remote Protection Facility (SRDF) and TimeFinder (clones, mirrors and snapshots).

This document focuses on block storage ingestion for VMAX, VMAX3, and VNX. There are numerous potential combinations of ingestible configurations with these storage arrays when considering local and remote replication options. Although this paper doesn't provide examples for each configuration, the scenarios detailed below establish the underlying concepts for ingestion while presenting enough information that will assist in the planning and design for ingesting various block storage environments.

VPLEX and XtremIO ingestion are not covered in this document.

AUDIENCE

This white paper is intended for customers and EMC implementation personnel who intend to ingest exported and unexported volumes from VMAX2, VMAX3, and VNX.

BROWNFIELD VERSUS COEXISTENCE AND INGESTION

Brownfield is a general term referring to a pre-existing environment configured by management tools prior to the introduction of ViPR Controller. Some examples of brownfield:

- A cluster has provisioned storage from one or more arrays.
- A volume not visible to a host has mirrors, clones or snapshots.

In ViPR Controller technical terms, "co-existence" and "ingestion" mean something very specific.

Co-existence is the process by which ViPR Controller is provisioning storage to a host or cluster that has one or more pre-existing array-level exports (e.g. VMAX3 Masking View or VNX Storage Group) on the target array. ViPR Controller has to decide which array-level export is the most appropriate to use. If it doesn't find one, it will create a new one in most cases.

Ingestion is the process by which ViPR Controller takes control of one or more volumes in one or more array-level exports associated to a host or cluster. In the process of ingesting the volume, ViPR Controller becomes aware of that volume's array-level export and adds it to the ViPR Controller database. If a host or cluster has multiple array-level exports discovered through the ingestion process, ViPR Controller will decide which array-level export is the most appropriate to use when provisioning new storage to that host or cluster.

The ViPR Controller Support Matrix ([link](#)) has tables for co-existence and ingestion. VMAX2, VNX, XtremIO, and VPLEX are supported with co-existence and ingestion. VMAX3 is only supported with ingestion. Going forward, ingestion should be the method for introducing ViPR Controller provisioning into all pre-existing environments. Standardizing on ingestion will simplify the steps related to provisioning across various storage platforms and produce reliable and predictable results.

WHY INGEST?

Block ingestion is used for three primary reasons.

1. Allows ViPR Controller to manage volumes not yet visible to a host or cluster for the purposes of exporting volumes at a later date. These volumes are known as unexported volumes.
2. Allows ViPR Controller to manage volumes that are visible to a host or cluster for the purposes of additional exports, adding local and remote protection, volume migration, and volume removal. These volumes are known as exported volumes.
3. Along with the previous points, it allows ViPR Controller to create internal database entries that map to array-level exports. This awareness and persistence of the existing environment's configuration is the first step in provisioning. Ingestion is the preferred operational method over co-existence.

BLOCK INGESTION CONSIDERATIONS

ViPR Controller provisions volumes based on specific host, SAN and array attributes. These are defined in the Virtual Arrays and Virtual Pools. Before ingesting volumes, the host, SAN, array, and volume configurations must be known before ingestion takes place. Without properly defined Virtual Assets, ingestion will fail.

Every customer environment is different. There are general guidelines, recommendations, and considerations that can be followed in this document. However, knowing how the environment is currently configured combined with knowing how ViPR Controller will be used in the future will simplify the ingestion process. Your EMC Professional Services team will help identify requirements, considerations and design criteria.

Here are some things to consider as you prepare for ingestion.

Which Virtual Pool and Project will these volumes be assigned to?	Both exported and unexported volumes are associated to a Virtual Pool and Project.
How many volumes do you <i>need</i> to ingest?	In order for ViPR Controller to provision to a host that already has existing array-level exports (e.g. VMAX Masking View), you need to ingest at least one volume from each array-level export as mentioned in the previous section.
How many volumes do you <i>want</i> to ingest?	Ingest all volumes that require direct ViPR Controller control for re-export, expansion, removal, local or remote replication, etc. Ingest all volumes that are provisioned from the underlying physical pool(s) so that ViPR Controller provides appropriate Virtual Pool utilization.
Have changes been made to the array since the last discovery?	Rediscover the Storage Provider and Storage System. Execute the Discover Unmanaged Volume service must happen before ingesting if changes have been made on the array side.
Is the volume visible to one or more hosts and/or clusters?	This will determine if you are using Ingest Exported Unmanaged Volume service or the Ingest Unexported Unmanaged Volume service.
Are the hosts, Fibre Channel switches and arrays discovered by ViPR Controller?	The end to end elements must be successfully discovered.
Does the volume have protection? SRDF? Mirrors? Clones? Snaps?	ViPR Controller cannot complete the ingestion of the volume until associated local or remote replicated volumes are also ingested.
Are there multiple VMAX Masking Views?	When there are multiple VMAX Masking Views for a host or cluster, all of them (except for ones with "no_vipr" in the name) must be ingested. In order for ViPR Controller to provision to a host that already has existing array-level exports, you need to ingest at least one volume from each array-level export.
How many paths to the volume are visible to the host?	Path visibility is based on a number of factors. Are initiator and target ports online and active? How many storage ports are in the storage array array-level export? How many zones are there between the host and array? Is there an intentional difference in the number of paths for different volumes from the same array to the same host?
What is the state of the clone?	Is it a differential or detached?
How were VMAX snapshots created? TimeFinder VP Snap or SnapVX?	There are limitations depending on the technology used.
What is the FAST policy or Service Level Offering (SLO) and Workload for the VMAX?	The settings for the Cascaded Storage Group affect Virtual Pool creation.

What is the FAST setting for the VNX?	The settings for the volume affect Virtual Pool creation.
What are the Host I/O Limits for the VMAX?	The settings for the Cascaded Storage Group affect Virtual Pool creation.
Post-ingestion provisioning.	Once ViPR Virtual Assets are created for ingestion, they can also be reused for provisioning to new or existing hosts. Virtual Arrays are flexible. New networks, storage ports and storage systems can be added in many cases. Virtual Pools are not as flexible when it comes to modifying them after resources are associated to them. That is, once a volume is provisioned or ingested, many attributes cannot be changed. Consider how you plan to use the Virtual Pool post-ingestion <i>before</i> the first volume is ingested. Configure the Virtual Pool for ingestion and post-ingestion needs.

LIMITATIONS AND CONSTRAINTS

The complete listing of ingestion limitations and constraints can be found in the EMC ViPR Controller Controller2.4 Ingest Service for Existing Environments Guide ([link](#)).

There are a few important ones to note here. Refer to the above document for all limitations and constraints.

- RecoverPoint protected volumes cannot be ingested.
- VMware Datastores are not ingested. Only the underlying volume is ingested.
- Volumes or metavolumes in a consistency group cannot be ingested.
- All masked storage ports to a host or cluster must be in the Virtual Array to successfully ingest.

WHEN TO INGEST ALL OR SOME VOLUMES IN A MASKING VIEW

In a brownfield environment, an administrator may *need to* fully ingest volumes or *want to* partially ingest volumes from an array-level export (e.g. VMAX Masking View). EMC recommends that all volumes be fully ingested.

Volumes are provisioned to hosts through array element manager tools (e.g. Unisphere for VMAX). The administrator must decide which volumes will be ingested by ViPR Controller. Before provisioning to a brownfield host, the recommendation is to ingest all volumes visible to that host. There are cases when it is a requirement.

ViPR Controller allows volumes to be ingested on an as-needed basis. Administrators have the option to ingest one, some or all the exported volumes that were provisioned to a host before ViPR Controller was introduced. If some exported volumes are ingested, the remaining volumes can be ingested at a later date. For example, 100 volumes were provisioned to a cluster using Unisphere for VMAX. The administrator ingests 20 volumes with the intent to create snapshots through ViPR Controller. At a later date, another 20 could be ingested and so on.

As noted in a previous section, ingestion allows ViPR Controller to manage volumes that are visible to a host or cluster for the purposes of additional exports, adding local and remote protection, volume migration, and volume removal. In addition to volume management, ingestion is the first step when provisioning into a brownfield environment. ViPR Controller needs at least one volume ingested from each array-level export before provisioning to the brownfield array. You may provision to greenfield arrays without doing any ingestion.

Since future ViPR Controller provisioning activities (e.g. exports, Virtual Pool changes and adding replication) are impacted by the ingestion process, it is important to properly plan what Virtual Arrays, Virtual Pools and Projects the volumes will be ingested into.

With array-based consistency groups, volumes across one or more array-level exports are assigned to ensure that snapshots or clones of all volumes in the group are taken at the same point in time. The Discover Unmanaged Volume service does not provide ViPR Controller with the relationship of existing volumes to the array consistency group. For example, if the administrator ingests eight out of ten volumes from the array consistency group, snapshots taken by ViPR Controller will only affect the ingested volumes. To prevent inconsistency across grouped volumes, full ingestion into a ViPR consistency group is required for all volumes in an array-based consistency group. It is the responsibility of the administrator to identify the volumes in each array consistency group and add them to the appropriate ViPR Controller consistency group.

Note: Full ingestion is recommended.

Note: Full ingestion into a ViPR consistency group is required for all volumes in an array-based consistency group.

