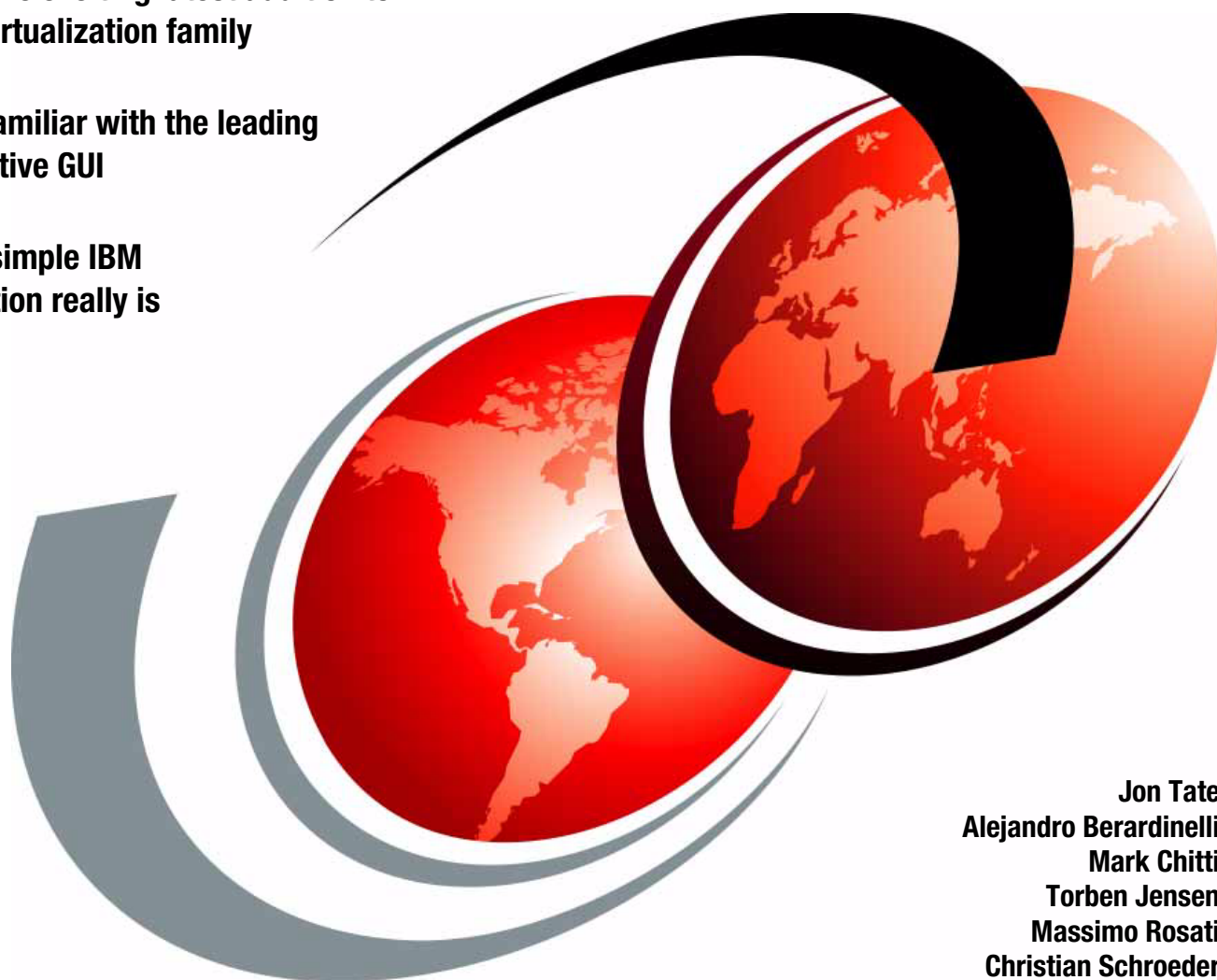


# Implementing the IBM Storwize V7000 V6.3

Discover the exciting latest addition to the IBM virtualization family

Become familiar with the leading edge intuitive GUI

See how simple IBM virtualization really is



Jon Tate  
Alejandro Berardinelli  
Mark Chitti  
Torben Jensen  
Massimo Rosati  
Christian Schroeder

**Redbooks**





International Technical Support Organization

**Implementing the IBM Storwize V7000 V6.3**

February 2012

**Note:** Before using this information and the product it supports, read the information in “Notices” on page ix.

## **Second Edition (February 2012)**

This edition applies to the IBM Storwize V7000 Version 6.3.0.

**Note:** This book is based on a pre-GA version of a product and may not apply when the product becomes generally available. Consult the product documentation or follow-on versions of this book for more current information.

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# Preface

Continuing its commitment to developing and delivering industry-leading storage technologies, IBM® introduces the IBM Storwize® V7000 solution, an innovative new storage offering that delivers essential storage efficiency technologies and exceptional ease of use and performance, all integrated into a compact, modular design that is offered at a competitive, midrange price.

The IBM Storwize V7000 solution incorporates some of the top IBM technologies typically found only in enterprise-class storage systems, raising the standard for storage efficiency in midrange disk systems. This cutting-edge storage system extends the comprehensive storage portfolio from IBM and can help change the way organizations address the ongoing information explosion.

This IBM Redbooks® publication introduces the features and functions of the IBM Storwize V7000 system through several examples. This book is aimed at pre- and post-sales technical support and marketing, storage administrators, and will help you understand the architecture of the Storwize V7000, how to implement it, and take advantage of the industry leading functions and features.

## The team who wrote this book

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Figure 1 Authors, L-R, Jon, Alejandro, Massimo, Torben, and Christian

This book was produced by a team of specialists from around the world working at Brocade Communications Systems, San Jose, and the International Technical Support Organization, San Jose, CA.

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# Summary of changes

This section describes the technical changes made in this edition of the book and in previous editions. This edition might also include minor corrections and editorial changes that are not identified.

Summary of Changes  
for SG24-7938-01  
for Implementing the IBM Storwize V7000 V6.3  
as created or updated on February 7, 2012.

## February 2012, Second Edition

This revision reflects the addition, deletion, or modification of new and changed information described below.

### **Changed information**

- ▶ All screen captures replaced with versions from Version 6.3.0
- ▶ Command examples changed





# **Overview of the IBM Storwize V7000 system**

This chapter provides an overview of the IBM Storwize V7000 architecture and includes a brief explanation of storage virtualization.

# 1.1 Storage virtualization

Storage virtualization, like server virtualization, is one of the foundations of building a flexible and reliable infrastructure solution that allows companies to better align their business and IT needs.

Storage virtualization allows an organization to implement pools of storage across physically separate disk systems (which might be from different vendors). Storage can then be deployed from these pools and can be migrated between pools without any outage of the attached host systems. Storage virtualization provides a single set of tools for advanced functions, such as instant copy and remote mirroring solutions, which means that deploying storage can be performed by using a single tool regardless of the underlying storage hardware.

Figure 1-1 shows a storage virtualization scenario.

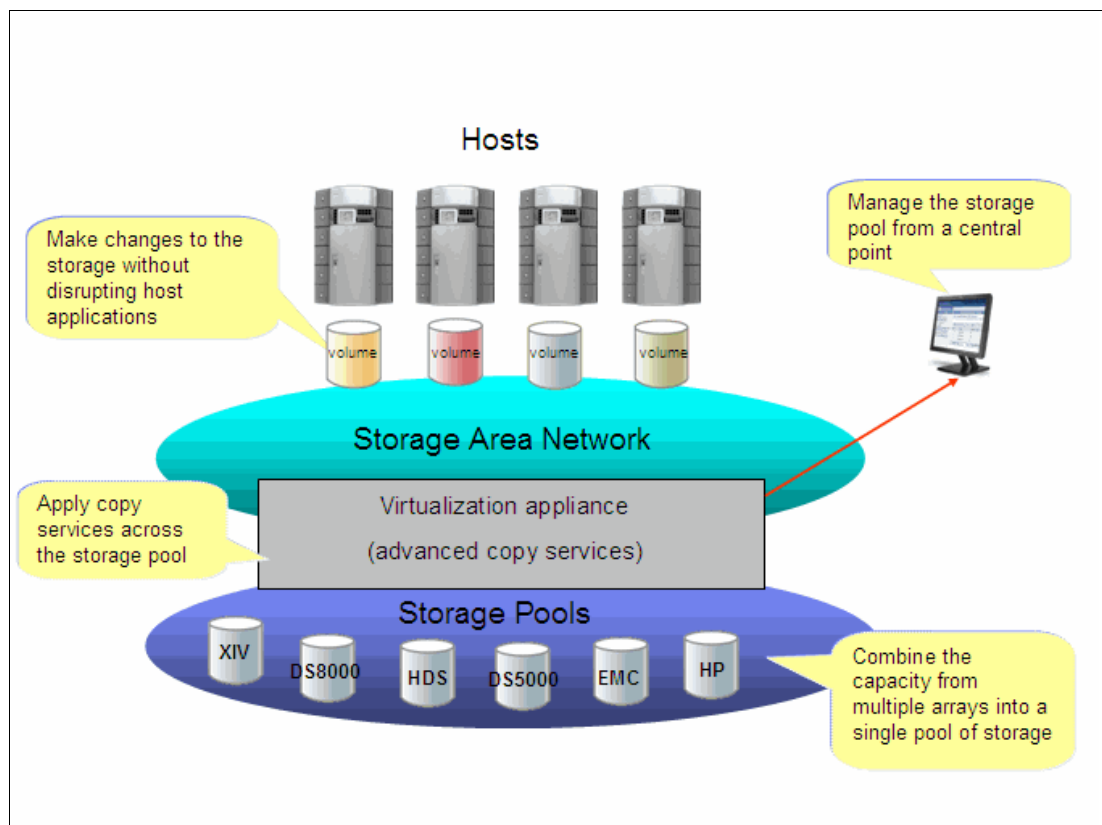


Figure 1-1 Storage virtualization

For a more detailed explanation of storage virtualization, see *Implementing the IBM System Storage SAN Volume Controller V6.1*, SG24-7933.

## 1.2 IBM Storwize V7000 overview

The IBM Storwize V7000 solution provides a modular storage system that includes the capability to virtualize external SAN-attached storage and its own internal storage. The IBM Storwize V7000 solution is built upon the IBM SAN Volume Controller technology base and uses technology from the IBM System Storage DS8000 family.

An IBM Storwize V7000 system provides a number of configuration options that are aimed at simplifying the implementation process. It also provides automated wizards, called *Directed Maintenance Procedures (DMP)*, to assist in resolving any events that might occur. An IBM Storwize V7000 system is a clustered, scalable, and midrange storage system, and an external virtualization device.

Figure 1-2 shows the IBM Storwize V7000 high-level overview.

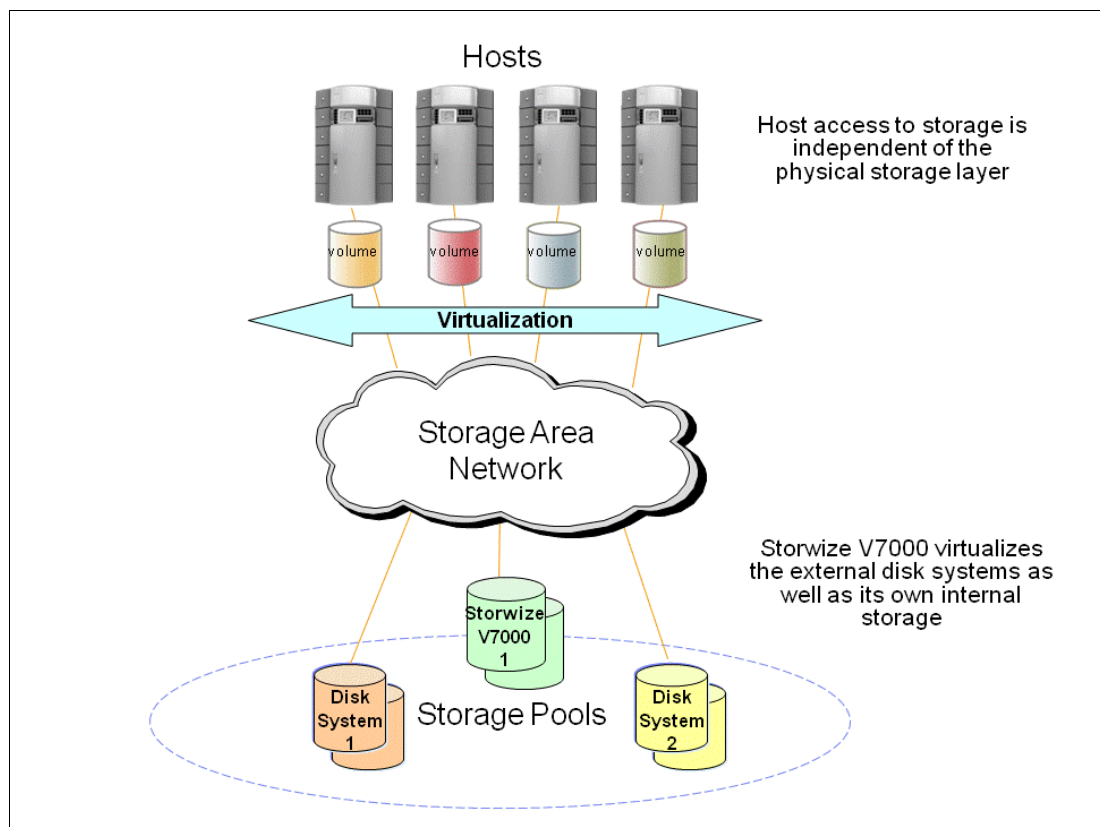


Figure 1-2 IBM Storwize V7000 overview

Included with an IBM Storwize V7000 system is a simple and easy to use graphical user interface (GUI) that is designed to allow storage to be deployed quickly and efficiently. The GUI runs on the IBM Storwize V7000 system, so there is no need for a separate console. The management GUI contains a series of preestablished configuration options called *presets* that use commonly used settings to quickly configure objects on the system. Presets are available for creating volumes and IBM FlashCopy® mappings and for setting up a RAID configuration.

The IBM Storwize V7000 solution provides a choice of up to 240 x 3.5-inch or 480 x 2.5-inch Serial Attached SCSI (SAS) drives for the internal storage and uses SAS cables and connectors to attach to the optional expansion enclosures.

When virtualizing external storage arrays, an IBM Storwize V7000 system can provide up to 32 PB of usable capacity. An IBM Storwize V7000 system supports a range of external disk systems similar to what the SAN Volume Controller supports today.

The IBM Storwize V7000 solution consists of a one or two control enclosures and, optionally, up to 18 expansion enclosures (and supports the intermixing of the different expansion enclosures). Within each enclosure are two canisters. Control enclosures contain two node canisters, and expansion enclosures contain two expansion canisters.

## 1.3 IBM Storwize V7000 terminology

The IBM Storwize V7000 system has introduced some new terminology, which is defined in Table 1-1.

*Table 1-1 IBM Storwize V7000 terminology*

<b>IBM Storwize V7000 term</b>	<b>Definition</b>
Chain	A set of enclosures that are attached to provide redundant access to the drives that are inside the enclosures. Each control enclosure can have one or more chains.
Clone	A copy of a volume on a server at a particular point in time. The contents of the copy can be customized while the contents of the original volume are preserved.
Control enclosure	A hardware unit that includes the chassis, node canisters, drives, and power sources that include batteries.
Event	An occurrence that is significant to a task or system. Events can include completion or failure of an operation, a user action, or the change in the state of a process.
Expansion canister	A hardware unit that includes the serial-attached SCSI (SAS) interface hardware that enables the node hardware to use the drives of the expansion enclosure.
Expansion enclosure	A hardware unit that includes expansion canisters, drives, and power sources that do not include batteries.
External storage	Managed disks (MDisks) that are Small Computer Systems Interface (SCSI) logical units presented by storage systems that are attached to and managed by the clustered system.
Host mapping	The process of controlling which hosts have access to specific volumes within a clustered system.
Internal storage	Array managed disks (MDisks) and drives that are held in enclosures and nodes that are part of the clustered system.
Lane	A single SAS channel.
Managed disk (MDisk)	A component of a storage pool that is managed by a clustered system. An MDisk is either part of a RAID array of internal storage or a Small Computer System Interface (SCSI) logical unit (LU) for external storage. An MDisk is not visible to a host system on the storage area network.
Node canister	A hardware unit that includes the node hardware, fabric and service interfaces, and serial-attached SCSI (SAS) expansion ports.

IBM Storwize V7000 term	Definition
PHY	A single SAS lane. There are four PHYs in each SAS cable.
Quorum disk	A disk that contains a reserved area that is used exclusively for cluster management. The quorum disk is accessed when it is necessary to determine which half of the cluster continues to read and write data. Quorum disks can either be MDisks or internal drives.
Snapshot	An image backup type that consists of a point-in-time view of a volume.
Storage pool	A collection of storage capacity that provides the capacity requirements for a volume.
Strand	The serial-attached SCSI (SAS) connectivity of a set of drives within multiple enclosures. The enclosures can be either control enclosures or expansion enclosures.
Thin provisioning or thin provisioned	The ability to define a storage unit (full system, storage pool, or volume) with a logical capacity size that is larger than the physical capacity assigned to that storage unit.
Volume	A discrete unit of storage on disk, tape, or other data recording medium that supports some form of identifier and parameter list, such as a volume label or input/output control.

### 1.3.1 IBM Storwize V7000 models

The IBM Storwize V7000 platform consists of enclosures and drives. Each enclosure contains two canisters that, although they can be replaced independently, are seen as part of the enclosure.

**Additional IBM Storwize V7000 information:** For the most up-to-date information about the features, benefits, and specifications of IBM Storwize V7000 models, see the following address:

[http://www-03.ibm.com/systems/storage/disk/storwize\\_v7000/index.html](http://www-03.ibm.com/systems/storage/disk/storwize_v7000/index.html)

The information in this book is valid at the time of writing, but as the IBM Storwize V7000 matures, expect to see new features and enhanced specifications.

The IBM Storwize V7000 models are described in Table 1-2.

Table 1-2 IBM Storwize V7000 models

Model	Cache	FC / iSCSI / SAS ports	Drive slots	Power supply
2076-112 (with two node canisters)	16 GB	8x8 Gb / 4x1 Gb / 4x6 Gb	12 x 3.5-inch	Integrated dual power supplies with battery backup
2076-124 (with two node canisters)	16 GB	8x8 Gb / 4x1 Gb / 4x6 Gb	24 x 2.5-inch	Integrated dual power supplies with battery backup

Model	Cache	FC / iSCSI / SAS ports	Drive slots	Power supply
2076-312 (with two node canisters)	16 GB	8x8 Gb / 4x1 Gb+4x10Gb / 4x6 Gb	12 x 3.5-inch	Integrated dual power supplies with battery backup
2076-324 (with two node canisters)	16 GB	8x8 Gb / 4x1 Gb+4x10Gb / 4x6 Gb	24 x 2.5-inch	Integrated dual power supplies with battery backup
2076-212 (with two expansion canisters)	N/A	-- / -- / 4x6 Gb	12 x 3.5-inch	Integrated dual power supplies
2076-224 (with two expansion canisters)	N/A	-- / -- / 4x6 Gb	24 x 2.5-inch	Integrated dual power supplies

Figure 1-3 shows the front view of the 2076-112, 212, and 312 enclosures.



Figure 1-3 IBM Storwize V7000 front view for 2076-112, 212, and 312 enclosures

The drives are positioned in four columns of three horizontal mounted drive assemblies. The drive slots are numbered 1 - 12, starting at upper left and going left to right, top to bottom.

Figure 1-4 shows the front view of the 2076-124, 224, and 324 enclosures.



Figure 1-4 IBM Storwize V7000 front view for 2076-124, 224, and 324 enclosures

The drives are positioned in one row of 24 vertically mounted drive assemblies. The drive slots are numbered 1 - 24, starting from the left. (There is a vertical center drive bay molding between slots 12 and 13).

### 1.3.2 IBM Storwize V7000 attributes

For a complete and updated list of IBM Storwize V7000 configuration limits and restrictions, see the following address:

<http://www-01.ibm.com/support/docview.wss?uid=ssg1S1003902>



### 1.3.3 IBM Storwize V7000 functions

The following functions are available with IBM Storwize V7000:

- ▶ Thin provisioning (No license required)

Traditional fully allocated volumes allocate real physical disk capacity for an entire volume even if that capacity is never used. Thin-provisioned volumes allocate real physical disk capacity only when data is written to the logical volume.

- ▶ Volume mirroring (No license required)

Provides a single volume image to the attached host systems while maintaining pointers to two copies of data in separate storage pools. Copies can be on separate disk storage systems that are being virtualized. If one copy failing, IBM Storwize V7000 provides continuous data access by redirecting I/O to the remaining copy. When the copy becomes available, automatic resynchronization occurs.

- ▶ FlashCopy (included with the base IBM Storwize V7000 license)

Provides a volume level point-in-time copy function for any storage being virtualized by IBM Storwize V7000. This function is designed to create copies for backup, parallel processing, testing, and development, and have the copies available almost immediately.

IBM Storwize V7000 includes the following FlashCopy functions:

- Full / Incremental copy

This function copies only the changes from either the source or target data since the last FlashCopy operation and is designed to enable completion of point-in-time online backups much more quickly than using traditional FlashCopy.

- Multitarget FlashCopy

IBM Storwize V7000 supports copying of up to 256 target volumes from a single source volume. Each copy is managed by a unique mapping and, in general, each mapping acts independently and is not affected by other mappings sharing the source volume.

- Cascaded FlashCopy

This function is used to create copies of copies and supports full, incremental, or nocopy operations.

- Reverse FlashCopy

This function allows data from an earlier point-in-time copy to be restored with minimal disruption to the host.

- FlashCopy nocopy with thin provisioning

This function provides a combination of using thin-provisioned volumes and FlashCopy together to help reduce disk space requirements when making copies. There are two variations of this option:

- Space-efficient source and target with background copy

Copies only the allocated space.

- Space-efficient target with no background copy

Copies only the space used for changes between the source and target and is generally referred to as “snapshots”.

This function may be used with multi-target, cascaded, and incremental FlashCopy.

- Consistency groups

Consistency groups address the issue where application data is on multiple volumes. By placing the FlashCopy relationships into a consistency group, commands can be issued against all of the volumes in the group. This action enables a consistent point-in-time copy of all of the data, even though it might be on a physically separate volume.

FlashCopy mappings can be members of a consistency group, or they can be operated in a stand-alone manner, that is, not as part of a consistency group. FlashCopy commands can be issued to a FlashCopy consistency group, which affects all FlashCopy mappings in the consistency group, or to a single FlashCopy mapping if it is not part of a defined FlashCopy consistency group.

- ▶ Metro Mirror (licensed based on the number of enclosures and includes both Metro and Global Mirror)

Provides a synchronous remote mirroring function up to approximately 300 km between sites. As the host I/O only completes after the data is cached at both locations, performance requirements might limit the practical distance. Metro Mirror is designed to provide fully synchronized copies at both sites with zero data loss after the initial copy is completed.

Metro Mirror can operate between multiple IBM Storwize V7000 systems.

- ▶ Global Mirror (licensed based on capacity being mirrored and includes both Metro and Global Mirror)

Provides long distance asynchronous remote mirroring function up to approximately 8,000 km between sites. With Global Mirror, the host I/O completes locally and the changed data is sent to the remote site later. This function is designed to maintain a consistent recoverable copy of data at the remote site, which lags behind the local site.

Global Mirror can operate between multiple IBM Storwize V7000 systems.

- ▶ Data Migration (no charge for temporary usage)

IBM Storwize V7000 provides a data migration function that can be used to import external storage systems into the IBM Storwize V7000 system.

It allows you to:

- Move volumes nondisruptively onto a newly installed storage system
- Move volumes to rebalance a changed workload
- Migrate data from other back-end storage to IBM Storwize V7000 managed storage

- ▶ IBM System Storage Easy Tier® (no charge)

Provides a mechanism to seamlessly migrate hot spots to the most appropriate tier within the IBM Storwize V7000 solution. This migration could be to internal drives within IBM Storwize V7000 or to external storage systems that are virtualized by IBM Storwize V7000.

This function is shown in Figure 1-5.

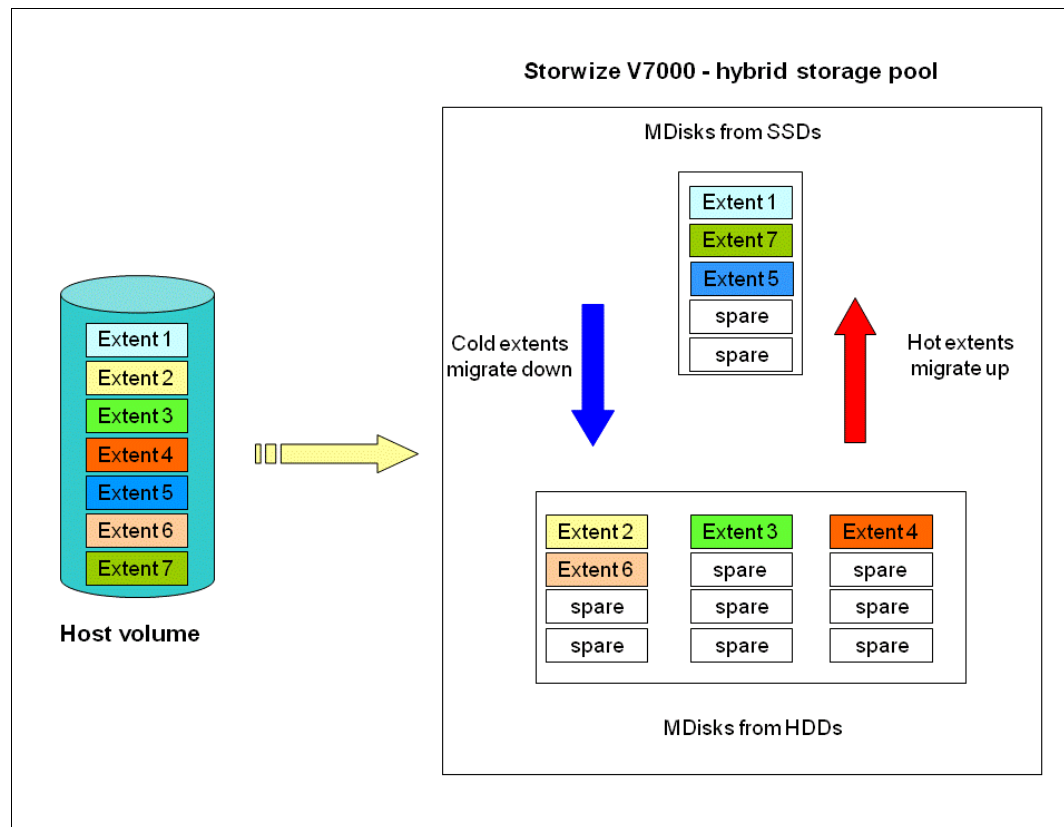


Figure 1-5 Easy Tier overview

### 1.3.4 IBM Storwize V7000 licensing

IBM Storwize V7000 might require the following licenses:

- ▶ Enclosure
- ▶ External Virtualization
- ▶ Remote Copy (Advanced Copy Services: Metro Mirror / Global Mirror)

Table 1-3 gives a summary of all the licenses that might be required.

Table 1-3 Licenses that might be required

License type	Unit	License number	License required?
Enclosure	Base+expansion Physical Enclosure Number	5639-VM1	Yes
External Virtualization	Physical Enclosure Number Of External Storage	5639-EV1	Optional
Remote Copy	Physical Enclosure Number	5639-RM1	Optional
FlashCopy	N/A	N/A	No
Volume Mirroring	N/A	N/A	No

License type	Unit	License number	License required?
Thin Provisioning	N/A	N/A	No
Volume Migration	N/A	N/A	No
Easy Tier	N/A	N/A	No

**Migration:** If the Storwize V7000 is used as a general migration tool, then the appropriate External Virtualization licenses must be ordered. The only exception is if you want to migrate existing data from external storage to IBM Storwize V7000 internal storage; you can temporarily configure your External Storage license for use within 45 days. For a more-than-45-day migration requirement from external storage to IBM Storwize V7000 internal storage, the appropriate External Virtualization license must be ordered.

## 1.4 IBM Storwize V7000 hardware

The IBM Storwize V7000 solution is a modular storage system that is built on a common enclosure (control enclosure and expansion enclosure) that is Storage Bridge Bay (SBB) compliant.

SBB is a specification created by a non-profit working group that defines a mechanical and electrical interface between a passive backplane drive array and the electronics packages that give the array its “personality”.

Figure 1-6 shows an overview of the hardware components of the IBM Storwize V7000 solution.

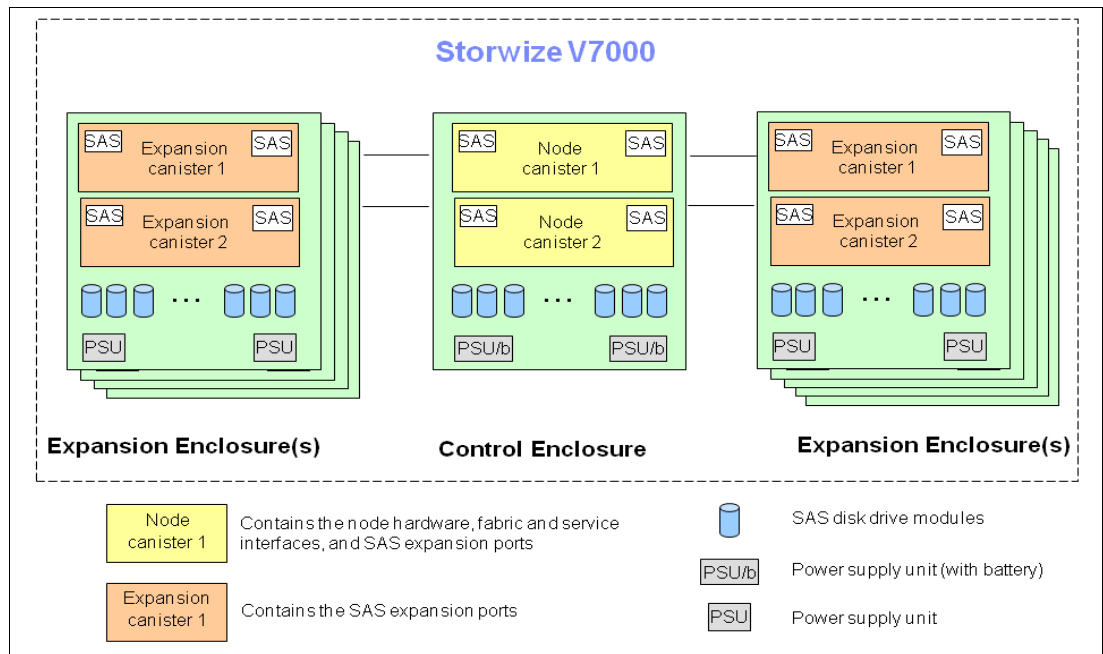


Figure 1-6 IBM Storwize V7000 hardware components

Figure 1-7 shows the controller rear view of models 112 and 124.

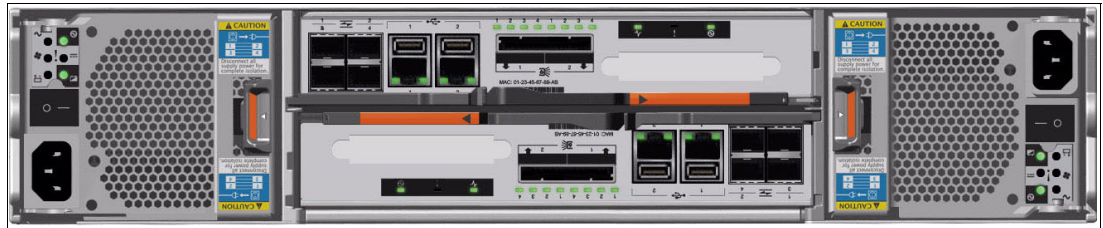


Figure 1-7 IBM Storwize V7000 controller rear view - models 112 and 124

There are two power supply slots, on the extreme left and extreme right, each taking up the full 2EIA height. The left slot is power supply 1, the right slot is power supply 2. The power supplies are inserted different ways up. Power supply 1 appears the correct way up, and power supply 2 upside down.

There are two *canister* slots, one above the other, in the middle of the chassis. The top slot is canister 1, the bottom slot canister 2. The canisters are inserted different ways up. Canister 1 appears the correct way up, and canister 2 upside down.

The new models, 312 and 324, look similar, but they have two 10 Gb Ethernet ports for use with iSCSI, as shown in Figure 1-8.

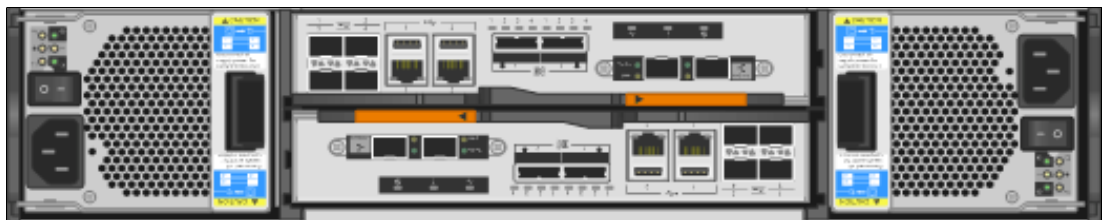


Figure 1-8 IBM Storwize V7000 controller rear view - models 312 and 324

## 1.4.1 Control enclosure

### IBM Storwize V7000 scalability:

All systems running Version 6.1.0.7 support is enabled for up to five enclosures.

For all systems running Version 6.1.0.7 or later, support is enabled for up to 10 enclosures.

For all systems running Version 6.2.0 or later with two controller enclosures, support is enabled for up to 20 enclosures.

Any software upgrade is concurrent and does not affect any application downtime.

Each IBM Storwize V7000 system has one or two (optional) control enclosures that contain two *node canisters* each, disk drives, and two power supplies. There are four models of the control enclosure with two models providing 12 3.5-inch disk slots and the other two models providing 24 2.5-inch disk slots. Two models (312 and 324) providing four 10Gb Ethernet ports for use with iSCSI.

Within a control enclosure, each power supply unit (PSU) contains a battery. The battery is designed to enable the IBM Storwize V7000 system to perform a memory dump of the cache to internal disks in the event of both power inputs failing.

**PSUs:** The power supply units for the control enclosure and expansion enclosure are not interchangeable

The two nodes act as a single processing unit and form an I/O group that is attached to the SAN fabric. The pair of nodes is responsible for serving I/O to a given volume.

The two nodes provide a highly available fault-tolerant controller so that if one node fails the surviving node automatically takes over. Nodes are deployed in pairs called *I/O groups*.

With the optional second controller, you have two I/O groups.

One node is designated as the configuration node, but each node in the control enclosures and in the I/O groups holds a copy of the control enclosure state information.

The terms *node canister* and *node* are used interchangeably throughout this book.

Figure 1-9 shows a single node canister.



Figure 1-9 A single canister for controller models 112 or 124

There are four Fibre Channel ports on the left side of the canister. They are in a block of four in two rows of two connectors. The ports are numbered 1 - 4, from left to right, top to bottom. The ports operate at 2, 4, or 8 Gbps. Use of the ports is optional. There are two green LEDs associated with each port: the speed LED and link activity LED.

There are two 10 / 100 / 1000 Mbps Ethernet ports side by side on the canister. They are numbered 1 on the left and 2 on the right. Using port 1 is required; port 2 is optional. There are two LEDs associated with each Ethernet port. The 2076 models 312 or 324 have four additional 10 Gb Ethernet ports (two per canister) for use with iSCSI.

There are two USB 2.0 ports side by side on the canister. They are numbered 1 on the left and 2 on the right. Use of the connectors is optional. The only defined usage is with USB flash drives, which is described in Chapter 2, “Initial configuration” on page 35.

There are two 6 Gbps SAS ports side by side on the canister. They are numbered 1 on the left and 2 on the right. These ports are used to connect to the optional expansion enclosures.

## 1.4.2 Expansion enclosure

The optional expansion enclosure contains two *expansion canisters*, disk drives, and two power supplies. There are two models of the control enclosure with one model providing 12 disk slots and the other providing 24 disk slots.

Figure 1-10 shows the expansion enclosure.



Figure 1-10 Expansion enclosure

The expansion enclosure power supplies are similar to the control enclosure but do not contain the battery. There is a single power lead connector on the power supply unit. The PSU has an IEC C14 socket and the mains connection cable has a C13 plug.

Each expansion canister provides two SAS interfaces that are used to connect to the control enclosure and any optional expansion enclosures. The ports are numbered 1 on the left and 2 on the right. SAS port 1 is the IN port and SAS port 2 is the OUT port. There is also a symbol printed above the SAS ports to identify whether it is an IN or an OUT port.

Use of the SAS connector 1 is mandatory, as the expansion enclosure must be attached to either a control enclosure or another expansion enclosure. SAS connector 2 is optional, as it is used to attach to additional expansion enclosures.

Each port connects four PHYs (ports of SAS drive). There is an LED associated with each PHY in each port (eight LEDs in total). The LEDs are green and are next to the ports, and for each port they are numbered 1 through 4. The LED indicates activity on the PHY.

Figure 1-11 shows an expansion canister.



Figure 1-11 A single expansion canister

### 1.4.3 Disk drive types

IBM Storwize V7000 enclosures currently support SSD, SAS, and Nearline SAS drive types. Each SAS drive has two ports (two PHYs) and I/O can be issued down both paths simultaneously.

Table 1-4 shows the IBM Storwize V7000 Disk Drive types that are available at the time of writing.

Table 1-4 IBM Storwize V7000 Disk Drive types

Drive type		Speed	Size
2.5-inch form factor	Solid-state disk	N/A	200, 300, and 400 GB
2.5-inch form factor	SAS	10,000 rpm	300,450, and 600 GB
2.5-inch form factor	SAS	15,000 rpm	146 and 300 GB
2.5-inch form factor	Nearline SAS	7,200 rpm	1 TB
3.5-inch form factor	Nearline SAS	7,200 rpm	2 and 3 TB

## 1.5 IBM Storwize V7000 components

The IBM Storwize V7000 is an entry / midrange virtualization RAID storage subsystem. It has the following benefits:

- ▶ Brings enterprise technology to entry / midrange storage
- ▶ Specialty administrators are not required
- ▶ Easy client setup and service
- ▶ Ability to grow the system incrementally as storage capacity and performance needs change
- ▶ Multiple storage tiers in a single system with nondisruptive migration between them
- ▶ Simple integration into the server environment

The IBM Storwize V7000 subsystem consists of a set of drive enclosures. Control enclosures contain disk drives and two nodes (an I/O group), which are attached to the SAN fabric. Expansion enclosures contain drives and are attached to control enclosures.

The simplest use of the IBM Storwize V7000 is as a traditional RAID subsystem. The internal drives are configured into RAID arrays and virtual disks created from those arrays.

The IBM Storwize V7000 can also be used to virtualize other storage controllers, as described in Chapter 9, “External storage virtualization” on page 333.

The IBM Storwize V7000 supports regular and solid-state drives and uses IBM System Storage Easy Tier to automatically place volume hot spots on better-performing storage.

### 1.5.1 Hosts

A host system is a server that is connected to IBM Storwize V7000 through a Fibre Channel connection or through an iSCSI connection.



Hosts are defined to IBM Storwize V7000 by identifying their worldwide port names (WWPNs) for Fibre Channel hosts. For iSCSI hosts, they are identified by using their iSCSI names. The iSCSI names can either be iSCSI qualified names (IQNs) or extended unique identifiers (EUIs).

