

Veritas CommandCentral™ — Supporting the Virtual Enterprise

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Contents

Executive summary	1
Veritas CommandCentral—supporting the virtual enterprise	1
Storage virtualization	2
Server virtualization	2
Veritas CommandCentral and storage virtualization	2
Veritas CommandCentral and server virtualization	4
Summary	5
Appendix: Virtual storage decomposition	5

Executive summary

Faced with exponential storage growth, increasing operational costs, data-center power and cooling limitations, and the need to provision and bring new applications online more rapidly to support critical business needs, many customers look to virtualization strategies to ease the management burden.

As IT organizations look to different server architectures (e.g., blade servers), customers will typically implement Linux® in a “farm” model and bring specific storage devices online to support this unique environment. A similar scenario occurs for many other Operating System platforms and applications throughout the data center, creating large pockets of underutilized resources. Additionally, most applications cannot keep up with the servers being deployed to support them or fully consume storage allocated to them. Servers configured with huge amounts of memory and dual, quad, or 32-instance partitioned CPUs often see large percentages of their resources sitting idle as the hosted application uses only a small proportion of the server resources. Multiplied by hundreds or thousands of servers and petabytes of storage across the enterprise, it is easy to see how the crisis of underutilized resources fuels virtualization adoption.

As customers adopt virtualization strategies, however, they discover that virtualization actually increases the complexities of storage management related to monitoring, reporting, and managing a virtual environment. With physical storage now separated by two or more degrees from the logical storage an application consumes, traditional storage management approaches are no longer valid. The task of understanding resources that applications depend on—which now traverses the virtualization layer—can be a daunting one for the storage administrator. Having the ability to decompose logical storage through the virtualization layer all the way back to one or more physical resources, including SAN connectivity, is imperative. This is the case not only for accurate root cause analysis (RCA) but, more importantly, for establishing and maintaining application service levels as well.

Veritas CommandCentral achieves these goals by addressing the demands and management complexities that virtualization presents. Virtualization, by definition, can apply to operating systems, applications and storage arrays. This paper will identify and briefly discuss the various virtualization categories, and it will demonstrate how Veritas CommandCentral can enable IT organizations to manage storage in the virtual enterprise.

Veritas CommandCentral—supporting the virtual enterprise

While there are several different implementations of virtualization, each can generally be placed in one of the following two categories:

- Storage virtualization—e.g., IBM SAN Volume Controller, HDS TagmaStor, NetApp V-Series
- Server virtualization—e.g., VMware, Xen, Solaris™ Logical Domains, IBM® Logical Partitions

Each of these areas can deliver value, but each can also increase storage management complexity. Fortunately, Veritas CommandCentral supports the decomposition of these virtual environments and helps IT organizations seamlessly manage the storage resources in both the physical and virtual environment.

Storage virtualization

Storage virtualization abstracts storage, separating out logical data access from physical access. It provides the bridge between one or more physical storage arrays, through one or more storage virtualization methods that present logical elements to the user/host. Storage virtualization typically employs a virtual LUN (vLUN) to mask its back-end physical complexity—effectively delivering storage as if it originated from a single device, even though several devices are actually being used. This practice presents a fundamental paradigm shift. Prior to the controller-based virtualization of Hitachi Data Systems TagmaStor or the appliance-based IBM SAN Volume Controller, it was an easy enough task to map an asset—such as an Oracle® table space—back to the physical disk in a given array. However, with the introduction of a vLUN, another layer of abstraction—and, consequently, complexity—is introduced. Traditional storage management solutions can no longer see the entire data path, from application to storage (LUN).

While storage virtualization masks the physical complexity to the end user, the storage management team requires deeper visibility of the entire path from host to virtual storage, as well as the capability to map the virtual storage to the physical storage devices. For administrators, manual tracking of physical to logical resource allocations is a daunting task. In many cases, administrators simply don't have the tools to correlate the outage of a back-end array LUN sitting behind a storage virtualization appliance to its potential impact on a business application.