GATEKEEPER MASKING VIEWS

VMAX gatekeeper devices are special LUNs that act as the target of command requests to Symmetrix microcode-based functionality. These devices are typically added to a dedicated Masking View. Administrators build separate Masking Views for data LUNs.

With dedicated gatekeeper Masking Views, the gatekeeper devices should not be ingested. ViPR Controller will not perform any operations on those devices nor should the Masking View be reused.

To prevent the gatekeeper Masking View from being reused, add “no_vipr” to the name of the Masking View. Rediscover the Storage Provider in the ViPR Controller UI. ViPR will ignore that Masking View in future provisioning operations.

VMAX2 EXPORTED VOLUME INGESTION WITH MULTIPLE MASKING VIEWS

The following section covers how to build Virtual Assets.

The VMAX Masking View provides the SAN administrator with flexibility on how volumes are presented to hosts. With that flexibility comes a variety of Masking View designs. It contains the Initiator Groups (“Hosts” in the case of VMAX3), Ports Groups, and Storage Groups.

Hosts or clusters may have different configurations for a variety of reasons. Some examples include:

- A cluster may have two Masking Views because the ports in the Port Group differ.
- There may be different throughput or performance requirements for some LUNs. As a result, multiple Masking Views are necessary to assign different Port Groups.
- There may be multiple SAN administrators using multiple element manager tools.
- As technology changes, new best practices are formulated.
- A new SAN administrator may have a different preference on Masking View design.

The VMAX2 SYMCLI outputs below highlight examples of multiple Masking Views for a cluster.

Note: When a host or cluster has multiple Masking Views, the administrator needs to ingest at least one volume from each if the intention is to re-use them for new provisioning operations.

Note: There is an exception to the note above. There are cases when the administrator wants to leave a Masking View untouched. That is, there will be neither new volume provisioning to it nor ingestion from it.

When there are multiple Masking Views for a host or cluster and the administrator does not plan to re-use for new provisioning or ingest existing volumes, “no_vipr” may be added to the name of the Masking View(s) to be ignored by ViPR Controller. This is supported for VMAX, VNX, and VPLEX.

Two VMAX Masking Views with Different Number of Paths

In the example below, there are two VMAX2 Masking Views for the same cluster. The difference between them is highlighted below. They have a different number of paths.

Masking View Name : Cluster4_MV1_4paths	Masking View Name : Cluster4_MV2_8paths																																																																																																
<p>Initiator Group Name : Cluster4_parentIG</p> <p>Host Initiators IG : lglbx029_new WWN : 10000090fa343854 WWN : 10000090fa343855 IG : lglbx030_new</p> <p>Port Group Name : Brocade-10f0-8f0-10f1-8f1</p> <p>Director Identification Director Ident Port WWN Port Name / iSCSI Target Name ----- FA-10F 000 5000097300240d64 FA-8F 000 5000097300240d5c FA-10F 001 5000097300240d65 FA-8F 001 5000097300240d5d</p> <p>Storage Group Name : Cluster4_2307_parentSG</p> <p>Number of Storage Groups : 1 Storage Group Names : Cluster4_2307_childSG (IsChild)</p> <table border="1"> <thead> <tr> <th>Sym</th> <th>Dir:Port</th> <th>Physical Device Name</th> <th>Host Lun</th> <th>Attr</th> <th>Cap(MB)</th> </tr> </thead> <tbody> <tr> <td>01737</td> <td>08F:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td>8193</td> </tr> <tr> <td></td> <td>08F:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>10F:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>10F:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td colspan="5">Total Capacity</td> <td>8193</td> </tr> </tbody> </table>	Sym	Dir:Port	Physical Device Name	Host Lun	Attr	Cap(MB)	01737	08F:000	Not Visible	0		8193		08F:001	Not Visible	0				10F:000	Not Visible	0				10F:001	Not Visible	0			Total Capacity					8193	<p>Initiator Group Name : Cluster4_parentIG</p> <p>Host Initiators IG : lglbx029_new WWN : 10000090fa343854 WWN : 10000090fa343855 IG : lglbx030_new</p> <p>Port Group Name : Brocade-7e0-8e0-9e1-10e1-10f0-8f0-10f1-8f1</p> <p>Director Identification Director Ident Port WWN Port Name / iSCSI Target Name ----- FA-10F 000 5000097300240d64 FA-8F 000 5000097300240d5c FA-8E 000 5000097300240d1c FA-7E 000 5000097300240d18 FA-10F 001 5000097300240d65 FA-8F 001 5000097300240d5d FA-10E 001 5000097300240d25 FA-9E 001 5000097300240d21</p> <p>Storage Group Name : Cluster4_2307_parentSG_2</p> <p>Number of Storage Groups : 1 Storage Group Names : Cluster4_2307_childSG_2 (IsChild)</p> <table border="1"> <thead> <tr> <th>Sym</th> <th>Dir:Port</th> <th>Physical Device Name</th> <th>Host Lun</th> <th>Attr</th> <th>Cap(MB)</th> </tr> </thead> <tbody> <tr> <td>01737</td> <td>07E:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td>11264</td> </tr> <tr> <td></td> <td>08E:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>09E:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>10E:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>08F:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>08F:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>10F:000</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td></td> <td>10F:001</td> <td>Not Visible</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td colspan="5">Total Capacity</td> <td>11264</td> </tr> </tbody> </table>	Sym	Dir:Port	Physical Device Name	Host Lun	Attr	Cap(MB)	01737	07E:000	Not Visible	0		11264		08E:000	Not Visible	0				09E:001	Not Visible	0				10E:001	Not Visible	0				08F:000	Not Visible	0				08F:001	Not Visible	0				10F:000	Not Visible	0				10F:001	Not Visible	0			Total Capacity					11264
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Creating Virtual Assets for Ingestion

A Virtual Array and Virtual Pool into which you want to ingest the storage pools must exist when the Discover Unmanaged Volume service is executed. There must be at least one Virtual Pool in ViPR Controller that matches the physical storage pool that contains the volume.

- Build a Virtual Array that contains physical array storage pools that you want to import and storage ports on which exported volumes are presented.
- Build a Virtual Pool that matches the physical pool where the unexported unmanaged volume resides.

Note: Virtual Asset creation is dynamic. Fabric and storage array changes are common. The Discover Unmanaged Volume service can be run at any time when changes are made in ViPR Controller, the Fibre Channel network, or the storage array.

Create the Virtual Array

Add the Storage System.

Name	Type	Status
<input checked="" type="checkbox"/> SYMMETRIX+000195702307	EMC VMAX	<input checked="" type="checkbox"/>
<input type="checkbox"/> SYMMETRIX+000195701186	EMC VMAX	<input checked="" type="checkbox"/>

Name	Type	Status
<input checked="" type="checkbox"/> SYMMETRIX+000195702307	EMC VMAX	<input checked="" type="checkbox"/>

Specify the Storage Ports.

By adding the Storage System, all storage ports present on the array are explicitly added to the Virtual Array. Depending on other ingestion operations or future provisioning orders, you may choose to leave all the ports or remove selected ones. In this example, the Virtual Array will include all ports needed to cover ingesting volumes from both *Cluster4_MV1_4paths* and *Cluster4_MV1_8paths*. As you can see, there is overlap in this example.

Ports in each Masking View.

Cluster4_MV1_4paths

- 8F0, 8F1, 10F0, 10F1

Cluster4_MV1_8paths

- 8F0, 8F1, 10F0, 10F1,
- 7E0, 8E0, 9E1, 10E1

Click "Storage Ports" and remove all ports except for 8F0, 8F1, 10F0, 10F1, 7E0, 8E0, 9E1, 10E1.

Name	Registered	Group	Storage System	Identifier	Alias	Type	Network	Allocatable	Status	Assigned
<input type="checkbox"/> FA-8F1	✓	FA-8F	SYMMETRIX+000195702307	50.00.09.73.00.24.00.5D	VMAX2307_8f1	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-9E1	✓	FA-9E	SYMMETRIX+000195702307	50.00.09.73.00.24.00.21	VMAX2307_9e1	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-8F0	✓	FA-8F	SYMMETRIX+000195702307	50.00.09.73.00.24.00.5C	VMAX2307_8f0	FC	FABRIC_FabricA-10.00.00.27.18:c4.60.07	🔒	✓	✓
<input type="checkbox"/> FA-10F1	✓	FA-10F	SYMMETRIX+000195702307	50.00.09.73.00.24.00.65	VMAX2307_10f1	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-10F0	✓	FA-10F	SYMMETRIX+000195702307	50.00.09.73.00.24.00.64	VMAX2307_10f0	FC	FABRIC_FabricA-10.00.00.27.18:c4.60.07	🔒	✓	✓
<input type="checkbox"/> FA-8E0	✓	FA-8E	SYMMETRIX+000195702307	50.00.09.73.00.24.00.1C	VMAX2307_8e0	FC	FABRIC_FabricA-10.00.00.27.18:c4.60.07	🔒	✓	✓
<input type="checkbox"/> FA-7E0	✓	FA-7E	SYMMETRIX+000195702307	50.00.09.73.00.24.00.18	VMAX2307_7e0	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-10E1	✓	FA-10E	SYMMETRIX+000195702307	50.00.09.73.00.24.00.25	VMAX2307_10e1	FC	FABRIC_FabricA-10.00.00.27.18:c4.60.07	🔒	✓	✓

The Virtual Array configuration has eight storage ports now.