## 1.5.2 Nodes

IBM Storwize V7000 can have two or four hardware components called nodes or node canisters that provide the virtualization of internal and external volumes, and cache and copy services (Remote Copy) functions. A clustered system consists of a one or two node pairs.

One of the nodes within the system is known as the configuration node and it is the node that manages configuration activity for the clustered system. If this node fails, the system nominates another node to become the configuration node.

## 1.5.3 I/O groups

Within IBM Storwize V7000, there are one or two pair of node canisters known as *I/O groups*. The IBM Storwize V7000 supports four node canisters in the clustered system, which provides two I/O groups.

When a host server performs I/O to one of its volumes, all the I/Os for a specific volume are directed to the I/O group. Also, under normal conditions, the I/Os for that specific volume are always processed by the same node within the I/O group.

Both nodes of the I/O group act as preferred nodes for their own specific subset of the total number of volumes that the I/O group presents to the host servers (a maximum of 2048 volumes). However, both nodes also act as a failover node for its partner node within the I/O group, so a node takes over the I/O workload from its partner node, if required, with no impact to the server's application.

In a Storwize V7000 environment, using active-active architecture, the I/O handling for a volume can be managed by both nodes of the I/O group. Therefore, it is mandatory for servers that are connected through Fibre Channel connectors to use multipath device drivers to be able to handle this capability.

The Storwize V7000 I/O groups are connected to the SAN so that all application servers accessing volumes from the I/O group have access to them. Up to 512 host server objects can be defined in two I/O groups.

**Important:** The active / active architecture provides availability to process I/Os for both controller nodes and allows the application to continue running smoothly, even if the server has only one access route or path to the storage controller. This type of architecture eliminates the path / LUN thrashing typical of an active / passive architecture.

## 1.5.4 Clustered system

A clustered system consists of one or two pairs of nodes. All configuration, monitoring, and service tasks are performed at the system level and the configuration settings are replicated across all node canisters in the clustered system. To facilitate these tasks, one or two management IP addresses are set for the system.

There is a process provided to back up the system configuration data on to disk so that the clustered system can be restored in the event of a disaster. This method does not back up application data, only Storwize V7000 system configuration information.

**System configuration backup:** After backing up the system configuration, save the backup data on your hard disk (or at the least outside of the SAN). If you are unable to access the Storwize V7000, you do not have access to the backup data if it is on the SAN.

For the purposes of remote data mirroring, two or more clustered systems (IBM Storwize V7000 systems or SAN Volume Controller systems starting from Version 6.3) must form a partnership before creating relationships between mirrored volumes.

**Important:** Starting with IBM Storwize V7000 6.3, a new parameter has been introduced named **layer**, it can be changed by running **chsystem** using the CLI only. The default is the storage layer, and you must change it to **replication** if you need to set up a copy services relationship between the IBM Storwize V7000 and the SAN Volume Controller.

One node is designated as the configuration node canister and it is the only node that activates the system IP address. If the configuration node canister fails, the system chooses a new configuration node and the new configuration node takes over the system IP addresses.

The system can be configured using either the IBM Storwize V7000 management software, the command-line interface (CLI), or through an application that uses the IBM Storwize V7000 CIMOM (IBM Tivoli Storage Productivity Center). IBM Systems Director also provides flexible server and storage management capability.

## 1.5.5 RAID

The Storwize V7000 setup contains a number of internal drive objects, but these drives cannot be directly added to storage pools. The drives need to be included in a Redundant Array of Independent Disks (RAID) to provide protection against the failure of individual drives.

These drives are referred to as members of the array. Each array has a RAID level. RAID levels provide different degrees of redundancy and performance, and have different restrictions regarding the number of members in the array.

IBM Storwize V7000 supports hot spare drives. When an array member drive fails, the system automatically replaces the failed member with a hot spare drive and rebuilds the array to restore its redundancy. Candidate and spare drives can be manually exchanged with array members.

Each array has a set of goals that describe the wanted location and performance of each array. A sequence of drive failures and hot spare takeovers can leave an array unbalanced, that is, with members that do not match these goals. The system automatically rebalances such arrays when the appropriate drives are available.

The available RAID levels are:

- ▶ RAID 0 (striping, no redundancy)
- ▶ RAID 1 (mirroring between two drives)
- ▶ RAID 5 (striping, can survive one drive fault)
- ▶ RAID 6 (striping, can survive two drive faults)
- ▶ RAID 10 (RAID 0 on top of RAID 1)

RAID 0 arrays stripe data across the drives. The system supports RAID 0 arrays with just one member, which is similar to traditional JBOD attach. RAID 0 arrays have no redundancy, so they do not support hot spare takeover or immediate exchange. A RAID 0 array can be formed by one to eight drives.

RAID 1 arrays stripe data over mirrored pairs of drives. A RAID 1 array mirrored pair is rebuilt independently. A RAID 1 array can be formed by two drives only.

RAID 5 arrays stripe data over the member drives with one parity strip on every stripe. RAID 5 arrays have single redundancy. The parity algorithm means that an array can tolerate no more than one member drive failure. A RAID 5 array can be formed by 3 to 16 drives.

RAID 6 arrays stripe data over the member drives with two parity stripes (known as the P-parity and the Q-parity) on every stripe. The two parity strips are calculated using different algorithms, which give the array double redundancy. A RAID 6 array can be formed by 5 to 16 drives.

RAID 10 arrays have single redundancy. Although they can tolerate one failure from every mirrored pair, they cannot tolerate two-disk failures. One member out of every pair can be rebuilding or missing at the same time. A RAID 10 array can be formed by 2 to 16 drives.

## 1.5.6 Managed disks

A managed disk (MDisk) refers to the unit of storage that IBM Storwize V7000 virtualizes. This unit could be a logical volume on an external storage array presented to the IBM Storwize V7000 or a RAID array consisting of internal drives. The IBM Storwize V7000 can then allocate these MDisks into various storage pools.

An MDisk is not visible to a host system on the storage area network, as it is internal or only zoned to the IBM Storwize V7000 system.

An MDisk has four modes:

- ▶ Array

Array mode MDisks are constructed from drives using the RAID function. Array MDisks are always associated with storage pools.

- ▶ Unmanaged

Unmanaged MDisks are not being used by the system. This situation might occur when an MDisk is first imported into the system, for example.

- ▶ Managed

Managed MDisks are assigned to a storage pool and provide extents so that volumes can use it.

- ▶ Image

Image MDisks are assigned directly to a volume with a one-to-one mapping of extents between the MDisk and the volume. This situation is normally used when importing logical volumes into the clustered system that already have data on them, which ensures that the data is preserved as it is imported into the clustered system.

## 1.5.7 Quorum disks

A quorum disk is a managed disk (MDisk) that contains a reserved area for use exclusively by the system. In the Storwize V7000, internal drives can be considered as quorum candidates. The clustered system uses quorum disks to break a tie when exactly half the nodes in the system remain after a SAN failure.

The clustered system automatically forms the quorum disk by taking a small amount of space from a managed disk (MDisk). It allocates space from up to three different MDisks for redundancy, although only one quorum disk is active.

If the environment has multiple storage systems, then to avoid the possibility of losing all of the quorum disks because of a failure of a single storage system, you should allocate the quorum disk on different storage systems. It is possible to manage the quorum disks by using the CLI.

## 1.5.8 Storage pools

A storage pool is a collection of MDisks (up to 128) that are grouped together to provide capacity for volumes. All MDisks in the pool are split into extents with the same size. Volumes are then allocated out of the storage pool and are mapped to a host system.

**Storwize V7000 object names:** The names must begin with a letter, which cannot be numeric. The name can be a maximum of 63 characters. Valid characters are uppercase (A-Z), lowercase letters (a-z), digits (0 - 9), underscore (\_), period (.), hyphen (-), and space. The names must not begin or end with a space.

MDisks can be added to a storage pool at any time to increase the capacity of the storage pool. MDisks can belong in only one storage pool and only MDisks in unmanaged mode can be added to the storage pool. When an MDisk is added to the storage pool, the mode changes from unmanaged to managed and vice versa when you remove it.

Each MDisk in the storage pool is divided into a number of extents. The size of the extent is selected by the administrator at creation time of the storage pool and cannot be changed later. The size of the extent ranges from 16 MB up to 8 GB.

The extent size has a direct impact on the maximum volume size and storage capacity of the clustered system. A system can manage 4 million (4 x 1024 x 1024) extents. For example, a system with a 16 MB extent size can manage up to 16 MB x 4 MB = 64 TB of storage.

The effect of extent size on the maximum volume size is shown in Table 1-5, and lists the extent size and the corresponding maximum clustered system size.

Table 1-5 Maximum volume capacity by extent size

Extent size	Maximum volume capacity for normal volumes (GB)
16	2048 (2 TB)
32	4096 (4 TB)
64	8192 (8 TB)
128	16384 (16 TB)
256	32768 (32 TB)

Extent size	Maximum volume capacity for normal volumes (GB)
512	65536 (64 TB)
1024	131072 (128 TB)
2048	262144 (256 TB)
4096	528288 (512 TB)
8192	1056576 (1,024 TB)

The effect of extent size on the maximum clustered system capacity is shown in Table 1-6.

Table 1-6 Extent size and effect on clustered system capacity

Extent size	Maximum storage capacity of cluster
16 MB	64 TB
32 MB	128 TB
64 MB	256 TB
128 MB	512 TB
256 MB	1 PB
512 MB	2 PB
1024 MB	4 PB
2048 MB	8 PB
4096 MB	16 PB
8192 MB	32 PB

Use the same extent size for all storage pools in a clustered system, which is a prerequisite for supporting volume migration between two storage pools. If the storage pool extent sizes are not the same, you must use volume mirroring to copy volumes between storage pools, as described in Chapter 7, “Storage pools” on page 223.

For most clustered systems, a capacity of 1 PB is sufficient. Use a value of 256 MB.

**Default extent size:** The GUI of IBM Storwize V7000 has a default extent size value of 256 MB when you define a new storage pool.

A storage pool can have a threshold warning set that automatically issues a warning alert when the used capacity of the storage pool exceeds the set limit.

### Single-tiered storage pool

MDisks that are used in a single-tiered storage pool should have the following characteristics to prevent performance and other problems:

- ▶ They should have the same hardware characteristics, for example, the same RAID type, RAID array size, disk type, and disk revolutions per minute (rpms).

- ▶ The disk subsystems providing the MDisks must have similar characteristics, for example, maximum input/output operations per second (IOPS), response time, cache, and throughput.
- ▶ Use MDisks of the same size, and ensure that the MDisks provide the same number of extents. If this configuration is not feasible, you need to check the distribution of the volumes' extents in that storage pool.

### Multitiered storage pool

A multitiered storage pool has a mix of MDisks with more than one type of disk tier attribute, for example, a storage pool containing a mix of generic\_hdd AND generic\_ssd MDisks.

A multitiered storage pool contains MDisks with different characteristics as opposed to the single-tiered storage pool. However, each tier should have MDisks of the same size and MDisks that provide the same number of extents.

A multitiered storage pool is used to enable automatic migration of extents between disk tiers using the IBM Storwize V7000 Easy Tier function, as described in Chapter 10, "Easy Tier" on page 345.

Figure 1-12 shows these components.

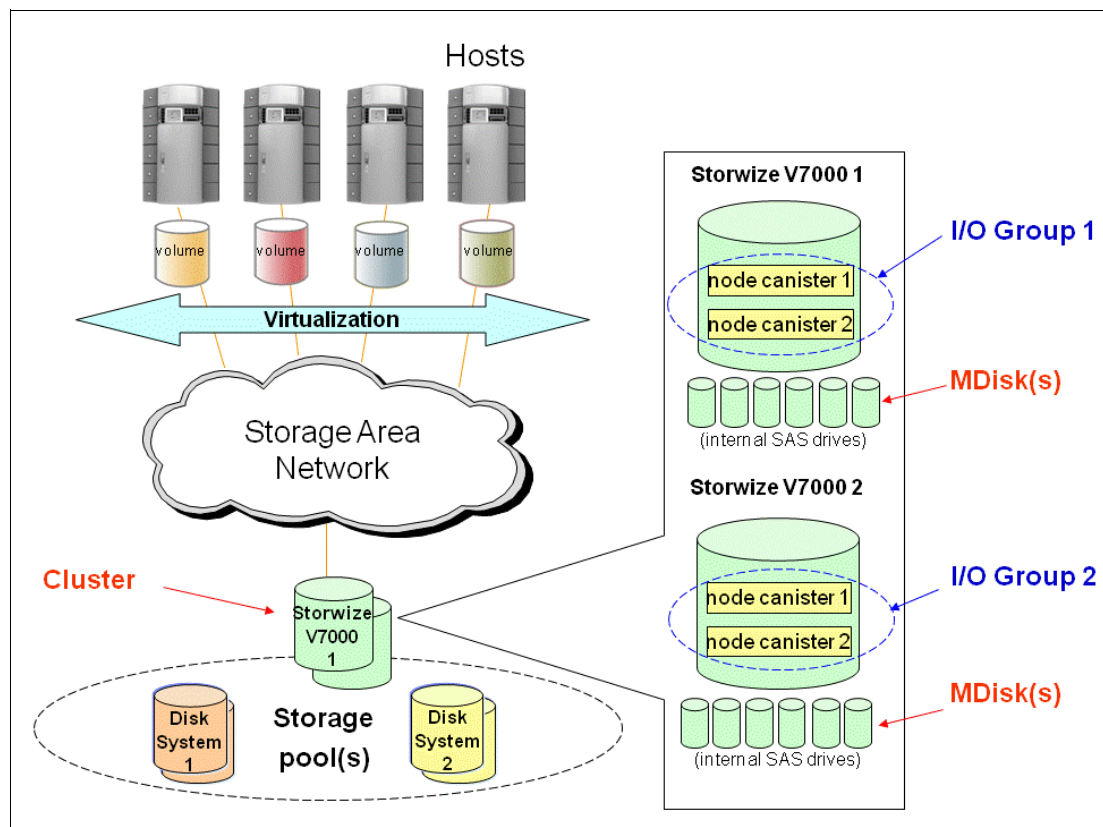


Figure 1-12 IBM Storwize V7000 virtualization components

## 1.5.9 Volumes

A volume is a logical disk that is presented to a host system by the clustered system. In our virtualized environment, the host system has a volume mapped to it by IBM Storwize V7000. IBM Storwize V7000 translates this volume into a number of extents, which are allocated across MDisks. The advantage with storage virtualization is that the host is “decoupled” from the underlying storage, so the virtualization appliance can move the extents around without impacting the host system.

The host system cannot directly access the underlying MDisks in the same manner as it could access RAID arrays in a traditional storage environment.

There are three types of volumes:

- Striped

A striped volume is allocated one extent in turn from each MDisk in the storage pool. This process continues until the space required for the volume has been satisfied.

It is also possible to supply a list of MDisks to use.

Figure 1-13 shows how a striped volume is allocated, assuming 10 extents are required,

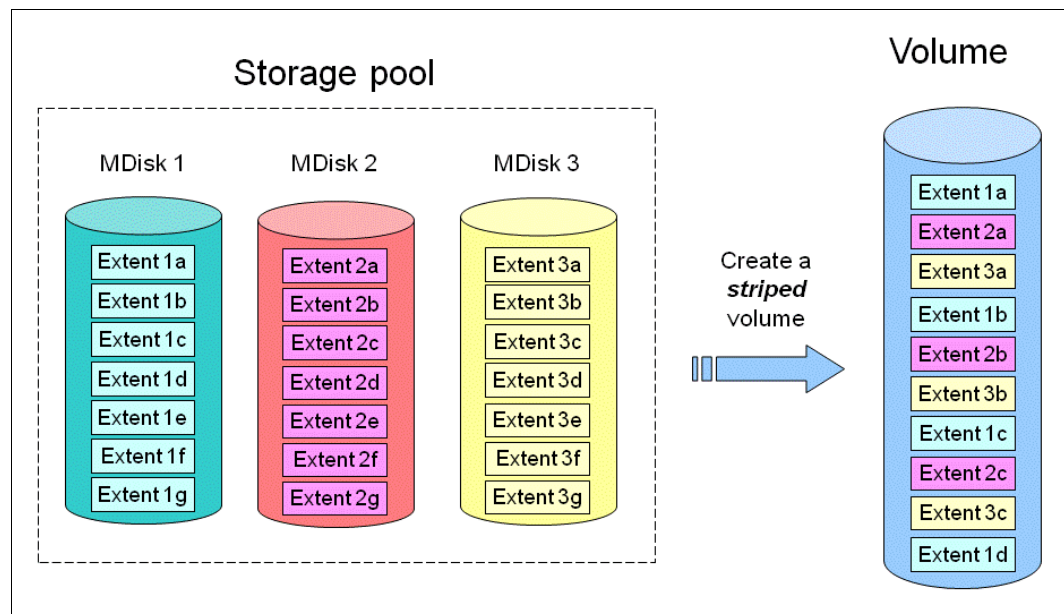


Figure 1-13 Striped volume

► Sequential

A sequential volume is where the extents are allocated one after the other from one MDisk to the next MDisk (Figure 1-14).

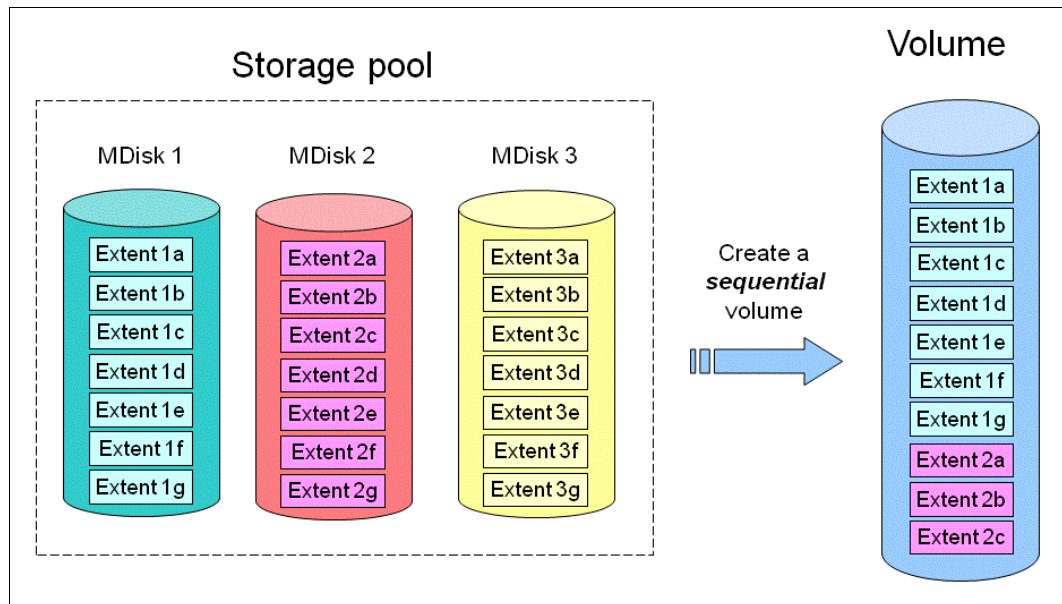


Figure 1-14 Sequential volume

► Image mode

Image mode volumes are special volumes that have a direct relationship with one MDisk. They are used to migrate existing data into and out of the clustered system.



When the image mode volume is created, a direct mapping is made between extents that are on the MDisk and the extents that are on the volume. The logical block address (LBA)  $x$  on the MDisk is the same as the LBA  $x$  on the volume, which ensures that the data on the MDisk is preserved as it is brought into the clustered system (Figure 1-15).

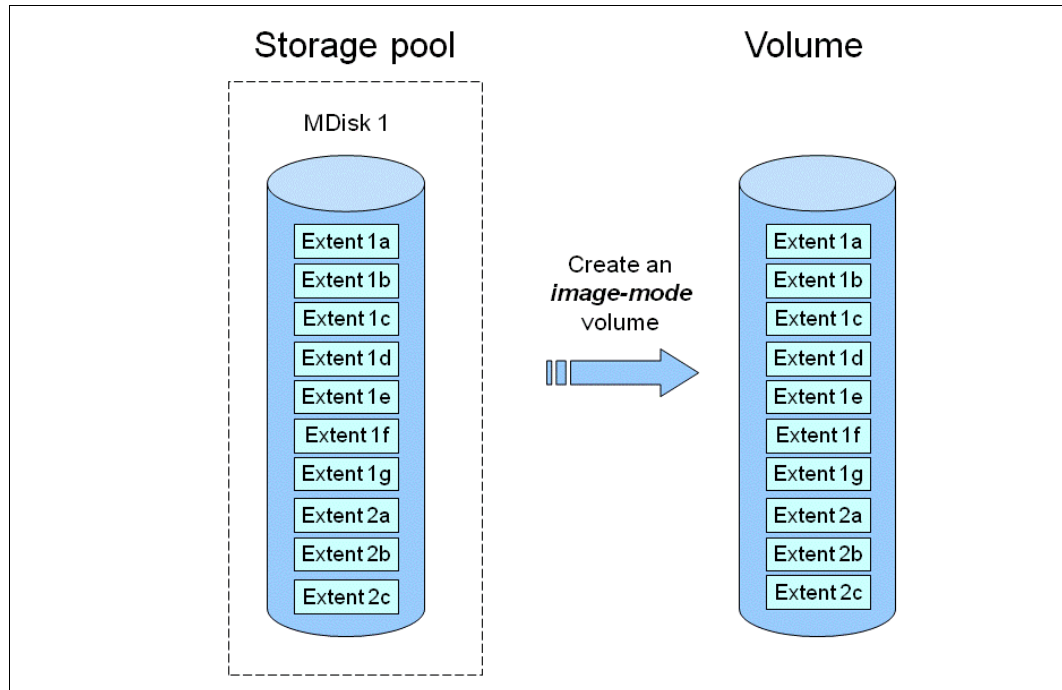


Figure 1-15 Image mode volume

Some virtualization functions are not available for image mode volumes, so it is often useful to migrate the volume into a new storage pool. After it is migrated, the MDisk becomes a managed MDisk.

If you add an MDisk containing data to a storage pool, any data on the MDisk is lost. Ensure that you create image mode volumes from MDisks that contain data before adding MDisks to the storage pools.

### 1.5.10 Thin-provisioned volumes

Volumes can be configured to either be *thin provisioned* or *fully allocated*. A thin-provisioned volume behaves with respect to application reads and writes as though they were fully allocated. When a volume is created, the user specifies two capacities: the real capacity of the volume and its virtual capacity.

The real capacity determines the quantity of MDisk extents that are allocated for the volume. The virtual capacity is the capacity of the volume reported to IBM Storwize V7000 and to the host servers.

The real capacity is used to store both the user data and the metadata for the thin-provisioned volume. The real capacity can be specified as an absolute value or a percentage of the virtual capacity.

The thin provisioning feature can be used on its own to create overallocated volumes, or it can be used with FlashCopy. Thin-provisioned volumes can be used with the mirrored volume feature as well.

A thin-provisioned volume can be configured to *autoexpand*, which causes IBM Storwize V7000 to automatically expand the real capacity of a thin-provisioned volume as its real capacity is used. Autoexpand attempts to maintain a fixed amount of unused real capacity on the volume. This amount is known as the *contingency capacity*.

The contingency capacity is initially set to the real capacity that is assigned when the volume is created. If the user modifies the real capacity, the contingency capacity is reset to be the difference between the used capacity and real capacity.

A volume that is created with a zero contingency capacity goes offline as soon as it needs to expand. A volume with a non-zero contingency capacity stays online until it has been used up.

Autoexpand does not cause the real capacity to grow much beyond the virtual capacity. The real capacity can be manually expanded to more than the maximum that is required by the current virtual capacity, and the contingency capacity is recalculated.

To support the autoexpansion of thin-provisioned volumes, the storage pools from which they are allocated have a configurable warning capacity. When the used free capacity of the group exceeds the warning capacity, a warning is logged. For example, if a warning of 80% has been specified, the warning is logged when 20% of the free capacity remains.

A thin-provisioned volume can be converted to a fully allocated volume using *volume mirroring* (and vice versa).

## 1.5.11 Mirrored volumes

IBM Storwize V7000 provides a function called *volume mirroring*, which enables a volume to have two physical copies. Each volume copy can belong to a different storage pool and can be on different physical storage systems, which provides a high-availability solution.

When a host system issues a write to a mirrored volume, IBM Storwize V7000 writes the data to both copies. When a host system issues a read to a mirrored volume, IBM Storwize V7000 places it into the primary copy. If one of the mirrored volume copies is temporarily unavailable, the IBM Storwize V7000 automatically uses the alternative copy without any outage for the host system. When the mirrored volume copy is repaired, IBM Storwize V7000 resynchronizes the data.

A mirrored volume can be converted into a non-mirrored volume by deleting one copy or by splitting one copy to create a new non-mirrored volume.

The mirrored volume copy can be any type: image, striped, sequential, and thin provisioned or not. The two copies can be different volume types.

Using mirrored volumes can also assist with migrating volumes between storage pools that have different extent sizes and can provide a mechanism to migrate fully allocated volumes to thin-provisioned volumes without any host outages.

Using Storwize V7000 V6.3, you can change the time-out value, *latency*, which prioritizes low host latency (default) or redundancy, which prioritizes redundancy (longer timeout)

**Unmirrored volumes:** An unmirrored volume can be migrated from one location to another by adding a second copy to the wanted destination, waiting for the two copies to synchronize, and then removing the original copy. This operation can be stopped at any time.

## 1.5.12 Easy Tier

Easy Tier is a performance function that automatically migrates or moves extents off a volume to, or from, SSD storage to HDD storage. Easy Tier monitors the host I/O activity and latency on the extent of all volumes with the Easy Tier function turned on in a multitiered storage pool over a 24-hour period. It then creates an extent migration plan based on this activity and then dynamically moves high activity or hot extents to a higher disk tier within the storage pool. It also moves extents' activity that has dropped off or cooled from the high tiered MDisk back to lower tiered MDisk.

The Easy Tier function may be turned on or off at the storage pool and volume level.

It is possible to demonstrate the potential benefit of Easy Tier in your environment before installing a solid-state disk. By turning on the Easy Tier function for a single level storage pool and the Easy Tier Function for the volumes within that pool, Easy Tier creates a migration report every 24 hours on the number of extents it would move if the pool was a multitiered pool. Easy Tier statistics measurement is enabled.

Using Easy Tier might make it more appropriate to use smaller storage pool extent sizes.

The usage statistics file can be offloaded from IBM Storwize V7000 nodes and then an IBM Storage Advisor Tool can be used to create a summary report.

Contact your IBM representative or IBM Business Partner for more information about the Storage Advisor Tool. We describe Easy Tier in more detail in Chapter 10, "Easy Tier" on page 345.

## 1.5.13 iSCSI

iSCSI is an alternative means of attaching hosts to the IBM Storwize V7000. All communications with back-end storage subsystems, and with other IBM Storwize V7000s, only occur through a Fibre Channel connection.

The iSCSI function is a *software function* that is provided by the IBM Storwize V7000 code, not hardware.

In the simplest terms, iSCSI allows the transport of SCSI commands and data over a TCP/IP network, based on IP routers and Ethernet switches. iSCSI is a block-level protocol that encapsulates SCSI commands into TCP/IP packets and uses an existing IP network, instead of requiring expensive FC HBAs and a SAN fabric infrastructure.

A pure SCSI architecture is based on the client/server model. A client (for example, server or workstation) initiates read or write requests for data from a target server (for example, a data storage system).

Commands, which are sent by the client and processed by the server, are put into the Command Descriptor Block (CDB). The server runs a command, and completion is indicated by a special signal alert.

The major functions of iSCSI include encapsulation and the *reliable delivery* of CDB transactions between initiators and targets through the Internet Protocol network, especially over a potentially unreliable IP network.

The concepts of names and addresses have been carefully separated in iSCSI:

- ▶ An *iSCSI name* is a location-independent, permanent identifier for an iSCSI node. An iSCSI node has one iSCSI name, which stays constant for the life of the node. The terms *initiator name* and *target name* also refer to an iSCSI name.
- ▶ An *iSCSI address* specifies not only the iSCSI name of an iSCSI node, but also a location of that node. The address consists of a host name or IP address, a TCP port number (for the target), and the iSCSI name of the node. An iSCSI node can have any number of addresses, which can change at any time, particularly if they are assigned by way of Dynamic Host Configuration Protocol (DHCP). An IBM Storwize V7000 node represents an iSCSI node and provides statically allocated IP addresses.

Each iSCSI node, that is, an initiator or target, has a unique iSCSI Qualified Name (IQN), which can have a size of up to 255 bytes. The IQN is formed according to the rules adopted for Internet nodes.

The iSCSI qualified name format is defined in RFC3720 and contains (in order) these elements:

- ▶ The string “iqn”.
- ▶ A date code specifying the year and month in which the organization registered the domain or subdomain name used as the naming authority string.
- ▶ The organizational naming authority string, which consists of a valid, reversed domain or a subdomain name.
- ▶ Optionally, a colon (:), followed by a string of the assigning organization’s choosing, which must make each assigned iSCSI name unique.

For IBM Storwize V7000, the IQN for its iSCSI target is specified as:

```
iqn.1986-03.com.ibm:2145.<clustername>.<nodename>
```

On a Windows server, the IQN, that is, the name for the iSCSI initiator, can be defined as:

```
iqn.1991-05.com.microsoft:<computer name>
```

The IQNs can be abbreviated by using a descriptive name, known as an *alias*. An alias can be assigned to an initiator or a target. The alias is independent of the name and does not need to be unique. Because it is not unique, the alias must be used in a purely informational way. It cannot be used to specify a target at login or used during authentication. Both targets and initiators can have aliases.

An iSCSI name provides the correct identification of an iSCSI device irrespective of its physical location. Remember, the IQN is an *identifier*, not an *address*.

**Changing names:** Before changing system or node names for an IBM Storwize V7000 clustered system that has servers connected to it using SCSI, be aware that because the system and node name are part of the IQN for the IBM Storwize V7000, you can lose access to your data by changing these names. The IBM Storwize V7000 GUI shows a specific warning, but the CLI does *not*.

The iSCSI session, which consists of a *login phase* and a *full feature phase*, is completed with a special command.

The login phase of the iSCSI is identical to the FC port login process (PLOGI). It is used to adjust various parameters between two network entities and to confirm the access rights of an initiator.

If the iSCSI login phase is completed successfully, the target confirms the login for the initiator; otherwise, the login is not confirmed and the TCP connection breaks.

As soon as the login is confirmed, the iSCSI session enters the full feature phase. If more than one TCP connection was established, iSCSI requires that each command / response pair goes through one TCP connection. Thus, each separate read or write command is carried out without the necessity to trace each request for passing separate flows. However, separate transactions can be delivered through separate TCP connections within one session.

For further details about configuring iSCSI, see Chapter 4, “Host configuration” on page 131.

## 1.6 Advanced copy services

IBM Storwize V7000 supports the following copy services:

- ▶ Synchronous Remote Copy
- ▶ Asynchronous Remote Copy
- ▶ FlashCopy

Starting with SAN Volume Controller V6.3, copy services functions are implemented within a single IBM Storwize V7000 or between multiple IBM Storwize V7000s and SAN Volume Controllers. The Copy Services layer sits above and operates independently of the function or characteristics of the underlying disk subsystems used to provide storage resources to an IBM Storwize V7000. Figure 1-16 shows an example of copy services with SAN Volume Controllers and IBM Storwize V7000 (they must be at Version 6.3 or later). A new parameter of the clustered system properties named **layer** has been introduced, which can be changed from storage (default) to replication if you need to make a new relationship between the IBM Storwize V7000 and SAN Volume Controller systems. You can change it only using the CLI command **chsystem**. In SAN Volume Controller systems, this parameter is fixed to replication and cannot be changed.

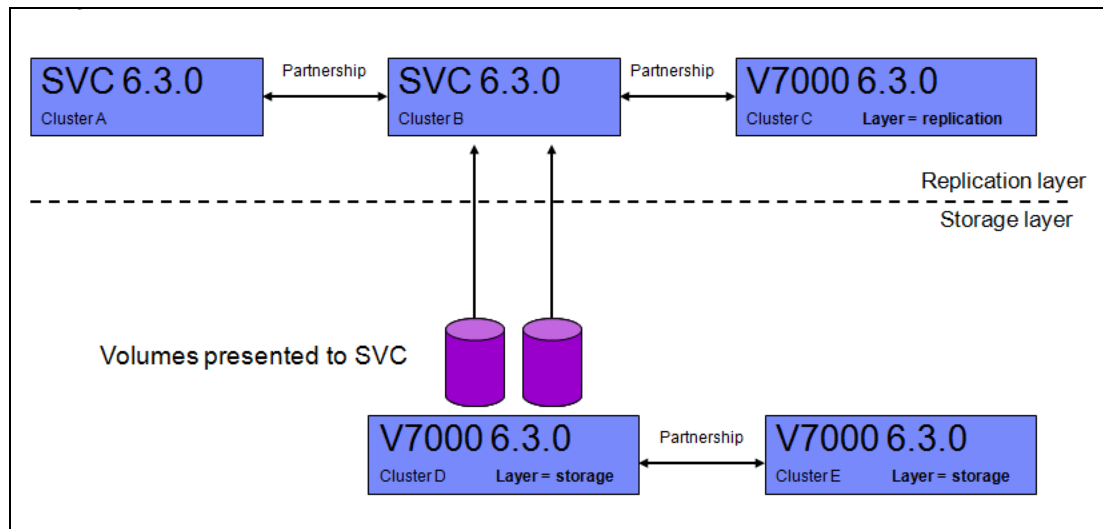


Figure 1-16 Example of SAN Volume Controller and Storwize V7000 copy services relationship

## 1.6.1 Synchronous / Asynchronous Remote Copy

The general application of Remote Copy seeks to maintain two copies of data. Often, the two copies are separated by distance, but not always.

The Remote Copy can be maintained in one of two modes: synchronous or asynchronous.

With the IBM Storwize V7000, Metro Mirror and Global Mirror are the IBM branded terms for the functions that are synchronous Remote Copy and asynchronous Remote Copy.

Synchronous Remote Copy ensures that updates are committed at both the primary and the secondary before the application considers the updates complete; therefore, the secondary is fully up to date if it is needed in a failover. However, the application is fully exposed to the latency and bandwidth limitations of the communication link to the secondary. In a truly remote situation, this extra latency can have a significant adverse effect on application performance.

Special configuration guidelines exist for SAN fabrics that are used for data replication. It is necessary to consider the distance and available bandwidth of the intersite links (see Chapter 11, “Copy services” on page 371).

A new function of Global Mirror designed for low bandwidth has been introduced in IBM Storwize V7000 6.3. It uses change volumes associated with the primary and secondary volumes. These volumes are used to record changes to the remote copy volume, the FlashCopy relationship that exists between the secondary volume and the change volume, and between the primary volume and the change volume. This function is called Global Mirror cycling mode. Figure 1-17 shows an example of this function where you can see the relationship between volumes and change volumes.

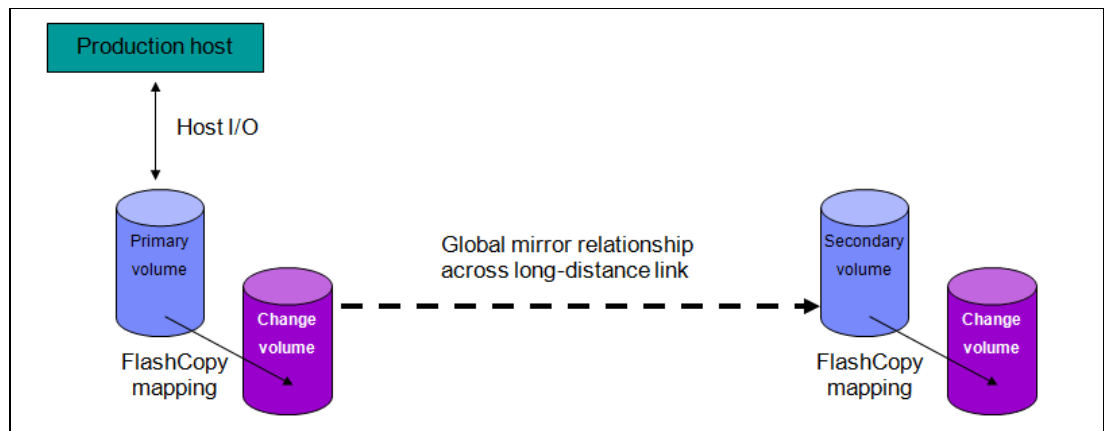


Figure 1-17 Global Mirror with change volumes

In asynchronous Remote Copy, the application acknowledges that the write is complete before the write is committed at the secondary. Hence, on a failover, certain updates (data) might be missing at the secondary. The application must have an external mechanism for recovering the missing updates, if possible. This mechanism can involve user intervention. Recovery on the secondary site involves starting the application on this recent “backup” and then rolling forward or backward to the most recent commit point.

IBM Support for automation is provided by IBM Tivoli Storage Productivity Center for Replication. The Tivoli documentation can also be accessed online at the IBM Tivoli Storage Productivity Center Information Center at the following website:

<http://publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp>

## 1.6.2 FlashCopy

FlashCopy makes a copy of a source volume on a target volume. The original content of the target volume is lost. After the copy operation has started, the target volume has the contents of the source volume as they existed at a single point in time. Although the copy operation takes time, the resulting data at the target appears as though the copy was made instantaneously.

FlashCopy is sometimes described as an instance of a time-zero (T0) copy or a point in time (PiT) copy technology.

FlashCopy can be performed on multiple source and target volumes. FlashCopy permits the management operations to be coordinated so that a common single point in time is chosen for copying target volumes from their respective source volumes.

IBM Storwize V7000 also permits multiple target volumes to be FlashCopied from the same source volume. This capability can be used to create images from separate points in time for the source volume, and to create multiple images from a source volume at a common point in time. Source and target volumes can be thin-provisioned volumes.

Reverse FlashCopy enables target volumes to become restore points for the source volume without breaking the FlashCopy relationship and without waiting for the original copy operation to complete. IBM Storwize V7000 supports multiple targets and thus multiple rollback points.

Most clients aim to integrate the FlashCopy feature for point in time copies and quick recovery of their applications and databases. IBM Support is provided by Tivoli Storage FlashCopy Manager, which is described at the following website:

<http://www-01.ibm.com/software/tivoli/products/storage-flashcopy-mgr/>

You can read a detailed description about the FlashCopy copy services in Chapter 11, “Copy services” on page 371.

## 1.6.3 Copy Services configuration limits

In Table 1-7, we describe the Copy Services configuration limits. For the most up-to-date list of these limits, see the following website:

<http://www-01.ibm.com/support/docview.wss?uid=ssg1S1003702&myns=s028&mynp=familyind5402112&mync=E>

Table 1-7 Copy Services configuration limits

Properties	Maximum number	Note
Remote Copy (Metro Mirror and Global Mirror) relationships per clustered system	4096	This configuration can be any mix of Metro Mirror and Global Mirror relationships.
Remote Copy relationships per consistency group	-	No limit is imposed beyond the Remote Copy relationships per clustered system limit
Remote Copy consistency groups per clustered system	256	-

Properties	Maximum number	Note
Total Metro Mirror and Global Mirror volume capacity per I/O group	1024 TB	This limit is the total capacity for all master and auxiliary volumes in the I/O group.
FlashCopy mappings per clustered system	4096	-
FlashCopy targets per source	256	-
Cascaded Incremental FlashCopy maps	4	A volume can be the source of up to four incremental FlashCopy maps. If this number of maps is exceeded, then the FlashCopy behavior for that cascade becomes non-incremental.
FlashCopy mappings per consistency group	512	-
FlashCopy consistency groups per clustered system	127	-
Total FlashCopy volume capacity per I/O group	1024 TB	-

## 1.7 Management and support tools

The IBM Storwize V7000 system can be managed through the IBM Systems Storage Productivity Center (SSPC) or by using the native management software that runs in the hardware itself. The IBM System Storage Productivity Center (SSPC) is an integrated hardware and software solution that provides a single point of entry for managing IBM Storwize V7000 clustered systems, IBM System Storage DS8000 systems, and other components of your data storage infrastructure.