Storage and server management solutions are required to provide the same levels of support to virtualized storage as for classic physical storage. Delivering solutions that provide full discovery and visibility, end-to-end resource mapping, monitoring, alerts, and reporting of virtual storage is critical to managing accurate capacity allocation/utilization levels—and, more importantly, to being able to provide root cause analysis to pinpoint the location of a potential interrupt that could impact or cause an application outage.

Server virtualization

There are many solutions that virtualize server resources (CPU, O/S, and application). The notion of running virtual machine(s) on a hypervisor is a method employed to increase the physical server utilization of an individual entity. However, management complexities arise from this virtual approach to delivering application services. Traditional storage management solutions see only the physical server (or, in the case of VMware, the entire ESX server) and have no insight into the applications running on virtual machines. Consequently, this additional layer of abstraction makes effective storage management impossible. The challenge for storage management teams is to understand what applications are running on virtual machines, when those virtual machines are moved from one physical server to another, and what storage resources are being consumed by each application (physical or virtual).

Veritas CommandCentral and storage virtualization

Symantec™ recognizes the virtualization trends that are being adopted in the industry and supports their requirements—such as managing resources centrally, standardizing processes to help lower management costs, increasing operational efficiencies, and maximizing resource utilization.

Currently, Veritas CommandCentral provides storage administrators with the tools they need to take charge of array- and NAS-based storage environments. It decomposes the entire physical data path, providing a comprehensive level of support, end-to-end discovery, mapping, monitoring, management, and reporting for array-based storage.

Veritas CommandCentral provides a comprehensive view into many characteristics and configurations related to heterogeneous storage devices:

- It discovers and maps array ports, LUNs and the ports they are bound to, LUN attributes including capacity, host masking tables, and physical disks that are unused or associated with a LUN and their capacities.
- Monitoring provides visibility into the health of every major array component and alerts on intermittent errors, failures, and environmental conditions such as battery states and temperature to help storage administrators maintain the operational readiness of the array— and performance statistics are monitored and measured to help determine loads and potential configuration issues that may impact performance.
- From the array, Veritas CommandCentral understands SAN connectivity and storage that may be directly attached to a host. It offers full data path visibility—from the array ports, outbound, into and out of the SAN switch and continuing to the HBA port at the host.
- I/O bandwidth is discovered from the HBA to the physical disk, while monitoring and reporting help to detect traffic bottlenecks and to understand read and write characteristics, caching states, and other metrics that may impact storage delivery to the host and the applications it supports.

Previous versions of Veritas CommandCentral supported NetApp and the Hitachi USP/NSC-based storage virtualization methods. This was done by mapping host-side storage allocations, used and unused capacities, the allocation of that storage to software virtualization applications, dual path configurations, assignments of storage to databases and applications from table space to the file systems, and their capacity utilization—including individual file types and the storage they consume.

Remember that we mentioned the paradigm shift related to mapping from a host-based LUN down to the physical disk where the data is actually written? Consider figure 1, which shows how an IBM SAN Volume Controller (SVC) takes back-end storage and presents virtual disks (LUNs) to a host. The diagram shows a host with storage allocated from an array storage virtualizer, such as the IBM SVC.

Notice that the Vendor 1 Array has created LUN 5 using physical disks 7 through 9. This LUN is exported—or masked—to the storage virtualizer, which takes LUN 5, assigns it to Managed Pool 1, and renames it as MD2 (managed disk). Similarly, the remainder of the LUNs from Vendors 1 and 2 have been masked to the storage virtualizer and assigned to Managed Pool 1, and renamed. Also note that the managed disks are segmented into smaller storage units referred to as extents.

Managed Pool 1 draws from all available extents across one or more managed disk-in the pool to create virtual disks that it exports out (or masks) to a host. The best mapping that can be provided, in this case, is to know that Vendor 1/2 VD1 came from Managed Pool 1 and was created with extents from Managed Disks 2, 3, and 4, which originated from two separate back-end arrays.

