Best Practices Guide:

Violin Memory Arrays With IBM System Storage SAN Volume Control

Implementation Best Practices and Performance Considerations

Version 1.0

Abstract

This technical report describes best practices for using Violin Memory Arrays and IBM SAN Volume Control (SVC) to deploy a scalable, high-performance storage system that leverages unified data management and block-level storage virtualization. The document provides guidance on a wide range of topics, including fabric architecture, LUN configuration, and multipathing to help optimize IBM SVC/Storwize environments through the use of Violin Memory technology.
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1 Introduction

IBM SVC provides a block-level virtualization environment to manage Tier-1, Tier-2 and Tier-3 storage systems from single management interface. Integrating Violin Memory arrays as Tier-1 storage and connecting them to IBM SVC systems enables provisioning of Tier-1, Tier-2 or Tier-3 block storage to the hosts based upon the applications I/O and bandwidth demand. Enabling “Easy Tier” functionality dynamically serves applicable high-performance or low-performance LUNS to the servers based upon applications I/O and performance demand. Easy tier provisioning is transparent to the hosts and applications. Violin Array and SVC provides scalable high-performance storage system and data management architecture.

1.1 Intended Audience

This document is targeted for systems and storage architects, storage administrators, and Storage Engineering staff who are responsible for IBM SVC and IBM Storwize deployments.

1.2 Purpose and Scope

The purpose of this document is to briefly present best practice recommendations when using Violin Memory Arrays and IBM SAN Volume Control (SVC) in SAN environment. This document is not a substitute for installation and configuration documents provided by IBM or Violin, and assumes that an authorized Violin Memory representative has installed any and all Violin devices.

1.3 Key Concepts

- **SVC cluster** – A SAN Volume Control (SVC) cluster has a maximum of eight nodes. Nodes are split into pairs called IO Groups, a cluster having up to four IO Groups. Each node has four Fibre Channel (FC) ports. The last digit of the model indicates the FC speed; so CG8 nodes have four 8Gb FC ports each.

- **IO group** – The pair of SVC nodes in SVC Cluster nodes is known as an input/output (I/O) group, which is defined during the configuration process of the cluster.

- **Storage pools** – Storage presented to an SVC cluster by a storage controller is managed in Storage Pools (also called Managed Disk Groups). All IO Groups in an SVC can create Logical Unit Numbers (LUNs) for host use in a Storage Pool

- **MDisk** – A managed disk (MDisk) is a logical unit of physical storage. MDisks are either arrays (RAID) from internal storage or volumes from external storage systems. The backend SVC storage presentation in external view (MDisks) is slightly different for each OEM vendor. IBM storage behind SVC appears as a single array, and all the LUNS are present.

- **vDisk** – Individual volumes (also called vDisks) are assigned to an IO Group and IO is performed via the “preferred node” in that IO Group. IO Group assignment and preferred node are specified at volume creation time and can be different for different volumes.
2 Overview of Violin Memory Arrays and IBM SVC

This section provides an overview of IBM SVC and IBM Storwize V7000 architecture for implementations that include a mix of Violin Memory arrays and standard disk storage, along with a summary of best practice recommendations for implementing Violin arrays in an SVC or Storwize environment.

2.1 Architectural Overview

The architecture of IBM SVC and Storwize V7000 are fundamentally the same, as illustrated in Figure 1.

While the architecture is the same for the SVC and V7000, there are a number of differences between the SVC and Storwize V7000 implementations. The key differences are:

- SVC contains no internal storage for user capacity whereas the V7000 enclosures support 12x3.5" drives or 24x2.5" drives. Multiple enclosures per V7000 cluster are supported.
- SVC nodes are 1U, plus each need a 1U UPS; V7000 has no external UPS.
- V7000 with Unified Storage supports NFS/CIFS access.
- SVC supports up to four solid-state drives (SSDs) per node in internal slots. V7000 supports SSDs in 2.5" drive bays.