SSPC simplifies storage management in the following ways:

- ▶ Centralizes the management of storage network resources with IBM storage management software.
- ▶ Provides greater synergy between storage management software and IBM storage devices.
- ▶ Reduces the number of servers that are required to manage your software infrastructure.
- ▶ Provides higher-level functions.

### 1.7.1 IBM Assist On-site and remote service

The IBM Assist On-site tool is a remote desktop-sharing solution that is offered through the IBM website. With it, the IBM service representative can remotely view your system to troubleshoot a problem.

You can maintain a chat session with the IBM service representative so that you can monitor this activity and either understand how to fix the problem yourself or allow the representative to fix it for you.



To use the IBM Assist On-site tool, the SSPC or master console must be able to access the Internet. The following website provides further information about this tool:

<http://www.ibm.com/support/assistsite/>

When you access the website, you sign in and enter a code that the IBM service representative provides to you. This code is unique to each IBM Assist On-site session. A plug-in is downloaded on to your SSPC or master console to connect you and your IBM service representative to the remote service session. The IBM Assist On-site contains several layers of security to protect your applications and your computers.

You can also use security features to restrict access by the IBM service representative.

Your IBM service representative can provide you with more detailed instructions for using the tool.

## 1.7.2 Event notifications

IBM Storwize V7000 can use Simple Network Management Protocol (SNMP) traps, syslog messages, and a Call Home email to notify you and the IBM Support Center when significant events are detected. Any combination of these notification methods can be used simultaneously.

Each event that IBM Storwize V7000 detects is assigned a notification type of Error, Warning, or Information. You can configure IBM Storwize V7000 to send each type of notification to specific recipients.

## 1.7.3 SNMP traps

SNMP is a standard protocol for managing networks and exchanging messages. IBM Storwize V7000 can send SNMP messages that notify personnel about an event. You can use an SNMP manager to view the SNMP messages that IBM Storwize V7000 sends. You can use the management GUI or the IBM Storwize V7000 command-line interface to configure and modify your SNMP settings.

You can use the Management Information Base (MIB) file for SNMP to configure a network management program to receive SNMP messages that are sent by the IBM Storwize V7000. This file can be used with SNMP messages from all versions of IBM Storwize V7000 Software.

## 1.7.4 Syslog messages

The syslog protocol is a standard protocol for forwarding log messages from a sender to a receiver on an IP network. The IP network can be either IPv4 or IPv6. IBM Storwize V7000 can send syslog messages that notify personnel about an event. IBM Storwize V7000 can transmit syslog messages in either expanded or concise format. You can use a syslog manager to view the syslog messages that IBM Storwize V7000 sends. IBM Storwize V7000 uses the User Datagram Protocol (UDP) to transmit the syslog message. You can use the management GUI or the IBM Storwize V7000 command-line interface to configure and modify your syslog settings.

## 1.7.5 Call Home email

The Call Home feature transmits operational and error-related data to you and IBM through a Simple Mail Transfer Protocol (SMTP) server connection in the form of an event notification email. When configured, this function alerts IBM service personnel about hardware failures and potentially serious configuration or environmental issues. You can use the call home function if you have a maintenance contract with IBM or if the Storwize V7000 is within the warranty period.

To send email, you must configure at least one SMTP server. You can specify as many as five additional SMTP servers for backup purposes. The SMTP server must accept the relaying of email from the IBM Storwize V7000 clustered system IP address. You can then use the management GUI or the IBM Storwize V7000 command-line interface to configure the email settings, including contact information and email recipients. Set the reply address to a valid email address. Send a test email to check that all connections and infrastructure are set up correctly. You can disable the Call Home function at any time using the management GUI or the IBM Storwize V7000 command-line interface.

## 1.8 Useful Storwize V7000 websites

The IBM Storwize V7000 Support page is at the following website

<http://www.ibm.com/storage/support/storwize/v7000>

The IBM Storwize V7000 home page is at the following website

[http://www-03.ibm.com/systems/storage/news/center/storwize\\_v7000/index.html](http://www-03.ibm.com/systems/storage/news/center/storwize_v7000/index.html)

The IBM Storwize V7000 Supported hardware list is at the following website:

<http://www-01.ibm.com/support/docview.wss?uid=ssg1S1003908>

The IBM Storwize V7000 Configuration Limit and Restrictions are at the following website:

<http://www-01.ibm.com/support/docview.wss?uid=ssg1S1003902>

The IBM Storwize V7000 Online documentation is at the following website:

[http://www-947.ibm.com/support/entry/portal/Documentation/Hardware/System\\_Storage/Disk\\_systems/Mid-range\\_disk\\_systems/IBM\\_Storwize\\_V7000\\_%282076%29](http://www-947.ibm.com/support/entry/portal/Documentation/Hardware/System_Storage/Disk_systems/Mid-range_disk_systems/IBM_Storwize_V7000_%282076%29)

The IBM Storwize V7000 Online Information Center is at the following website:

<http://publib.boulder.ibm.com/infocenter/storwize/ic/index.jsp>

You can see IBM Redbooks publications about IBM Storwize V7000 at the following website:

<http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=v7000>

## 1.8.1 IBM Storwize V7000 learning videos on YouTube

Some interesting videos are available on YouTube that describe the IBM Storwize V7000 GUI and are available at the URLs shown in Table 1-8.

Table 1-8 Videos available on YouTube

Description of the video	Link WEB
IBM Storwize V7000 Storage Virtualization Terminology Overview	<a href="http://www.youtube.com/watch?v=I2rzt3m2gP0">http://www.youtube.com/watch?v=I2rzt3m2gP0</a>
IBM Storwize V7000 Interface tour	<a href="http://www.youtube.com/watch?v=FPbNRs9HacQ">http://www.youtube.com/watch?v=FPbNRs9HacQ</a>
IBM Storwize V7000 Volume management	<a href="http://www.youtube.com/watch?v=YXeKqH8Sd9o">http://www.youtube.com/watch?v=YXeKqH8Sd9o</a>
IBM Storwize V7000 Migration	<a href="http://www.youtube.com/watch?v=dXxnUN6dk74">http://www.youtube.com/watch?v=dXxnUN6dk74</a>
IBM Storwize V7000 Introduction to FlashCopy	<a href="http://www.youtube.com/watch?v=MXWgGwjBzG4">http://www.youtube.com/watch?v=MXWgGwjBzG4</a>
IBM Storwize V7000 Introduction to Remote Copy 1	<a href="http://www.youtube.com/watch?v=koFYm--gnEc">http://www.youtube.com/watch?v=koFYm--gnEc</a>
IBM Storwize V7000 Introduction to Remote Copy 2	<a href="http://www.youtube.com/watch?v=kMOFFS3NYas">http://www.youtube.com/watch?v=kMOFFS3NYas</a>
IBM Storwize V7000 Rapid Application Storage Solution - Tivoli Storage FlashCopy Manager	<a href="http://www.youtube.com/watch?v=1zgE1jRVDSc">http://www.youtube.com/watch?v=1zgE1jRVDSc</a>
VMware data protection with Storwize V7000	<a href="http://www.youtube.com/watch?v=vec0ap-qwbA">http://www.youtube.com/watch?v=vec0ap-qwbA</a>
IBM SAN Volume Controller and Storwize V7000 Performance Panel Sped-up! (HD)	<a href="http://www.youtube.com/watch?v=7noC71tLkWs">http://www.youtube.com/watch?v=7noC71tLkWs</a>





# Initial configuration

This chapter provides a description of the IBM Storwize V7000 initial configuration steps.

In this chapter, we describe the following topics:

- ▶ Planning for IBM Storwize V7000 installation
- ▶ First time setup
- ▶ Initial configuration steps
- ▶ Call Home, email event alert, and inventory settings

## 2.1 Hardware installation planning

Proper planning before the actual physical installation of the hardware is required. Here is a checklist of requirements to use to plan your installation:

- Install the hardware as described in *IBM Storwize V7000 Quick Installation Guide Version 6.3.0*, GC27-2290.
- For information about planning the IBM Storwize V7000 environment, see the following address:  
[http://publib.boulder.ibm.com/infocenter/storwize/ic/index.jsp?topic=/com.ibm.storwize.v7000.doc/svc\\_installplan\\_22qgvs.html](http://publib.boulder.ibm.com/infocenter/storwize/ic/index.jsp?topic=/com.ibm.storwize.v7000.doc/svc_installplan_22qgvs.html)
- An appropriate 19-inch rack with 2 - 20U of space should be available depending on the number of enclosures to install. Each enclosure measures 2U and one control enclosure with up to nine expansion enclosures constitutes an IBM Storwize V7000 system.
- There should be redundant power outlets in the rack for each of the two power cords included per enclosure. 2 - 20 outlets are required depending on the number of enclosures to install. The power cords conform to the IEC320 C13/C14 standards.
- A minimum of four Fibre Channel ports attached to the fabric are required, but it is a best practice to use eight 2-, 4-, or 8- Gbps Fibre Channel ports.

**FC ports:** FC ports are required only if FC hosts or remote mirroring are used. You can use the Storwize V7000 with Ethernet-only cabling for iSCSI hosts.

- You should have eight 2-, 4-, or 8- Gbps compatible Fibre Channel cable drops.
- You should have a minimum of two Ethernet ports on the LAN, with four preferred for additional configuration access redundancy or iSCSI host access.
- You should have a minimum of two Ethernet cable drops, with four preferred for additional configuration access redundancy or iSCSI host access. Ethernet port one on each node canister must be connected to the LAN with port two being optional.

**Ports:** Port 1 on each node canister must be connected to the same physical LAN or be configured in the same VLAN and be on the same subnet or set of subnets.

- Verify that the default IP address configured on Ethernet port 1 on each of the node canisters, 192.168.70.121 on node one and 192.168.70.122 on node 2, do not conflict with existing IP addresses on the LAN. The default mask used with these IP addresses is 255.255.255.0 and the default gateway address used is 192.168.70.1.
- You should have a minimum of three IPv4 or IPv6 IP addresses for system configuration. One is for the clustered system and is what the administrator uses for management, and one for each node canister for service access as needed.

**IP addresses:** A fourth IP address should be used for backup configuration access. This additional IP address allows a second system IP address to be configured on port 2 of either node canister, which the storage administrator can also use for management of the IBM Storwize V7000 system.

- A minimum of one and up to four IPv4 or IPv6 addresses are needed if iSCSI attached hosts access volumes from the IBM Storwize V7000.

- Two 1-, 3-, or 6-meter SAS cables per expansion enclosure are required. The length of the cables depends on the physical rack location they are installed in relative to the control enclosure or other expansion enclosures. Locate the control enclosure so that four enclosures can be located above it and five enclosures below, as shown in Figure 2-1 (which shows the full racking and cabling scheme).

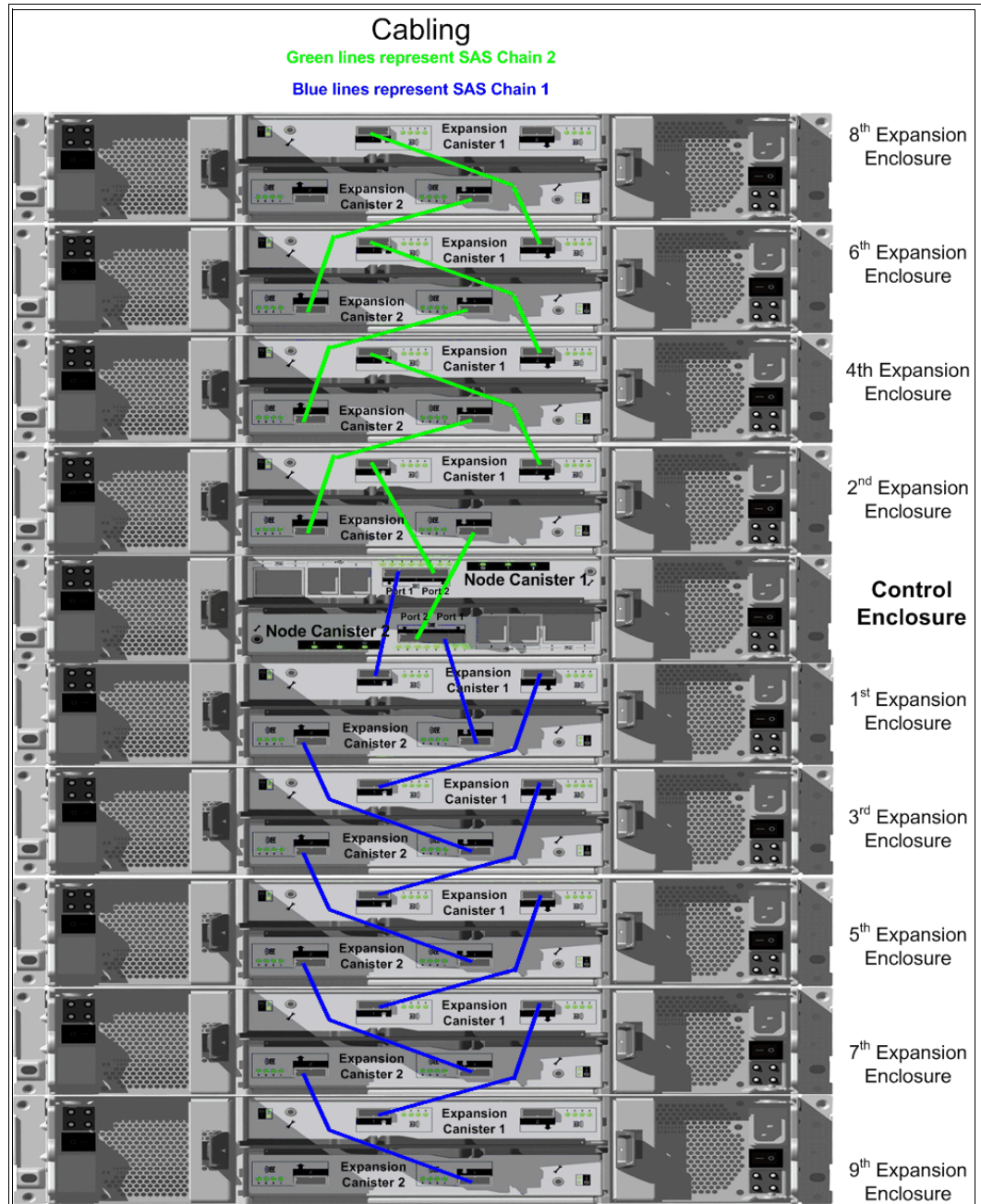


Figure 2-1 Racking and cabling diagram

**Disk drives:** The disk drives included with the control enclosure, model 2076-224 or 2076-212, are part of SAS chain number two. Therefore, only four additional expansion enclosures can be connected to this chain. SAS chain number one supports the addition of up to five expansion enclosures. The first expansion enclosure should be connected to SAS chain number one so both chains are used and the full bandwidth of the system is used.

## 2.2 SAN configuration planning

The recommended SAN configuration is composed of a minimum of two fabrics with all host ports, and any ports on external storage systems to be virtualized by IBM Storwize V7000. The IBM Storwize V7000 ports themselves are evenly split between the two fabrics to provide redundancy in the event one of the fabrics goes offline (either planned or unplanned).

After the IBM Storwize V7000, hosts, and optional external storage systems are connected to the SAN fabrics, zoning needs to be implemented.

In each fabric, create a zone with just the four IBM Storwize V7000 WWPNs, two from each node canister. If there is an external storage system to be virtualized, then in each fabric, create a zone with the four IBM Storwize V7000 WWPNs, two from each node canister, along with up to a maximum of eight WWPNs from the external storage system. Assuming every host has a Fibre Channel connection to each fabric, then in each fabric, create a zone with the host WWPN and one WWPN from each node canister in the IBM Storwize V7000 system.

**Maximum ports or WWPNs:** IBM Storwize V7000 supports a maximum of 16 ports or WWPNs from a given external storage system that is virtualized.



Figure 2-2 shows how to cable devices to the SAN. See this example as we describe the zoning.

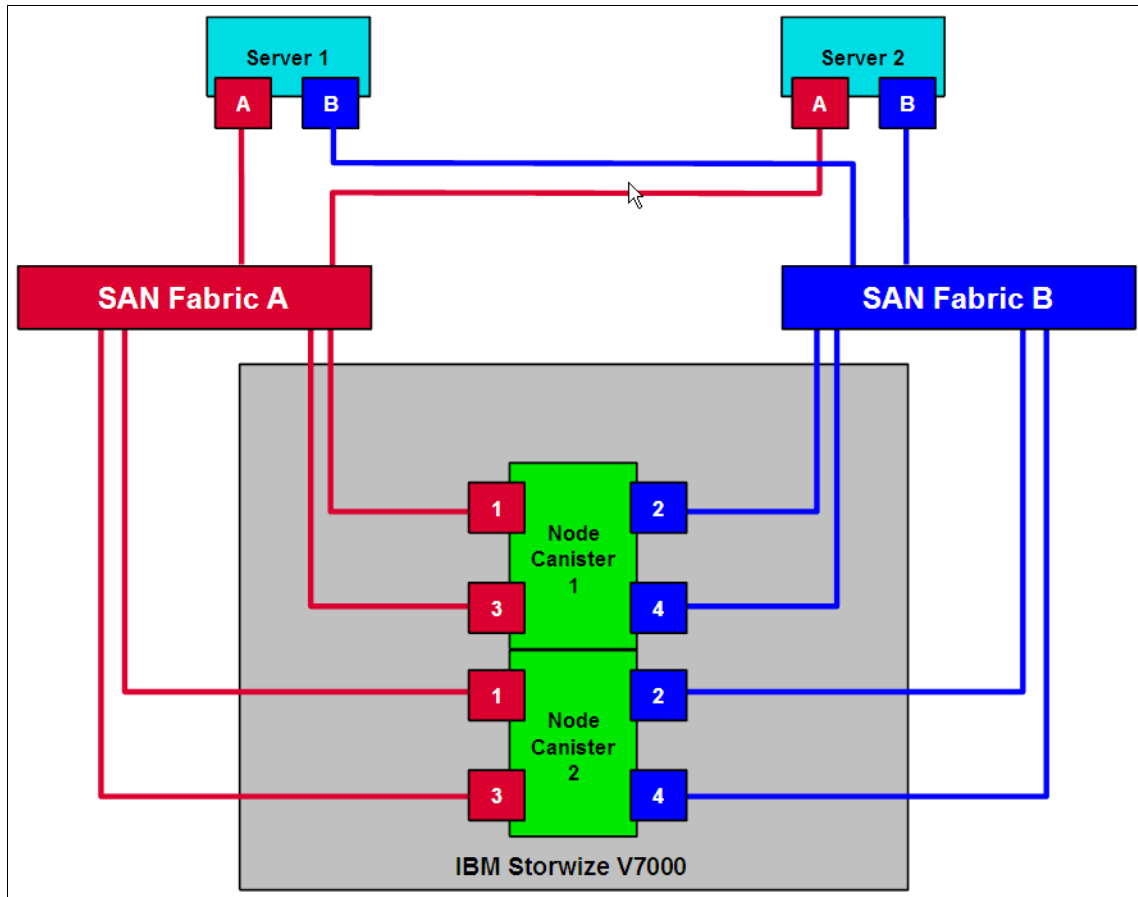


Figure 2-2 SAN cabling and zoning diagram

Create a host / IBM Storwize V7000 zone for each server to which volumes are mapped to from the clustered system. For example:

- ▶ Zone Server 1 port A (RED) with all node port 1s
- ▶ Zone Server 1 port B (BLUE) with all node port 2s
- ▶ Zone Server 2 port A (RED) with all node port 3s
- ▶ Zone Server 2 port B (BLUE) with all node port 4s

Verify that the SAN switches or directors that the IBM Storwize V7000 connects to meet the following requirements (see <http://www.ibm.com/storage/support/Storwize/V7000> for more information):

- ▶ Switches or directors are at the firmware levels supported by the IBM Storwize V7000.
- ▶ IBM Storwize V7000 port login maximums listed in restriction document must not be exceeded.

**Connectivity issues:** If you have any connectivity issues between IBM Storwize V7000 ports and Brocade SAN Switches or Directors at 8 Gbps, see <http://www-01.ibm.com/support/docview.wss?rs=591&uid=ssg1S1003699> for the correct setting of the fillword port config parameter in the Brocade operating system.

## 2.3 LAN configuration planning

There are two Ethernet ports per node canister available for connection to the LAN on an IBM Storwize V7000 system. Port 1 on each node canister must be connected to the LAN to provide access for the management of the clustered system and service access. Optionally, port 2 on each node canister can be connected to the LAN to provide redundant management access. In addition, all four ports can also be configured for access to IBM Storwize V7000 volumes by iSCSI hosts.

**Configuring IP addresses:** There is no issue with configuring multiple IPv4 or IPv6 addresses on a given Ethernet port or using the same Ethernet port for management and iSCSI access. However, you cannot use the same IP address for both management and iSCSI host use.

Figure 2-3 shows a possible IP configuration of the Ethernet ports on the IBM Storwize V7000 system.

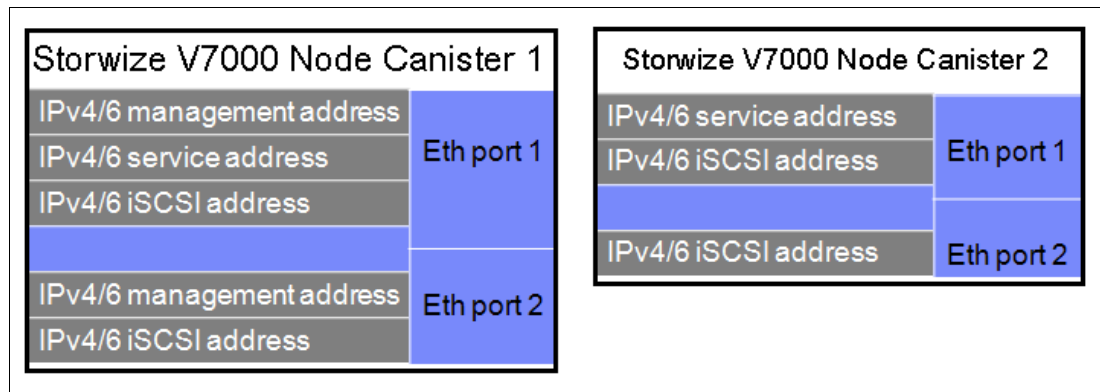


Figure 2-3 Example of IP address configuration options per node canister

**IP management addresses:** The IP management address shown on node canister 1 is an example of the configuration node; in case of failover, these addresses transfer to node canister 2 and this node canister becomes the new configuration node. The management addresses are managed by the configuration node canister only (1 or 2; in this case, by Node Canister 1).

### 2.3.1 Management IP address considerations

Because Ethernet port 1 from each node canister must be connected to the LAN, a single management IP address for the clustered system is configured as part of the initial setup of the IBM Storwize V7000 system.

The management IP address is associated with one of the node canisters in the clustered system and that node then becomes the configuration node. Should this node go offline, either planned or unplanned, the management IP address fails over to the other node's Ethernet port 1.

For additional clustered system management redundancy, you should connect Ethernet port 2 on each of the node canisters to the LAN, which allows for a backup management IP address to be configured for access if necessary.

Figure 2-4 shows a logical view of the Ethernet ports available for configuration of the one or two management IP addresses. These IP addresses are for the clustered system itself and therefore only associated with one node, which is then considered the configuration node.

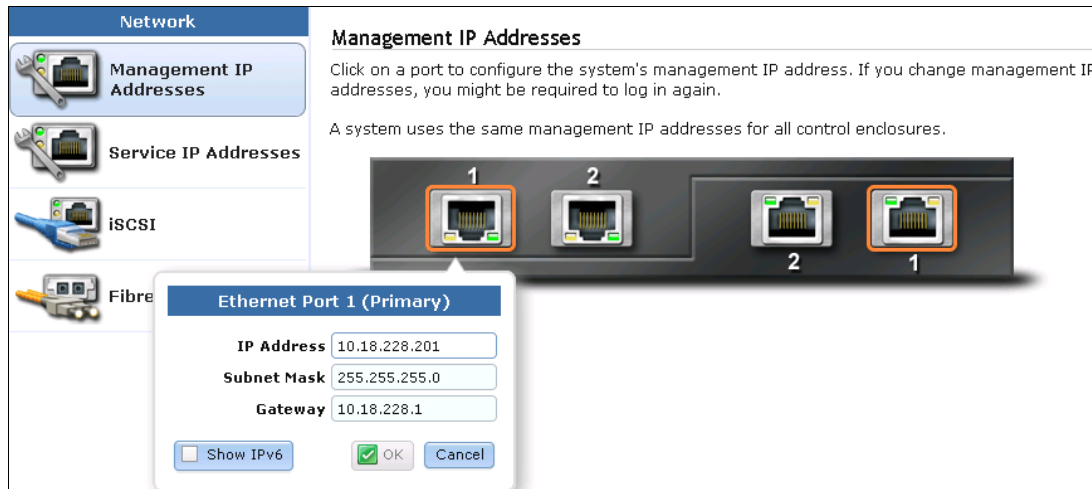


Figure 2-4 Ethernet ports available for configuration

### 2.3.2 Service IP address considerations

The Ethernet port 1 on each node canister is used for system management, and also used for service access when required. In normal operation, the service IP addresses are not needed. However, in the event of a node canister problem, it might be necessary for service personnel to log on to the node to perform service actions.

By default, the service IP address on node canister 1 is 192.168.70.121 and 192.168.70.122 on node canister 2. The default mask is 255.255.255.0 and the default gateway address is 192.168.70.1.

Figure 2-5 shows a logical view of the Ethernet ports available for configuration of the service IP addresses. Only port one on each node can be configured with a service IP address.

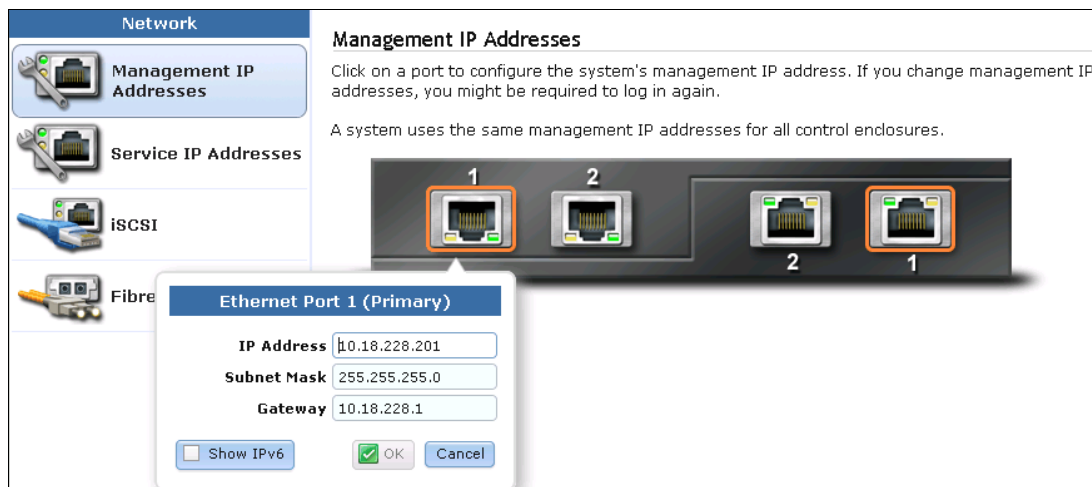


Figure 2-5 Service IP addresses available for configuration

## 2.4 Host configuration planning

Hosts should have two Fibre Channel connections for redundancy, but IBM Storwize V7000 supports hosts with a single HBA port connection. However, if that HBA or its link to the SAN fabric or the fabric itself fails, then the host loses access to its volumes. Even with just a single connection to the SAN, the host has multiple paths to the IBM Storwize V7000 volumes, because that single connection must be zoned with at least one Fibre Channel port per node. Therefore, a multipath driver is required.

SAN Boot with IBM Storwize V7000 is supported. The requirements are listed on the IBM Storwize V7000 support matrix and configuration instructions are provided in the *IBM Storwize V7000 Host Attachment Guide*, which can be found at the following address:

[http://publib.boulder.ibm.com/infocenter/storwize/ic/index.jsp?topic=/com.ibm.storwize.v7000.doc/svc\\_over\\_1dcur0.html](http://publib.boulder.ibm.com/infocenter/storwize/ic/index.jsp?topic=/com.ibm.storwize.v7000.doc/svc_over_1dcur0.html)

Verify that the hosts that access volumes from the IBM Storwize V7000 meet the requirements found at the following website:

<http://www.ibm.com/storage/support/storwize/v7000>

Keep the following items under consideration:

- ▶ Host operating systems are at the levels supported by the IBM Storwize V7000.
- ▶ HBA BIOS, device drivers, and firmware, along with the multipathing drivers, are at the levels supported by IBM Storwize V7000.
- ▶ If boot from SAN is required, ensure that it is supported for the operating systems to be deployed.
- ▶ If host clustering is required, ensure that it is supported for the operating systems to be deployed.

For more details, see Chapter 4, “Host configuration” on page 131.

## 2.5 Miscellaneous configuration planning

During the initial setup of the IBM Storwize V7000 system, the installation wizard asks for various information that you should have available during the installation process. If you do not have this information or choose not to configure some of the items at this time, you can configure them later through the GUI.

Here is a checklist of information to gather before performing the initial setup. The date and time can be manually entered, but to keep the clock synchronized, use a network time protocol (NTP) service.

- Document the current LAN NTP server IP address used for synchronization of devices.
  - If external storage systems are used by IBM Storwize V7000, then a license must be purchased to cover the number of enclosures to be virtualized.
- Document the number of external physical enclosures that are virtualized under the IBM Storwize V7000.

- Document the total number of physical enclosures, including both the internal and external virtualized enclosures for the Global Mirror and Metro Mirror features. You must have enough Global Mirror and Metro Mirror licenses for all the enclosures attached to the system, regardless of the amount of Global Mirror and Metro Mirror capacity you intend to use.

The Easy Tier function is included with the IBM Storwize V7000 system and is not a purchased feature. If the system has solid-state drives, and this capability is used to optimize the usage of the SSD drives, then this function is enabled.

For alerts to be sent to storage administrators and to set up Call Home to IBM for service and support, you need the following information:

- Name of primary storage administrator for IBM to contact if necessary.
- Email address of the storage administrator for IBM to contact if necessary.
- Phone number of the storage administrator for IBM to contact if necessary.
- Physical location of the IBM Storwize V7000 system for IBM service (for example, Building 22, first floor).
- SMTP or email server address to direct alerts to and from the IBM Storwize V7000.

For the Call Home service to work, the IBM Storwize V7000 system must have access to an SMTP server on the LAN that can forward emails to the default IBM service address `callhome0@de.ibm.com`.

- Email address of local administrators needing to be notified of alerts.
- IP address of SNMP server to direct alerts to if wanted (for example, operations or help desk).

After the IBM Storwize V7000 initial configuration, you might want to add additional users who can manage the system. You can create as many users as you need, but currently there are only four roles generally configured for users:

- ▶ Security Admin
- ▶ Administrator
- ▶ Copyoperator
- ▶ Monitor

The Security Admin role allows the user to perform any function on the IBM Storwize V7000.

The administrator role allows the user to perform any function on the IBM Storwize V7000 system except create users.

**User creation:** The create users function is allowed by the Security Admin role only and should be limited to as few users as possible.

The copyoperator role allows the user to view anything in the system, but the user can only configure and manage copy functions that include the replication functions of Metro and Global Mirror and the FlashCopy capabilities.

The monitor role can view object and system configuration, but cannot configure, manage, or modify any system resource.

The only other role available is the service role, which is used if you create a user ID for the IBM service representative. This role allows IBM service personnel to view anything on the system, as with the monitor role, plus perform service-related commands, such as adding a node back to the system after being serviced or include disks that have been excluded.

## 2.6 System management

The graphical user interface (GUI) is used to configure, manage, and troubleshoot the IBM Storwize V7000 system. It is used primarily to configure RAID arrays and logical drives, assign logical drives to hosts, replace and rebuild failed disk drives, and expand the logical drives.

It allows for troubleshooting and management tasks, such as checking the status of the storage server components, updating the firmware, and managing the storage server.

Finally, it offers advanced functions, such as FlashCopy, Volume Mirroring, and Remote Mirroring. A command-line interface (CLI) for the IBM Storwize V7000 system is available as well.

This section briefly describes the system management using GUI and CLI.

### 2.6.1 Graphical user interface (GUI)

A web browser is used for GUI access. You must use a supported web browser to access the management GUI. For a list of supported web browsers, see the *Recommended Software Level* document at the following website:

<http://www.ibm.com/storage/support/storwize/v7000>

Open your web browser on a workstation and point it to the IBM Storwize V7000 system management address (this address is defined in 2.7, “First-time setup” on page 46).

After the initial configuration described in 2.8, “Initial configuration” on page 54 is completed, the IBM Storwize V7000 Welcome window opens (Figure 2-6).

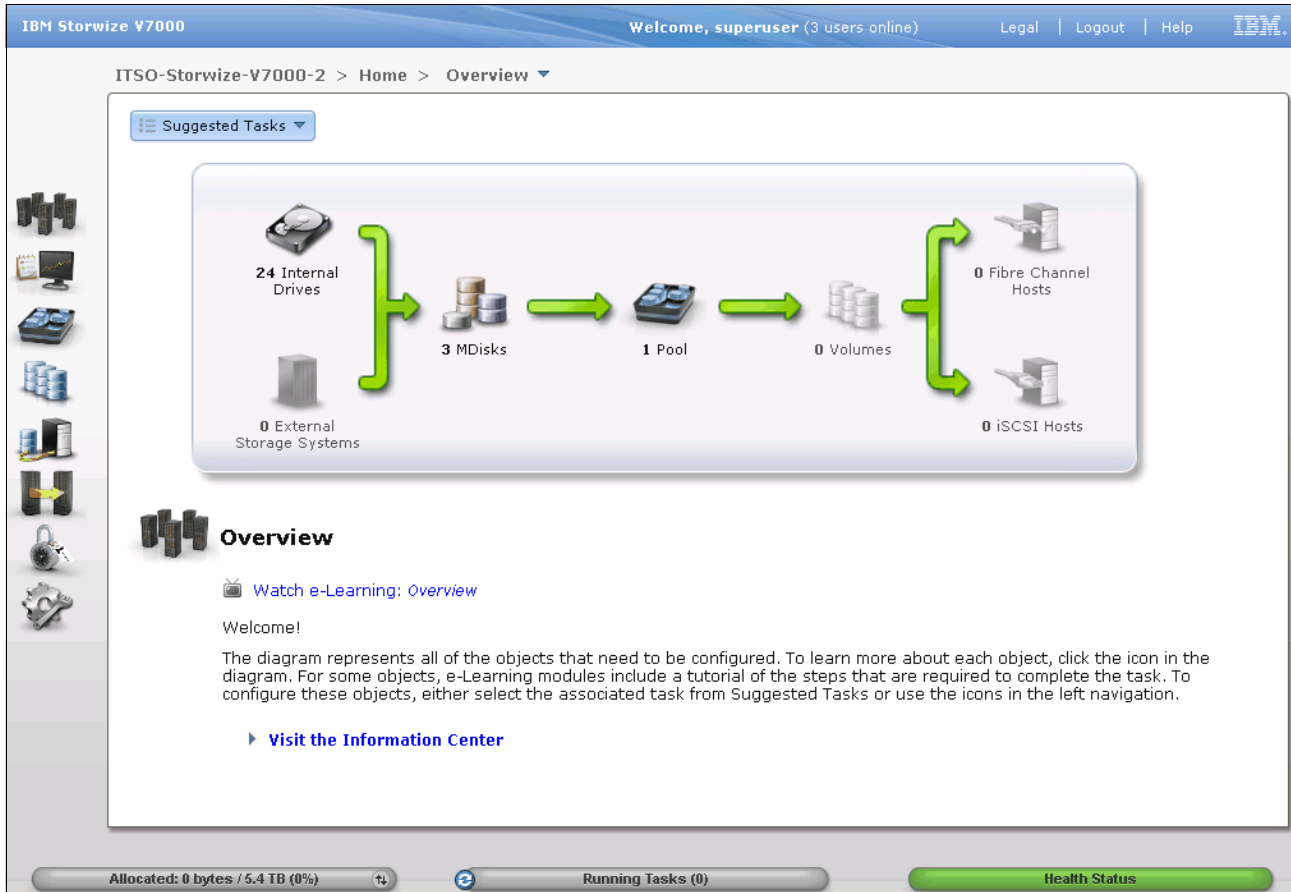


Figure 2-6 IBM Storwize V7000 Welcome window

## 2.6.2 Command-line interface

The command-line interface (CLI) is a flexible tool for system management and uses the SSH protocol. A public / private SSH key pair is optional for SSH access. Appendix A, “CLI setup and SAN Boot” on page 569 describes how to set up SSH access for Windows or UNIX systems. The storage system can be managed using the CLI (Example 2-1).

### Example 2-1 System management using the command-line interface (CLI)

```
IBM_2076:ITS0-Storwize-V7000-2:admin>lsuser
id name      password ssh_key remote usergrp_id usergrp_name
0  superuser  yes      no      no      0          SecurityAdmin
1  massimo    yes      yes     no      0          SecurityAdmin
2  mark       yes      no      no      2          CopyOperator
3  christian   yes      no      no      3          Service
4  torben     yes      no      no      1          Administrator
5  alejandro  yes      no      no      1          Administrator
6  jon        yes      no      no      4          Monitor
IBM_2076:ITS0-Storwize-V7000-2:admin>
```

**Commands:** Starting with IBM Storwize V7000 6.3, the `svctask` and `svcinfo` command prefixes are no longer necessary when issuing a command. If you have existing scripts that use those prefixes, they continue to function. You do not need to change the scripts.

Another important change is that you can use `lssystem` command instead of `svcinfo lsccluster` or `chsystem` instead of `svctask chcluster`. The old commands are maintained for compatibility purposes with any previously written scripts.

The initial IBM Storwize V7000 system setup should be done using the graphical tools we describe in 2.7, “First-time setup” on page 46.

## 2.7 First-time setup

This section describes how to perform a first-time IBM Storwize V7000 system setup.

IBM Storwize V7000 uses an easy to use initial setup that is contained within a USB key. The USB key is delivered with each storage system and contains the initialization application called `InitTool.exe`. A system management IP address, the subnet mask, and the network gateway address are required. The initialization application creates a configuration file on the USB key.

The IBM Storwize V7000 starts the initial setup as soon as you plug in the USB key with the newly created file in to the storage system.

**USB key:** If you are unable to find the official USB key supplied with the IBM Storwize V7000, you can use any USB key you have and download and copy the `initTool.exe` application from the IBM Storwize V7000 Support website at the following address:

<http://www.ibm.com/storage/support/Storwize/V7000>

The USB key contains the `initTool.exe` file (Figure 2-7).


Name ^	Date modified	Type	Size
 InitTool	9/20/2011 10:27 AM	Application	552 KB

Figure 2-7 *InitTool program in the USB key*



To complete the initial setup using the USB key, complete the following steps:

1. Plug the USB key into an Windows system and start the initialization tool. If the system is configured to autorun USB keys, the initialization tool starts automatically; otherwise, open My Computer and double-click the `InitTool.exe` file. The opening window of the tool is shown in Figure 2-8. After the tool is started, select **Initialize a new system using the USB Key** and click **Next** (Figure 2-8).