The paradigm shift is the realization, in the presence of a storage virtualizer, the inability to trace an asset like an Oracle table space back to the physical back-end array disk. Now, pieces of that asset are potentially scattered across multiple different vendors. Best practices call for the storage administrator to create a separate managed pool and allocate LUNs from a single vendor to a single separate managed pool. At least, this keeps the storage traceable back to one back-end array.

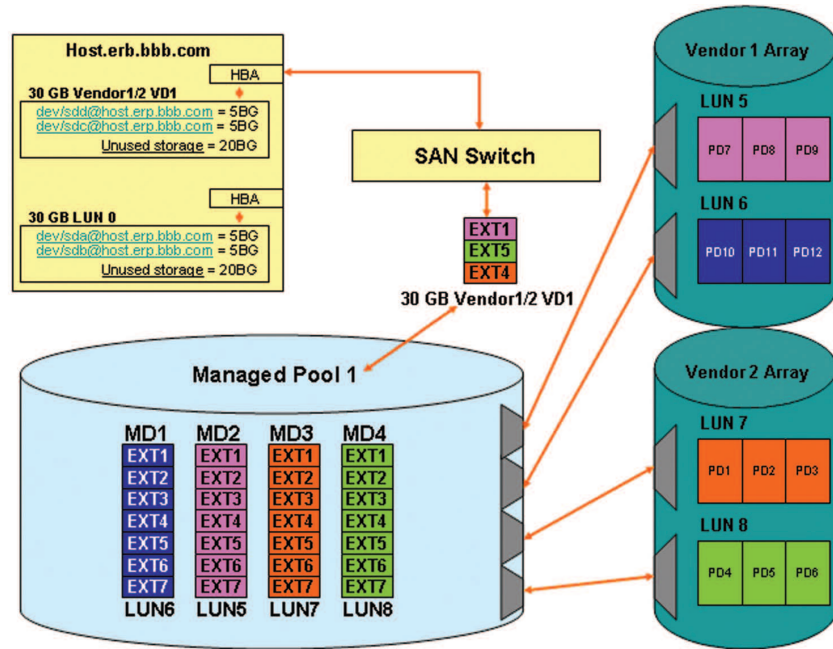


Figure 1. IBM SVC presents back-end storage as virtual disks (LUNs) to a host

Veritas CommandCentral and server virtualization

Veritas CommandCentral delivers automatic resource mapping for guest O/S to ESX server, discovery and mapping of storage pool capacities, RDM storage capacities and allocation to guests, and SAN fabric connectivity and zoning information. The previous version of Veritas CommandCentral provided these capabilities but required an agent on the VMware ESX.

Veritas CommandCentral delivers these capabilities without requiring an agent on the ESX server. CommandCentral leverages VMware Infrastructure interfaces to remotely discover ESX server resources. CommandCentral also integrates with Virtual Center to enable quick configuration of the VMware environment for discovery purposes.

Customers can still install the Veritas CommandCentral agent on a guest O/S instance running on a virtual machine, assuming that the O/S version is supported. Storage allocated to that virtual machine can be discovered, along with any applications including VM/ FS. In this instance, the storage is reported as direct-attached.

Summary

Veritas CommandCentral is an enterprise storage management solution that provides the ability to manage storage effectively not only in the physical environment, but in the virtual environment as well. As organizations evaluate different physical and virtual solutions, it is imperative to consider the management implications of server and storage virtualization. With Veritas CommandCentral, organizations can rest assured that Symantec will support the virtual enterprise.

Appendix: Virtual storage decomposition

This exercise demonstrates the unique ability of Veritas CommandCentral to trace virtual storage allocated to a host, from the virtual volume to the array storage virtualizer (in this case, an IBM SAN Volume Controller [SVC]), to the virtual storage pool within the SVC, and then out to the back-end physical storage array (in this case, a logical size expansion LUN [LUSE]) owned by a Hitachi 9960 storage array.