Note: Removing ports is not a required step. The ingestion and future use of the Virtual Array should be considered as part of a wider ViPR Controller solution design.

Create the Virtual Pool

The Virtual Pool has a number of attributes that impact volume creation, pathing, protection, and more. This same pool may be used for provisioning new volumes. So, settings like Thin Volume Preallocation, access control and others must be known in advance. The attributes of the Virtual Pool also affect other ViPR Controller provisioning operations post-ingestion. For example, after a volume is ingested, the administrator may want to expand the volume, create a mirror or a snapshot. It is important to configure the Virtual Pool correctly in order for ingestion to succeed, but you must consider operations after ingestion. Most Virtual Pool attributes cannot be changed after a Resource is assigned to it either through provisioning or ingesting.

In order to ingest, identify the attributes of the volume and the Storage Group within the Masking View. Note the following:

- How many initiators per host are in the Initiator Group? (Host in the case of VMAX3)
- Is the volume thick or thin?
- What is the transport protocol?
- What is the FAST policy? (SLO and Workload in the case of the VMAX3)
- What are the Host I/O Limits?
- How many total paths and paths per initiator?
- Is there VPLEX protection?
- Is there SRDF protection?
- What is the underlying array thin or thick pool containing the volume? (Storage Resource Pool [SRP] in the case of VMAX3)

Note: Ingestion is not affected by an Initiator Group or Storage Group that is or is not cascaded.

For post-ingestion operations, you need to consider the other Virtual Pool attributes:

- Will the volume be added to a Consistency Group?
- Will the volume be expanded? Will it be striped or concatenated?
- Will mirrors or snapshots of the volume be created?

In the SYMCLI outputs above, there are two identically configured Masking Views except for the number of paths. Here are the Virtual Pool settings for the *Cluster4_MV1_4paths* Masking View.

- How many initiators in the Initiator Group?
 - There are two in each Child Initiator Group
- Is the volume thick or thin?
 - Thin (Obtained from looking at volume details in SYMCLI or Unisphere)
- What is the transport protocol?
 - Fibre Channel
- What is the System Type?
 - If there is FAST policy on the Storage Group or SRDF protection the volume, you need to specify "EMC VMAX" as the System Type.
- What is the FAST policy?
 - None
- What are the Host I/O Limits?
 - None

The screenshot shows the 'Hardware' configuration page for a Virtual Pool. The settings are as follows:

- Provisioning Type:** Thin
- Protocols:** FC
- Drive Type:** None
- System Type:** EMC VMAX
- RAID Level(s):** RAID1, RAID5, RAID6
- Thin Volume Preallocation:** %
- Unique Auto-tiering Policy Names:** Check to show unique policy names in Auto-tiering Policy.
- Auto-tiering Policy:** Select an Option
- Multi-Volume Consistency:** If selected, resources provisioned from this pool will support the use of consistency groups
- Expandable:** If selected, resources provisioned from this pool will support expansion.

Fast Expansion: If selected, expansion will be performed more quickly but potentially decreases performance.

Host Front End Bandwidth Limit (MB/sec): Unlimited if 0 or not specified.

Host Front End I/O Limit (IOs/sec): Unlimited if 0 or not specified.

- How many total paths and paths per initiator?
- Pathing needs to be considered from the perspective of the individual host and not the total number of initiators that comprise a cascaded Initiator Group.

Note: Keep in mind during Virtual Pool creation time, ViPR Controller does not consider the number of initiators in each discovered host as physical storage pools are filtered. There may be tens, hundreds or thousands of hosts discovered by a ViPR Controller instance. All of them will very likely have at least two initiators with dual Fibre Channel switch connectivity for redundancy. However, other hosts may have four, six or even eight initiators.

The SAN Multi Path attributes determine how many paths to a physical array are possible based on the number of storage ports from a Storage System that are present in the Virtual Array(s) associated to the Virtual Pool(s). Those Storage Systems that can comply with the maximum number of paths will appear in the Storage Pool section of the Virtual Pool.

- From the host perspective, the administrator needs to select SAN Multi Path values that will reflect the paths per initiator, minimum paths and maximum paths of the volume being ingested for a given host.
- In the SYMCLI output for *Cluster4_MV1_4paths* for, you can see:
 - Host *lglbx029_new* has two initiators.
 - There are four FA ports in the Masking View.
 - The number of initiators on the host or the Masking View and the number of FA ports in the Masking View don't paint the entire picture. Zoning between initiators and targets must be understood.

Fabric A	Fabric B
zone: lglbx029_VMAX2307_8f0_10f0 10:00:00:90:fa:34:38:54 50:00:09:73:00:24:0d:5c 50:00:09:73:00:24:0d:64	zone: lglbx029_VMAX2307_8f1_10f1 10:00:00:90:fa:34:38:55 50:00:09:73:00:24:0d:5d 50:00:09:73:00:24:0d:65

- With this information, the SAN Multi Path can be finalized because we know that the host is zoned to storage ports as defined in the Masking View.
- There are several ways this could be configured. We'll set the SAN Multi Path to 2/4/2.
 - A minimum of two paths for any ingested or newly provisioned volume.
 - A maximum of four paths for any ingested or newly provisioned volume.
 - Two paths for each initiator.

- Possibilities with this Virtual Pool:
 - Ingesting volumes for hosts with two initiators will succeed when there are four target ports across redundant fabrics.
 - Ingesting volumes for hosts with one initiator will succeed when there are at least two target ports in one fabric.
 - Provisioning new volumes to hosts with two initiators will succeed when there are four target ports across redundant fabrics.
 - Provisioning new volumes to hosts with one initiator will succeed when there are two target ports in one fabric.
 - Ingesting hosts with more than four paths will fail.
 - Provisioning hosts with more than two initiators will succeed; however, only two initiators (one on each fabric/network) will be used. Because the maximum paths would be exceeded with more than two initiators, ViPR doesn't use other SAN-connected initiators.

- Is there VPLEX protection?
 - None
- Is there SRDF protection?
 - None
- What is the underlying array thin or thick pool containing the volume? (SRP in the case of VMAX3)
 - FCPool1

Pool Assignment:

Choosing manual pool assignment allows selection of a subset of the storage pools matching the criteria

Search...

	Name	Storage System	Provisioning	Drive Types	Free	Subscribed	Total
<input type="checkbox"/>	EFDPool-QE	SYMMETRIX+000195702307	Thin	SSD	998 GB	136 GB	999 GB
<input type="checkbox"/>	EFDPool1	SYMMETRIX+000195702307	Thin	SSD	999 GB	635 GB	999 GB
<input type="checkbox"/>	FCPool-QE	SYMMETRIX+000195702307	Thin	FC	3363 GB	1529 GB	3999 GB
<input checked="" type="checkbox"/>	FCPool1	SYMMETRIX+000195702307	Thin	FC	4690 GB	8912 GB	4999 GB
<input type="checkbox"/>	SATAPool-QE	SYMMETRIX+000195702307	Thin	SATA	8096 GB	9270 GB	8099 GB
<input type="checkbox"/>	SATAPool1	SYMMETRIX+000195702307	Thin	SATA	16321 GB	4887 GB	17199 GB

Showing 1 to 6 of 6 entries

As noted above, in the SYMCLI outputs, there are two identically configured Masking Views except for the number of paths. The Virtual Pool settings for the *Cluster4_MV1_8paths* Masking View will be identical except for the SAN Multi Path attributes.

- o In the SYMCLI output for *Cluster4_MV1_8paths* for, you can see:
 - Host *lglbx029_new* has two initiators.
 - There are eight FA ports in the Masking View.
 - The number of initiators on the host or the Masking View and the number of FA ports in the Masking View don't paint the entire picture. Zoning between initiators and targets must be understood.

Fabric A	Fabric B
zone: lglbx029_VMAX2307_8e0_8f0_10e1_10f0	zone: lglbx029_VMAX2307_7e0_8f1_9e1_10f1
10:00:00:90:fa:34:38:54	10:00:00:90:fa:34:38:55
50:00:09:73:00:24:0d:1c	50:00:09:73:00:24:0d:18
50:00:09:73:00:24:0d:5c	50:00:09:73:00:24:0d:5d
50:00:09:73:00:24:0d:25	50:00:09:73:00:24:0d:21
50:00:09:73:00:24:0d:64	50:00:09:73:00:24:0d:65

- With this information, the SAN Multi Path can be finalized because we know that the host is zoned to storage ports as defined in the Masking View.
- There are several ways this could be configured. We'll set the SAN Multi Path to 4/8/4.
 - A minimum of four paths for any ingested or newly provisioned volume.
 - A maximum of eight paths for any ingested or newly provisioned volume.
 - Four paths for each initiator.