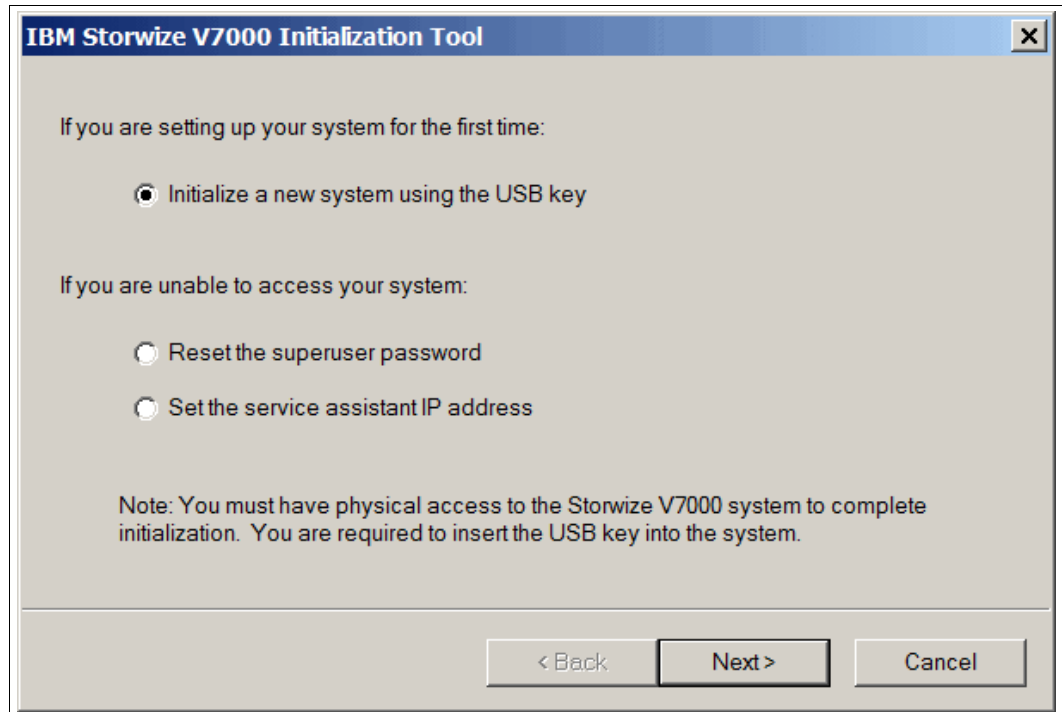
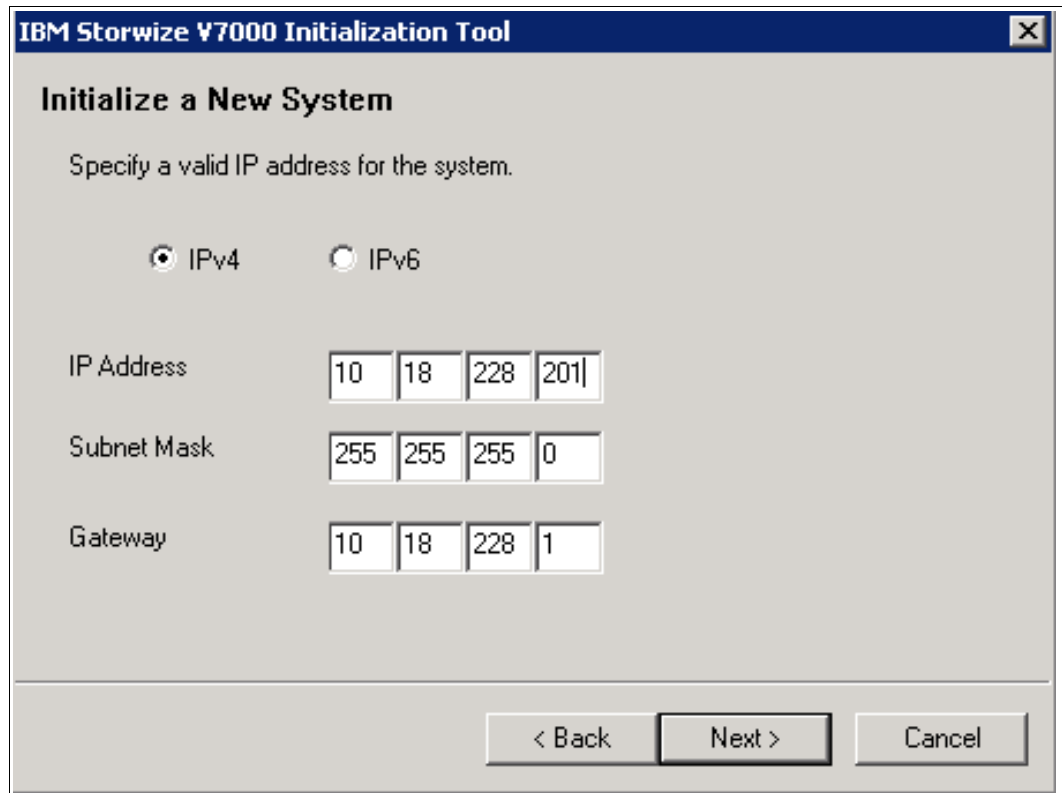


Figure 2-8 Initialization application - Welcome window

2. Enter the IPV4 or IPV6 address, subnet mask, and network gateway address and click **Next** (Figure 2-9).



The screenshot shows a window titled "IBM Storwize V7000 Initialization Tool" with a close button in the top right corner. The main heading is "Initialize a New System". Below this, the instruction "Specify a valid IP address for the system." is displayed. There are two radio buttons: "IPv4" (which is selected) and "IPv6". Below the radio buttons are three rows of input fields, each with four boxes. The first row is labeled "IP Address" and contains the values 10, 18, 228, and 201. The second row is labeled "Subnet Mask" and contains the values 255, 255, 255, and 0. The third row is labeled "Gateway" and contains the values 10, 18, 228, and 1. At the bottom right of the window, there are three buttons: "< Back", "Next >", and "Cancel".

Figure 2-9 Initialization application - Network configuration

3. Click **Finish** (Figure 2-10).

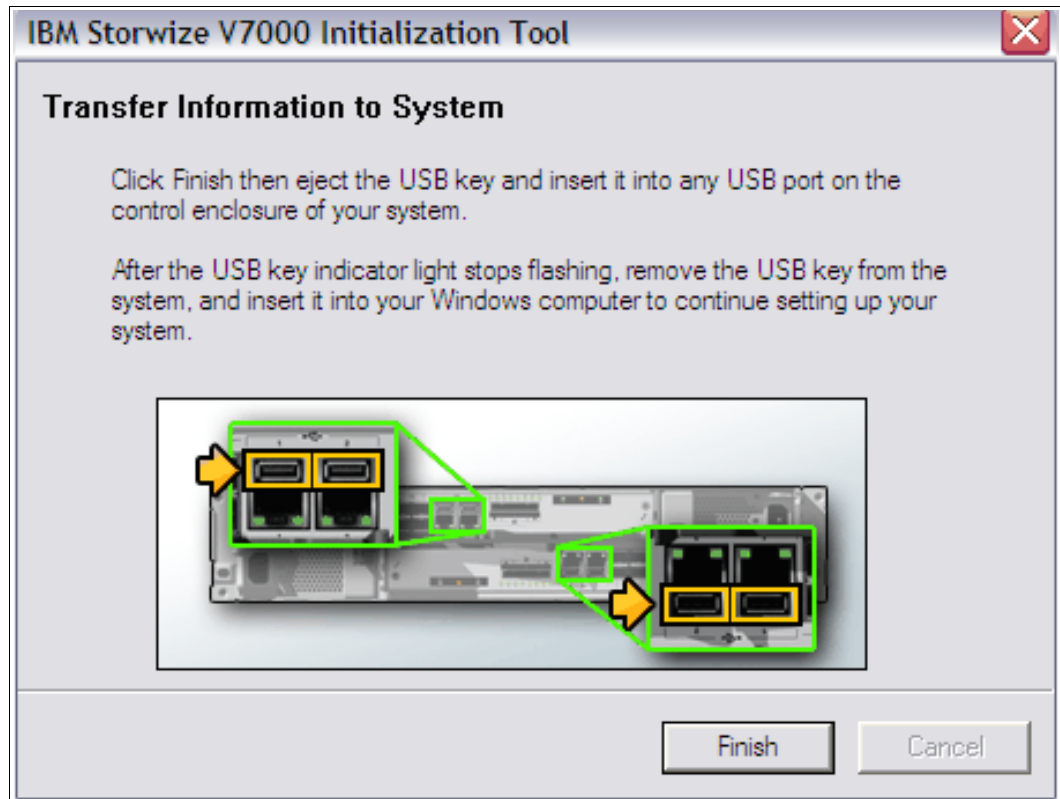


Figure 2-10 Initialization application - Finalizing the initial setup

The application creates a file called `satask.txt` on the USB key (Figure 2-11).

Name ^	Date modified	Type	Size
InitTool	9/20/2011 10:27 AM	Application	552 KB
satask_result	9/20/2011 9:13 PM	Firefox Document	5 KB

Figure 2-11 The `satask.txt` file created during the `InitTool` procedure

The contents of this file is similar to the following command:

```
satask mkcluster -clusterip 10.18.228.201 -gw 10.18.228.1 -mask 255.255.255.0
```

4. Unplug the USB key from your Windows system and plug it into the IBM Storwize V7000 USB connector slot and the storage system will automatically:
  - a. Detect the key.
  - b. Read the `satask.txt` file and run its contents.
  - c. Delete the `satask.txt` file.
  - d. Write the response to a new file called `satask_result.html` (Figure 2-12).

Name ^	Date modified	Type	Size
InitTool	9/20/2011 10:27 AM	Application	552 KB
satask_result	9/20/2011 9:13 PM	Firefox Document	5 KB

Figure 2-12 `satask_result.html` file created during the `InitTool` procedure

**Clustered system creation:** While the clustered system is being created, the amber fault LED on the node canister flashes. When the amber fault LED stops flashing, remove the USB key from IBM Storwize V7000 and insert it in your system to check the results.

After this task has completed successfully, the initial setup is done. The IBM Storwize V7000 is available for further configuration changes using the newly defined configuration address.

Each node has two Ethernet ports that can be used for system management. Ethernet port 1 is used for system management and must be configured and connected on both nodes. The use of Ethernet port 2 is optional.

Each IBM Storwize V7000 clustered system has one or two system IP addresses. If the configuration node fails, the system IP addresses are transferred to another node in the same clustered system.

**Important:** The first system management IP address always uses port 1. Always connect port 1 for all node canisters to the management network.

A sample of the contents of the `satask_result.html` file is shown in Example 2-2.

*Example 2-2 satask\_result.html file contents*

---

Service Command Results

```
satask mkcluster -clusterip 10.18.228.201 -gw 10.18.228.1 -mask 255.255.255.0
```

Tue Sep 20 10:51:57 PDT 2011

System Status

```
sainfo lsservicenodes
```

```
panel_name cluster_id      cluster_name      node_id node_name relation
node_status error_data
78G00RJ-1  00000200A0A006B2 Cluster_10.18.228.201 1      node1      local
Active
```

```
sainfo lsservicestatus
```

```
panel_name 78G00RJ-1
cluster_id 00000200a0a006b2
cluster_name Cluster_10.18.228.201
cluster_status Active
cluster_ip_count 2
cluster_port 1
cluster_ip 10.18.228.201
cluster_gw 10.18.228.1
cluster_mask 255.255.255.0
cluster_ip_6
cluster_gw_6
cluster_prefix_6
cluster_port 2
cluster_ip
```

```
cluster_gw
cluster_mask
cluster_ip_6
cluster_gw_6
cluster_prefix_6
node_id 1
node_name node1
node_status Active
config_node Yes
hardware 100
service_IP_address
service_gateway
service_subnet_mask
service_IP_address_6
service_gateway_6
service_prefix_6
node_sw_version 6.3.0.0
node_sw_build 54.0.1109090000
cluster_sw_build 54.0.1109090000
node_error_count 1
error_code 835
error_data
error_code
error_data
error_code
error_data
error_code
error_data
error_code
error_data
error_code
error_data
fc_ports 4
port_id 1
port_status Active
port_speed 2Gb
port_WWPN 50050768021005a8
SFP_type Short-wave
port_id 2
port_status Active
port_speed 4Gb
port_WWPN 50050768022005a8
SFP_type Short-wave
port_id 3
port_status Inactive
port_speed N/A
port_WWPN 50050768023005a8
SFP_type Short-wave
port_id 4
port_status Inactive
port_speed N/A
port_WWPN 50050768024005a8
SFP_type Short-wave
ethernet_ports 2
ethernet_port_id 1
port_status Link Online
port_speed 1Gb/s - Full
```

```
MAC e4:1f:13:74:09:fb
ethernet_port_id 2
port_status Not Configured
port_speed
MAC e4:1f:13:74:09:fa
ethernet_port_id 3
port_status
port_speed
MAC
ethernet_port_id 4
port_status
port_speed
MAC
product_mtm 2076-124
product_serial 78G00RJ
time_to_charge 0
battery_charging 100
dump_name 78G00RJ-1
node_WWNN
disk_WWNN_suffix
panel_WWNN_suffix
UPS_serial_number
UPS_status
enclosure_WWNN_1 50050768020005a8
enclosure_WWNN_2 50050768020005a9
node_part_identity 11S85Y5849YG50CG09827P
node_FRU_part 85Y5899
enclosure_identity 11S85Y5963YG50CG0AN7A0
PSU_count 2
PSU_id 1
PSU_status active
PSU_id 2
PSU_status active
Battery_count 2
Battery_id 1
Battery_status active
Battery_id 2
Battery_status active
node_location_copy 1
node_product_mtm_copy 2076-124
node_product_serial_copy 78G00RJ
node_WWNN_1_copy 50050768020005a8
node_WWNN_2_copy 50050768020005a9
latest_cluster_id 200a0a006b2
next_cluster_id 200a0c006b2
console_IP 10.18.228.201:443
has_nas_key no

sainfo lsservicerecommendation

service_action
Follow troubleshooting procedures to fix hardware.

sainfo lshardware
```

```
panel_name 78G00RJ-1
node_id 1
node_name node1
node_status Active
hardware 100
actual_different no
actual_valid yes
memory_configured 8
memory_actual 8
memory_valid yes
cpu_count 1
cpu_socket 1
cpu_configured 4 core Intel(R) Xeon(R) CPU C3539 @ 2.13GHz
cpu_actual 4 core Intel(R) Xeon(R) CPU C3539 @ 2.13GHz
cpu_valid yes
cpu_socket
cpu_configured
cpu_actual
cpu_valid
adapter_count 5
adapter_location 0
adapter_configured Four port 8Gb/s FC adapter
adapter_actual Four port 8Gb/s FC adapter
adapter_valid yes
adapter_location 0
adapter_configured 1Gb/s Ethernet adapter
adapter_actual 1Gb/s Ethernet adapter
adapter_valid yes
adapter_location 0
adapter_configured 1Gb/s Ethernet adapter
adapter_actual 1Gb/s Ethernet adapter
adapter_valid yes
adapter_location 0
adapter_configured High Speed SAS adapter
adapter_actual High Speed SAS adapter
adapter_valid yes
adapter_location 0
adapter_configured Midplane bus adapter
adapter_actual Midplane bus adapter
adapter_valid yes
adapter_location
adapter_configured
adapter_actual
adapter_valid
```

---

## 2.8 Initial configuration

This section describes how to complete the initial configuration, including:

- ▶ Setting name, date, and time
- ▶ Initial storage configuration using the setup wizard

Complete the following steps:

1. Start the configuration wizard using a web browser on a workstation and point it to the system management IP address defined in 2.7, “First-time setup” on page 46. Type in the default superuser password <passw0rd> (where 0 = zero) (Figure 2-13).



Figure 2-13 Setup wizard - Login window



2. Read and accept the license agreement (Figure 2-14).

**License Agreement (Step 1 of 6)**

Read the license agreement carefully.

**License** IBM Notices Java Notices Non-IBM Licenses Additional Licenses and Notices

International Program License Agreement

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"IBM" - International Business Machines Corporation or one of its subsidiaries.

I agree with the terms in the license agreement.

I do not agree with the terms in the license agreement.

Next >

Figure 2-14 Setup wizard - License Agreement

3. Set up the system name, current date, and time (Figure 2-15).

**Name, Date, and Time (Step 2 of 6)**

**System Name**

IBM-Storwize-V7000-2

**Time Zone**

(GMT-8:00) US Pacific Time

**Set Date and Time**

**Date** 9/20/2011

12-Hour  24-Hour

**Time** 10:46 PM

**Set NTP Server IP Address**

Next >

Figure 2-15 Setup wizard - Set name, date, and time

4. Optionally, you can type in advanced licenses for virtualization of external storage devices and a Remote Copy limit, as applicable. The virtualization license for all local devices is already included in the system and must not be added here.

Figure 2-16 shows an example of how to add a license for external storage, Remote Copy, and Real Time Compression.

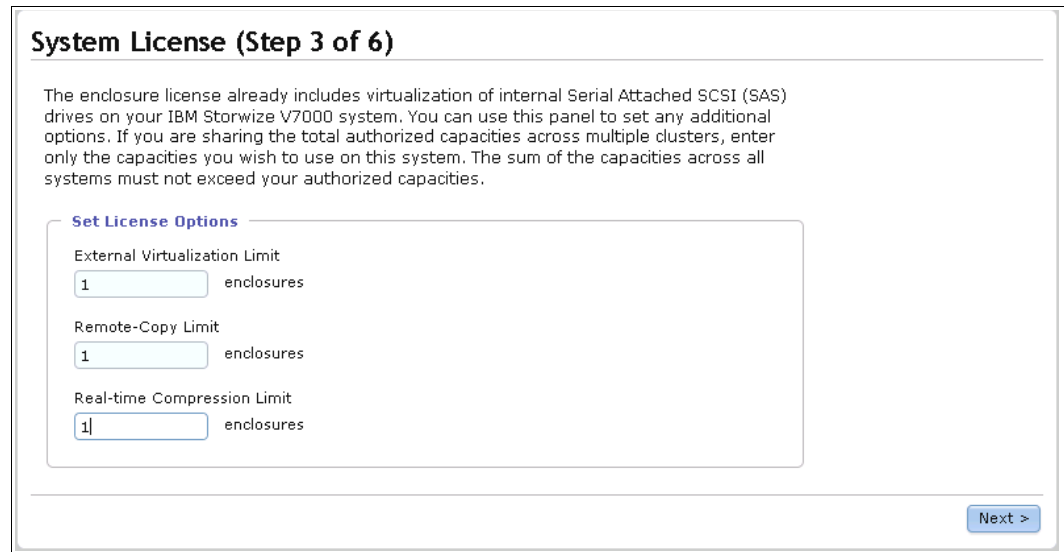


Figure 2-16 Setup wizard - License setting

## 2.8.1 Configure Call Home, email alert, and inventory

If your system is within warranty, or you have a hardware maintenance agreement, configure your system to send email reports to IBM if an issue that requires hardware replacement is detected. This function is called *Call Home*. When this email is received, IBM automatically opens a problem report and contacts you to verify if replacements parts are required.

**Call Home:** When configuring Call Home, use one of the following email addresses, depending on country or region of installation:

- ▶ callhome1@de.ibm.com: USA, Canada, Latin America, and Caribbean Islands
- ▶ callhome0@de.ibm.com: All other countries/regions

To configure the Call Home and email alert event notification in IBM Storwize V7000, complete the following steps.

1. Click **Configure Email Event Notification** (Figure 2-17) to start the email configuration wizard.

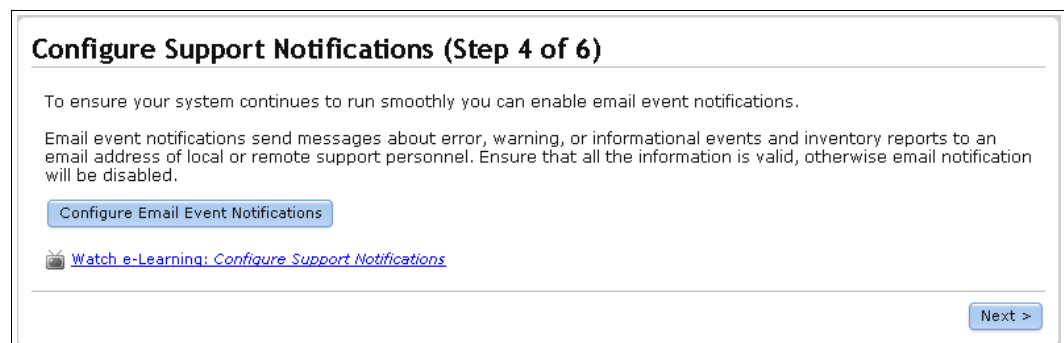


Figure 2-17 Setup wizard option email and event configuration

2. Define the sending email account (Figure 2-18).

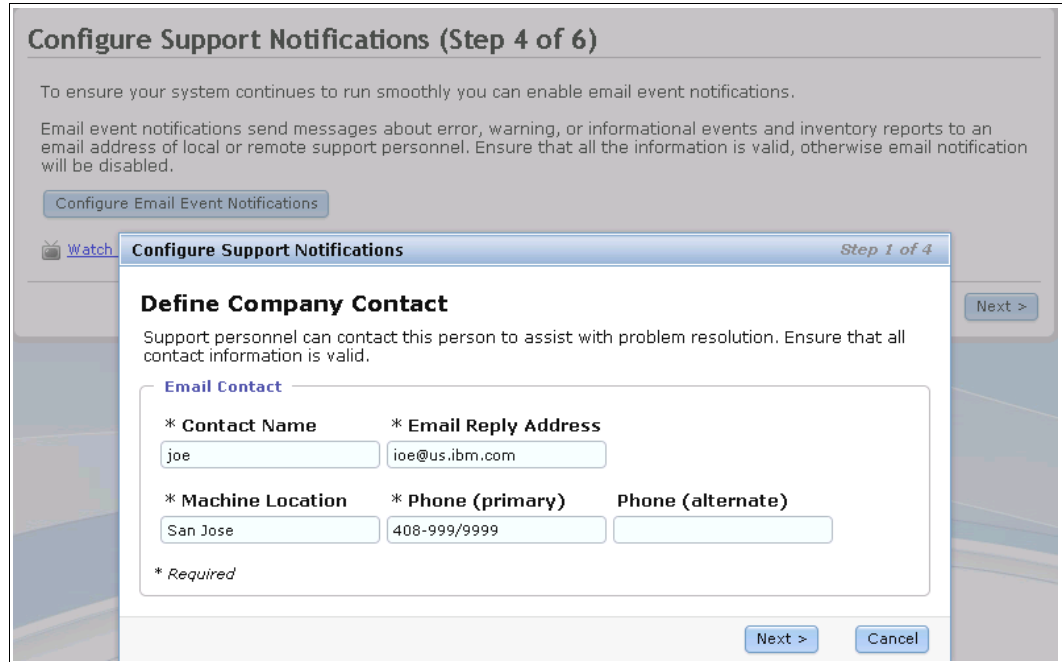


Figure 2-18 Email and event configuration - Setting contact information

3. Configure the email server (Figure 2-19).

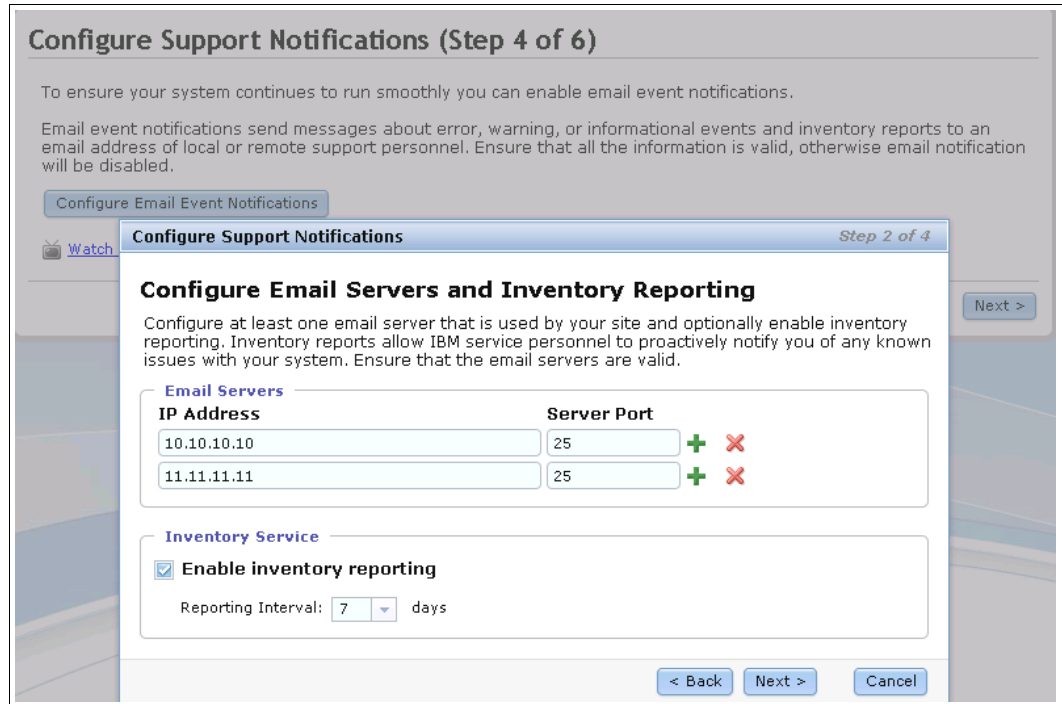


Figure 2-19 Email and event configuration - Email server definition

- Type in the receiving email address for local users and for support and select the appropriate message type for each user (Figure 2-20).

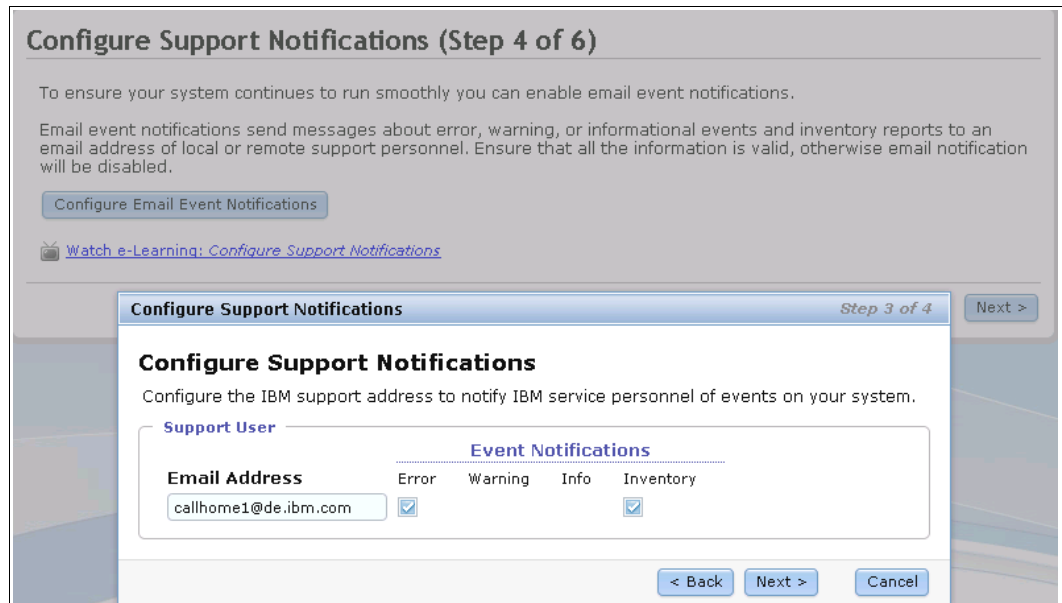


Figure 2-20 Email and event configuration - Setting email address and event level for Call Home

- Click **Next** to verify the email configuration and click **Finish** (Figure 2-21).

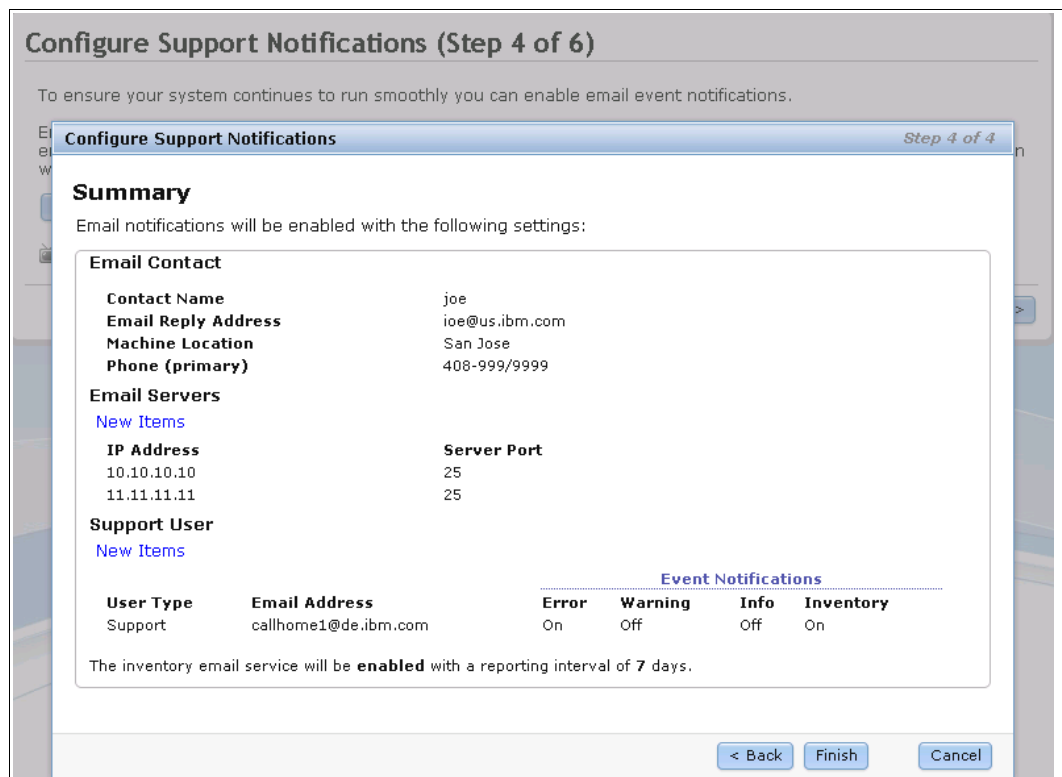


Figure 2-21 Email and event configuration - Verify email addresses and finish the configuration

- The Email Event Notification setup is successfully done. The setup wizard shows the new email configuration. You can modify the settings, discard them, or continue with the configuration by clicking **Next** (Figure 2-22).

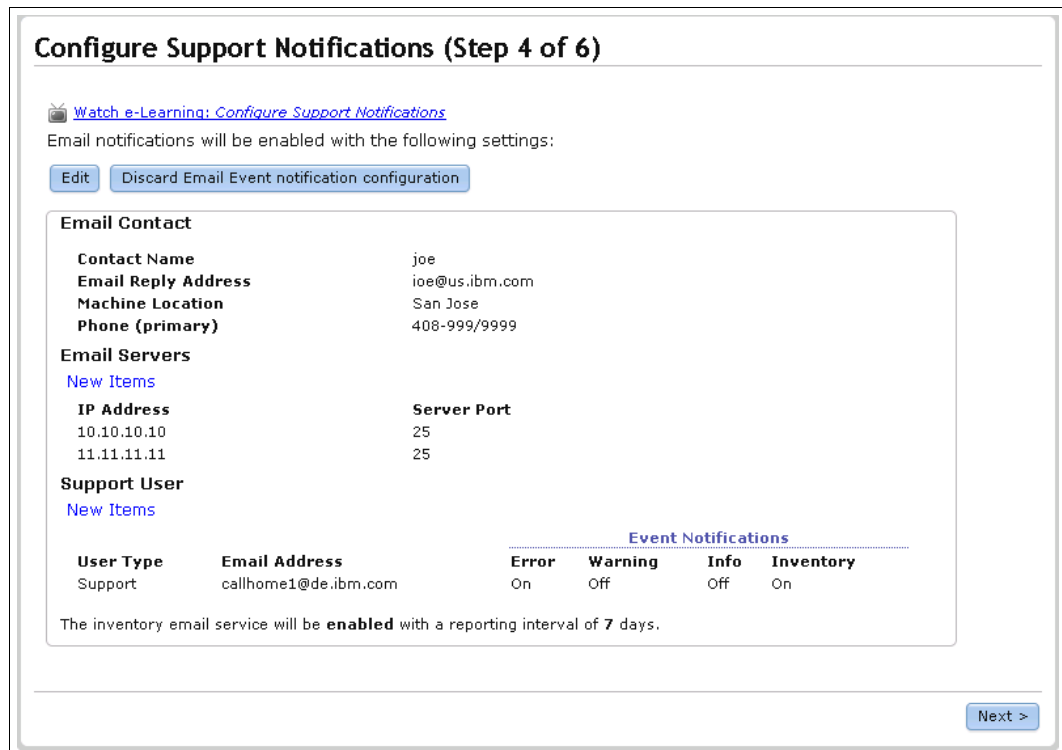


Figure 2-22 Setup wizard - Finalize email settings

7. The configuration wizard continues with the hardware configuration. Verify the hardware (Figure 2-23).

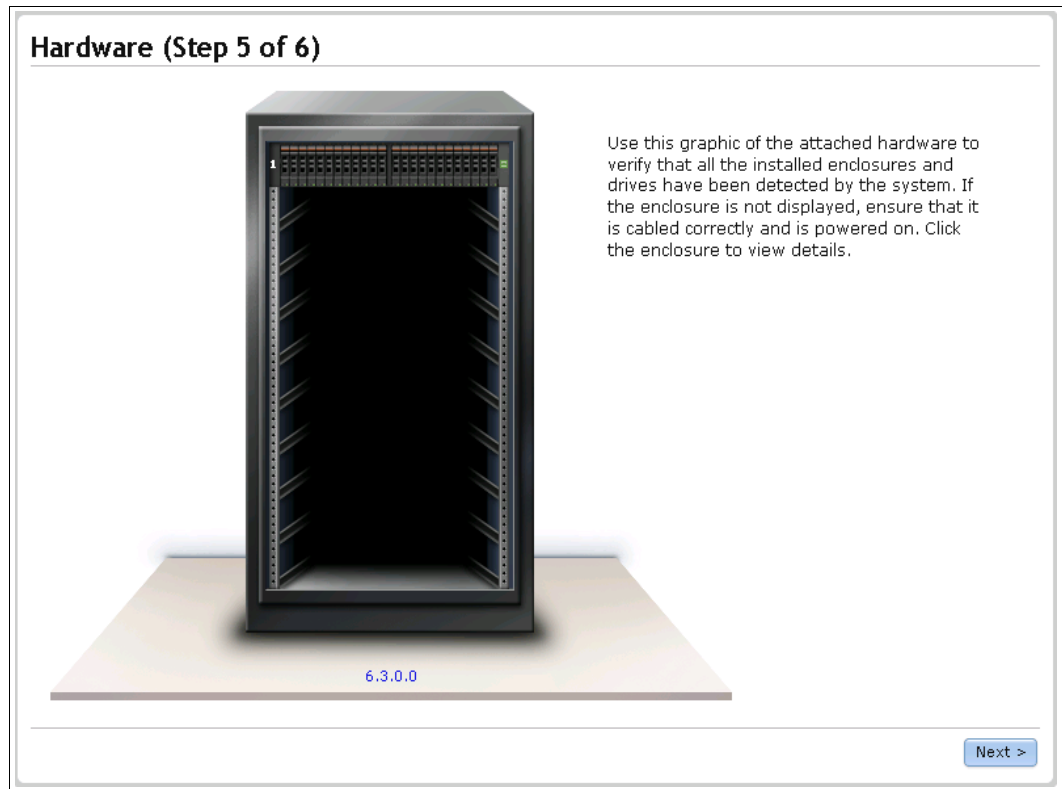


Figure 2-23 Setup wizard - Verify the detected hardware

8. After you click **Next**, an Add Enclosure window opens. Wait until The task completed windows opens (Figure 2-24).

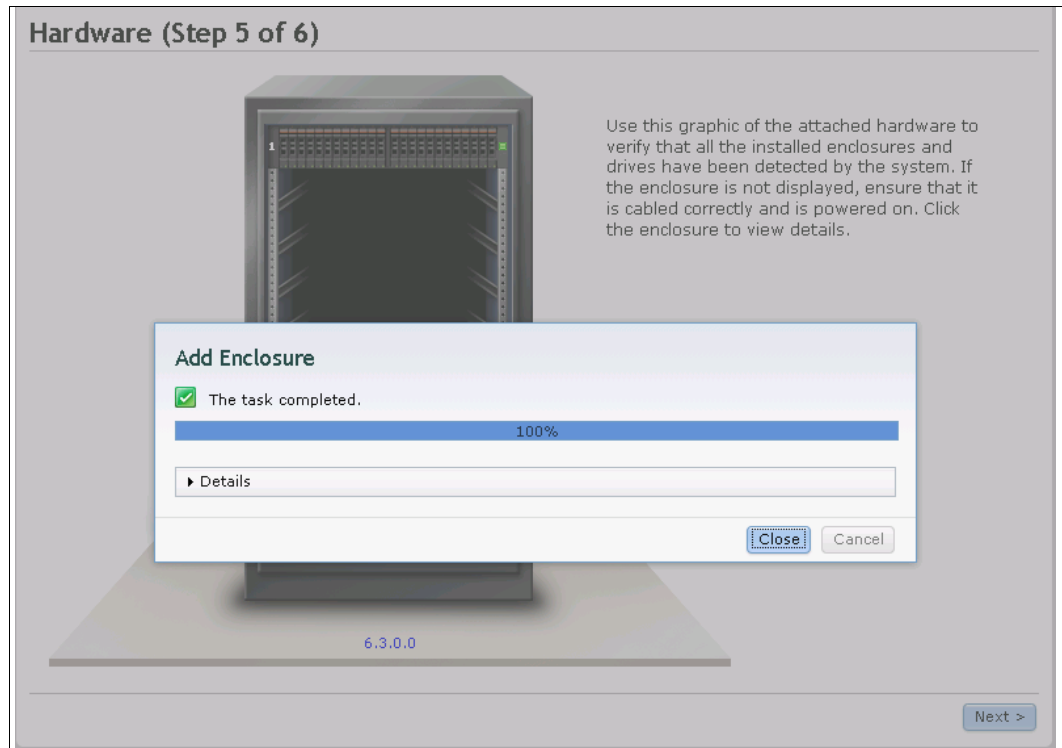


Figure 2-24 Setup wizard - Task completed

9. Finally, the configuration wizard detects the internal disk drives and offers you a choice about the storage configuration for all internal disk drives:
- If the proposed configuration is acceptable to you, select the check box and click **Finish** to finalize the initial configuration (Figure 2-25).
  - If you prefer a customized configuration, leave the check box blank, click **Finish**, and continue with the storage configuration using Advanced Storage Configuration. Advanced Storage Configuration is described in Chapter 8, “Advanced host and volume administration” on page 269 and Chapter 11, “Copy services” on page 371.
  - Optionally, you can start the migration wizard and let the system guide you.



Figure 2-25 Setup wizard - Automatically configure the storage configuration



After you click **Finish**, a Synchronizing memory cache window opens. Wait until the task completed window opens (Figure 2-26).