Figure 1: SVC and V7000 Architectural Overview
• Intermix of SVC and V7000 is not supported in a single cluster, however an SVC cluster can manage V7000s as storage controllers.

2.2 Summary of Recommendations
The following list summarizes the recommendations included in this Best Practice guide:
• Connect Violin Flash Memory Arrays via Fibre Channel (FC) switches because SVC does not support direct connects.
• For optimal configuration, the fabric architecture must be comprised of three zones:
  o SVC-clustered system zone
  o Host zone
  o Storage zone
That way, ports are shared and SVC can see storage controllers and hosts, but storage controllers and hosts cannot see each other.
• LUNs must be created with a 512-byte sector size on Violin Array. SVC does not support 4096 byte sector disks
• When creating Logical Unit Numbers (LUNs) for Managed Disks (MDisks), bear in mind that the SVC will spread data over all the MDisks in a storage pool
• Normally it is better to have a few large MDisks than many small ones. Violin supports MDISK sizes of 2TB or more.
• Violin supports MLC- and SLC-based flash storage. However, it is highly recommended not to mix the two into same storage pool unless that is your specific intent (e.g., when using EasyTier).

3 Configuration and Setup
This section provides specific recommendations that customers should observe during hardware installation, storage zoning setup, and LUN configuration.

3.1 Connecting Violin Flash Memory Arrays to Your SAN
IBM SVC does not support direct connects. Therefore, it is necessary to connect Violin Flash Memory Arrays via a shared storage interface. This document focuses on the use of Fibre Channel switches and connections.

SVC expects hosts and storage to share the same ports. Best practice is to separate storage and hosts into separate FC zones. This allows port sharing, and enables IBM SVC to see all storage controllers and hosts, but without allowing storage controllers and hosts to see each other.
Always use all SVC ports; do not dedicate some for host, some for storage controllers and some for replication. This is not expected due to the restricted number of ports on a node.

3.2 SVC Zoning

The fabric must have three distinct zones:

1. SVC clustered system zone: Create one zone per fabric, with all of the SVC ports cabled to this fabric to allow SVC internode communication. Storage and hosts should not be included.

2. Host zones: Create an SVC host zone for each server that is accessing storage from the SVC system.

3. Storage zone: Create one SVC storage zone for each Violin flash memory array subsystem that is virtualized by the SVC. This is important because all SVC nodes need to be able to access the LUNs being created, otherwise the SVC will report it is in a degraded state.

![Figure 2: Fibre Channel Zones](image)

Present each Violin Memory Gateway (VMG) zone port as a controller on the SVC external storage screen. If eight ports of the VMG are zoned, then eight controllers will be presented on the SVC external storage screen. The storage will appear as if it is only available on a single controller, but it is actually accessible on all the defined controllers.

3.2.1 HBA Zoning

Host bus adapters (HBAs) in dissimilar hosts or dissimilar HBAs in the same host need to be in separate zones. For example, IBM AIX and Microsoft hosts need to be in separate zones. In this case, “dissimilar” means that the hosts are running separate operating systems or are using separate hardware platforms. Therefore, various levels of the same operating system are regarded as similar. Note that this requirement is a SAN interoperability issue, rather than an SVC requirement. Host zones are to contain only one initiator (HBA) each and as many SVC
node ports as you need, depending on the high availability and performance that you want from your configuration.

![IBM SVC Zoning Diagram](image)

**Figure 3: IBM SVC Zoning**

### 3.3 LUN Considerations

LUNs (MDisks) must have exclusive access to a single SVC-clustered system and cannot be shared between other SVC-clustered systems or hosts. A storage controller can present LUNs to both the SVC (as MDisks) and to other hosts in the SAN. It is highly recommended to avoid having SVC and hosts use the same ports of the Violin Array(s).

#### 3.3.1 Using Easy-Tier

IBM SVC is used as a storage virtualization layer to front-end multiple different storage subsystems of different characteristics and group them into “pools” and “tiers.”