This exercise will then trace the LUSE LUN from the Hitachi storage array's LUN masking to show the allocation of the LUSE LUN to a storage array port owned by the IBM SVC. We will see this storage array port mapped to a storage view in the SVC that is associated with the host. This exercise begins to complete the extensive end-to-end mapping capabilities of Veritas CommandCentral.

In figure 2 below, Veritas CommandCentral presents a host storage view showing a device handle associated with a virtual LUN: HDS9960 VD1-4.

Host: hal-sunb100-2.veritas.com

Overview Connectivity Zoning Storage Volumes Projections Reporting Topology Monitoring Attributes

LUNs [Masked]

Rediscover Go

Name	Array	Capacity (GB)	Path Count	Has Device Handle	Is Based On External
HDS9960_VD1.4	halrmvsc	0.49	2	Yes	Yes
Total: 1		0.49		2	

Device Handles

Multi Pathing Operations Go

Device Handle	HBA Port	Storage Port	LUN Owner	LUN	Connection Protocol
/dev/rdisk/c374012@hal-sunb100-2	10000000C3390F7D	5005015800600147	5005015800600147	50.06.01.60.80.60.01.47.50.06.01.60.80	Fibre Channel
/dev/rdisk/c344212@hal-sunb100-2	10000000C3390F7D	50050788012009F9	halrmvsc	HDS9960_VD1.4	Fibre Channel
/dev/rdisk/c344212@hal-sunb100-2	10000000C3390F7D	50050788012009F9	halrmvsc	HDS9960_VD1.4	Fibre Channel
/dev/rdisk/c004012@hal-sunb100-2	10000000C3390F7D	5005078801200E73	halrmvsc	HDS9960_VD1.4	Fibre Channel
/dev/rdisk/c004012@hal-sunb100-2	10000000C3390F7D	5005078801200E73	halrmvsc	HDS9960_VD1.4	IDE
Total: 4					

Figure 2. Tracing virtual storage to a host

Figure 3 shows the virtual disk, HDS9960_VD1:4, assigned from a larger managed disk group (storage pool). The managed disk group comprises six managed disks—in this case, six HDS LUSE LUNs from HDS array 30646.

Note: Extent mappings are not shown due to a limitation in the SMI-S provider. Extent mapping will be supported in a future release of Veritas CommandCentral. For now, the SMI-S provider tells us that the virtual disk HDS9960_VD1:4 were created from extents from all of the managed disks in the managed disk group.

LUN: HDS9960_VD1:4

Overview Reporting Monitoring Attributes

Array: halibm23c LUN Capacity (GB): 0.49
Vendor Layout: Striped
Masking Status: Masked Binding Status: Bound
Vendor Device ID: 4

Managed Disk Groups

Managed Disk Group	Raw Capacity (GB)	Based on External	Overhead (GB)	Total Logical Capacity (GB)	Addressable (GB)	Available (GB)
HDS9960DG1	110.02	Yes	0.14	109.88	10.98	98.75
Total: 1	110.02		0.14	109.88	10.98	98.75

Managed Disks

Disk	Size (GB)	Configured (GB)	Backend LUN	External Port WWN	Backend Enclosure
HDS9960_D1	18.34	18.34	LUSE_OPEN-3:10:A8	500060E80277B614	30645
HDS9960_D2	18.34	18.34	LUSE_OPEN-3:10:A9	500060E80277B614	30645
HDS9960_D3	18.34	18.34	LUSE_OPEN-3:10:CA	500060E80277B614	30645
HDS9960_D4	18.34	18.34	LUSE_OPEN-3:10:BB	500060E80277B614	30645
HDS9960_D5	18.34	18.34	LUSE_OPEN-3:10:CB	500060E80277B614	30645
HDS9960_D6	18.34	18.34	LUSE_OPEN-3:10:DC	500060E80277B614	30645
Total: 6	110.02	110.02			