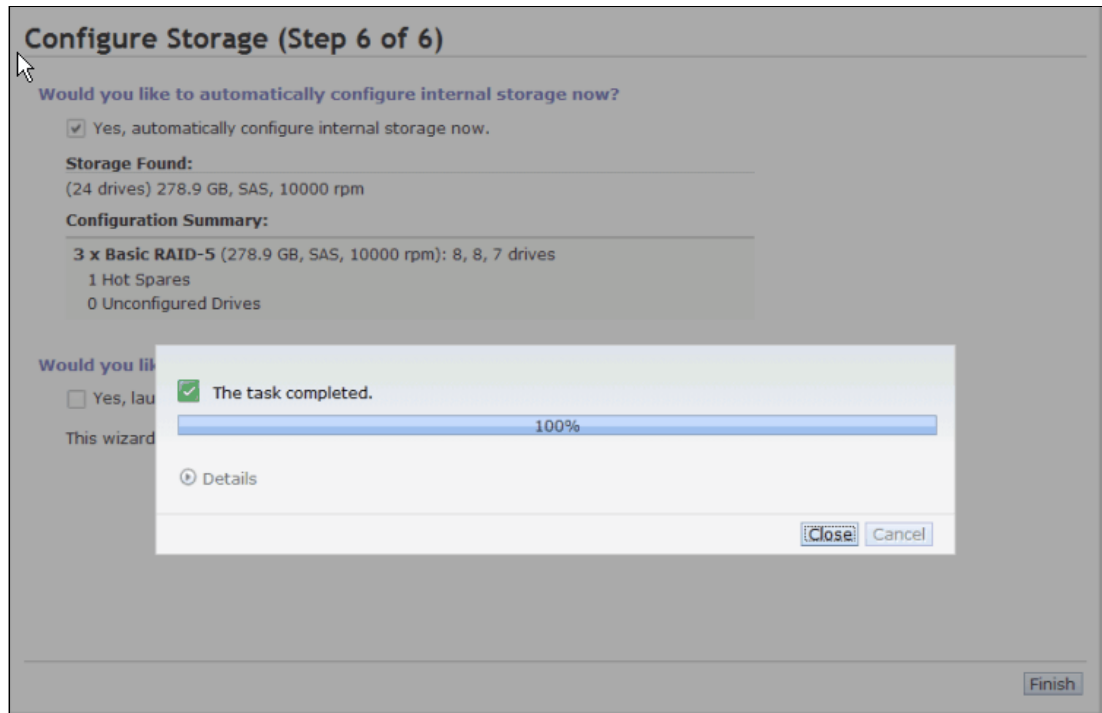


Figure 2-26 Setup wizard - Task completed

You have now successfully finalized the initial configuration wizard for the IBM Storwize V7000 system. Figure 2-27 shows the Getting Started window.



Figure 2-27 IBM Storwize V7000 - Getting Started window



## Graphical user interface overview

This chapter provides an overview of the graphical user interface for IBM Storwize V7000 and shows how to use the navigation tools.

## 3.1 Overview of IBM Storwize V7000 management software

The new graphical user interface is designed to simplify storage management and provide a fast and more efficient management tool. It is loosely based on the IBM System Storage XIV® software and has a similar look and feel.

**JavaScript:** You might need to enable JavaScript in your browser. Additionally, if you are using Firefox, under Advanced JavaScript Settings, you need to click **Disable or replace context menus** and allow cookies.

### 3.1.1 Access to the storage management software

To log on to the management software, point your web browser at the IP address that was set during the initial setup process. The login window opens (Figure 3-1).



Figure 3-1 Login window

After you have logged in successfully, the Getting Started window opens (Figure 3-2).

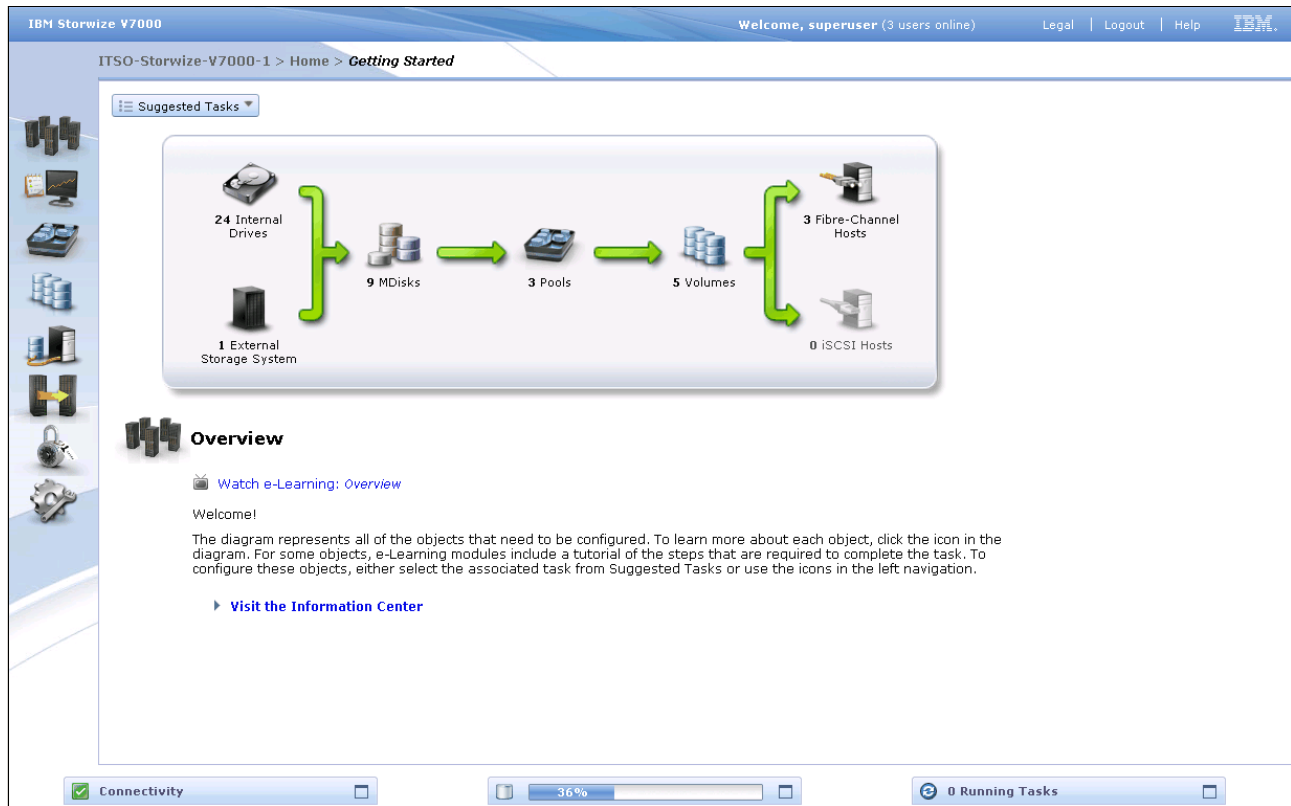


Figure 3-2 Home menu showing the Getting Started window

### 3.1.2 Getting Started window layout

This window has three main sections for navigating through the management tool. On the far left of the window are eight *function icons*. The eight function icons represent:

- ▶ The Home menu
- ▶ The Troubleshooting menu
- ▶ The Physical Storage menu
- ▶ The Volumes menu
- ▶ The Hosts menu
- ▶ The Copy Services menu
- ▶ The User Management menu
- ▶ The Configuration menu

In the middle of the window is a diagram illustrating the existing configuration. Clicking the function icons in this area provides extended help references, including a link to a short video presentation to explain the topic in more detail. This video is not a navigation tool, but rather an extended help window that includes configuration information.

At the bottom of the window are three status indicators. Clicking any of them provides more detailed information about the existing configuration of the IBM Storwize V7000 solution. Click any of these function icons to expand them and minimize them as required.

Figure 3-3 shows the main areas.

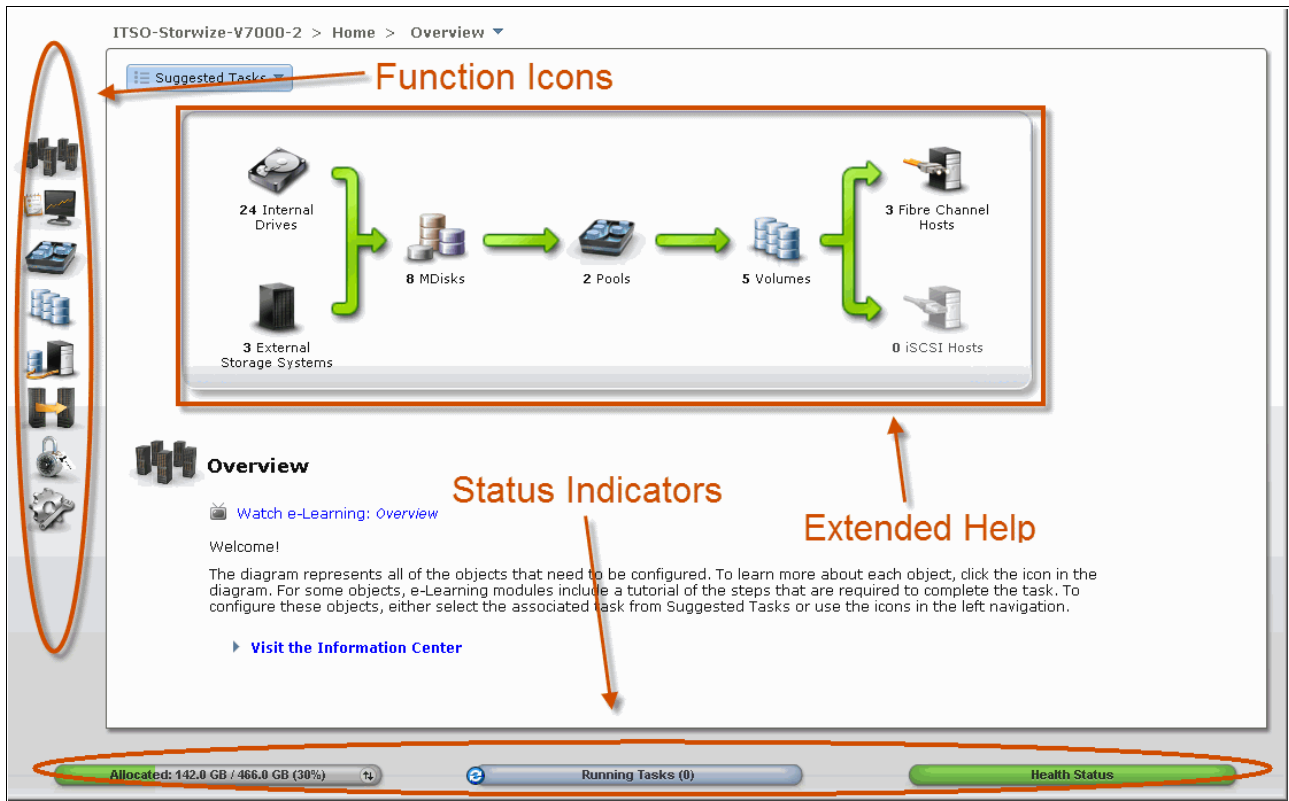


Figure 3-3 Main areas

### 3.1.3 Navigation

Navigating around the management tool is simple. You can hover the cursor over one of the eight function icons on the left side of the window, which highlights the function icon and shows a list of options. You can then move the cursor to the wanted option and click it (Figure 3-4).

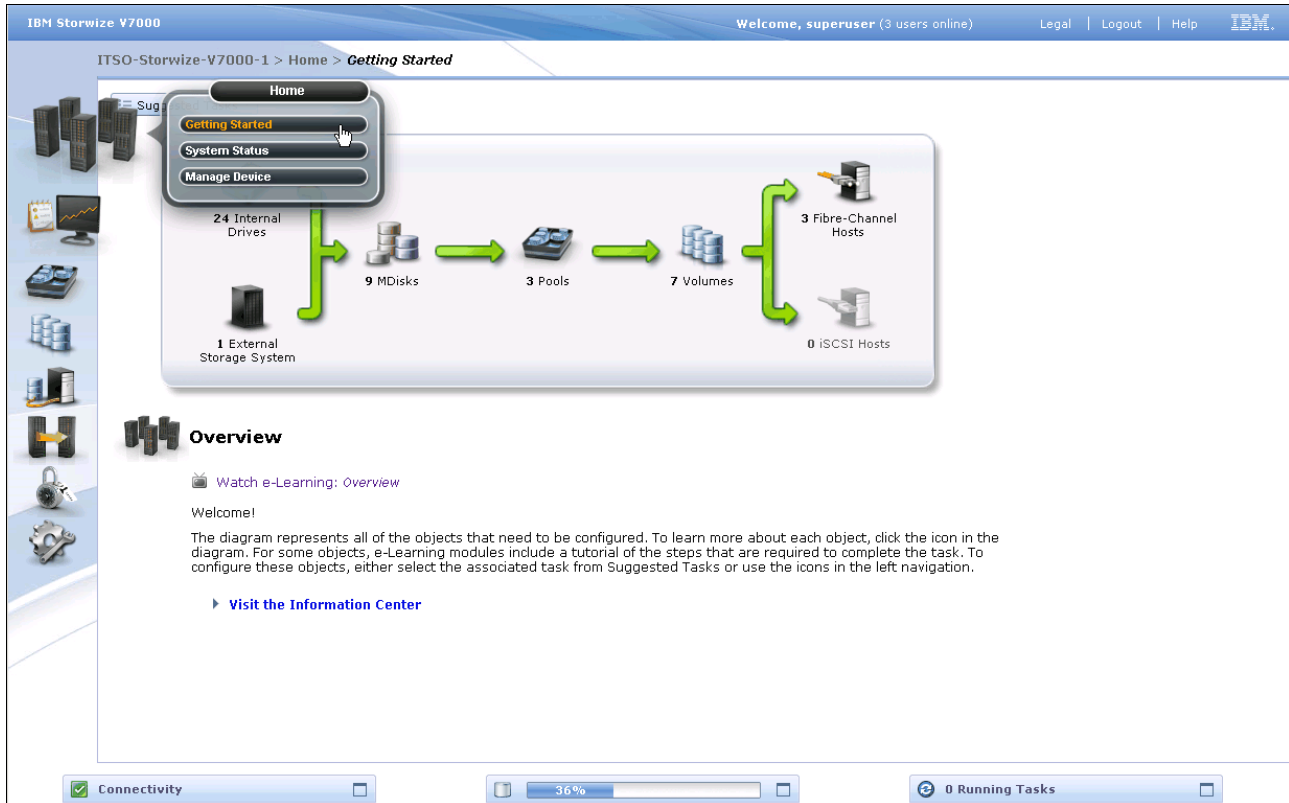


Figure 3-4 Navigation using the menu options

An alternative method is to click the wanted function icon, which opens the corresponding window (Figure 3-5).

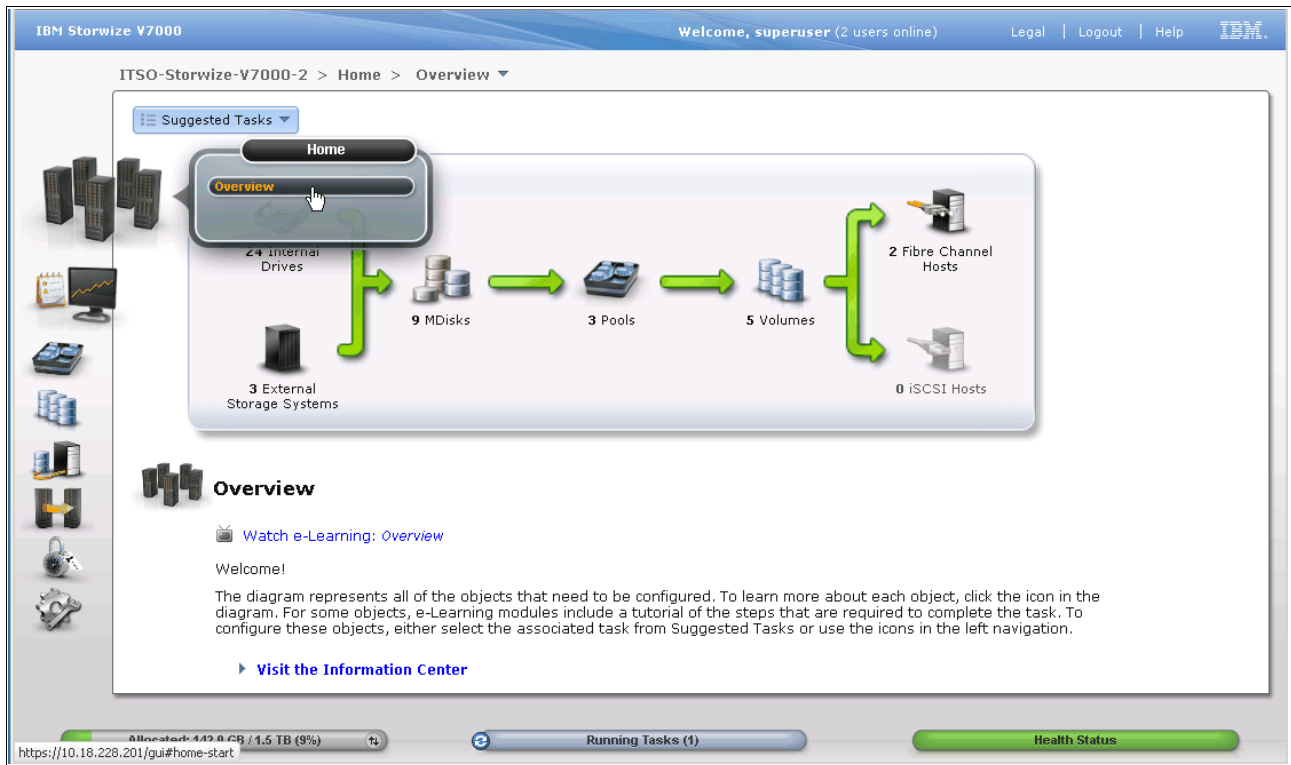


Figure 3-5 Navigation using the menu tabs



If you click the **All Hosts** menu, you can change the window's view (Figure 3-6). This action also applies to any other menu options.

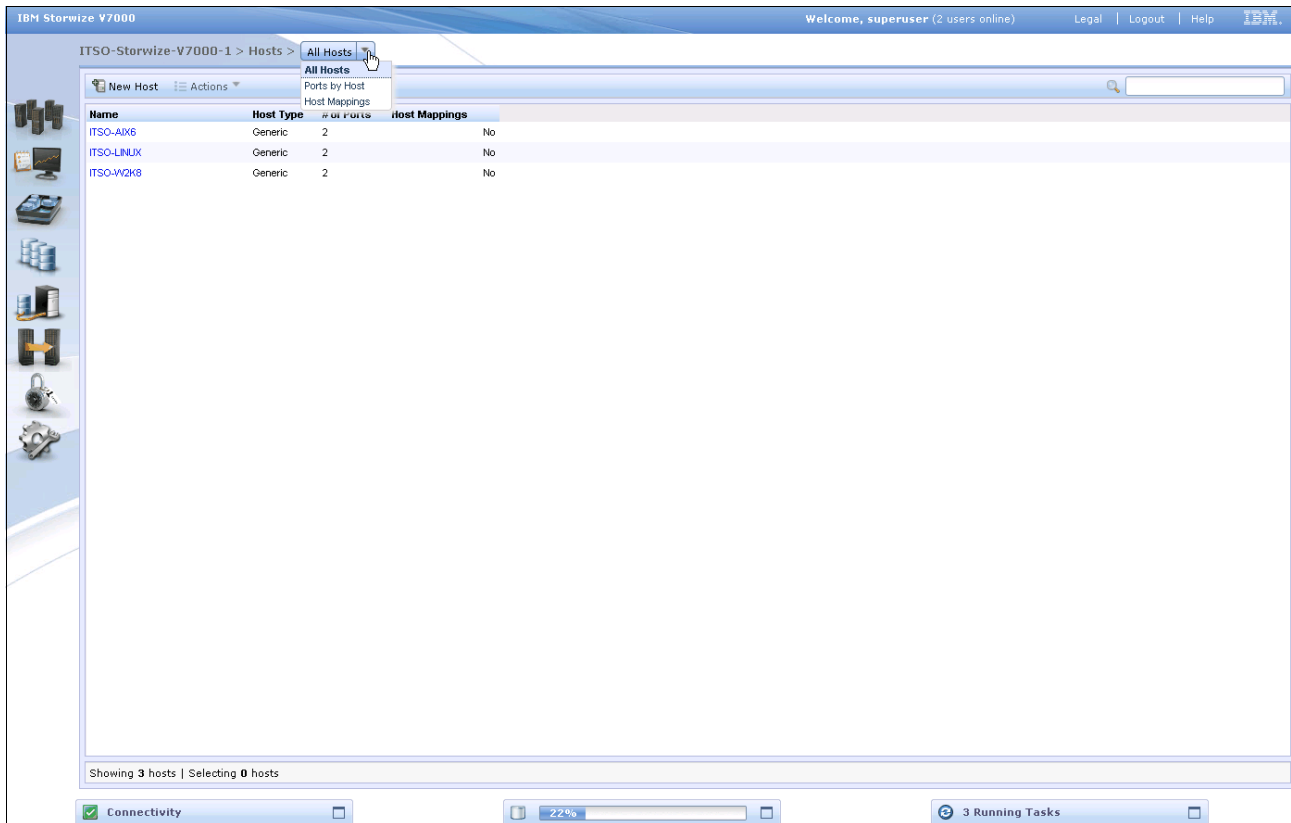


Figure 3-6 Navigation using the change view

Figure 3-7 shows a list of the IBM Storwize V7000 Software function icons and the associated menu options.

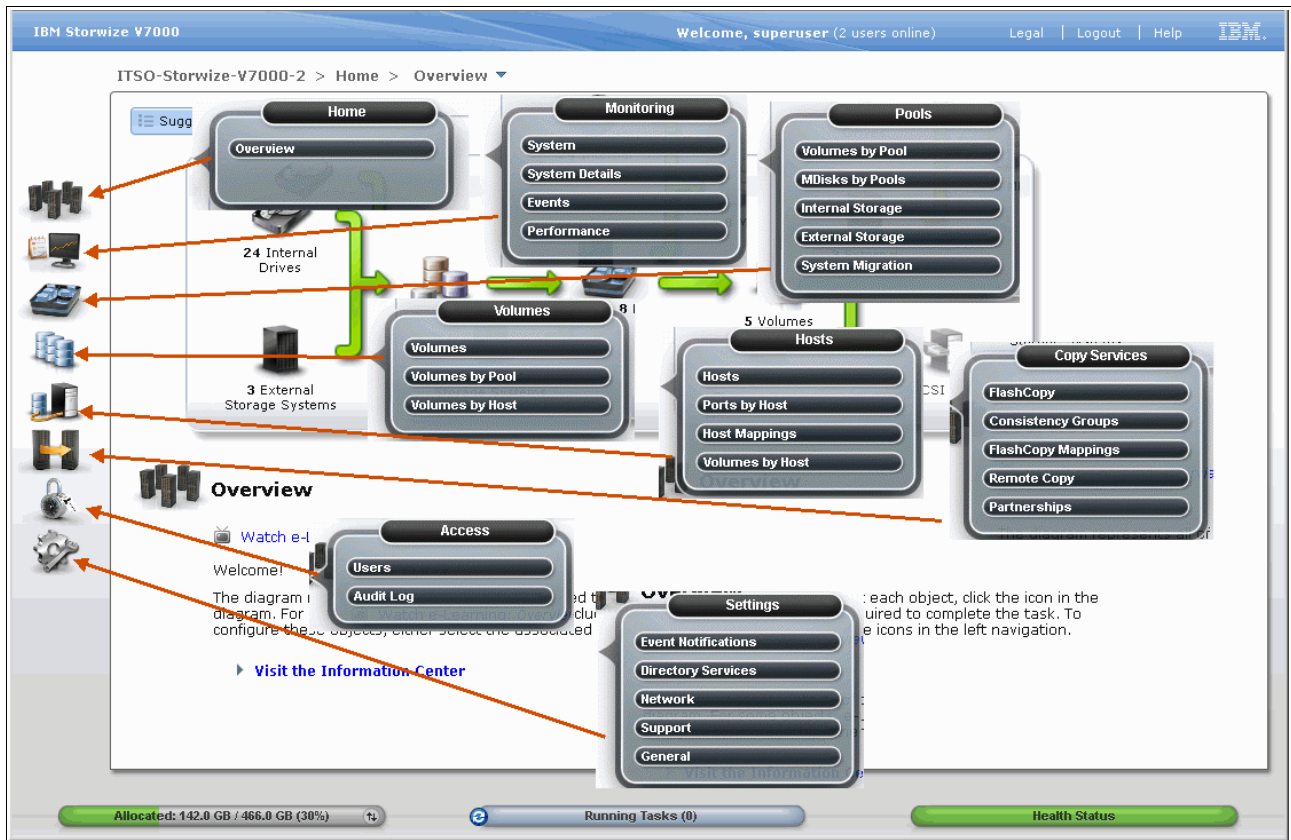


Figure 3-7 IBM Storwize V7000 Software - Menu options

### 3.1.4 Multiple selections

The new management tool also lets you select multiple items by using a combination of the Shift or Ctrl keys. To select multiple items in a display, click the first item, press and hold the Shift key, and click the last item in the list you require. All the items in between those two items are selected (Figure 3-8).

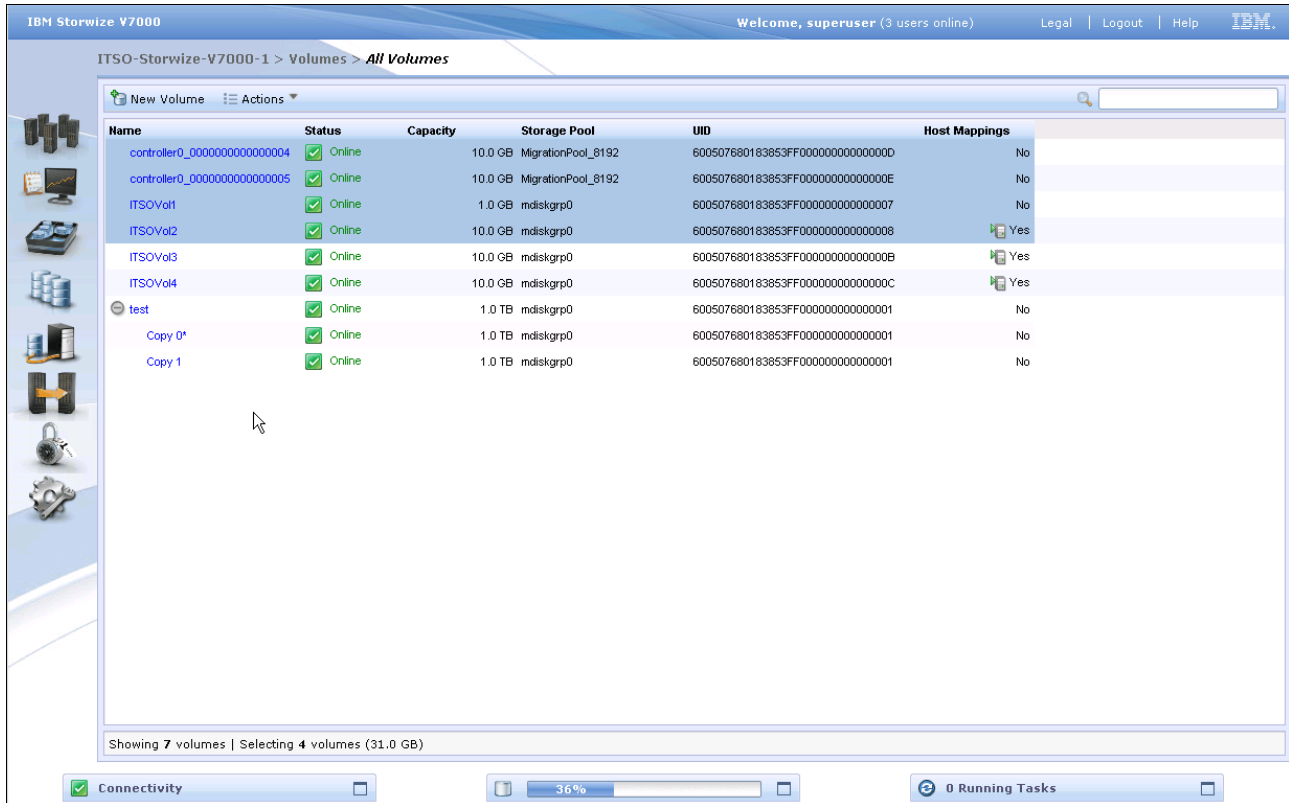


Figure 3-8 Multiple selections using the Shift key

If you want to select multiple items that are not in sequential order, click the first item, press and hold the Ctrl key, and click the other items you require (Figure 3-9).

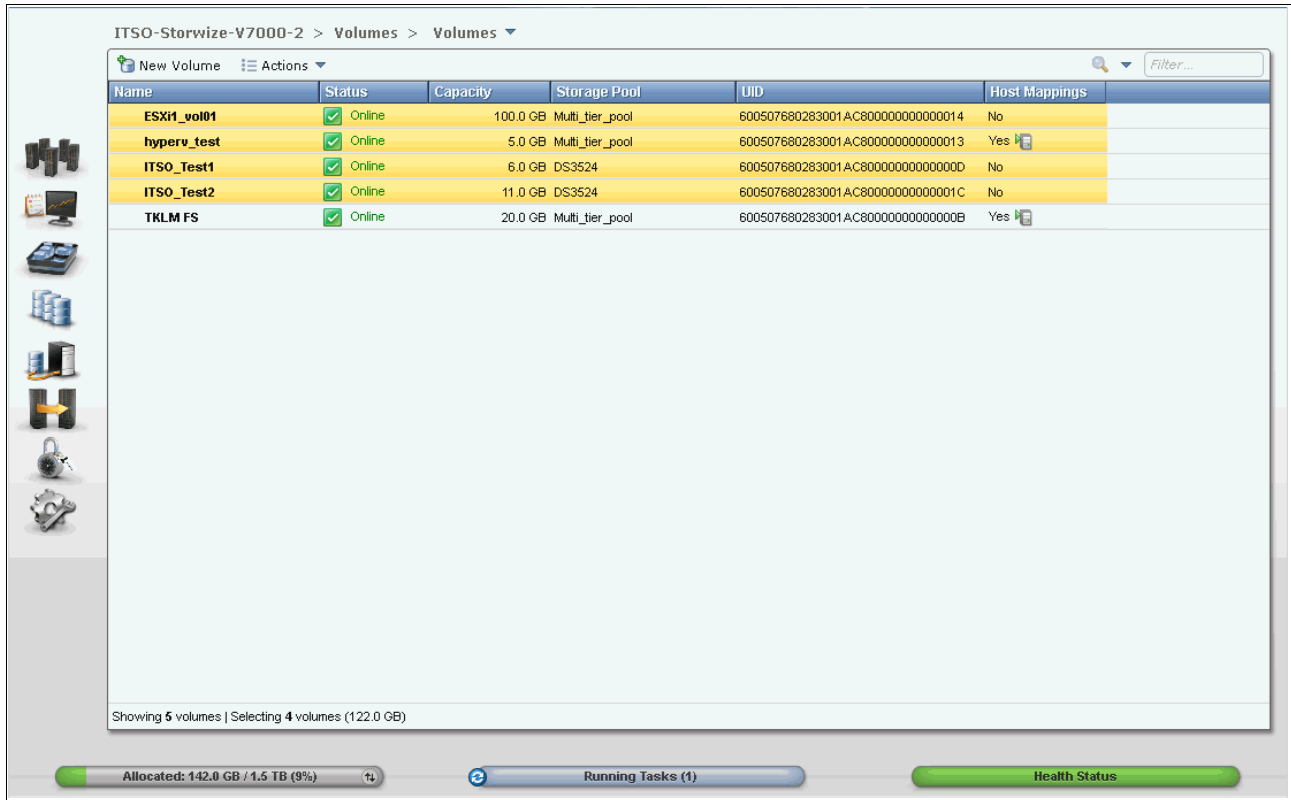


Figure 3-9 Multiple selections using the Ctrl key

### 3.1.5 Status Indicators menus

Other useful tools are the Status Indicator menus that appear at the bottom of the window (Figure 3-10). These menus can be maximized and minimized and provide links to connectivity options, a storage allocation window, and a window of long running tasks.

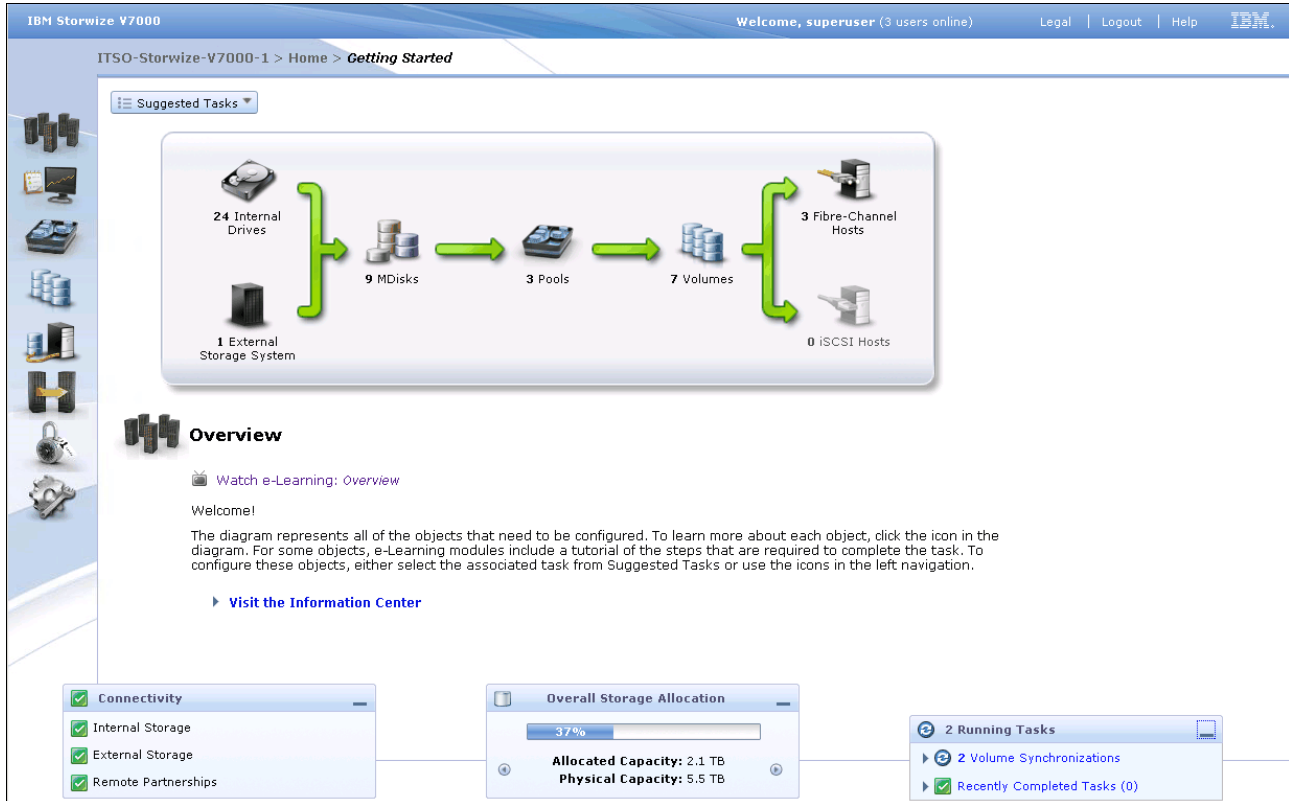


Figure 3-10 Status Indicators menus

You can view the details of the running task by clicking the status indicator bars at the bottom of the window (Figure 3-11).

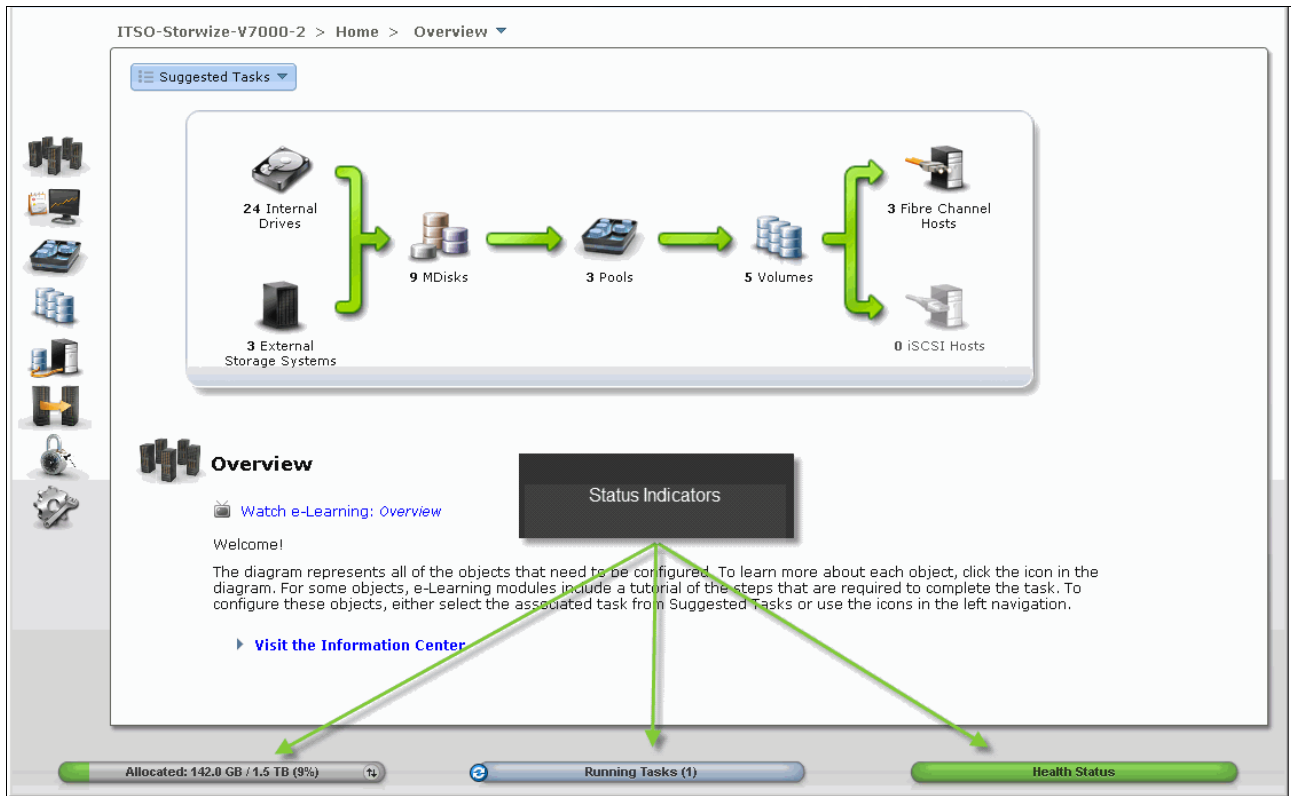


Figure 3-11 Show running task details window

## 3.2 Home menu

The IBM Storwize V7000 management software provides an efficient and quick mechanism for navigating between the various different functions. Clicking one of the eight function icons on the left side of the window causes a menu option to open that allows you to navigate directly to the selected option (Figure 3-12).