Easy-Tier is a performance optimization function, which automates I/O activity between SVC Pools and Volumes. Easy-Tier will automatically migrate or move extents belonging to a volume between MDisk storage tiers or Pools.

To use Easy-Tier:
1. Create a hybrid pool that has two disk types.
2. Make sure you set the Violin MDisks to external Solid-State-Disk.
3. Once you have a multi-tier pool with two disk tiers in it you have Easy-Tier potential.
4. Create vDisks/volumes in the hybrid pool.
5. Mark some of the vDisks/volumes as EasyTier-eligible.
4 Performance Considerations

It is highly recommended to create a few large Managed Disks with an extent size dependent on the projected size of the storage pool. For example, if an extent size of 16 MB is chosen, then total size of the pool is 64TB. A single pool can be as large as 32 PB if using a larger extent size. Violin supports MDISKs greater than 2TB when connected as a target behind SVC. For SVC performance considerations, refer to IBM SVC Best Practice and Performance Guidelines at http://www.redbooks.ibm.com/redpieces/abstracts/sg247521.html.

For host performance considerations, refer to hardware, operating system and application best practices guidelines provided by their respective manufacturers.

5 SVC Certification Matrix and Function Support

The following table is an extract from the IBM-supported hardware matrix.

IBM publishes a supportability Matrix on their Web Site which states what kind of hosts, HBA’s, Switches and Storage Subsystems are supported/Certified with IBM SVC.

The below shows the latest screenshot of Violin Arrays work with SVC version 6.4.x

IBM SVC/V7000 support matrix for V6.4.x

5.1 Cluster-Level Support

For Violin devices that are supported by SVC running on firmware levels supported by SVC, the following are supported:

- **MDisks greater than 2TB.** MDisks are how LUNs created on a storage controller appear on the SVC.
- **Quorum Disks.** An SVC cluster has three quorum disks which are used in the process of managing cluster failure scenarios to avoid split-brain scenarios.
• **External Virtualization Software.** This is specific to V7000 only. To attach external storage devices such as Violin to a V7000, the external virtualization feature needs to be purchased. The customer must check with IBM on the exact terms for this.

5.1.1 Functions and Support

Functions and support on SVC are split into two distinct types. The first type is generic support, which is applicable at the SVC cluster level. The second type is applicable at the volume or vDisk level. Both types of functions and support may be restricted by the storage controller. All the functions documented here are supported at V6.4.0.1.

5.2 Multipathing Support

Host multipathing for volumes is provided on SVC by through use of IBM Subsystem Device Driver, or SDD. This is provided by IBM for supported platforms unless otherwise stated in the hardware interoperability matrix. Support for multipathing of MDisks is provided within the SVC itself.

5.3 Volume-Level Functions

The following SVC functions are supported on Violin arrays that appear in the SVC supported hardware matrix on the Internet:

• **VDisk or volume mirroring** – This is a function that operates in a similar to LVM mirroring on hosts. It will mirror a volume onto a second volume in the SVC cluster (possibly in a different Storage Pool). In the event of one volume failing, the SVC will use the second without interruption. This is a base function; no additional license needed.

• **EasyTier** – Sub-LUN tiering at a volume level. This requires at least one multitier storage pool to be active. Any LUNs in that storage pool that have been set up to be managed by EasyTier will have their blocks automatically moved between tiers. This is a base function; no additional license needed.

• **Space-efficient volumes** -- Provides the ability to create thin-provisioned volumes. This is a base function. No additional license is needed.

• **Volume expansion** -- Provides ability to grow the size of a volume. It is important to ensure that the host can cope with a volume that has grown in size. This is a base function; no additional license is needed.

• **VDisk movement** – This allows vDisks to be moved from one location to another (e.g., from one storage pool or controller to another) on the same I/O group. This is a base function; no additional license is needed.