SAN Multi Path configuration interface showing the following settings:

- Minimum Paths:** 4 (Minimum number of total paths from the host to storage array)
- Maximum Paths:** 8 (Maximum number of total paths from the host to storage array)
- Paths Per Initiator:** 4 (Number of paths per host initiator)

- Possibilities with this Virtual Pool:
 - Ingesting volumes for hosts with two initiators will succeed when there are four target ports across redundant fabrics.
 - Ingesting volumes for hosts with one initiator will succeed when there are at least four target ports in one fabric.
 - Provisioning new volumes to hosts with two initiators will succeed when there are eight target ports across redundant fabrics.
 - Provisioning new volumes to hosts with one initiator will succeed when there are four target ports in one fabric.
 - Ingesting hosts with more than eight paths will fail.
 - Provisioning hosts with more than two initiators will succeed; however, only two initiators (one on each fabric/network) will be used. Because the maximum paths would be exceeded with more than two initiators, VIPR doesn't use other SAN-connected initiators.

Two VMAX Masking Views Resulting from a Different FAST Policies and Cascading

Masking View Name: Cluster4_MV3_cascaded	Masking View Name: Cluster4_MV4_noncascaded																																		
Initiator Group Name : Cluster4_parentIG Host Initiators IG : lglbx029_new IG : lglbx030_new Port Group Name : Brocade-10f0-8f0-10f1-8f1 Director Identification Director <table border="1"> <thead> <tr> <th>Ident</th> <th>Port</th> <th>WWN Port Name / iSCSI Target Name</th> </tr> </thead> <tbody> <tr><td>FA-10F 000</td><td></td><td>5000097300240d64</td></tr> <tr><td>FA-8F 000</td><td></td><td>5000097300240d5c</td></tr> <tr><td>FA-10F 001</td><td></td><td>5000097300240d65</td></tr> <tr><td>FA-8F 001</td><td></td><td>5000097300240d5d</td></tr> </tbody> </table> Storage Group Name : Cluster4_2307_cascaded <div style="border: 2px solid red; padding: 2px;"> Number of Storage Groups : 1 Storage Group Names : Cluster4_2307_childSG_GOLD (IsChild) </div> <table border="1"> <thead> <tr> <th>Storage Group Name</th> <th>Policy Name</th> </tr> </thead> <tbody> <tr> <td>Cluster4_2307_childSG_GOLD</td> <td>GOLD</td> </tr> </tbody> </table>	Ident	Port	WWN Port Name / iSCSI Target Name	FA-10F 000		5000097300240d64	FA-8F 000		5000097300240d5c	FA-10F 001		5000097300240d65	FA-8F 001		5000097300240d5d	Storage Group Name	Policy Name	Cluster4_2307_childSG_GOLD	GOLD	Initiator Group Name : Cluster4_parentIG Host Initiators IG : lglbx029_new IG : lglbx030_new Port Group Name : Brocade-10f0-8f0-10f1-8f1 Director Identification Director <table border="1"> <thead> <tr> <th>Ident</th> <th>Port</th> <th>WWN Port Name / iSCSI Target Name</th> </tr> </thead> <tbody> <tr><td>FA-10F 000</td><td></td><td>5000097300240d64</td></tr> <tr><td>FA-8F 000</td><td></td><td>5000097300240d5c</td></tr> <tr><td>FA-10F 001</td><td></td><td>5000097300240d65</td></tr> <tr><td>FA-8F 001</td><td></td><td>5000097300240d5d</td></tr> </tbody> </table> Storage Group Name : Cluster4_2307_noncascaded Number of Storage Groups : 0 Storage Group Names : None	Ident	Port	WWN Port Name / iSCSI Target Name	FA-10F 000		5000097300240d64	FA-8F 000		5000097300240d5c	FA-10F 001		5000097300240d65	FA-8F 001		5000097300240d5d
Ident	Port	WWN Port Name / iSCSI Target Name																																	
FA-10F 000		5000097300240d64																																	
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FA-10F 001		5000097300240d65																																	
FA-8F 001		5000097300240d5d																																	
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FA-8F 000		5000097300240d5c																																	
FA-10F 001		5000097300240d65																																	
FA-8F 001		5000097300240d5d																																	

As noted in the previous section, when a host or cluster has multiple Masking Views, the administrator needs to ingest at least one volume from each if the intention is to re-use them for new provisioning operations. If the administrator does not plan to re-use a Masking View or ingest any volumes from it, "no_vipr" may be added to the name of the Masking View. ViPR Controller will ignore it.

Note: ViPR Controller can ingest volumes from Masking Views with cascaded or non-cascaded Storage Groups. Virtual Pool attributes are not impacted by Initiator Groups or Storage Groups that are or are not cascaded.

Creating Virtual Assets for Ingestion

Create the Virtual Array

Add the Storage System.

One Virtual Array would be sufficient because both Masking Views use the same set of FA ports.

Create the Virtual Pool

In the example above, two Virtual Pools would be needed for ingestion.

Masking View details:

- *Cluster4_MV3_cascaded*
 - Same cascaded Initiator Group
 - Same Port Group
 - Cascaded Storage Group
 - Child Storage Group has GOLD FAST policy.
- *Cluster4_MV3_noncascaded*
 - Same cascaded Initiator Group
 - Same Port Group
 - Non-cascaded Storage Group with no FAST policy.

As compared to the example in the previous section, this is less complex. Both Masking Views for the same cluster have the same number of paths. The only difference between them from an ingestion standpoint is the FAST policy.

- To ingest volumes from *Cluster4_MV3_cascaded* Masking View, the Virtual Pool needs this Auto-tiering Policy setting:

Auto-tiering Policy:

SYMMETRIX+000195702307+FASTPOLICY+GOLD_Policy ▼

- To ingest volumes from *Cluster4_MV3_noncascaded* Masking View, the Virtual Pool needs this Auto-tiering Policy setting:

Auto-tiering Policy:

None ▼

There are multiple ways for Masking Views to be created. The previous sections highlight what to consider and how to create Virtual Assets for ingestion, when to ingest volumes, and how to ingest when there are multiple Masking Views for a host or cluster. The VMAX examples above represent a small portion of various reasons why there may be more than one Masking View or how they may be designed.

The Masking Views may have been created by Unisphere for VMAX, SYMCLI or another management tool that interfaces with the VMAX. Once ViPR Controller is introduced as the new provisioning tool, the other software tools should no longer be used.

VMAX3 EXPORTED VOLUME INGESTION

The following section covers building the Virtual Assets and ingestion of a VMAX3 volume with associated replicas. The process for ingestion with VMAX3 is the same as VMAX2. Refer to the Block Ingestion Considerations section as you plan to ingest exported VMAX3 volumes. The following examples apply to a VMAX2 as well.

VMAX3 Specific Ingestion Constraints

These constraints are related directly to VMAX3.

- SnapVX sessions are not ingested. (Snaps without a linked target)
 - SnapVX linked target can be ingested.
- VP Snap snapshots are not supported.
- SnapVX snapshots cannot be restored.

VMAX3 Exported Volume Ingestion with SRDF and Snapshot Protection

The following example ingests a VMAX3 volume which is exported to a host. The volume has SRDF protection. The R2 device has a snapshot. As in the previous section, obtain the volume, Initiator Group, Storage Group, Port Group, and zoning information to re-use or create the necessary Virtual Assets to ingest the volume(s).

SYMCLI provides a significant level of detail. The outputs below have been abridged to focus on the fields needed by ViPR Controller to create Virtual Assets for ingestion.

Masking View					
Masking View Name	:	lglbx036_MV			
Initiator Group Name	:	lglbx036_IG			
Host Initiator					
WWN	:	10000090fa343ac6			
WWN	:	10000090fa343ac7			
Port Group Name	:	Brocade-1d4-2d4-3d4-4d4			
Director Identification					
Director					
Ident	Port	WWN	Port Name / iSCSI Target Name		

FA-1D	004	5000097350128804		Storage Ports	
FA-2D	004	5000097350128844			
FA-3D	004	5000097350128884			
FA-4D	004	50000973501288c4			
Storage Group Name	:	lglbx036_SG			
Number of Storage Groups : 1					
Storage Group Names	:	lglbx036_SG_1		(IsChild)	
Sym			Host		
Dev	Dir:Port	Physical Device Name	Lun	Attr	Cap(MB)

00168	01D:004	Not Visible	1		30720
	02D:004	Not Visible	1		
	03D:004	Not Visible	1		
	04D:004	Not Visible	1		

Service Level Offering(SLO)					SLO: Diamond Workload: OLTP SRP (Physical Pool): SRP_1		
Storage Group Name	Flags	Number	Number	Child	SLO Name	Workload	SRP Name
	EFMSL	Devices	GKs	SGs			
lglbx036_SG_1	FXXC.	1	0	0	Diamond	OLTP	SRP_1

Zoning	
Fabric A	Fabric B
zone: lglbx036_VMAX3 10:00:00:90:fa:34:3a:c7 50:00:09:73:50:12:88:04 50:00:09:73:50:12:88:84	zone: lglbx036_VMAX3 10:00:00:90:fa:34:3a:c6 50:00:09:73:50:12:88:44 50:00:09:73:50:12:88:c4