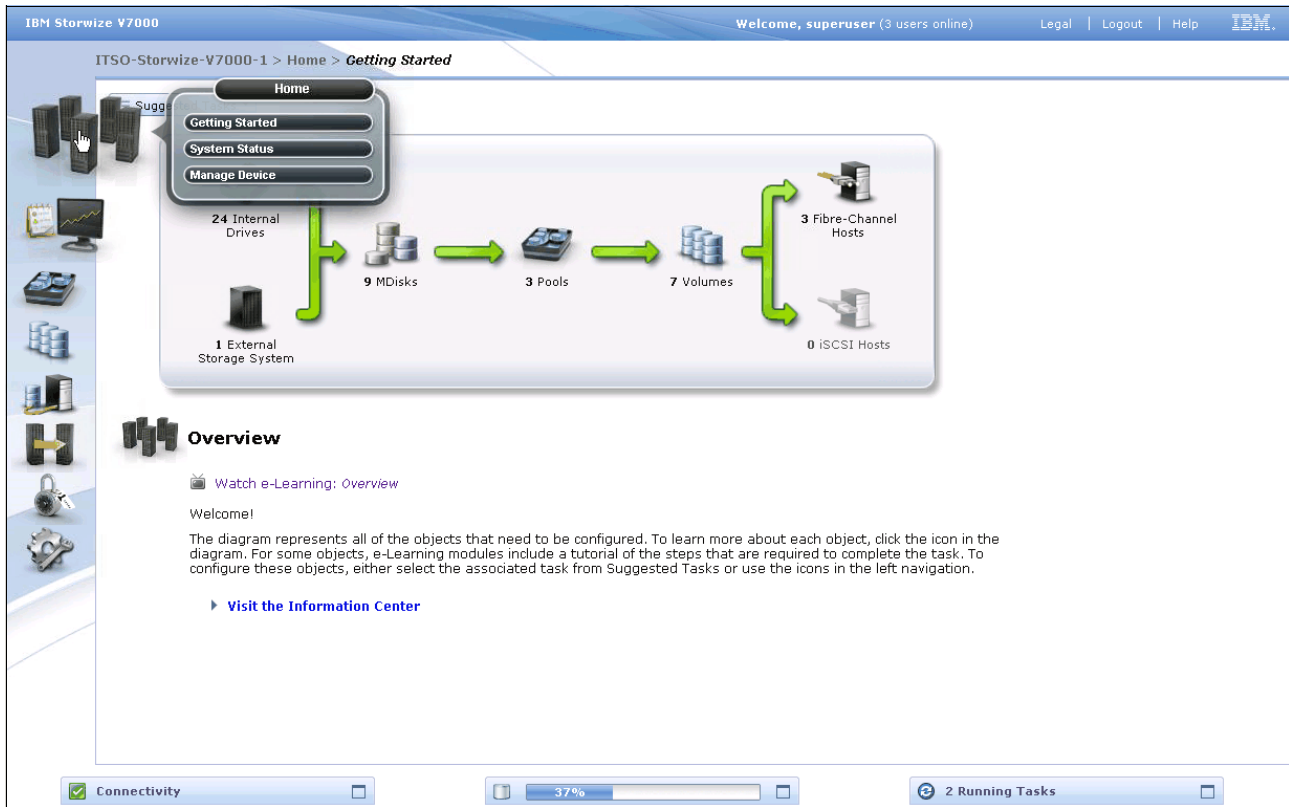


Figure 3-12 Navigate to the Home menu

### 3.2.1 Monitoring System menu

The System menu is useful for identifying configuration information about the IBM Storwize V7000 solution. This window shows a bar on the left that lists the physical and usable capacity of the system when you hover the cursor over it (Figure 3-13). Figure 3-13 also shows the control enclosure and any expansion enclosures of the IBM Storwize V7000 solution.

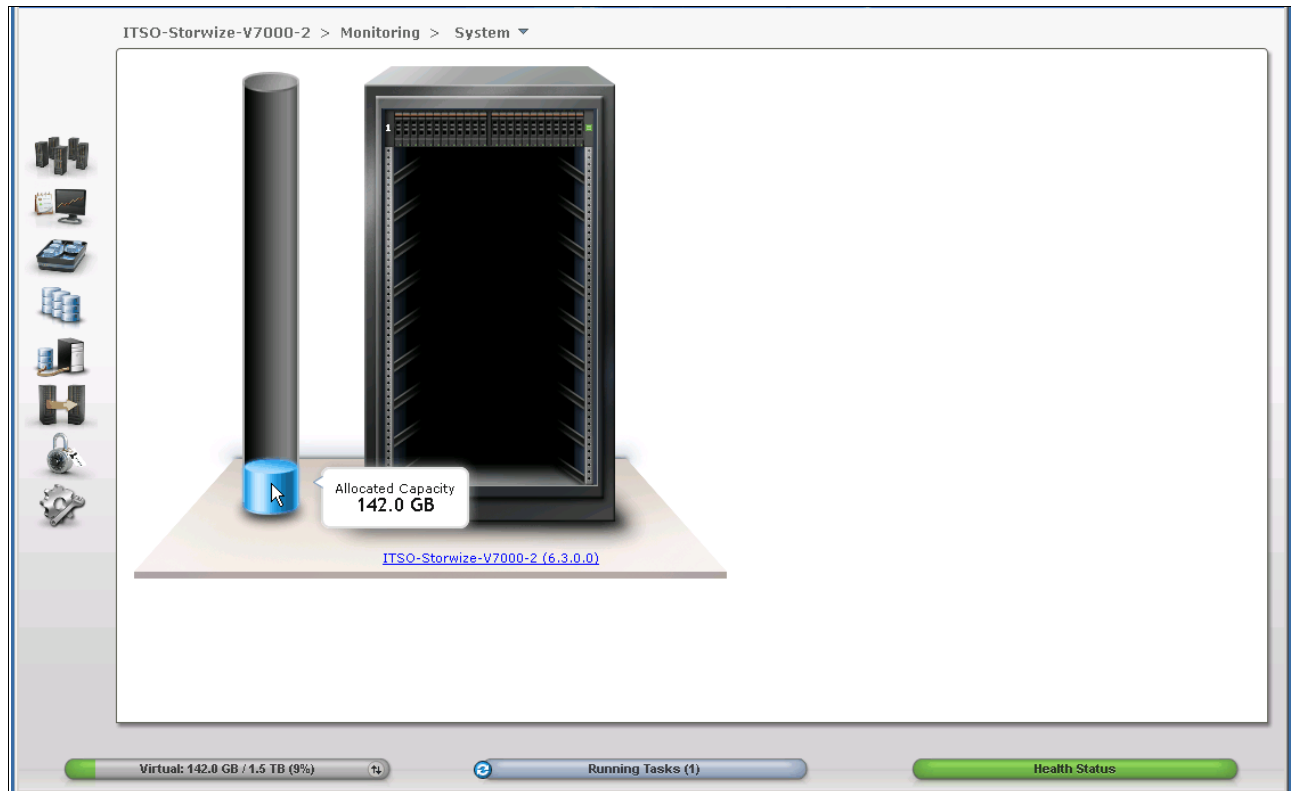


Figure 3-13 System Status window showing allocated capacity



If you hover the cursor over this bar, the used capacity is displayed (Figure 3-14).

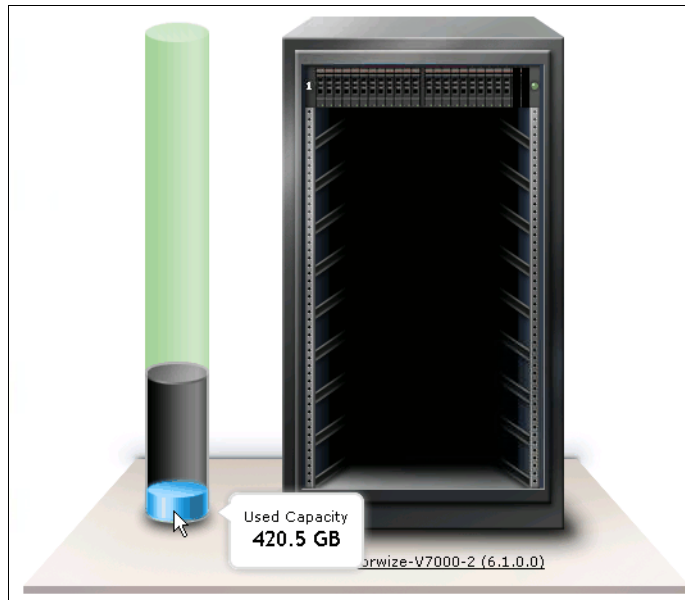


Figure 3-14 System Status window showing used capacity

When you move the cursor up this bar, the Virtual Capacity is displayed (Figure 3-15). The virtual capacity is the capacity reported by IBM Storwize V7000 to the host when you are using thin-provisioned volumes.

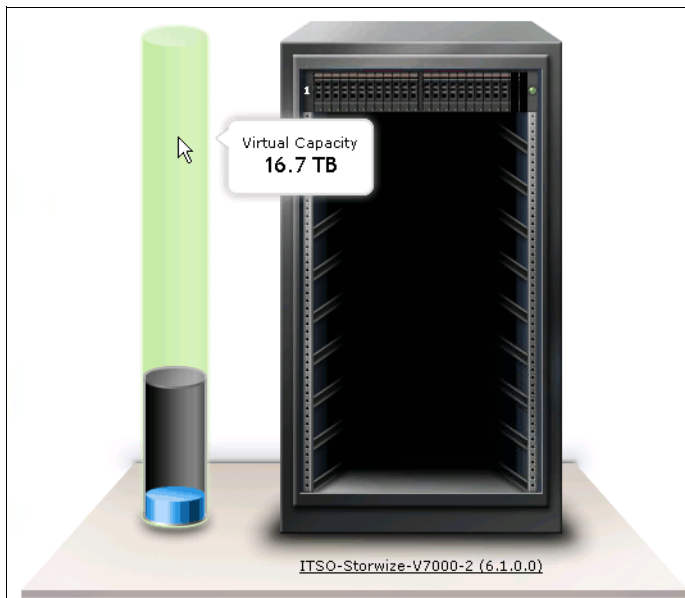


Figure 3-15 System Status window showing virtual capacity

The System Status menu can also display the status of the various IBM Storwize V7000 components. By clicking the enclosure and then hovering the cursor over the affected drive, a status report is displayed for the drive in question (Figure 3-16).

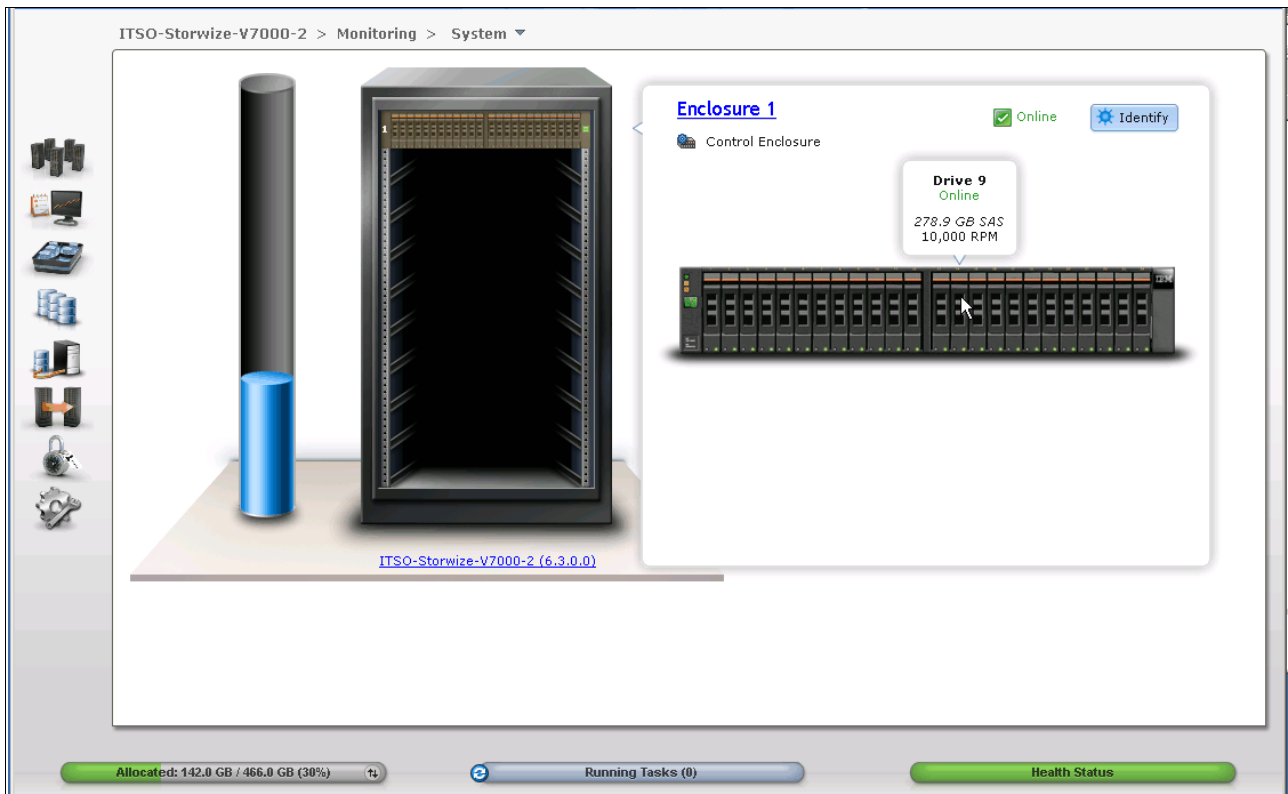


Figure 3-16 System Status window showing an enclosure

When you click the cluster name at the bottom of the IBM Storwize V7000 picture, more detailed configuration information is displayed (Figure 3-17).

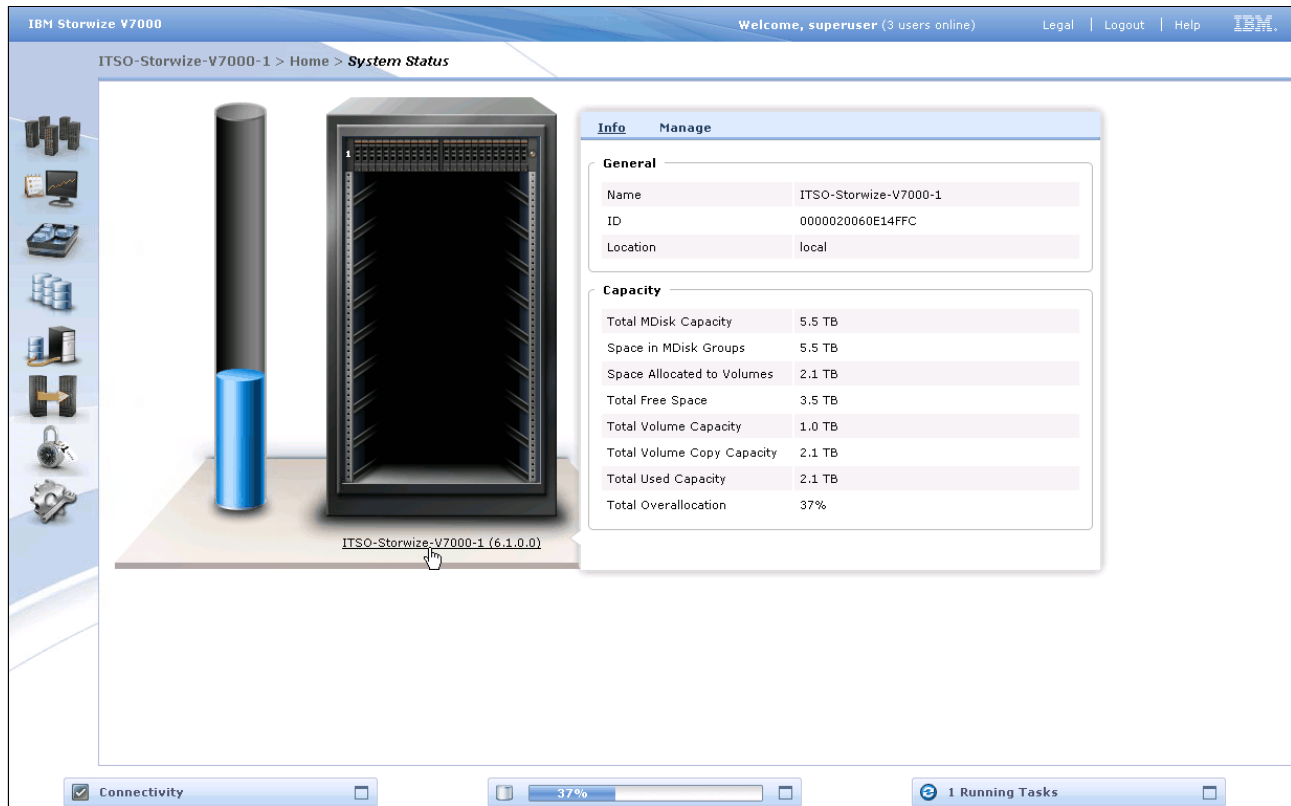


Figure 3-17 System Status window showing cluster information

### 3.3 Monitoring and Troubleshooting menu

In this section, we describe the Monitoring menu and its options. Hover the cursor over the Troubleshooting function icon and the Monitoring menu opens (Figure 3-18).

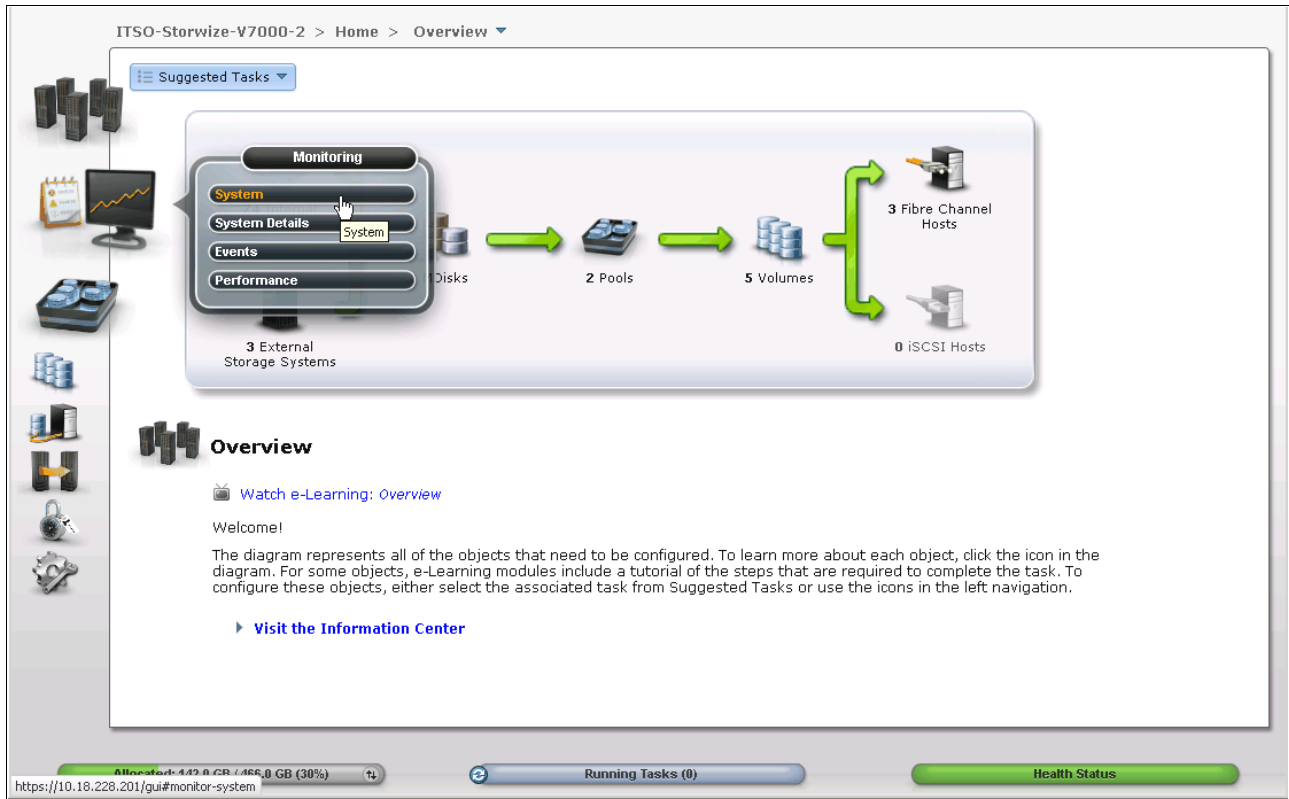


Figure 3-18 Navigate to the Monitoring menu

### 3.3.1 Recommended Actions menu

Clicking **Recommended Actions** opens the window shown in Figure 3-19. This window lists any events that have occurred that might impact the IBM Storwize V7000 solution. To fix an event, click **Run Fix Procedure**, and a Directed Maintenance Procedure (DMP) starts that walks you through the process to fix that particular event.

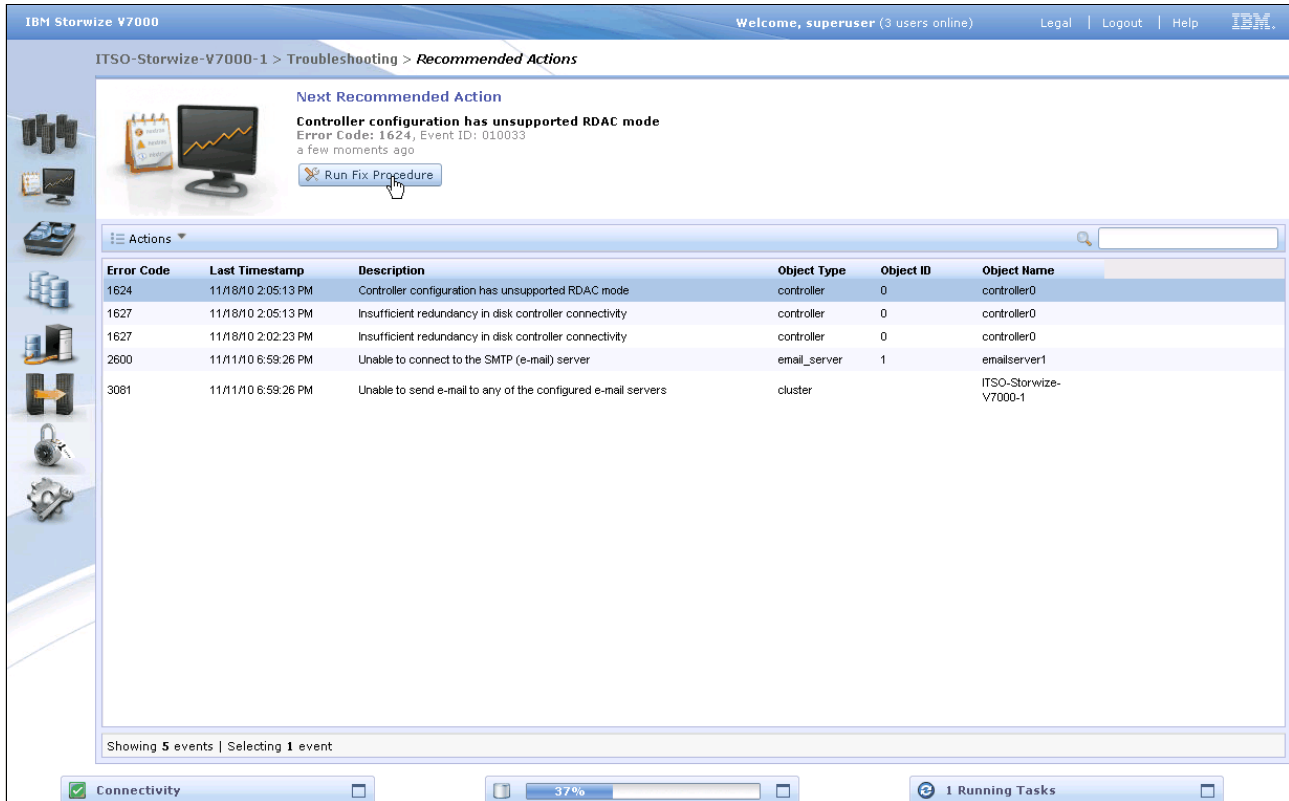


Figure 3-19 Recommended Actions menu

Another way to fix an event is to right-click the particular event and click **Run Fix Procedure**. To view the details of a specific event, click **Properties** (Figure 3-20). The Properties window opens (Figure 3-21 on page 85).

ITSO-Storwize-V7000-2 > Monitoring > Events

**Next Recommended Action**  
**Fibre Channel Speed Change**  
 Error Code: 1065, Event ID: 073305  
 1½ weeks ago  
 Run This Fix Procedure

Actions Refresh Recommended actions Filter...

Error Code	Last Timestamp	Status	Description	Object Type	Object ID	Object Name
1065	10/4/11 2:11:55 PM	Alert	Fibre Channel Speed Change(node node1)	port	3	
1625	9/27/11 10:57:14 AM	Alert	irect controller configuration	controller	0	DS3524
1625	9/27/11 10:57:14 AM	Alert	irect controller configuration	controller	0	DS3524
1627	10/5/11 3:17:17 PM	Alert	Insufficient redundancy in disk controller connectivity	controller	0	DS3524
1627	10/5/11 11:00:37 AM	Alert	Insufficient redundancy in disk controller connectivity	controller	0	DS3524
1630	9/29/11 5:32:27 PM	Alert	Number of device logins reduced	controller	2	controller2
1630	9/29/11 4:49:28 PM	Alert	Number of device logins reduced	controller	1	controller1
1630	9/26/11 3:06:01 PM	Alert	Number of device logins reduced	controller	0	DS3524
1695	9/27/11 10:39:48 PM	Alert	Persistent unsupported controller configuration	controller	0	DS3524
1695	9/27/11 10:37:03 PM	Alert	Persistent unsupported controller configuration	controller	0	DS3524
2010	10/5/11 12:36:27 PM	Alert	Software upgrade process failed	node	1	node1
2600	10/5/11 4:11:59 PM	Alert	Unable to connect to the SMTP (e-mail) server	email_server	1	emailserver1
3081	10/5/11 4:11:59 PM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...
3081	10/5/11 3:52:49 PM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...
3081	9/26/11 1:08:57 PM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...
3081	9/26/11 1:02:35 PM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...
3081	9/23/11 8:11:28 AM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...

Showing 17 events | Selecting 1 event

Allocated: 142.0 GB / 466.0 GB (30%) Running Tasks (0) Health Status

Figure 3-20 Right-click a single event

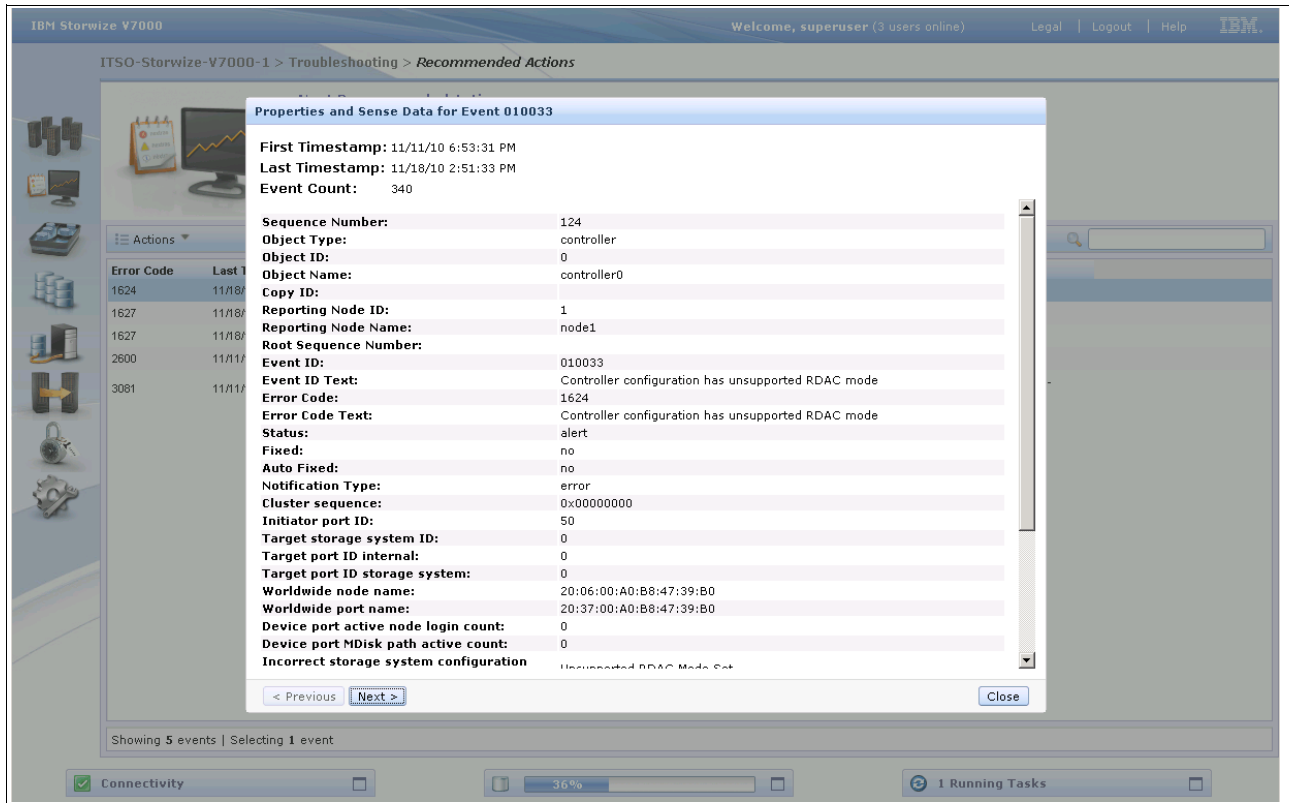


Figure 3-21 Properties of the event

### 3.3.2 Event Log menu

Clicking the **Event Log** menu opens the window shown in Figure 3-22. From this window, you can use the action buttons to either mark an event as fixed or clear the log.

ITSO-Storwize-V7000-2 > Monitoring > Events ▾

**Next Recommended Action**  
**Fibre Channel Speed Change**  
 Error Code: 1065, Event ID: 073305  
 1½ weeks ago  
 Run This Fix Procedure

Actions ▾ Clear Log Refresh Show all Filter...

Time	Status	Description	Object type	Object ID	Object Name
8 AM	Message	FC discovery occurred, no configuration changes were detected	cluster		ITSO-Storwize-V70...
8 AM	Alert	Unable to send e-mail to any of the configured e-mail servers	cluster		ITSO-Storwize-V70...
8 AM	Alert	Controller configuration has unsupported RDAC mode	controller	0	DS3524
8 AM	Message	FC discovery occurred, configuration changes pending	cluster		ITSO-Storwize-V70...
8 AM	Alert	Managed Disk is not on the preferred path	mdisk	9	mdisk10
8 AM	Alert	Managed Disk is not on the preferred path	mdisk	10	mdisk6
8 AM	Alert	Managed Disk is not on the preferred path	mdisk	11	
9/23/11 8:11:58 AM	Message	FC discovery occurred, configuration changes complete	cluster		ITSO-Storwize-V70...
1627 9/23/11 10:12:22 AM	Alert	Insufficient redundancy in disk controller connectivity	controller	0	DS3524
1627 9/23/11 10:13:02 AM	Alert	Insufficient redundancy in disk controller connectivity	controller	0	DS3524
9/24/11 1:00:03 AM	Message	FC discovery occurred, configuration changes pending	cluster		ITSO-Storwize-V70...
9/24/11 1:00:03 AM	Message	FC discovery occurred, configuration changes complete	cluster		ITSO-Storwize-V70...
1625 9/24/11 1:00:03 AM	Alert	Incorrect controller configuration	controller	0	DS3524
1625 9/24/11 1:00:03 AM	Alert	Incorrect controller configuration	controller	0	DS3524
9/26/11 12:07:44 PM	Message	FC discovery occurred, no configuration changes were detected	cluster		ITSO-Storwize-V70...
9/26/11 12:13:39 PM	Message	FC discovery occurred, configuration changes pending	cluster		ITSO-Storwize-V70...
9/26/11 12:13:39 PM	Message	FC discovery occurred, configuration changes complete	cluster		ITSO-Storwize-V70...
9/26/11 12:56:53 PM	Message	SAS discovery occurred, configuration changes pending	io_ara	0	io_ara0

Showing 312 events | Selecting 1 event

Allocated: 142.0 GB / 466.0 GB (30%) Running Tasks (0) Health Status

Figure 3-22 Event Log menu



Alternatively, you can select the particular event you are interested in and right-click it, which lets you access the options shown in Figure 3-23.

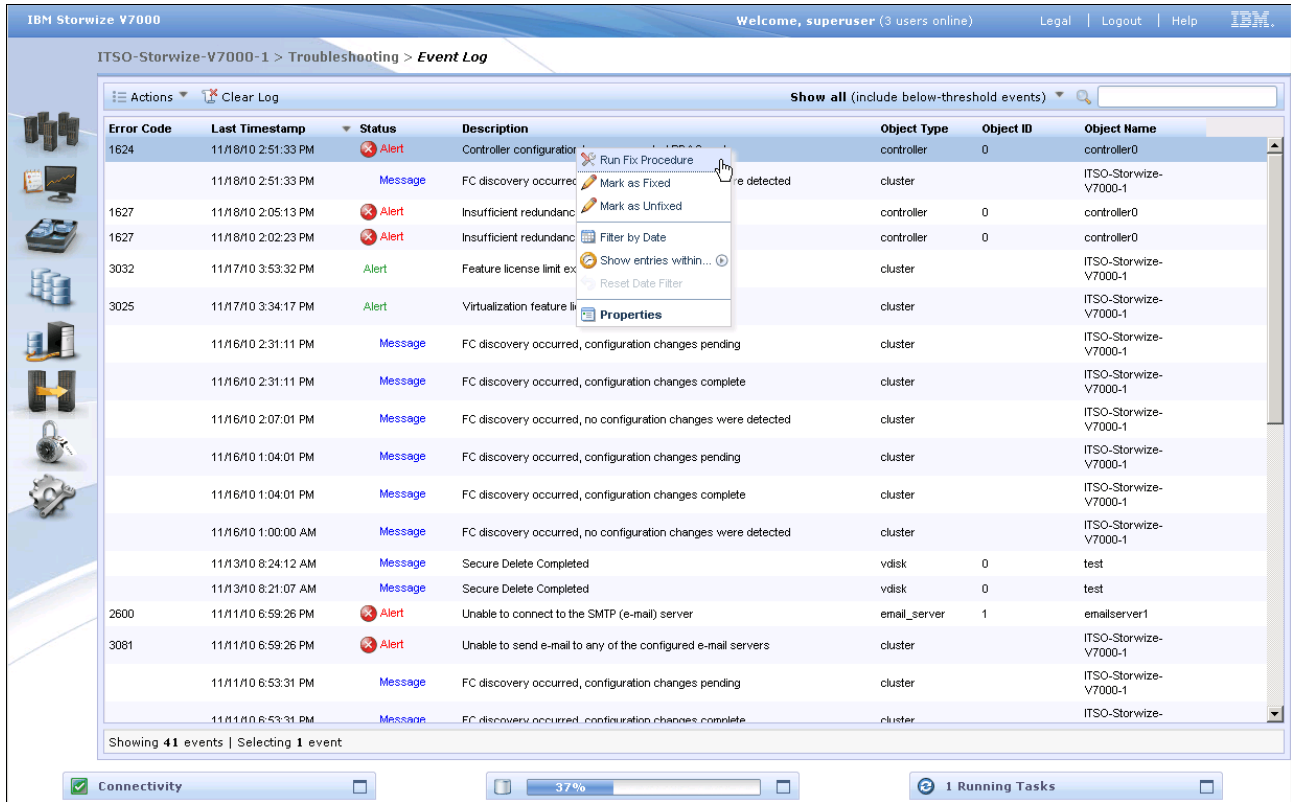


Figure 3-23 Event Log menu options

### 3.3.3 Support menu

Clicking **Support** opens the window shown in Figure 3-24. From this window, click **Show full log listing** to show all the log files.

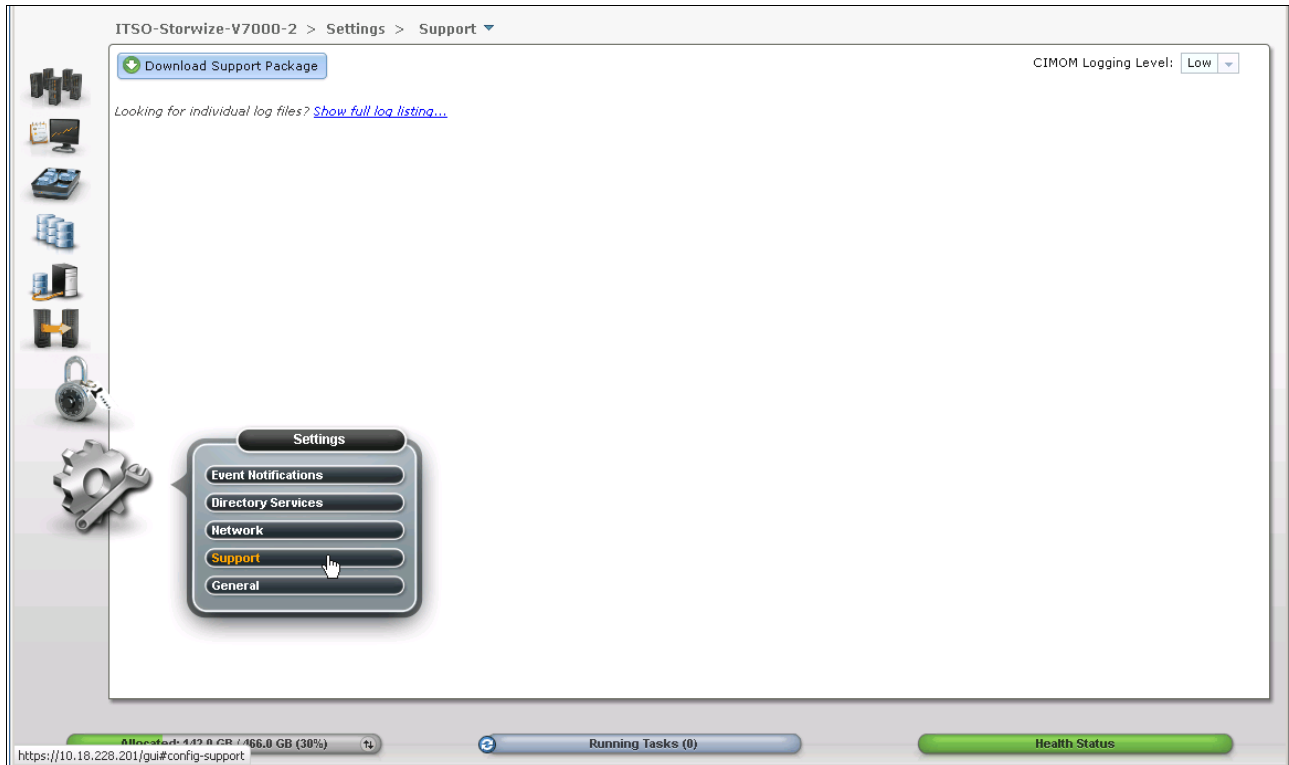


Figure 3-24 Support menu

You can download any of the various log files or delete them by selecting a single item (Figure 3-25) and click either the **Download** or **Delete** options under the Actions button.