• **Metro mirror** – Synchronous replication of one volume to another volume, either on the same SVC cluster or another. This carries the latency overhead of transferring the data from one location to another. This is provided as part of the Metro/Global Mirror license on SVC along with Global Mirror.
• **Global mirror** – Asynchronous replication of one volume to another volume, either on the same SVC cluster, or another. This is provided as part of the Metro/Global Mirror license on SVC along with Metro Mirror: Note: It is possible to switch a volume from MM to GM or vice versa without stopping replication of the volume.

• **Flashcopy** – Provides a ‘Point in Time’ copy or T0 copy function including snapshots and clones of volumes. Supports consistency groups for either. This is provided as part of the Flashcopy license for SVC.

### 5.3.1 New Functions for SVC

As of early June, 2012, IBM had announced SVC 6.4.0 for both the SVC and V7000 (excluding Unified systems). This introduced a number of new functions, including:

- Primary storage compression
- FCOE support
- Four controller enclosure clusters (V7000 now supports four I/O groups the same as SVC).
- Non-Disruptive vDisk Move (ability to move vDisks between I/O groups without disruption)

### Appendix: Checking Your SVC Configuration

The following section provides examples of how to check the setup of an SVC and Violin Memory Array. It is not a complete list of commands or parameters for the commands. It also does not represent a ‘best practice’ configuration. It is intended to give the reader a view of some of the useful commands and their outputs along with an explanation.

Check to see how many nodes are in a cluster by using the `lsiogr` command

![Command Output]

```plaintext
IBM_2145:violin-svc:superuser>lsiogr
id name       node_count vdisk_count host_count
0  io_grp0     2           1          1
1  io_grp1     0           0          1
2  io_grp2     0           0          1
3  io_grp3     0           0          1
4  recovery_io_grp 0          0          0
IBM_2145:violin-svc:superuser>
```
This shows that we have one IO Group (2 nodes) and it has one host connected and one vDisk created. To see what the SVC has visibility of use the `lsfabric` command.

Currently, each Violin Memory Array connection shows up as a controller. The SVC has a 6000 and a 3000 attached; one has one fibre connected, the other has two fibres connected. Using the `lscontroller` command you see three controllers.

Checking the same configuration via the SVC GUI, three controllers are visible. The first controller has a single MDisk defined.
The second and third controllers are actually two paths to the same array. On this controller, there are eight LUNs that are defined as visible from the SVC and are in a storage pool.
Controller 3 is the second path to the same array as Controller 2. Note that no MDisks appear. This is normal; each MDisk should appear on one of the controllers, not necessarily all on the same one.

If there are two storage pools, both of which have the same disk type, EasyTier is inactive. Using the `lsmdiskgrp` command it is possible to check whether or not EasyTier is active for a pool.

Checking the MDisks by using an lsmdisk command, note the first MDisk has been defined as an SSD, whereas the rest are defined as normal HDDs.

When the SVC GUI checks the properties of ‘v3000-aix’, it is defined as a Solid-State Drive...
### Violin Memory Arrays With IBM System Storage SAN Volume Controller

#### MDisk Details: v3000-aix

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[www.vmem.com](http://www.vmem.com)
About Violin Memory

Violin Memory is pioneering a new class of high-performance flash-based storage systems that are designed to bring storage performance in-line with high-speed applications, servers and networks. Violin Flash Memory Arrays are specifically designed at each level of the system architecture starting with memory and optimized through the array to leverage the inherent capabilities of flash memory and meet the sustained high-performance requirements of business critical applications, virtualized environments and Big Data solutions in enterprise data centers. Specifically designed for sustained performance with high reliability, Violin’s Flash Memory Arrays can scale to petabytes of storage and millions of IOPS with low, predictable latency. Founded in 2005, Violin Memory is headquartered in Mountain View, California.

For more information about Violin Memory products, visit [www.vmem.com](http://www.vmem.com).