LUN Masking

Masked To	Masked By	Host	Device Handle
10000000C3290F70	hal-sunb100-2	hal-sunb100-2.veritas.com	/dev/rdisk/c-32862c2@hal-sunb100-2.veritas.com
10000000C3290F70	hal-sunb100-2	hal-sunb100-2.veritas.com	/dev/rdisk/c-3462c2@hal-sunb100-2.veritas.com
Total: 2			

Array Port Bindings

Array Port	SCSI LUN ID
0:1	2
Total: 1	

Figure 3. Virtual disk HDS9960_VD1:4

Continuing on, we follow one of the HSD LUSE LUNs back to the HDS array. Now, we will backtrack and trace this LUSE LUN from the back-end array perspective back to the host, where a part of this LUSE was used to create the HDS9960_VD4:1.

In figure 4, we can see the logical devices that were used to create the LUSE LUN. We can also see that this LUSE LUN was masked to a storage port WWN 50050768011009F9.

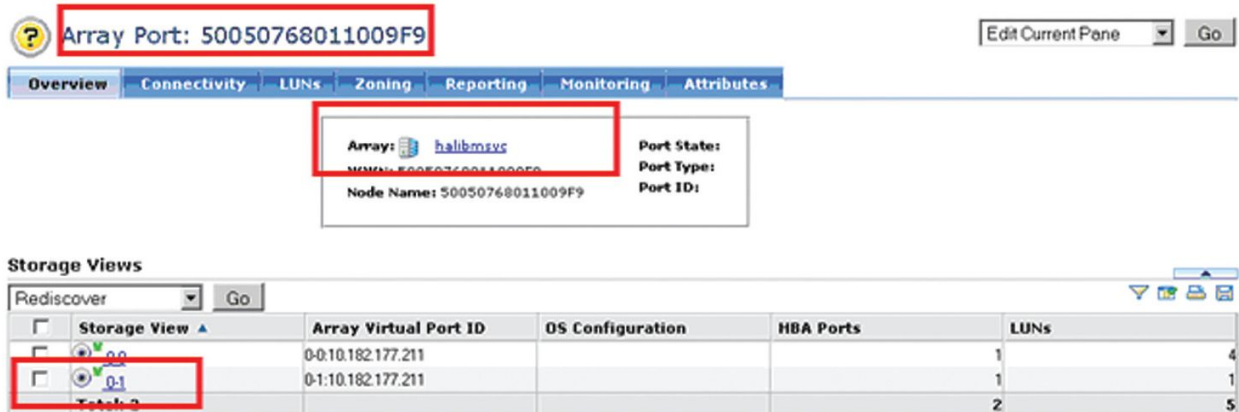


Figure 4. LUSE LUN detail

Clicking on the Masked To link in figure 4, we see that this is an array port part of the IBM SVC array, and we see that this array port has two storage views associated with it, as shown in figure 5.