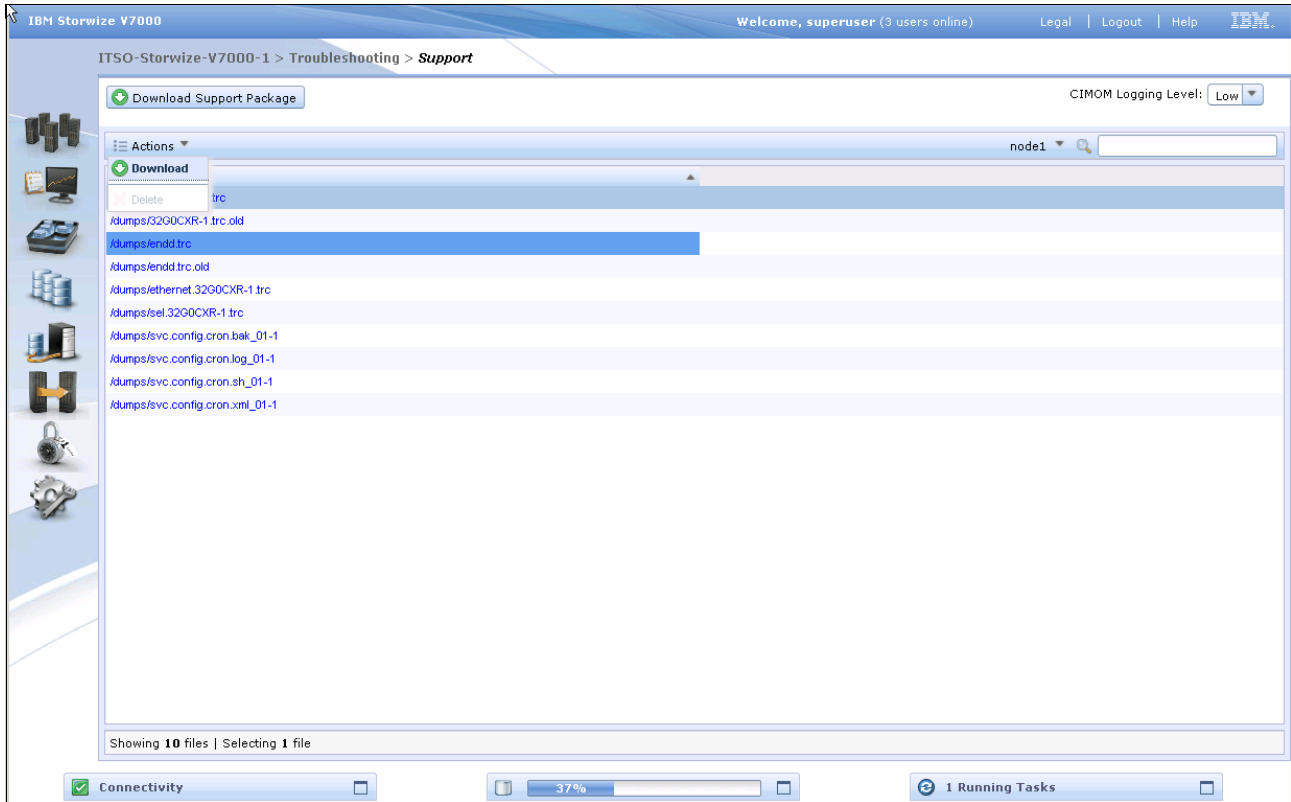


Figure 3-25 Download / Delete options of the Actions button

**Delete option:** When the Delete option is not available, the file cannot be deleted because it is a file being used by the system.

At the upper right of the window, there is a Node option that can be used to show node canister 1 or 2 log files (Figure 3-26).

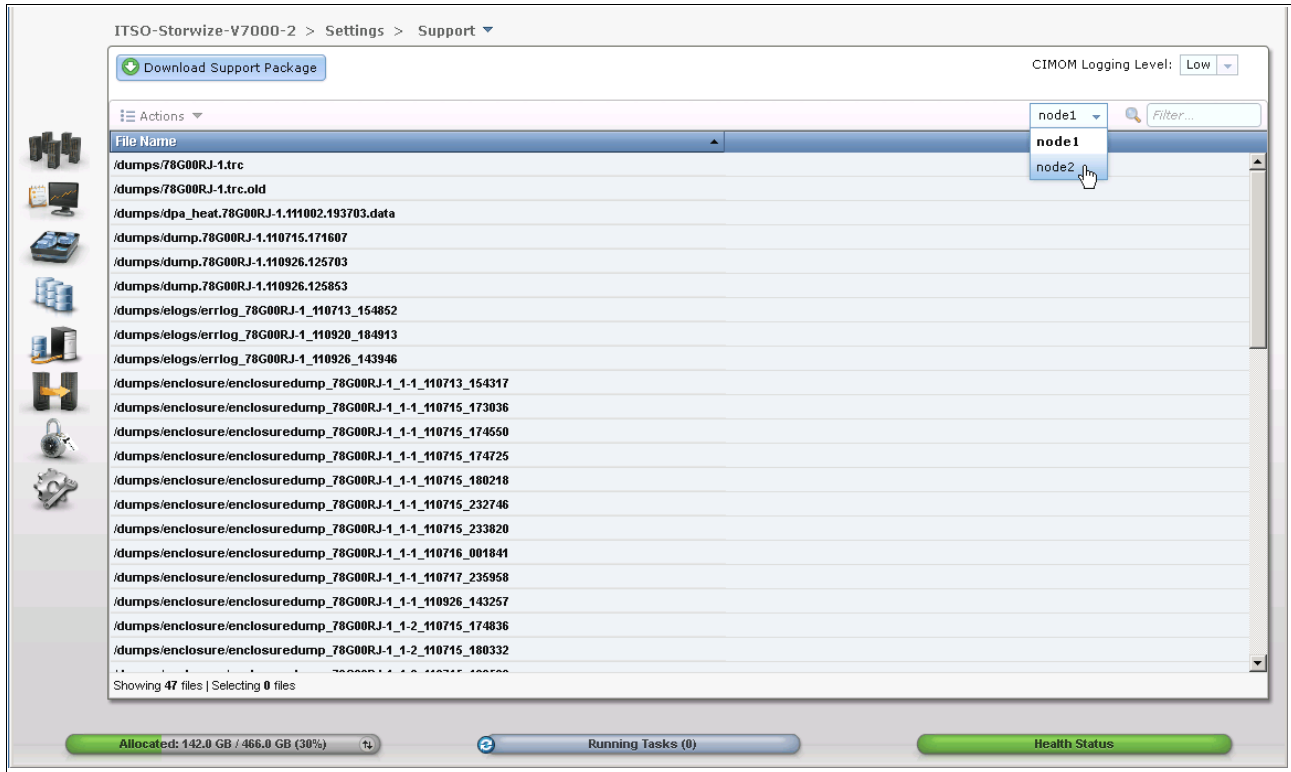


Figure 3-26 Change the log listing of the Nodes canister

Clicking **Download Support Package** opens the window shown in Figure 3-27. This window provides a number of different options that can be used to collect logs and save state information from the cluster.

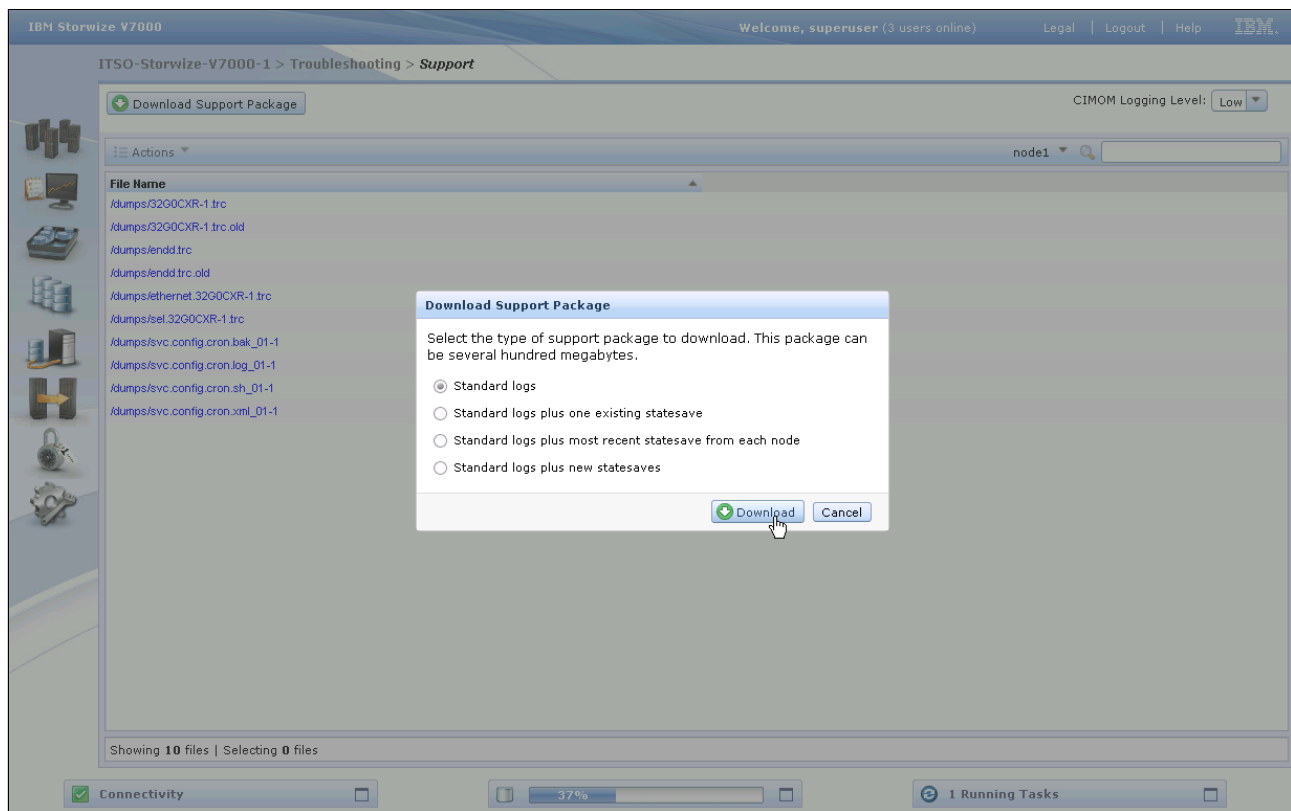


Figure 3-27 Download a support package

Clicking **Download** generates the support package shown in Figure 3-28.

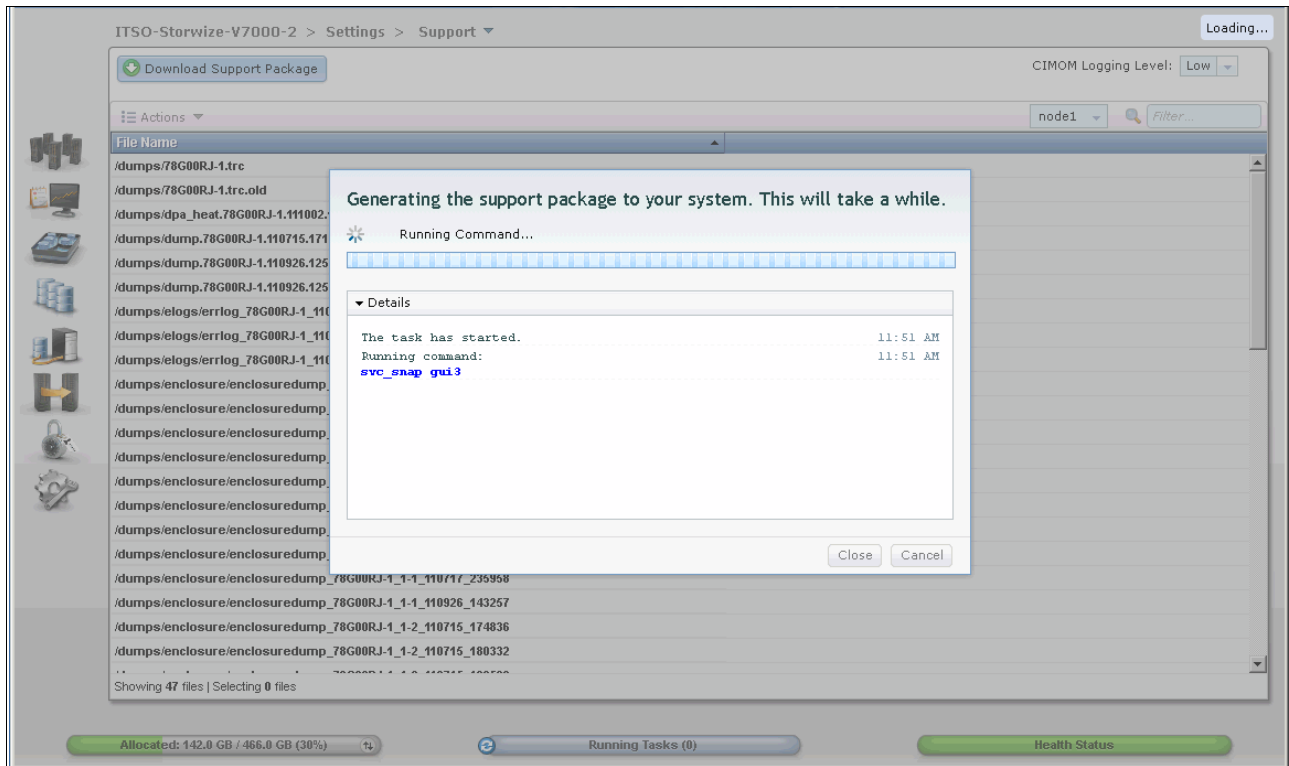


Figure 3-28 Generate a support package

Click **Save File** and then **OK** to save a copy of the package (Figure 3-29).

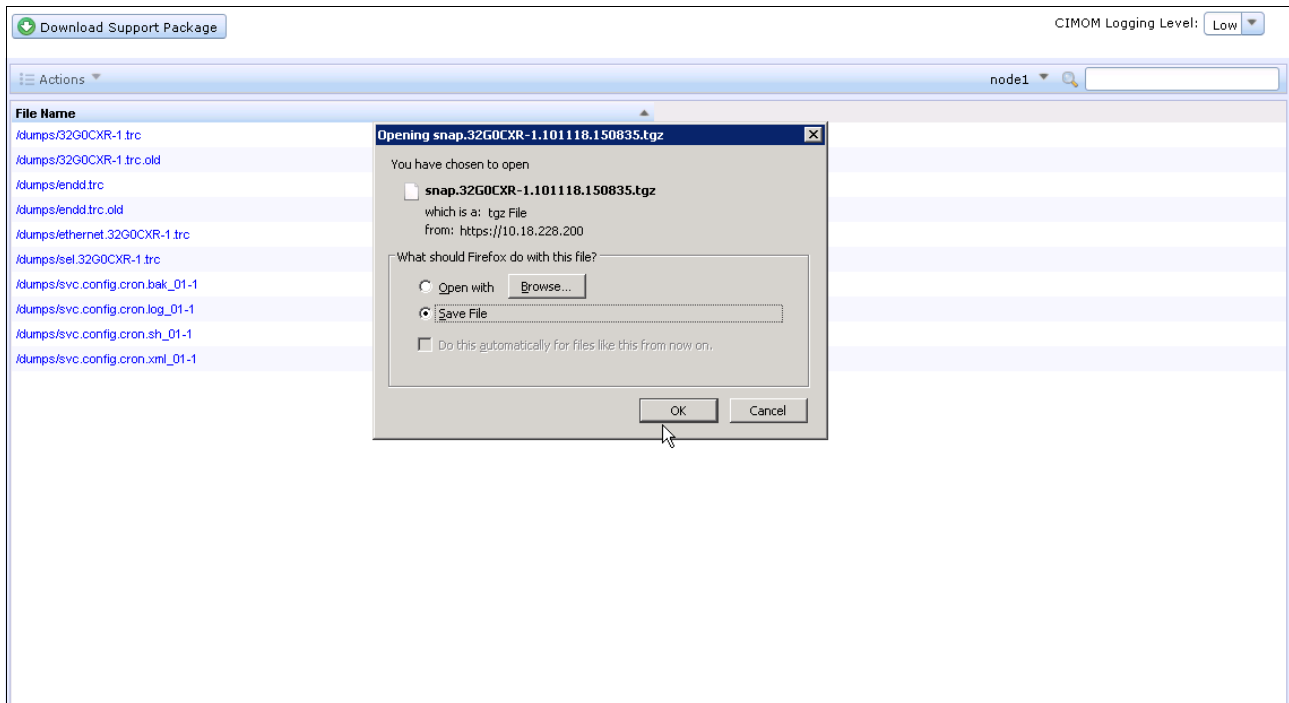


Figure 3-29 Save a file

### 3.4 Pools menu

When you hover the cursor over the Pools function icon, a set of menu options appears (Figure 3-30).

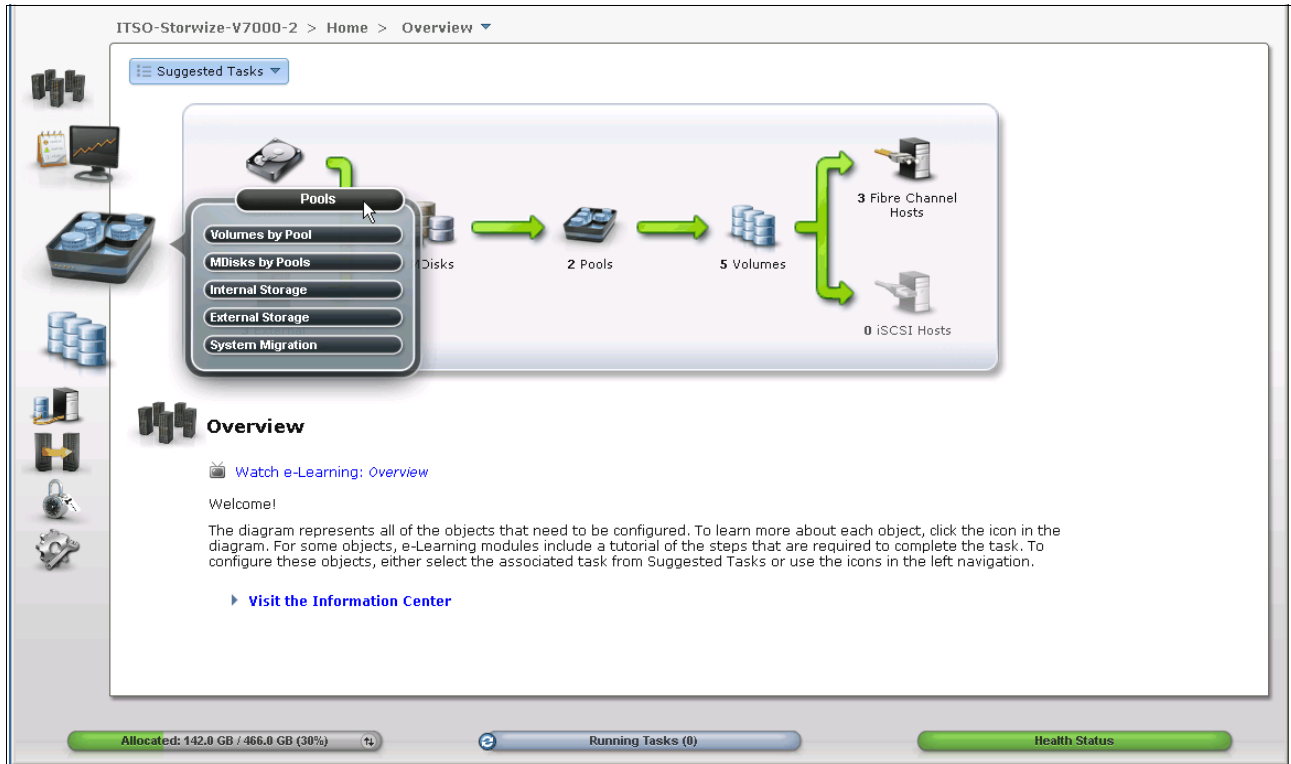


Figure 3-30 Navigate to the Pools menu

### 3.4.1 Internal menu

Clicking the **Internal** option opens the window shown in Figure 3-31. From this window, you can place internal disk drives into storage pools. This window also provides the option to display the internal drives based on their capacity and speed.

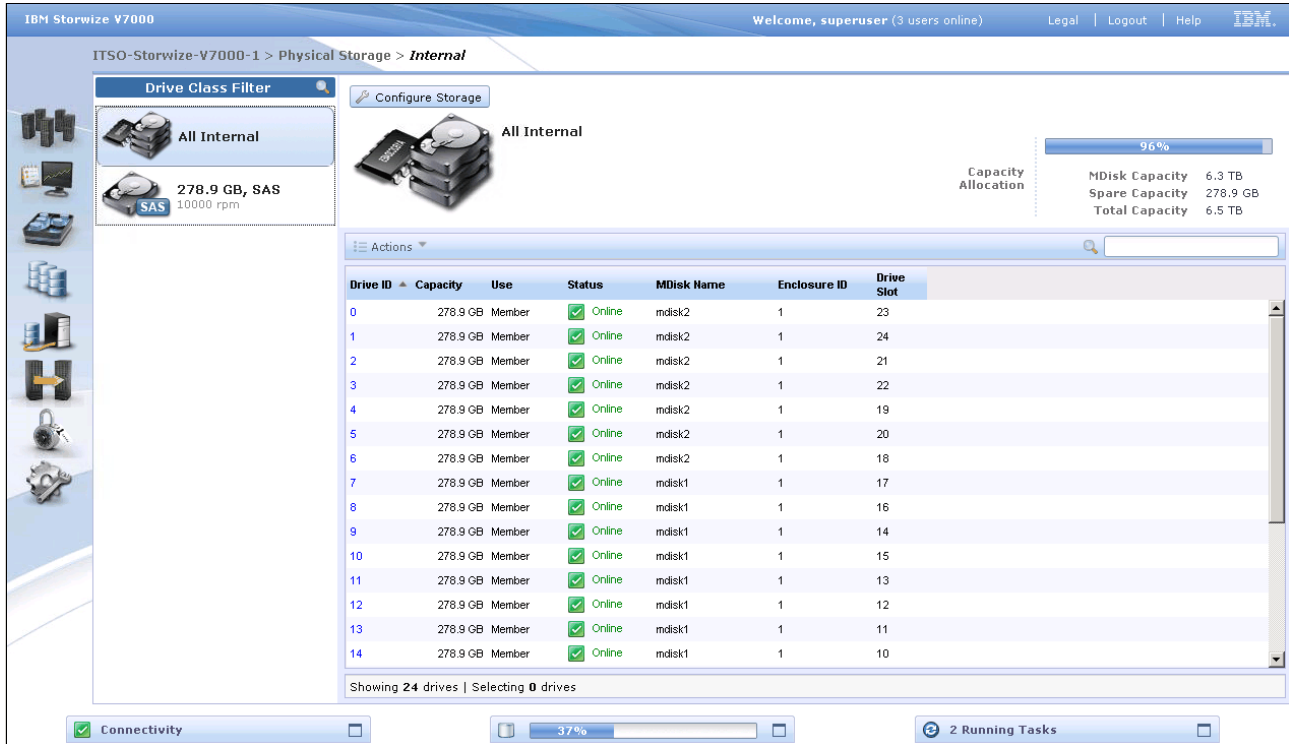


Figure 3-31 Internal storage window



### 3.4.2 External menu

Clicking the **External** option opens the window shown in Figure 3-32. This window shows any virtual external disk systems in that IBM Storwize V7000. From this window, you can add MDisks to existing pools, import them as image mode volumes, or rename them. If you highlight a MDisk, you can also display any dependent volumes.

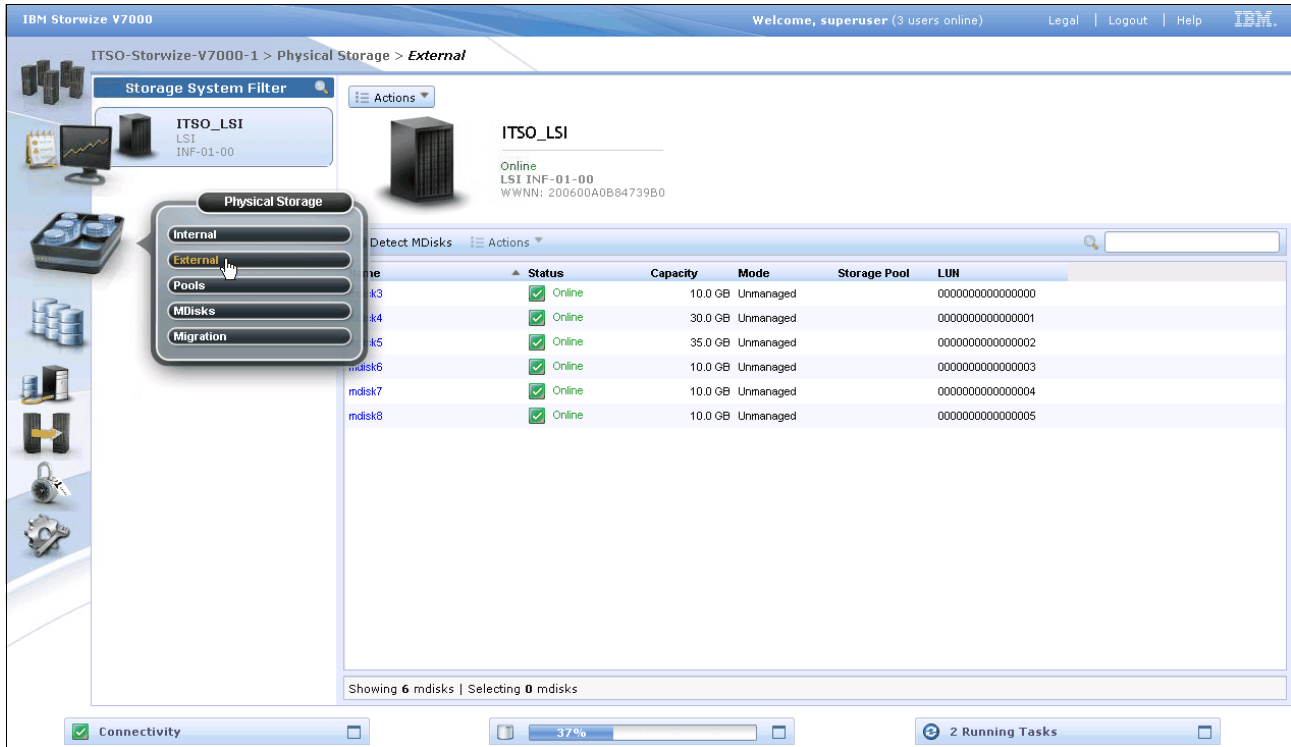


Figure 3-32 External storage systems menu

### 3.4.3 Storage Pools menu

Figure 3-33 shows the Storage Pools menu, where you can create or delete storage pools.

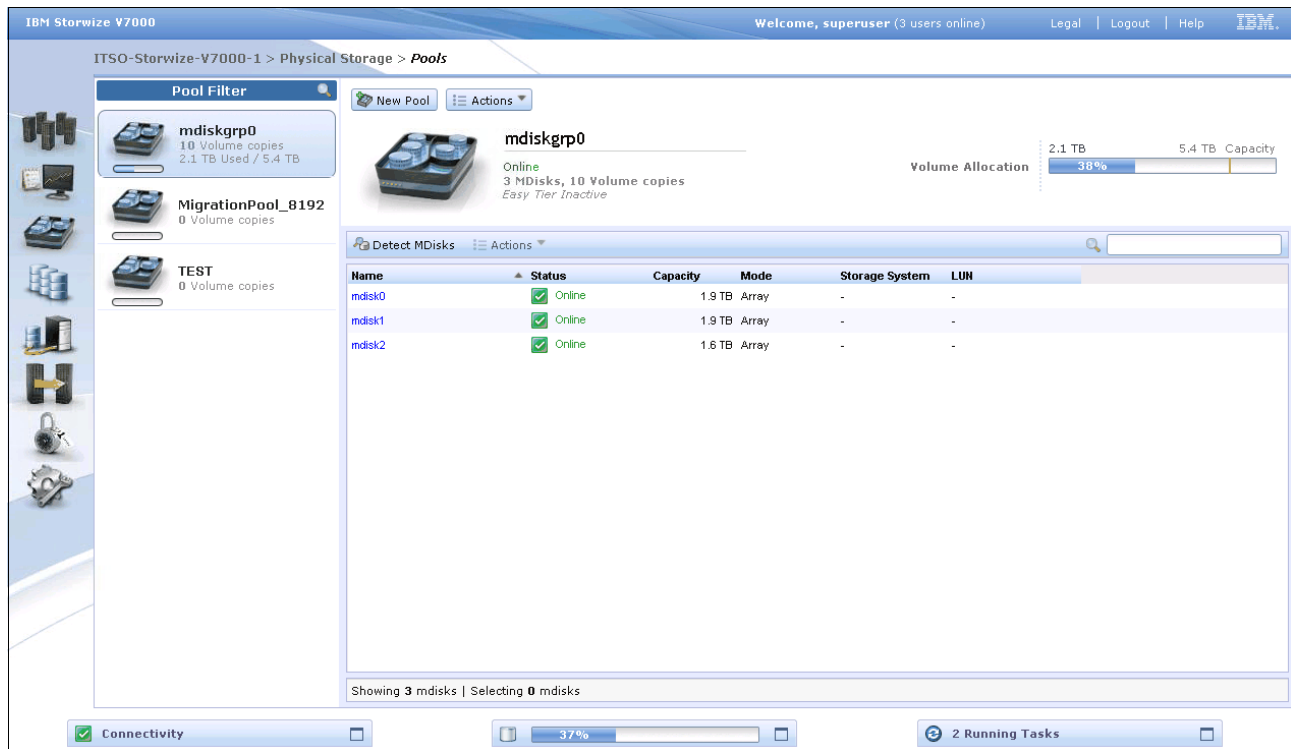


Figure 3-33 Storage Pool window

### 3.4.4 MDisks menu

Figure 3-34 shows the MDisks that are available to the IBM Storwize V7000 system. The MDisks show whether they are *managed*, in which case the storage pool is displayed, or whether they are *unmanaged*, in which case the storage pools can be added to a new pool.

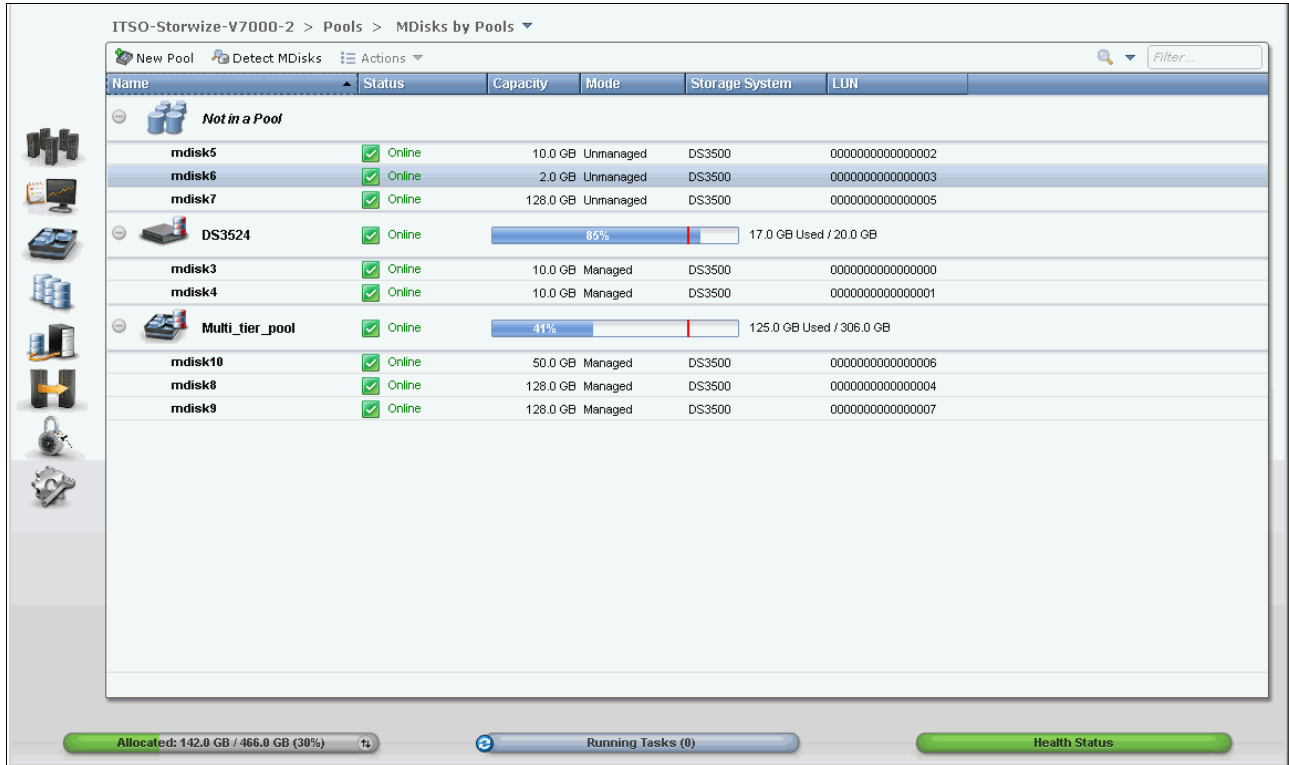


Figure 3-34 MDisk window

By clicking the display bar (Figure 3-35), you can choose to change the fields that are displayed. Select the items you want to be displayed.

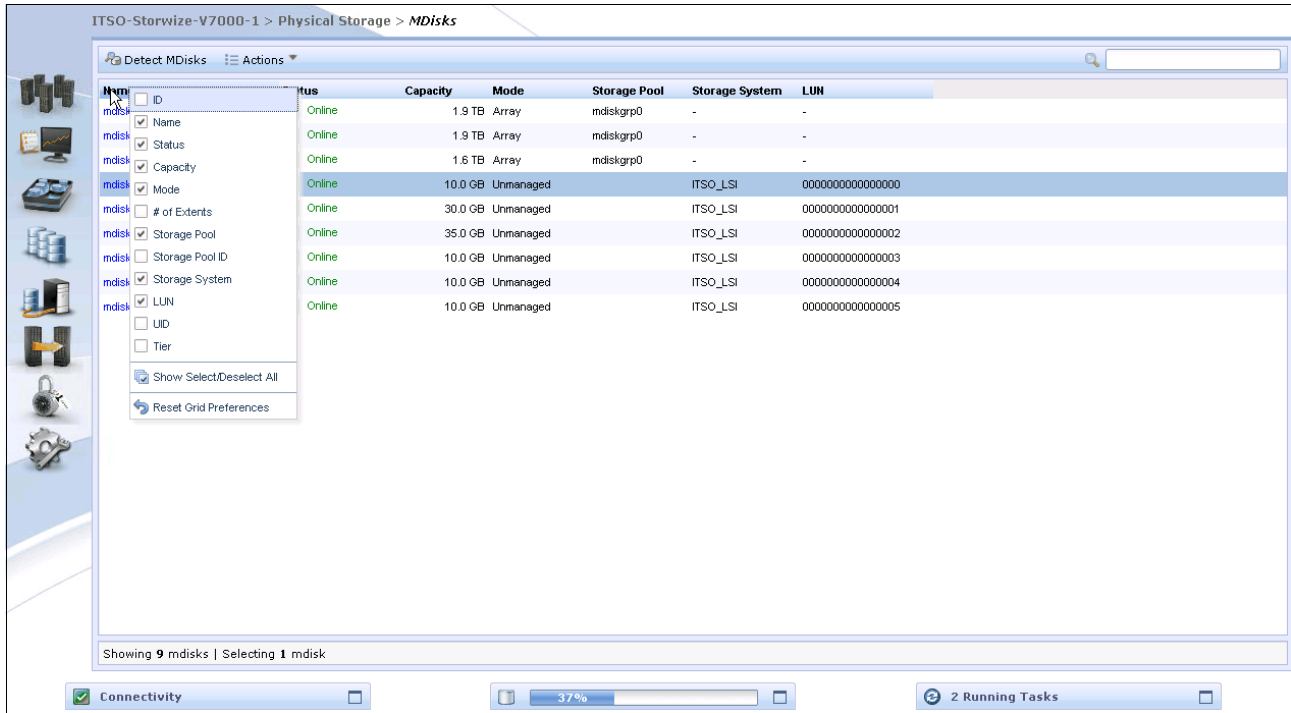


Figure 3-35 Display additional fields

From this window, you can choose to either use the options of the Action button or you could choose to highlight the particular MDisks that you require, right-click, and access those same options (Figure 3-36).

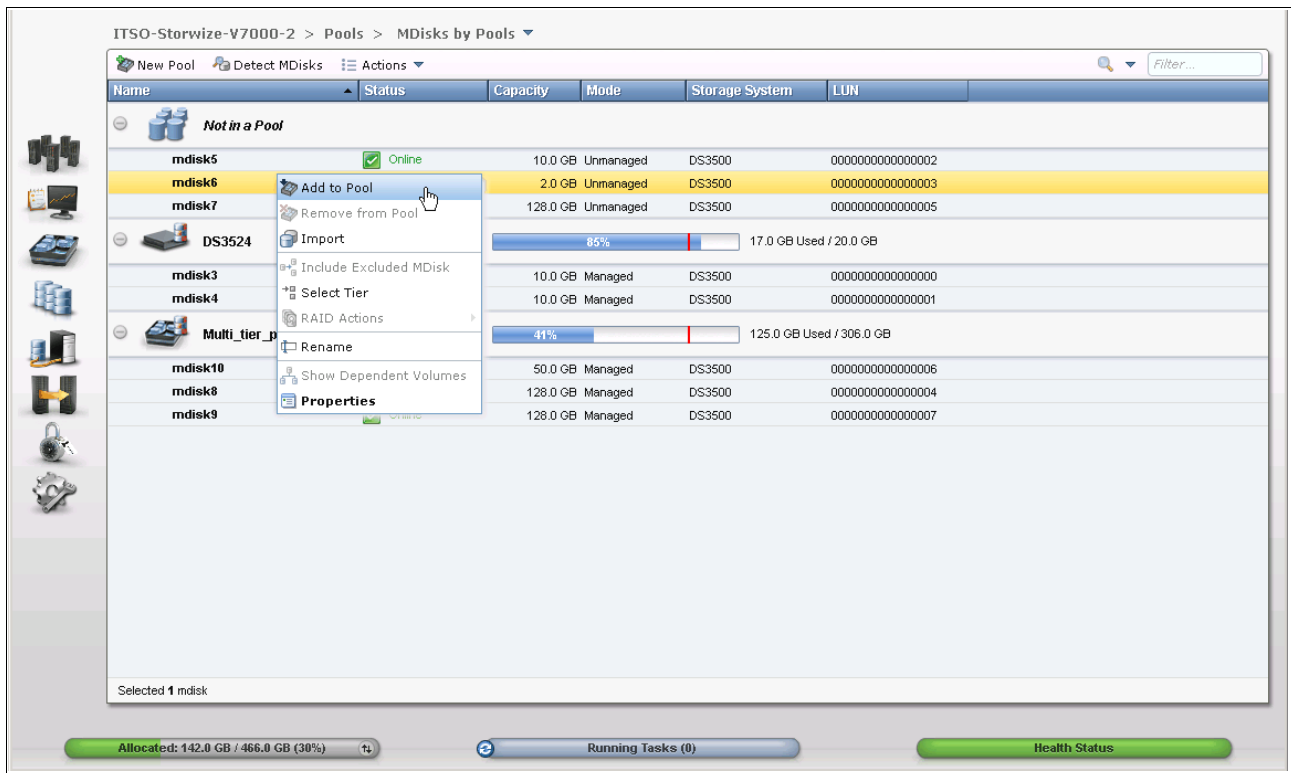


Figure 3-36 Actions for a single MDisk from the MDisks menu

## 3.5 Volumes menu

In this section, we describe the Volumes menu and its options. When you hover the cursor over the Volumes function icon, the menu shown in Figure 3-37 opens.