Volumes	
Source Volume (R1)	Target Volume (R2)
Device Symmetrix Name : 00168 Symmetrix ID : 000196701186	Device Symmetrix Name : 0170B Symmetrix ID : 000195702307
Bound Pool Name : SRP_1 Device Configuration : RDF1+TDEV	Bound Pool Name : FCPool1 Device Configuration : RDF2+TDEV
SnapvX Source : False SnapvX Target : False	
SRP_1 R1 device No SnapVX session	
FCPool1 R2 device	
Mirror Set Type : [Thin,R2 Remote,N/A,N/A]	Mirror Set Type : [R1 Remote,Thin,N/A,N/A]
Mirror Configuration Information { Mirror Number : 1 Mirror Type : Thin Mirror Status : Ready (RW) Mirror Number : 2 Mirror Type : R2 Remote Mirror Status : Not Ready (NR) }	Mirror Configuration Information { Mirror Number : 1 Mirror Type : R1 Remote Mirror Status : Not Ready (NR) Mirror Number : 2 Mirror Type : Thin Mirror Status : Ready (RW) }
RDF Information { Device Symmetrix Name : 00168 RDF Type : R1 RDF (RA) Group Number : 5 (04)	RDF Information { Device Symmetrix Name : 0170B RDF Type : R2 RDF (RA) Group Number : 5 (04)
RDF Group 5	
Remote Device Symmetrix Name : 0170B Remote Symmetrix ID : 000195702307 RDF Mode : Asynchronous	Remote Device Symmetrix Name : 00168 Remote Symmetrix ID : 00019670118 RDF Mode : Asynchronous
Asynchronous Mode	
Snapshot of R2 device with VP Snap	
	Clone Device Information { Source (SRC) Device Symmetrix Name : 0170B Target (TGT) Device Symmetrix Name : 0171E Clone State Flags : (VP Snap) }

RDF Group										
Local	Remote	RDF Group Name		Group	RDFA Info					
LL	RA-Grp	sec	RA-Grp	SymmID	ST	Name	LPDS	CHTM	Dir Cfg	Flags Cycle
										Pri
5 (4)	10	5 (4)	000195702307	00	RDFIngest	XX...X.	F-S	.IS-	15	33

Create Virtual Assets

The volume exposed to the host is SRDF-protected. Also, the SRDF-protected volume has a snapshot. ViPR Controller ingests the source volume and marks it "internal" until the associated replica volumes are ingested. Since ViPR Controller does not view these volumes as stand-alone volumes, you cannot perform any operations on these volumes until you ingest the associated replica volumes.

Virtual Assets to be created:

- 1) Virtual Array for exported volume
- 2) Virtual Pool for exported volume
- 3) Virtual Array for SRDF target
- 4) Virtual Pool for SRDF and snapshot

Note: Even though the SRDF target device is not exported to a host, it could be at some point after ingestion. For example, there may be a site failover resulting in the need to export the R2 device to a local host at the DR site. The ingested volume is associated to a Virtual Array as well as the Virtual Pool and Project. When creating the Virtual Array for the remote site, consider the storage ports that will be used to export the R2 device to a host or cluster.

Create Virtual Arrays

Create the Virtual Array for the Source site. Add the Storage System.

Add Storage System

Search...

<input type="checkbox"/> Name	Type	Status
<input type="checkbox"/> SYMMETRIX+000196702207	EMC VMAX	✓
<input checked="" type="checkbox"/> SYMMETRIX+000196701186	EMC VMAX	✓

First ← 1 → Last 1 entries selected Showing 1 to 2 of 2 entries

+ Add × Cancel

Block, File and Object Storage

A Virtual Array aggregates the management of storage capacity (pools) and connectivity (ports). Storage Pools and Ports can be directly assigned to the Virtual Array, or implicitly assigned via Network connectivity.

- Networks 2
- Storage Ports 4
- Storage Pools 2

+ Add Storage System

Associated Storage Systems 1

List of Storage Systems associated with the Virtual Array through Networks, Storage Ports or Storage Pools

Search...

Name	Type	Status
<input checked="" type="checkbox"/> SYMMETRIX+000196701186	EMC VMAX	✓

First ← 1 → Last 1 entries selected

Associated Virtual Pools 1

Specify the Storage Ports.

Ports in Masking View as seen in the SYMCLI output.

- Iglbx036_MV
 - o 1d4, 1d5, 2d4, 2d5

Name	Registered	Group	Storage System	Identifier	Alias	Type	Network	Allocatable	Status	Assigned
<input type="checkbox"/> FA-3D:4	✓	FA-3D	SYMMETRIX+000196701186	50:00:09:73:50:12:88:84	VMAX3_03d4	FC	FABRIC_FabricA-10.00.00.27:f8:c4:60:07	🔒	✓	✓
<input type="checkbox"/> FA-2D:4	✓	FA-2D	SYMMETRIX+000196701186	50:00:09:73:50:12:88:44	VMAX3_02d4	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-4D:4	✓	FA-4D	SYMMETRIX+000196701186	50:00:09:73:50:12:88:C4	VMAX3_04d4	FC	FABRIC_FabricB	🔒	✓	✓
<input type="checkbox"/> FA-1D:4	✓	FA-1D	SYMMETRIX+000196701186	50:00:09:73:50:12:88:04	VMAX3_01d4	FC	FABRIC_FabricA-10.00.00.27:f8:c4:60:07	🔒	✓	✓

Create the Virtual Array for the Target site. Add the Storage System.

Name	Type	Status
<input checked="" type="checkbox"/> SYMMETRIX+000195702307	EMC VMAX	✓
<input type="checkbox"/> SYMMETRIX+000196701186	EMC VMAX	✓

Block, File and Object Storage

A Virtual Array aggregates the management of storage capacity (pools) and connectivity (ports). Storage Pools and Ports can be directly assigned to the Virtual Array, or implicitly assigned via Network connectivity.

- Networks 2
- Storage Ports 23
- Storage Pools 10

+ Add Storage System

Associated Storage Systems 1

List of Storage Systems associated with the Virtual Array through Networks, Storage Ports or Storage Pools

Name	Type	Status
SYMMETRIX+000195702307	EMC VMAX	✓

Associated Virtual Pools

Create Target Virtual Pool

Create the Target Virtual Pool for the R2 device and snapshot using the SYMCLI information for the Storage Groups, SLOs, Volumes and Zoning. It must be created first because it is reference in the Source Virtual Pool.

- How many initiators in the Initiator Group?
 - The target volume is not currently presented to a host, but it could be in a disaster scenario. The number of initiators will likely match those of the Source site.
- Is the volume thick or thin?
 - Thin
- What is the transport protocol?
 - Fibre Channel
- What is the System Type?
 - If there is FAST policy on the Storage Group or SRDF protection the volume, you need to specify "EMC VMAX" as the System Type.
- What is the FAST policy?
 - None
- What are the Host I/O Limits?
 - None

Hardware

Provisioning Type: Thin *

Protocols: FC *

Matching storage pools will be limited to those that can support all selected protocols

Drive Type: None *

System Type: EMC VMAX *

RAID Level(s): RAID1 RAID5 RAID6

Thin Volume Preallocation: %

Unique Auto-tiering Policy Names: Check to show unique policy names in Auto-tiering Policy.

Auto-tiering Policy: Select an Option

Multi-Volume Consistency: If selected, resources provisioned from this pool will support the use of consistency groups

Expandable: If selected, resources provisioned from this pool will support expansion.

Fast Expansion: If selected, expansion will be performed more quickly but potentially decreases performance.

Host Front End Bandwidth Limit (MB/sec): Unlimited if 0 or not specified.

Host Front End I/O Limit (IOs/sec): Unlimited if 0 or not specified.

- How many total paths and paths per initiator?
 - Pathing needs to be considered from the perspective of the individual host and not the total number of initiators that comprise a cascaded Initiator Group. The target volume is not currently presented to a host, but it could be in a disaster scenario. The number of initiators will likely match those of the Source site.
- In the SYMCLI output for *lglbx036_MV* for, you can see:
 - Host *lglbx036_MV* has two initiators.
 - There are four FA ports in the Masking View.
 - There are four FA ports zoned to the initiators.
 - With this information, the SAN Multi Path can be finalized because we know that the host is zoned to storage ports as defined in the Masking View.
 - There are several ways this could be configured. We'll set the SAN Multi Path to 2/4/2 for future exporting of the R2 devices.
 - A minimum of two paths for any ingested or newly provisioned volume.
 - A maximum of four paths for any ingested or newly provisioned volume.
 - Two paths for each initiator.

The screenshot shows the 'SAN Multi Path' configuration section. It contains three dropdown menus, each with a red box around its value:

- Minimum Paths:** 2 (Minimum number of total paths from the host to storage array)
- Maximum Paths:** 4 (Maximum number of total paths from the host to storage array)
- Paths Per Initiator:** 2 (Number of paths per host initiator)

- How many snapshots per volume?
 - There is only one snapshot for the R2 in this example. However, you may want more.
- Protection System?
 - For the R2 device, there is no setting needed here.

The screenshot shows the 'Data Protection' configuration section. It contains several settings:

- Maximum Snapshots:** 10 (Maximum number of local snapshots allowed for resources from this Virtual Pool)
- Maximum Continuous Copies:** (Maximum number of native continuous copies allowed for resources from this Virtual Pool. Allowed only for non-expandable Virtual Pool.)
- Continuous Copies Virtual Pool:** Select an Option (Optionally select a different Virtual Pool to use for native continuous copies (applicable only if maximum copies > 0))
- Protection System:** Select an Option (Specifies storage that is protected by the selected data protection type.)