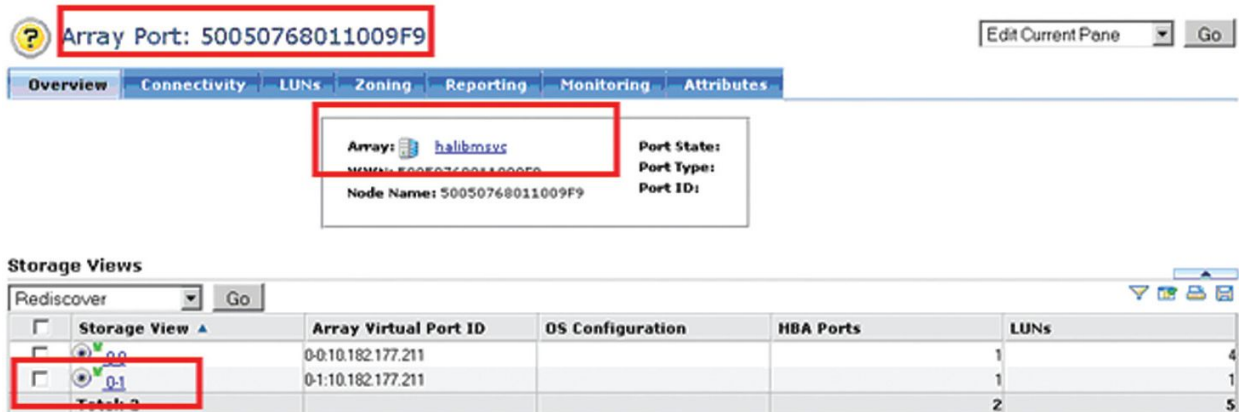


Figure 5. Array port detail

Clicking on Storage View 0-1, we see, in figure 6, a host associated with it. Note that this is the same host we started with at the beginning of this appendix. In figure 7, we have drilled into the HBA on that host and arrive back at the device handle, where we began to trace the virtual disk. This is a complete end-to-end mapping from a host, through a storage virtualizer, out to the back-end array and back again.

Storage View: 0-1 Edit Current Pane Go

Overview Reporting Attributes

Array: [halibmsvc](#) **Array Virtual Port ID:** 0-1:10.182.177.211
OS Configuration:

HBA Ports

Rediscover Go

Port	HBA	Host	Host OS Type	Fabric
10000000C9390F7D	Emulex Corporation 20000000C9390F7D	hal-sunb100-2.veritas.com	Solaris	
Total: 1				

HBA Port Groups

Rediscover Go

HBA Port Group	HBA Ports
hal-sunb100-2	1
Total: 1	

LUNs

Rediscover Go

LUN	Capacity (GB)	SCSI LUN ID
HDS9960 VD1-4	0.49	2
Total: 1		

Figure 6. Host associated with Storage View 0-1

HBA Port: 10000000C9390F7D Edit Current Pane Go

Overview Connectivity Zoning Reporting Monitoring Attributes

Host: [hal-sunb100-2.veritas.com](#) HBA: [Emulex Corporation 20000000C9390F7D](#)
 Port State: Online

Device Handles

Multi Pathing Operations Go

Device Handle	HBA	HBA Port	Storage Port	LUN	LUN Owner	Connection Protocol	Capacity (GB)
/dev/rdisk/c2442720	Emulex Corporation 20000000C9390F7D	10000000C9390F7D	50050768012009F9	HDS9960 VD1-4	halibmsvc	Fibre Channel	0.49
/dev/rdisk/c2740720	Emulex Corporation 20000000C9390F7D	10000000C9390F7D	5006016800600147	50 06 01 60 80 60 01 < 5006016080600147	halibmsvc	Fibre Channel	0.49
/dev/rdisk/c2842720	Emulex Corporation 20000000C9390F7D	10000000C9390F7D	5005076801200E73	HDS9960 VD1-4	halibmsvc	Fibre Channel	0.49
Total: 3							

HBA Port Groups

Rediscover Go

HBA Port Group	# of Ports	Array
hal-sunb100-2	1	halibmsvc
Total: 1		

Array Virtual Ports

Rediscover Go

Array Virtual Port	Array	Array Virtual Port ID	OS Configuration	Mapped LUNs
0-1	halibmsvc	0-1:10.182.177.211		1
Total: 1				

Figure 7 . Drilling into the host for the device handle

About Symantec

Symantec is a global leader in providing security, storage and systems management solutions to help consumers and organizations secure and manage their information-driven world. Our software and services protect against more risks at more points, more completely and efficiently, enabling confidence wherever information is used or stored.

For specific country offices and contact numbers, please visit our website.

Symantec World
Headquarters
20330 Stevens Creek Blvd.
Cupertino, CA 95014 USA
+1 (408) 517 8000
1 (800) 721 3934
www.symantec.com

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