- What is the underlying array thin or thick pool containing the volume?
 - FCPool1

Pool Assignment: Manual

Choosing manual pool assignment allows selection of a subset of the storage pools matching the criteria

Search...

<input type="checkbox"/>	Name	Storage System	Provisioning	Drive Types	Free	Subscribed	Total
<input type="checkbox"/>	EFDPool-QE	SYMMETRIX+000195702307	Thin	SSD	998 GB	136 GB	999 GB
<input type="checkbox"/>	EFDPool1	SYMMETRIX+000195702307	Thin	SSD	999 GB	635 GB	999 GB
<input type="checkbox"/>	FCPool-QE	SYMMETRIX+000195702307	Thin	FC	3363 GB	1529 GB	3999 GB
<input checked="" type="checkbox"/>	FCPool1	SYMMETRIX+000195702307	Thin	FC	4690 GB	8912 GB	4999 GB
<input type="checkbox"/>	SATAPool-QE	SYMMETRIX+000195702307	Thin	SATA	8096 GB	9270 GB	8099 GB
<input type="checkbox"/>	SATAPool1	SYMMETRIX+000195702307	Thin	SATA	16321 GB	4887 GB	17199 GB

Showing 1 to 6 of 6 entries

Create Source Virtual Pool

Create the Source Virtual Pool. This pool includes the Virtual Pool for the R2 device and snapshot. Use the SYMCLI information for the Storage Groups, SLOs, Volumes and Zoning to complete the Virtual Pool configuration.

- How many initiators in the Initiator Group?
 - There are two in each Child Initiator Group
- Is the volume thick or thin?
 - Thin
- What is the transport protocol?
 - Fibre Channel
- What is the System Type?
 - If there is FAST policy on the Storage Group or SRDF protection the volume, you need to specify "EMC VMAX" as the System Type.
- What is the SLO and Workload policy?
 - Diamond and OLTP
- What are the Host I/O Limits?
 - None

Hardware

Provisioning Type: Thin

Protocols: FC

Matching storage pools will be limited to those that can support all selected protocols

Drive Type: None

System Type: EMC VMAX

RAID Level(s): RAID1

Thin Volume Preallocation: %

Unique Auto-tiering Policy Names: Check to show unique policy names in Auto-tiering Policy.

Auto-tiering Policy: SYMMETRIX+000196701186+SLO_POLICY+Diamond SLO OLTP Work...

Fast Expansion: If selected, expansion will be performed more quickly but potentially decreases performance.

Host Front End Bandwidth Limit (MB/sec):
Unlimited if 0 or not specified.

Host Front End I/O Limit (IOs/sec):
Unlimited if 0 or not specified.

- How many total paths and paths per initiator?
 - Pathing needs to be considered from the perspective of the individual host and not the total number of initiators that comprise a cascaded Initiator Group.
- In the SYMCLI output for *lglbx036_MV* for, you can see:
 - Host *lglbx036_MV* has two initiators.
 - There are four FA ports in the Masking View.
 - There are four FA ports zoned to the initiators.
 - With this information, the SAN Multi Path can be finalized because we know that the host is zoned to storage ports as defined in the Masking View.
 - There are several ways this could be configured. We'll set the SAN Multi Path to 2/4/2 for future exporting of the R2 devices.
 - A minimum of two paths for any ingested or newly provisioned volume.
 - A maximum of four paths for any ingested or newly provisioned volume.
 - Two paths for each initiator.

▼ SAN Multi Path

Minimum Paths: Minimum number of total paths from the host to storage array

Maximum Paths: Maximum number of total paths from the host to storage array

Paths Per Initiator: Number of paths per host initiator



- How many snapshots per volume?
 - There are no snapshots
- Protection System?
 - SRDF Protection. Asynchronous mode. Select the appropriate Target Virtual Array and Virtual Pool.

▼ Data Protection

Maximum Snapshots:
Maximum number of local snapshots allowed for resources from this Virtual Pool

Maximum Continuous Copies:
Maximum number of native continuous copies allowed for resources from this Virtual Pool. Allowed only for non-expandable Virtual Pool.

Continuous Copies Virtual Pool: Select an Option
Optionally select a different Virtual Pool to use for native continuous copies (applicable only if maximum copies > 0)

Protection System: VMAX SRDF
Specifies storage that is protected by the selected data protection type.

SRDF Copy Mode: Asynchronous

SRDF Copies:	Virtual Array	Virtual Pool
	vArray2-Brocade-VMAX2307	2307 - Target RDF Snap Clone Mirror ✕

Configure target Virtual Arrays and optional target Virtual Pools for SRDF copies.

- What is the underlying VMAX3 SRP containing the volume?
 - SRP_1

➤ Storage Pools 1

Pool Assignment: Automatic
Choosing manual pool assignment allows selection of a subset of the storage pools matching the criteria

Search...

Name	Storage System	Provisioning	Drive Types	Free	Subscribed	Total
SRP_1	SYMMETRIX+000196701186	Thin	FC, SSD	73790 GB	782 GB	74208 GB

Showing 1 to 1 of 1 entries

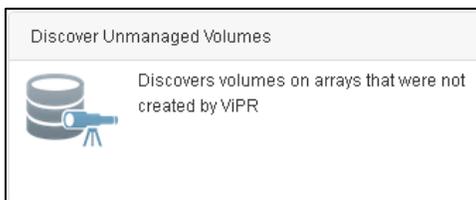
- What is the Project?
 - RDFIngest. The ViPR Controller Project name must match the RDF Group name.



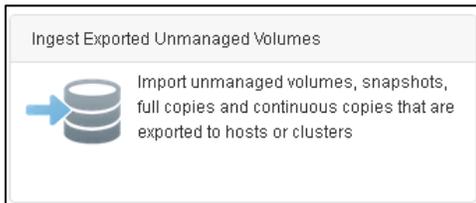
Ingest the Volume

Login with a user with VDC privileges and execute the appropriate services.

Service Catalog > Block Storage Services > Discover Unmanaged Volumes
Discover the source and target arrays.



Service Catalog > Block Storage Services > Ingest Exported Unmanaged Volumes
Ingested exported volume(s).



If the Virtual Array and Virtual Pool settings are correct, the volume targeted for ingestion will appear in the list.

Ingest Exported Unmanaged Volumes
Import unmanaged volumes, snapshots, full copies and continuous copies that are exported to hosts or clusters

Storage Type: Exclusive *

Host: Iglbx036 [cluster: VSE_WinCluster1] *

Virtual Array: vArray1-Brocade-VMAX1186 *

Virtual Pool: Source RDF (1 Volumes) *

Project: RDFIngest *

Volume Filter: Volume 00168 - Volume 00168 *

Ingestion Method: Full Ingestion Including Backend Volumes *

VPLEX Ingestion Type. Default type is 'Full'.

Volumes: Volume 00168 (00168) [30.0 GB] *

Volumes not currently managed. If your desired volumes are not shown here, you may need to run discover first, or they may already be ingested.

[Order](#) [Cancel](#)

Because there are replica devices, the ingestion process is not complete. The error in the following screenshot is expected. The error identifies the uningested R2 device.

Ingest Exported Unmanaged Volumes
Import unmanaged volumes, snapshots, full copies and continuous copies that are exported to hosts or clusters

Order Number: 38
Date Submitted: Dec 17th 2015, 1:29:18 PM
Submitted By: root
Status: ✘ Error Occurred Processing Order
Execution Time: 11 seconds
Precheck Steps: 1/2
Execution Steps: 1/2

Storage Type: Exclusive
Host: Iglbx036 [cluster: VSE_WinCluster1]
Virtual Array: vArray1-Brocade-VMAX1186
Virtual Pool: Source RDF
Project: RDFIngest
Volume Filter: 0
Ingestion Method: Full
Volumes: 00168
Resubmit: [Order](#)

Error 64000: The unmanaged volume 00168 has been partially ingested, but not all replicas have been ingested. Uningested replicas: SYMMETRIX+000195702307+VOLUME+0170B.
The unmanaged volume 00168 has been ingested but the VIPR object has been marked as internal.

[Logs](#)
[Precheck Steps](#)
[Execution Steps](#)

Ingest the R2 device and snapshot of the R2 device using the Ingest Unexported Unmanaged Volumes service.

Ingest Unexported Unmanaged Volumes
Import unexported unmanaged volumes, snapshots, full copies and continuous copies of VIPR

Ingest Unexported Unmanaged Volumes

Import unexported unmanaged volumes, snapshots, full copies and continuous copies to bring them under management of ViPR

Storage Systems: SYMMETRIX+000195702307

Virtual Array: vArray2-Brocade-VMAX2307

Virtual Pool: Target RDF and Snapshot

Project: R2Ingest

Volume Filter: R2Ingest - Volume 0171E

Ingestion Method: Full Ingestion Including Backend Volumes
VPLEX Ingestion Type. Default type is 'Full'.

Volumes:

- R2Ingest (0170B) [30.0 GB]
- Volume 0171E (0171E) [30.0 GB] [Snapshot]

Volumes not currently managed. If your desired volumes are not shown here, you may need to run discover first, or they may already be ingested.

[Order](#) [Cancel](#)

The exported volume, the SRDF R2 volume, and the snapshot now appear as Resources under ViPR Controller control.

Project: R2Ingest

SRDF target volumes have been disabled for deletion. Deleting source SRDF volume will also automatically delete the target volume.

Volumes

<input type="checkbox"/>	Volume Name	Size	Virtual Array	Virtual Pool	Protocols	WWN
<input type="checkbox"/>	R2Ingest	30.00	vArray2-Brocade-VMAX2307	Target RDF and Snapshot	FC	60000970000195702307533031373042
<input type="checkbox"/>	Volume 00168	30.00	vArray1-Brocade-VMAX1186	Source RDF	FC	60000970000196701186533030313638

First 1 Last 0 entries selected

[Delete Volume](#)

Volume 00168

Volume

WWN: 60000970000196701186533030313638
Size: 30.00 GB Provisioned / 30.00 GB Requested
Virtual Array: vArray1-Brocade-VMAX1186
Virtual Pool: Source RDF

[More Details](#)

- Exports
- Snapshots
- Full Copies
- Continuous Copies

R2Ingest

Volume

WWN: 60000970000195702307533031373042
Size: 30.00 GB Provisioned / 30.00 GB Requested
Virtual Array: vArray2-Brocade-VMAX2307
Virtual Pool: Target RDF and Snapshot

[More Details](#)

- Exports
- Snapshots
 - Volume 0171E



VNX EXPORTED VOLUME INGESTION

The following section covers building the Virtual Assets and ingestion of VNX volumes with associated replicas.

In a VNX SAN configuration, initiators are registered to a host. The host is added to the Storage Group. Assuming that all of a host's initiators are registered to a single host, that host may be in one Storage Group at any time.

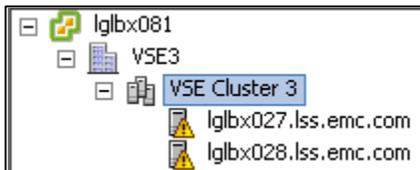
The Storage Group can be built in multiple ways.

- Single host, no cluster with data LUNs.
- Single host, no cluster with boot and data LUNs.
- Single host in a cluster shared data LUNs.
- Single host in a cluster with boot and shared data LUNs.
- Multiple hosts with data LUNs (no boot).

Whether it is a boot LUN, data LUN, cluster or non-cluster, ingestion can be used in any of the scenarios above.

In the following example, there is a 2-node ESX cluster. There are 7 shared volumes and 1 unshared volumes.

vCenter:



lglbx027.lss.emc.com:

View: Datasources Devices	
Devices	
Name	
DGC Fibre Channel Disk (naa.50060160b6601bb950060160b6601bb9)	
DGC Fibre Channel Disk (naa.60060160186035005828f0282be7e411)	
DGC Fibre Channel Disk (naa.60060160186035009964e0c439b9e411)	
DGC Fibre Channel Disk (naa.6006016018603500ceef3a80dc4e411)	
DGC Fibre Channel Disk (naa.6006016018603500d6a5a0aa29e7e411)	
DGC Fibre Channel Disk (naa.6006016018603500f6bf41c3e3b6e411)	
DGC Fibre Channel Disk (naa.6006016018603500fa8d3c74dce2e411)	

Shared LUN

lglbx028.lss.emc.com:

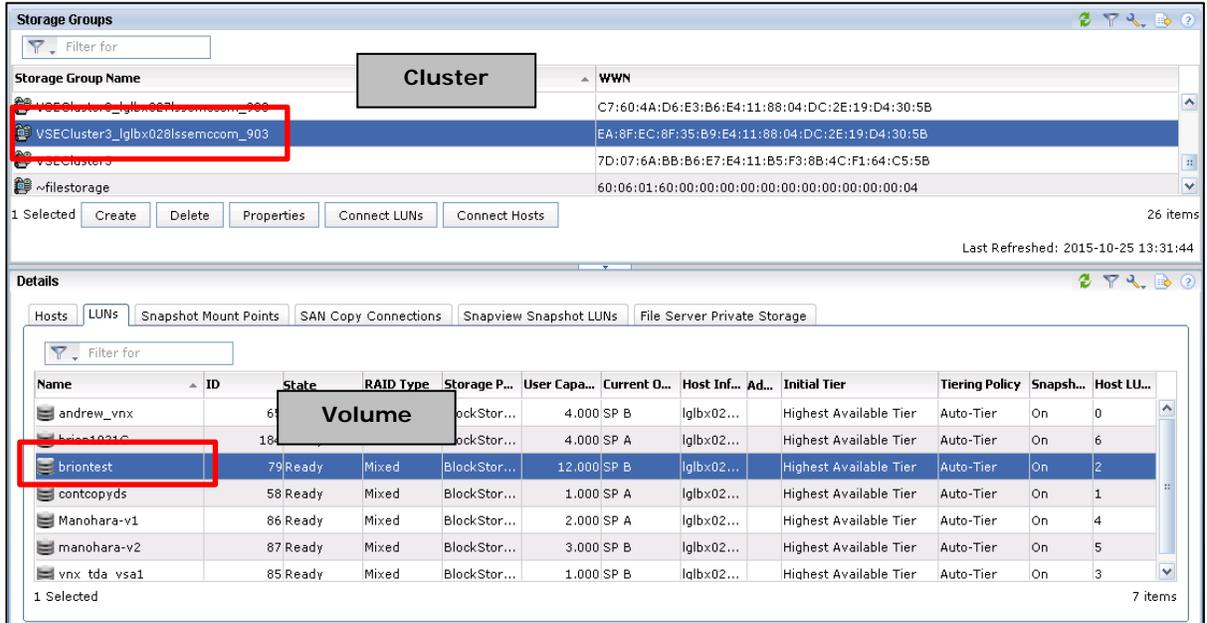
View: Datasources Devices	
Devices	
Name	
DGC Fibre Channel Disk (naa.50060160b6601bb950060160b6601bb9)	
DGC Fibre Channel Disk (naa.6006016018603500330c1bba0478e511)	
DGC Fibre Channel Disk (naa.60060160186035005828f0282be7e411)	
DGC Fibre Channel Disk (naa.60060160186035009964e0c439b9e411)	
DGC Fibre Channel Disk (naa.6006016018603500ceef3a80dc4e411)	
DGC Fibre Channel Disk (naa.6006016018603500d6a5a0aa29e7e411)	
DGC Fibre Channel Disk (naa.6006016018603500f6bf41c3e3b6e411)	
DGC Fibre Channel Disk (naa.6006016018603500fa8d3c74dce2e411)	

Exclusive LUN

Shared LUN

Using Unisphere or naviseccli, identify the attributes of the volume(s) to be ingested.

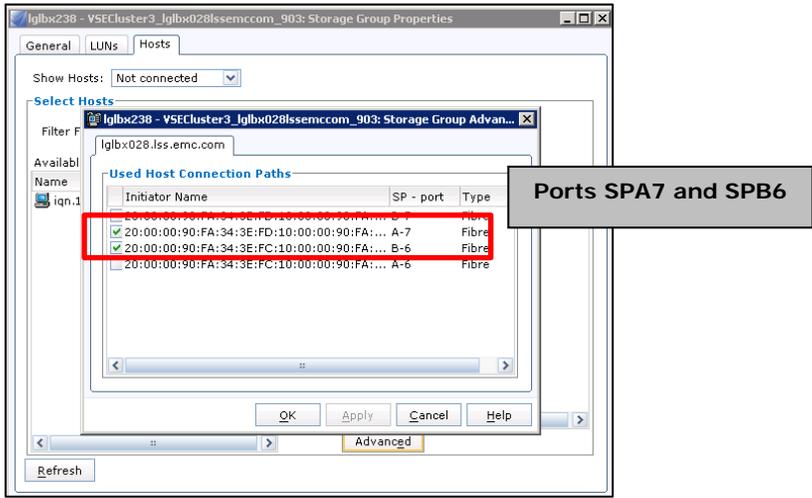
The volume "briontest" is a shared volume for the cluster.



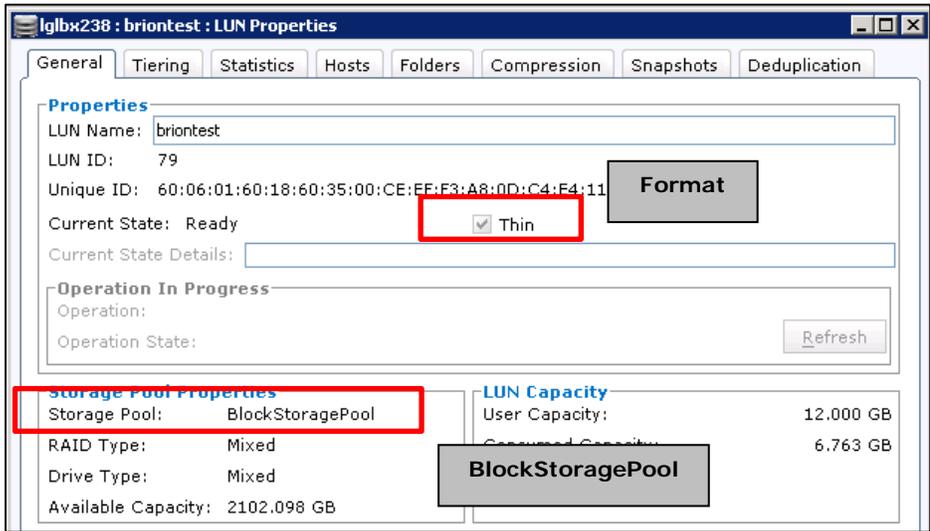
The Tiering Policy is "Start High then Auto-Tier"



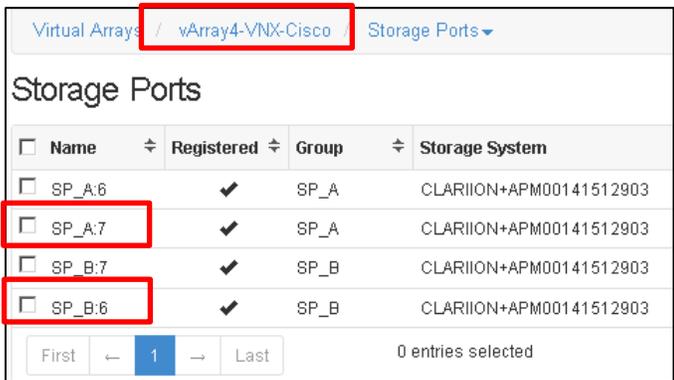
The number of paths in the Storage Group is 2.



The format and the physical Storage Pool Properties of the volume.



Create a Virtual Array that includes the Storage System and Storage Processor Ports.



Note: The Virtual Array may contain additional Storage Systems and Storage Ports not directly associated to the ingestion operation.

Create a Virtual Pool that includes the Virtual Array, volume attributes, and pathing listed above.

Edit Block Virtual Pool
Edit an existing block virtual pool.

This virtual pool has associated resources. Only a limited number of fields may be changed.

Name: VNX vPool - 2 paths *

Description: VNX vPool - 2 paths *

Virtual Arrays:

- vArray1-VMAX2307
- vArray2-VMAX2258
- vArray3-VNX
- vArray4-VNX-Cisco

Hardware

Provisioning Type: Thin *

Protocols: FC *

Matching storage pools will be limited to those that can support all selected protocols

Drive Type: None *

System Type: EMC VNX Block *

RAID Level(s):

- RAID5
- RAID6
- RAID10

Auto-tiering Policy: DEFAULT_START_HIGH_THEN_AUTOTIER *

SAN Multi Path

Minimum Paths: 2 *

Minimum number of total paths from the host to storage array

Maximum Paths: 4 *

Maximum number of total paths from the host to storage array

Paths Per Initiator: 1 *

Number of paths per host initiator

Storage Pools 6

Pool Assignment: Manual

Choosing manual pool assignment allows selection of a subset of the storage pools matching the criteria

Name	Storage System	Provisioning	Drive Types
<input checked="" type="checkbox"/> BlockStoragePool	CLARIION+APM00141512903	Thin, Thick	SAS, NL_SAS, SSD
<input type="checkbox"/> BlockStoragePool1	CLARIION+APM00141512903	Thin, Thick	SAS
<input type="checkbox"/> FileStoragePool	CLARIION+APM00141512903	Thin, Thick	SAS
<input type="checkbox"/> VSE Cluster 2 - DO NOT DELETE	CLARIION+APM00141512903	Thin, Thick	SAS, NL_SAS, SSD
<input type="checkbox"/> VSE Cluster 2(2) - DO NOT DELETE	CLARIION+APM00141512903	Thin, Thick	SAS
<input type="checkbox"/> VSE Repository-Fdrive-DO NOT DELETE	CLARIION+APM00141512903	Thin, Thick	NL_SAS

Login with a user with VDC privileges and execute the appropriate services.

Service Catalog > Block Storage Services > Discover Unmanaged Volumes
 Discover the source and target arrays.



Service Catalog > Block Storage Services > Ingest Exported Unmanaged Volumes
 Ingested exported volume(s).



If the Virtual Array and Virtual Pool settings are correct, the shared volume targeted for ingestion will appear in the list.

Ingest Exported Unmanaged Volumes
Import unmanaged volumes, snapshots, full copies and continuous copies that are exported to hosts or clusters

Storage Type: Shared

Host: VSE Cluster 3

Virtual Array: vArray4-VNX-Cisco

Virtual Pool: VNX vPool - 2 paths (6 Volumes)

Project: Project1

Volume Filter: All Volumes

Volumes:

- andrew_vnx (00065) [4.0 GB]
- briontest (00079) [12.0 GB]
- contespyds (00059) [1.0 GB]
- Manohara-v1 (00086) [2.0 GB]
- manohara-v2 (00087) [3.0 GB]
- vnx_tda_vsa1 (00085) [1.0 GB]

Buttons: All, None

If the Virtual Array and Virtual Pool settings are correct, the exclusive volume targeted for ingestion will appear in the list.

Ingest Exported Unmanaged Volumes
Import unmanaged volumes, snapshots, full copies and continuous copies that are exported to hosts or clusters

Storage Type: Exclusive

Host: lglbx028.lss.emc.com [cluster: VSE Cluster 3]

Virtual Array: vArray4-VNX-Cisco

Virtual Pool: VNX vPool - 2 paths (1 Volumes)

Project: Project1

Volume Filter: All Volumes

Volumes:

- brion1021C (00184) [4.0 GB]

UNEXPORTED VOLUME INGESTION

Unexported volumes are volumes that were created on the Storage System, but they do not reside in an array-level export (e.g. VMAX3 Masking View). As a result, these volumes are not visible to any host. The ingestion process is basically the same as the process for ingesting an exported volume. In both cases, ingested volumes are tied to a ViPR Controller Project and Virtual Pool. However, there is a major difference.

Ingesting an exported volume requires the administrator to know the exact storage ports and the total number of paths that the volume is seen by the host or cluster. The SAN Multi Path settings in the Virtual Pool are important because they are a reflection of the ports in the array-level exports and zones in the Fibre Channel switch fabric. Without this information, exported volume ingestion will fail.

After an unexported volume is ingested, ViPR Controller has full control of that it. The administrator can export that volume to a host or cluster at a later time. Even though the SAN Multi Path settings are not important for the initial ingestion, they are important for future exports. Since that ingested unexported volume is tied to the Virtual Pool, future export operations are bound to the SAN Multi Path setting. New array masking views and zones are directly tied to these settings. Ingestion may succeed for the unexported volume. However, future exports may not achieve the desired connectivity, redundancy and high availability if the settings were not considered before ingestion. Once a volume is created from or ingested to a Virtual Pool, the SAN Multi Path settings cannot be changed.

Before ingesting an unexported volume, plan how that volume will be used in the future. A Virtual Pool Change service is available in case a volume needs to be moved from one Virtual Pool to another. There are restrictions, so it may not always be an option. It is important to plan how a volume will be ingested even if it's not currently visible to a host.

BASIC INGESTION TROUBLESHOOTING

To successfully ingest, there must be a Virtual Array containing the storage ports in the array-level export (Masking View). There must also be a Virtual Pool that is configured to match the attributes of the volume and the underlying Storage Group in the case of VMAX. If errors are received when ingesting, you may need to reconfigure your Virtual Array and Virtual Pool. The error messages are generic across array types for the most part. Here are four examples based on real world usage that help the troubleshooting process:

Incorrect VMAX3 SLO defined in the Virtual Pool:

```
Error 64000: Unmanaged volume 0014F does not match the auto tiering policy set in virtual pool Ingest Pool.
```

Not all storage ports were added to the Virtual Array:

```
Error 64000: None of the export masks of the unmanaged volume 0015B have been ingested, so the volume cannot be ingested. Additional information: Storage Port(s) FA-2D:4 in unmanaged export mask lglbx030_Ingest_MV are not available in Virtual Array vArray2-1186-Brocade
```

Zone between host and VNX is not present on one of the fabrics:

```
Error 64000: Zoning is not consistent across hosts in this cluster. Zoning may be missing, insufficient, or otherwise incompatible for one or more hosts: 1 of 1 unmanaged export mask(s) failed zoning checks: Initiator 10:00:00:90:FA:34:4C:26 of host 10.247.144.30 has a different number of ports (2) than what is required according to the virtual pool (1)
```

SAN Multi Path section of the Virtual Pool specifies 2 maximum paths, but the host actually has 4 paths:

```
Error 64000: Initiator 10:00:00:90:FA:34:4C:26 of host 10.247.144.30 has a different number of ports (2) than what is required according to the virtual pool (1)
```

Note: If you believe Virtual Assets are configured correctly, rediscover the Physical Assets and run the Discover Unmanaged Volume service again. Then, run the appropriate ingest catalog service.

SUMMARY

ViPR Controller enables storage arrays to be added to a virtual data center and for their storage pools to be used as the target for block and file storage provisioning operations. ViPR Controller provides a mechanism to manage volumes or file systems that were created outside of ViPR Controller.