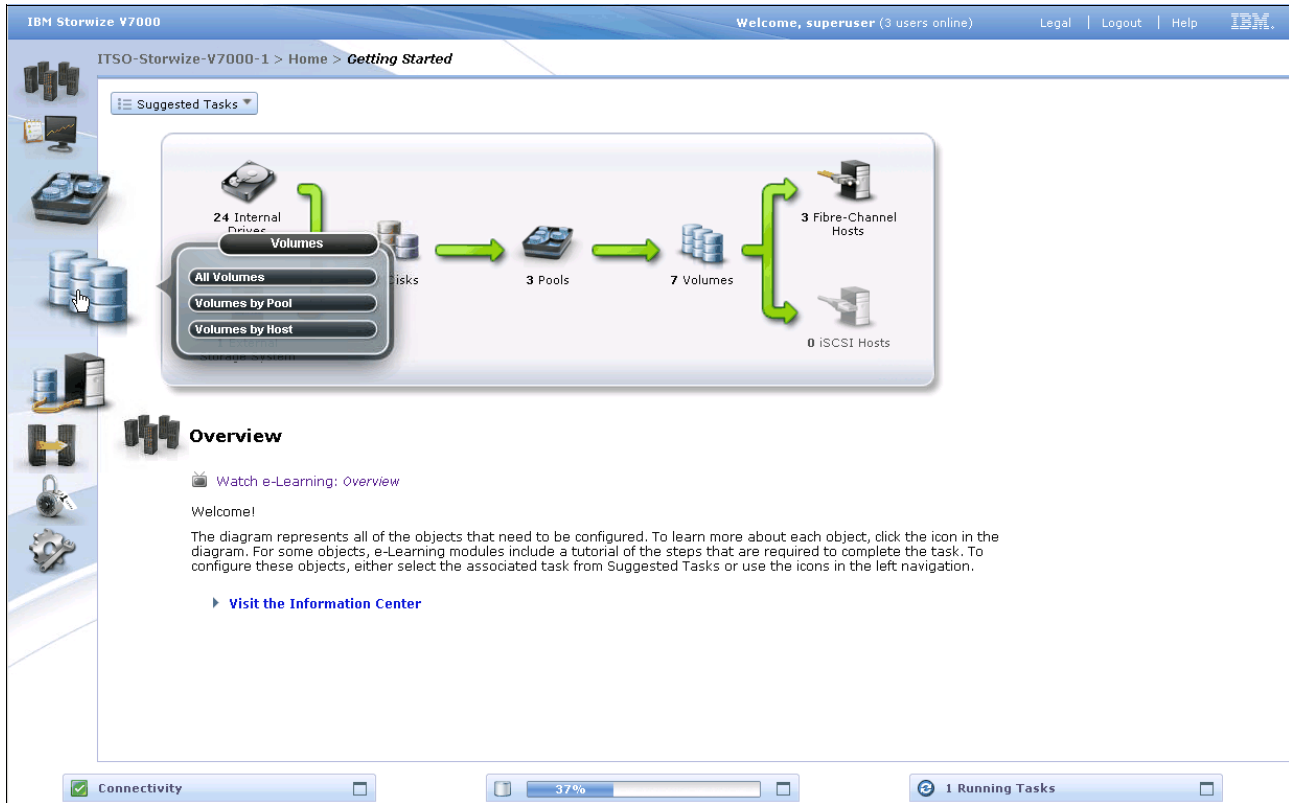


Figure 3-37 Navigate to the Volumes menu

### 3.5.1 All Volumes menu

Clicking the **All Volumes** menu opens the window shown in Figure 3-38. From here you can perform tasks on the volumes, such as shrink or enlarge them, map them to a host, or migrate a volume.

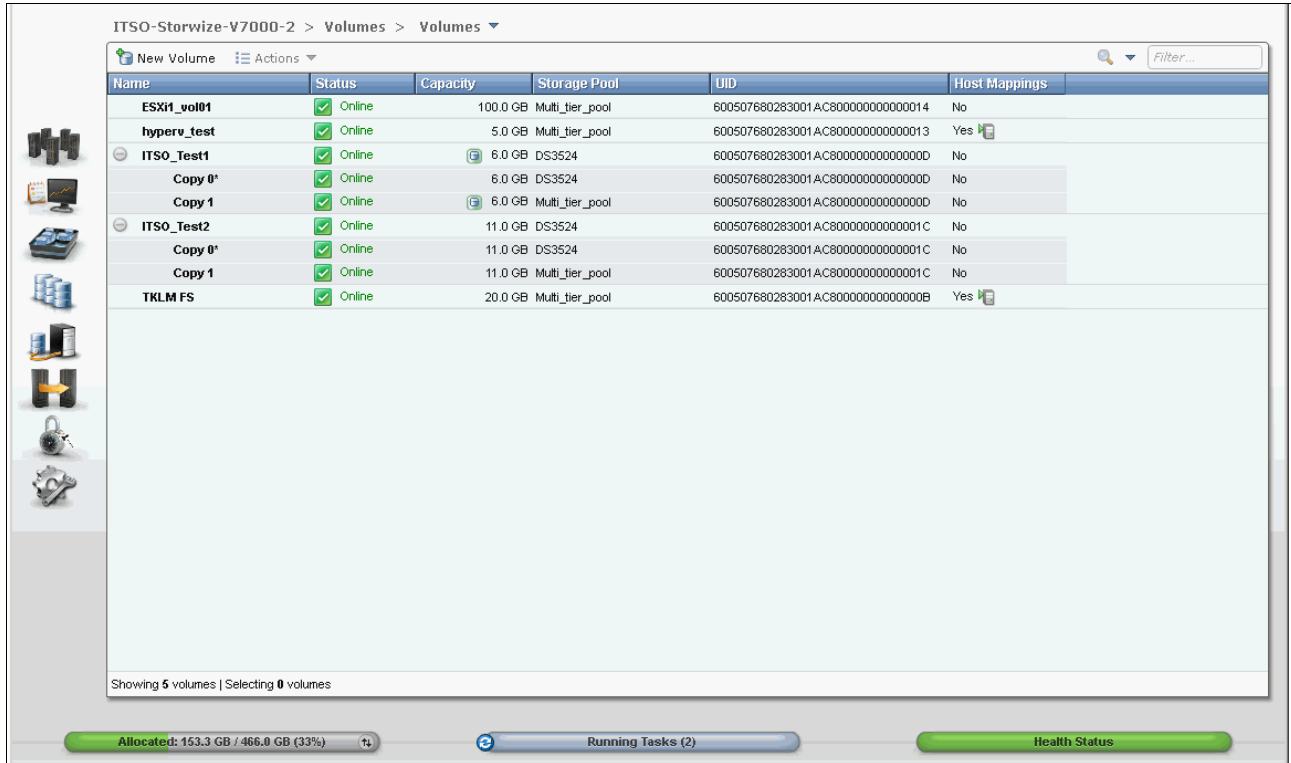


Figure 3-38 All Volumes window

From this menu, you can perform various operations on the volumes. You can use the Action button to access these operations, or you can right-click the Volume name, which opens list of operations that can be performed against the volume (Figure 3-39).

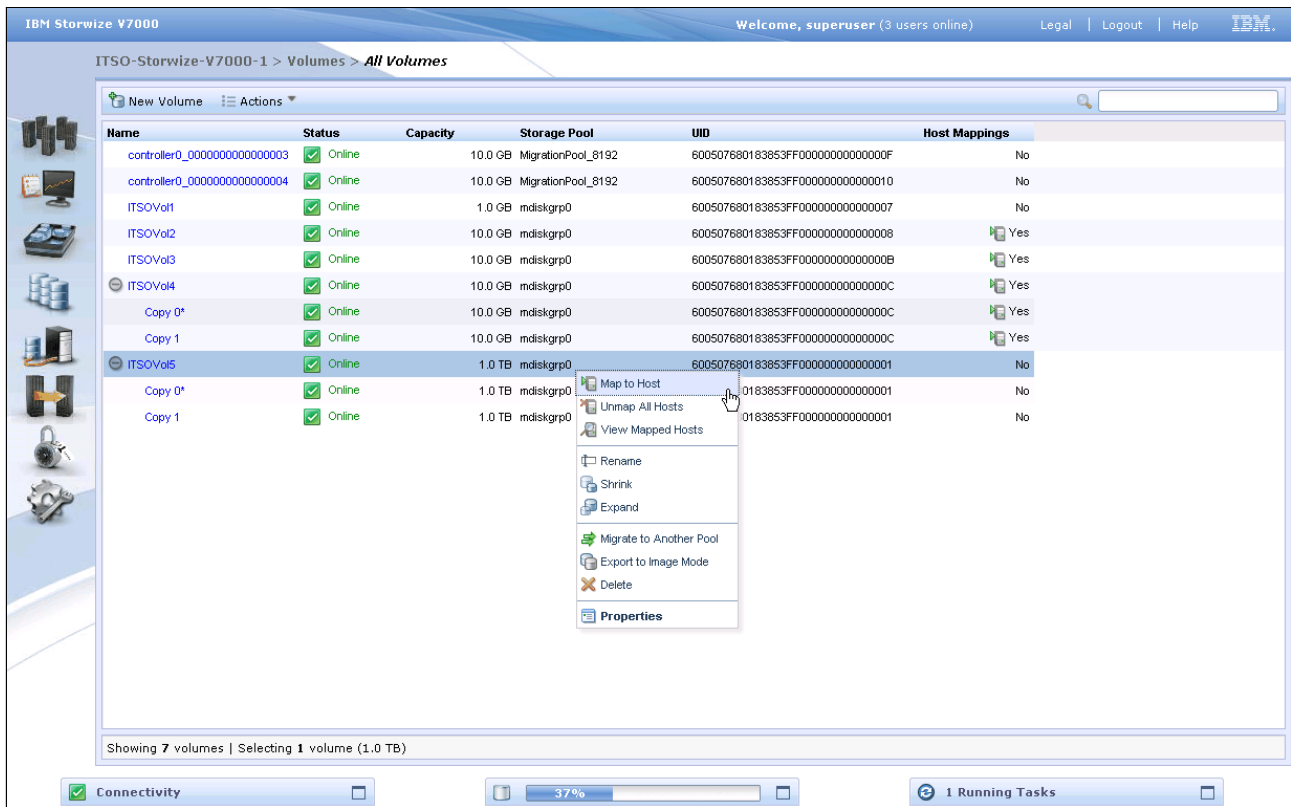


Figure 3-39 Volume operations



### 3.5.2 Volumes by Pool menu

Clicking the **Volumes by Pool** menu opens the window shown in Figure 3-40.

The screenshot displays the 'Volumes by Pool' window for a storage system. The breadcrumb path is 'ITSO-Storwize-V7000-2 > Volumes > Volumes by Pool'. On the left, a 'Pool Filter' sidebar shows two pools: 'DS3524' (2 Volume copies, 17.0 GB Used / 20.0 GB) and 'Multi\_tier\_pool' (5 Volume copies, 136.3 GB Used / 306.0 GB). The main area shows the 'Multi\_tier\_pool' details: 'Online', '3 MDisks, 5 Volume copies', and 'Easy Tier Active'. A 'Volume Allocation' bar indicates 136.3 GB used (4.5%) out of a 306.0 GB capacity. Below this is a table of volumes:

Name	Status	Capacity	UID	Host Mappings
ESX1_vol01	Online	100.0 GB	600507680283001AC80000000000014	No
hyperv_test	Online	5.0 GB	600507680283001AC80000000000013	Yes
ITSO_Test1	Online	6.0 GB	600507680283001AC8000000000000D	No
Copy 0*	Online	6.0 GB	600507680283001AC8000000000000D	No
Copy 1	Online	6.0 GB	600507680283001AC8000000000000D	No
ITSO_Test2	Online	11.0 GB	600507680283001AC80000000000001C	No
Copy 0*	Online	11.0 GB	600507680283001AC80000000000001C	No
Copy 1	Online	11.0 GB	600507680283001AC80000000000001C	No
TKLM FS	Online	20.0 GB	600507680283001AC80000000000000B	Yes

At the bottom of the window, there are three status bars: 'Allocated: 153.3 GB / 466.0 GB (33%)', 'Running Tasks (2)', and 'Health Status'.

Figure 3-40 Volumes by Pool window

Similar to the previous window, you can either use the Action button to access the menu operations or you can right-click the pool to display a list of valid commands (Figure 3-41).

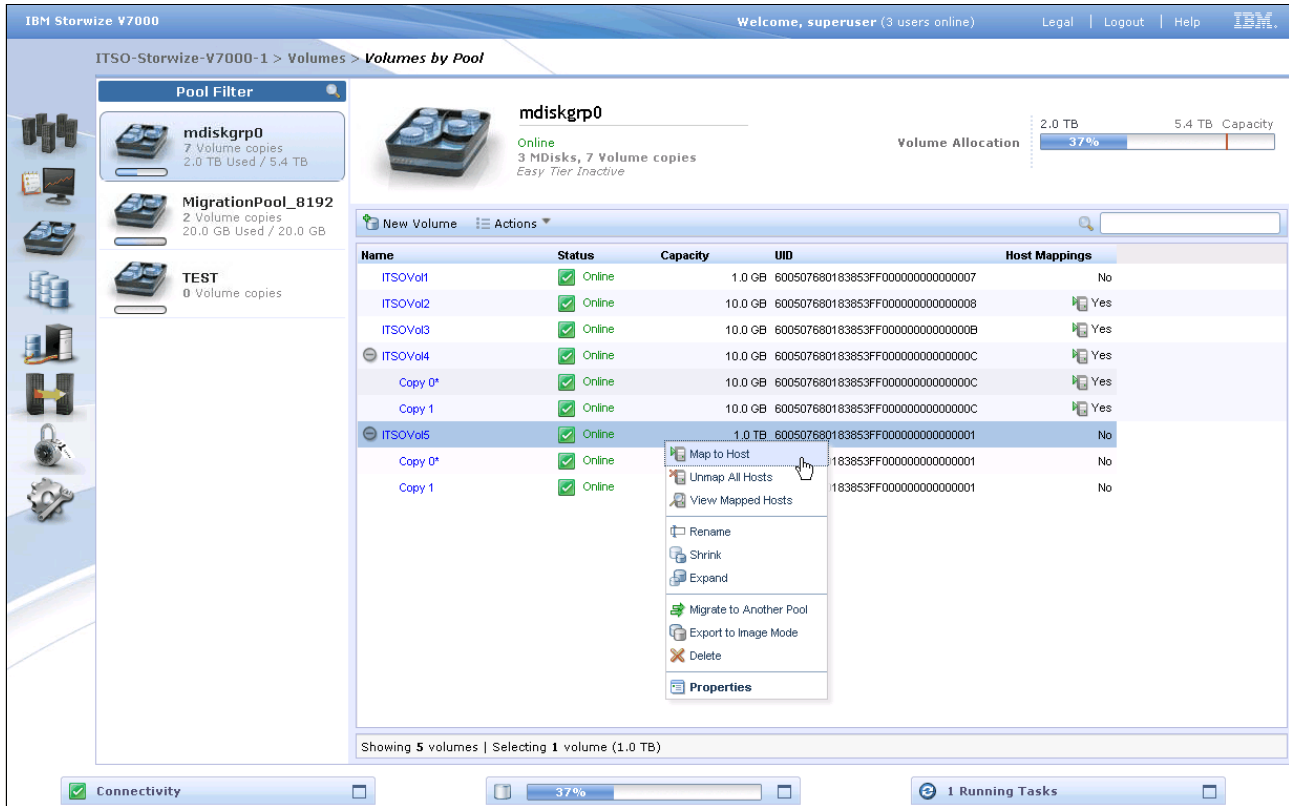


Figure 3-41 Commands for a single volume from the Volume by Pool menu

### 3.5.3 Volumes by Host menu

Clicking the **Volumes by Host** option opens the window shown in Figure 3-42. This window shows the volumes that have been mapped to a given host.

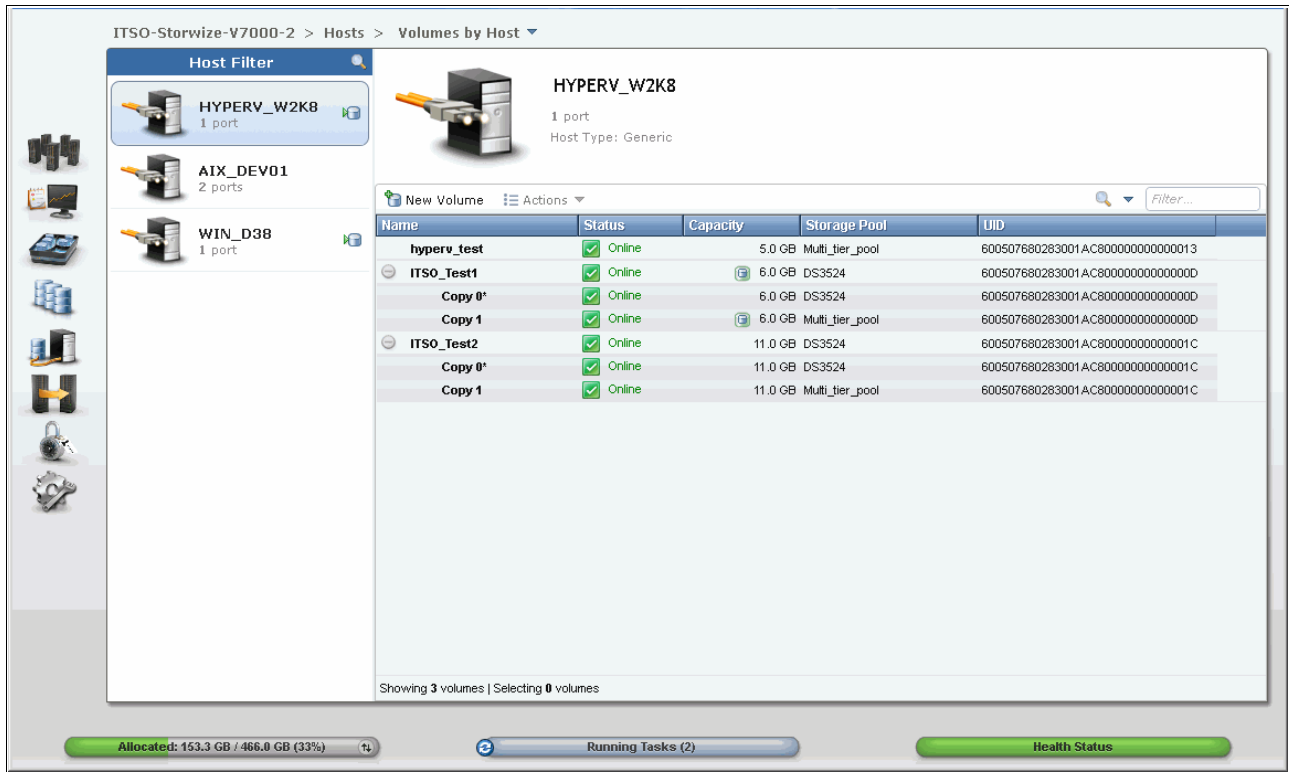


Figure 3-42 Volumes by Host window

You can use the Action button or you can right-click the pool to show a list of valid commands (Figure 3-43).

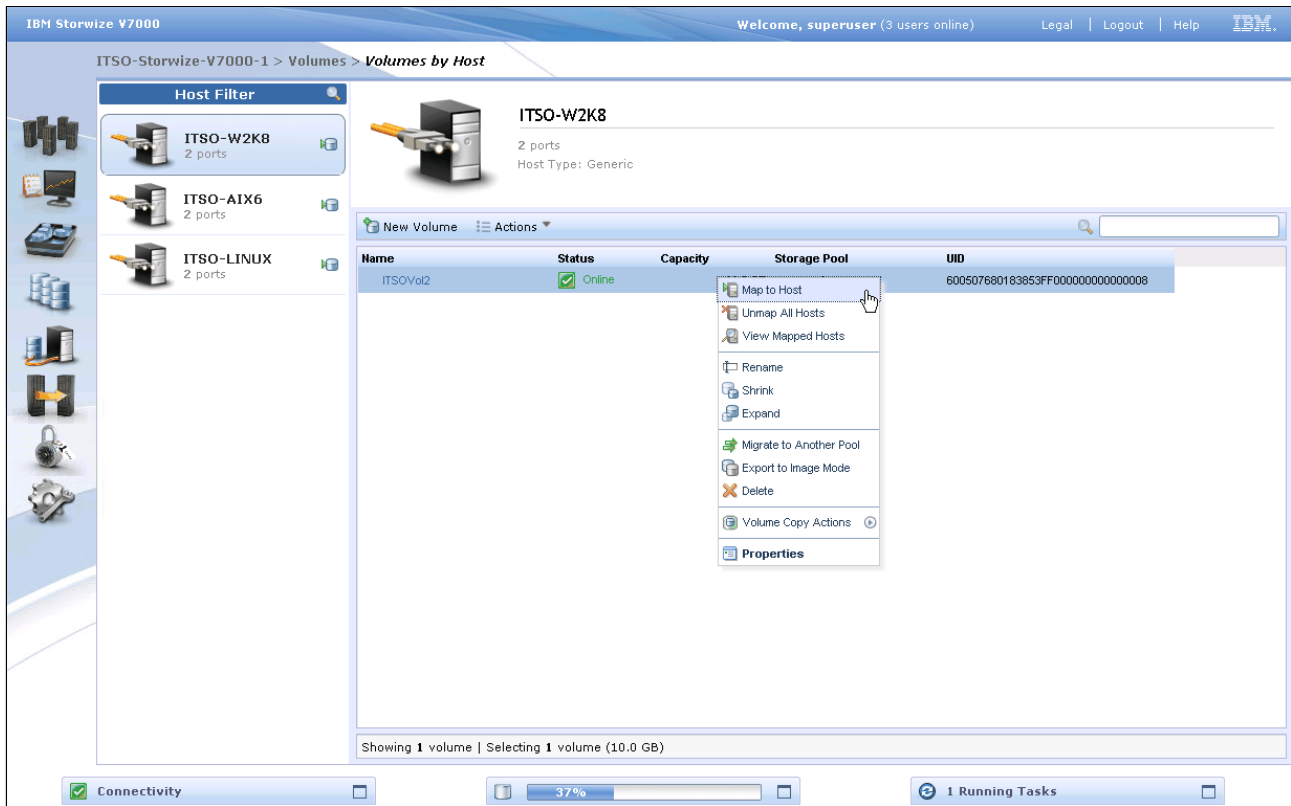


Figure 3-43 Commands for a single volume from the Volume by Host menu

## 3.6 Hosts menu

In this section, we describe the Hosts menu and its options. When you hover the cursor over the Host function icon, a menu opens (Figure 3-44).

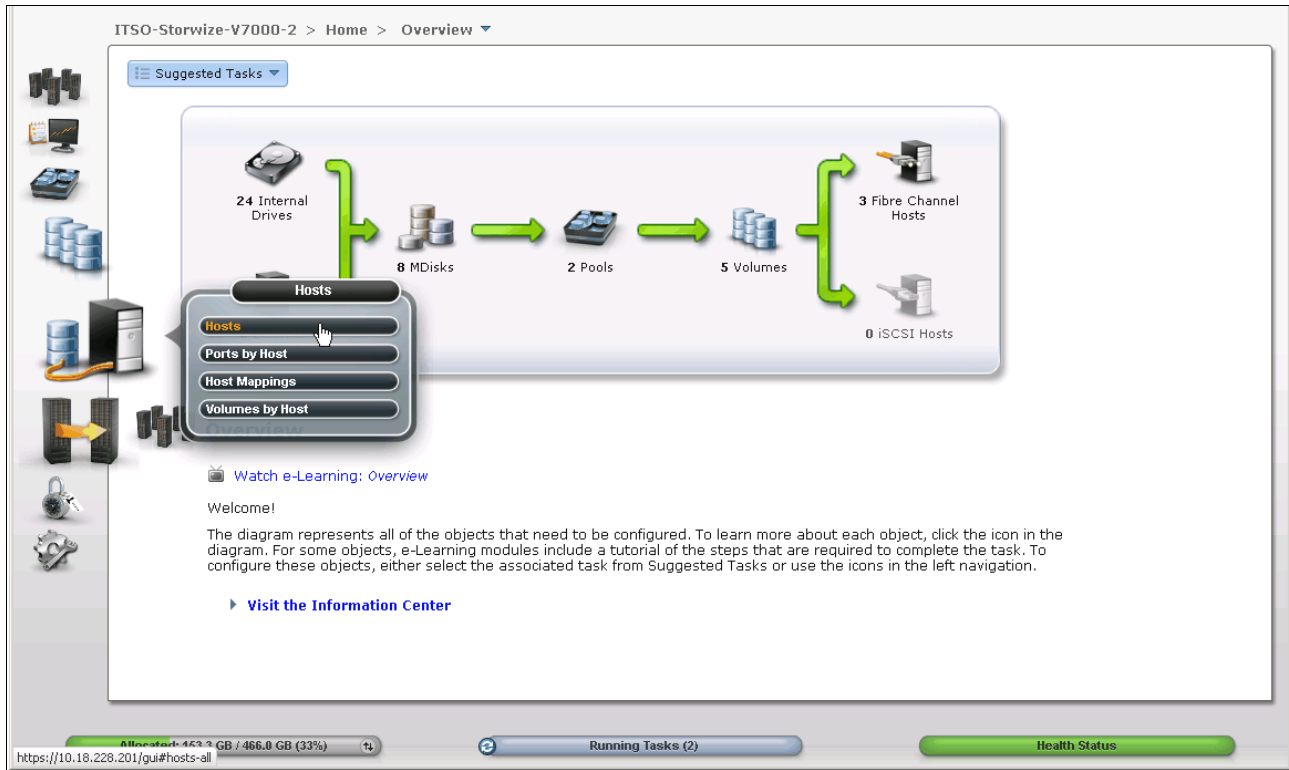


Figure 3-44 Navigate to the Hosts menu

### 3.6.1 All Hosts menu

Clicking **All Hosts** opens the window shown in Figure 3-45. From here you can modify host mappings, unmap hosts, rename hosts, and create new hosts.

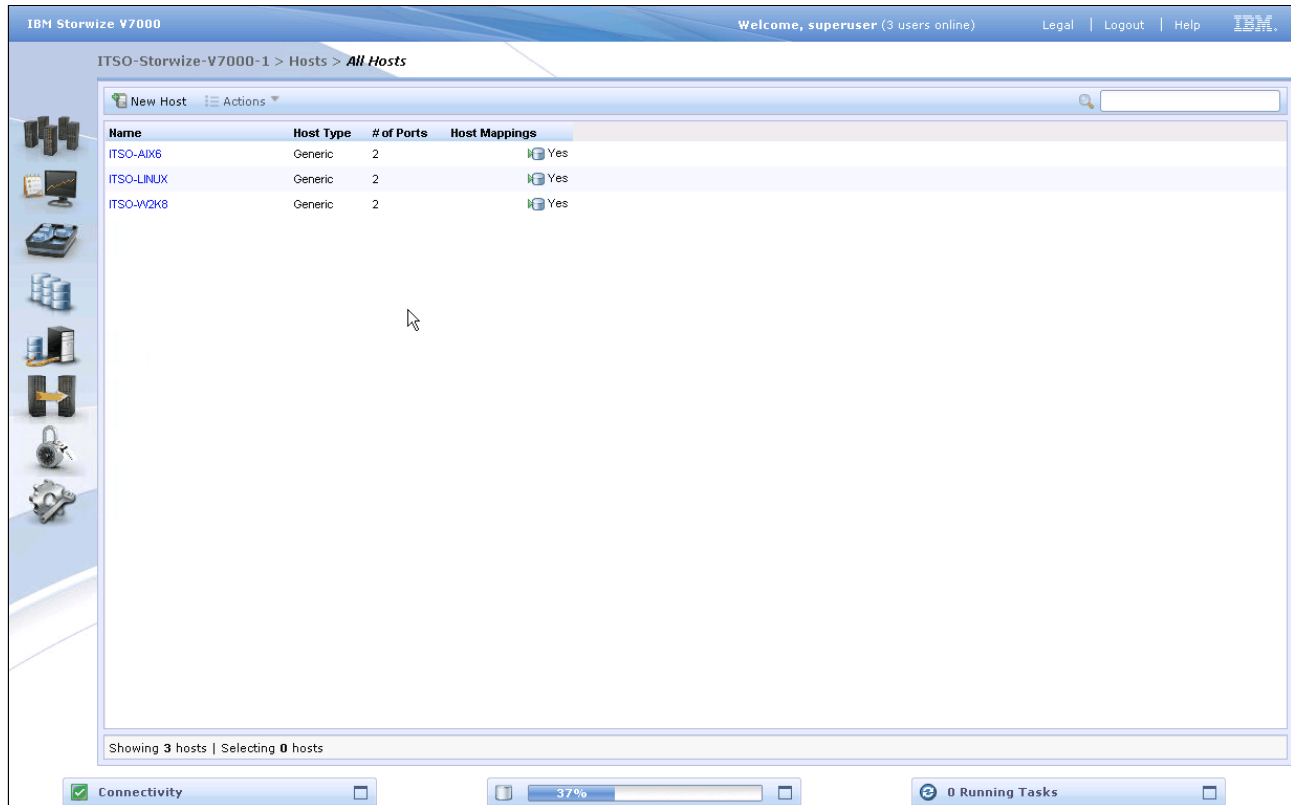


Figure 3-45 All Hosts window

As with a number of other windows, you can use the command buttons or you can select a host and right-click it to access the commands (Figure 3-46).

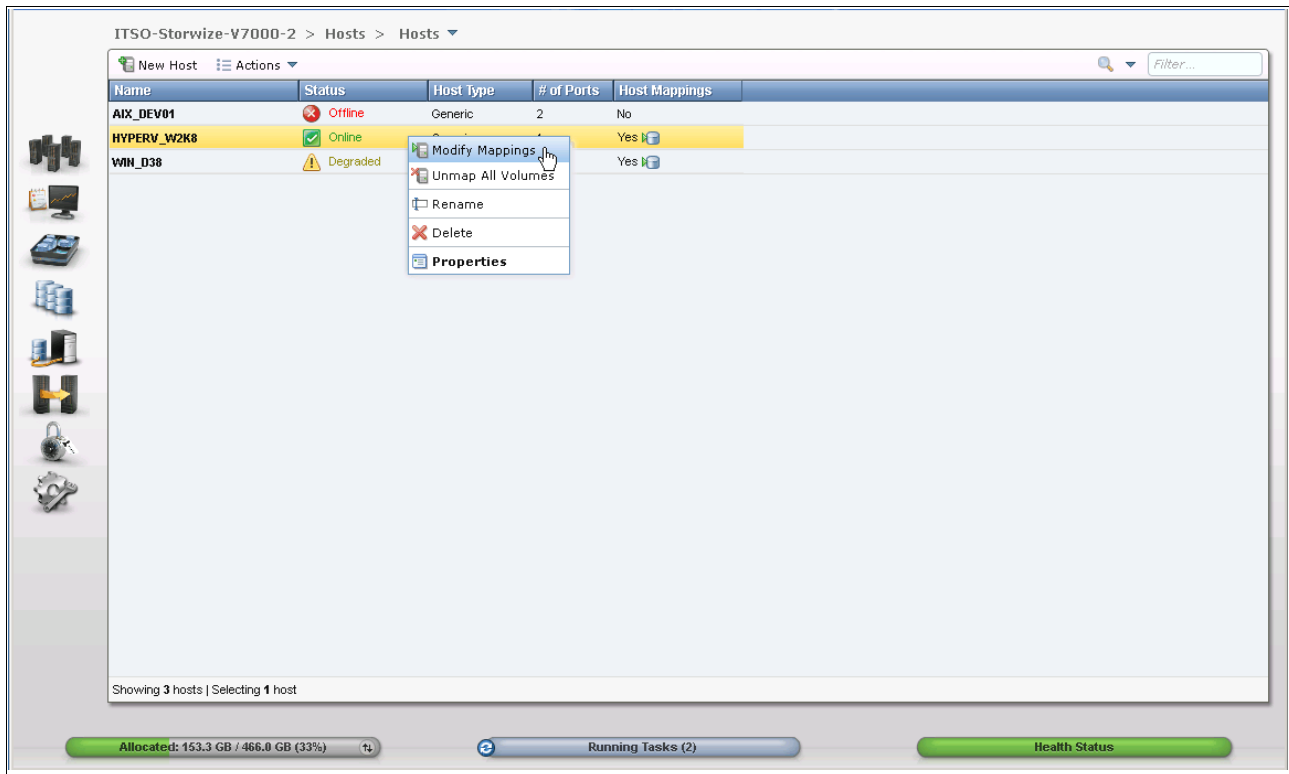


Figure 3-46 Actions for a single host from the All Hosts menu

### 3.6.2 Ports by Host menu

Clicking **Ports by Hosts** opens the window shown in Figure 3-47. This window shows the Fibre Channel and iSCSI ports that are assigned to a particular host.

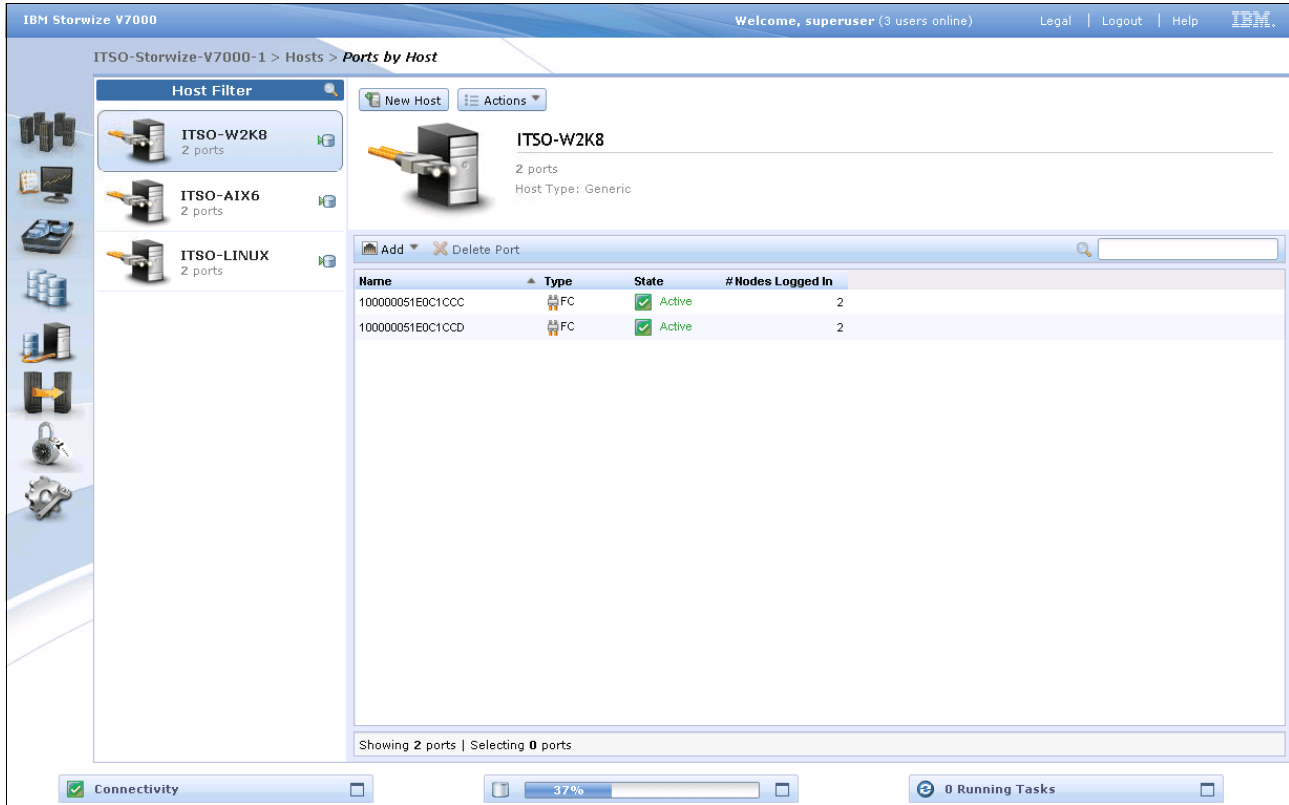


Figure 3-47 Ports by Host window



Clicking the **Actions** button allows you to modify the mappings, unmap volumes, rename hosts, and delete ports (Figure 3-48).

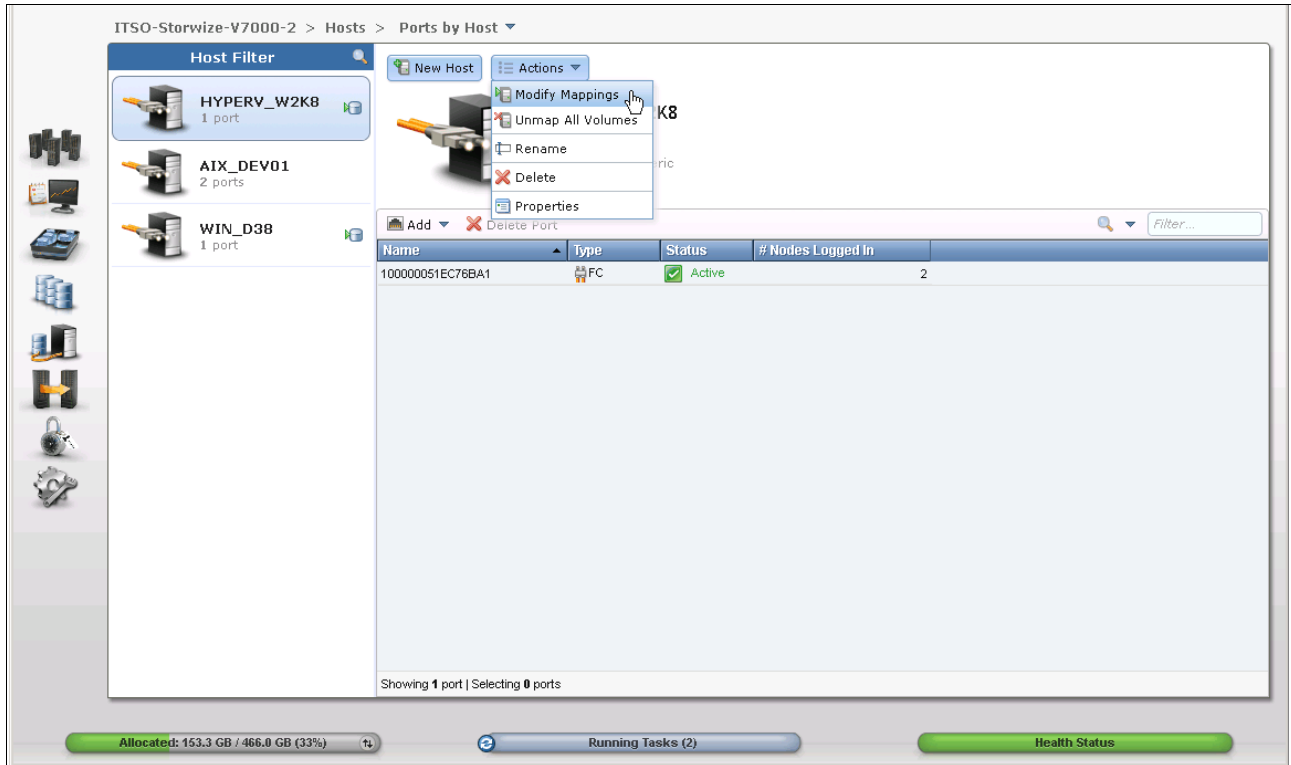


Figure 3-48 Actions for a single host from the Ports by Host window

### 3.6.3 Host Mappings menu

Clicking **Host Mappings** opens the window shown in Figure 3-49. This window shows the host ID, SCSI identifier, and the Volume identifier for all the mapped volumes.

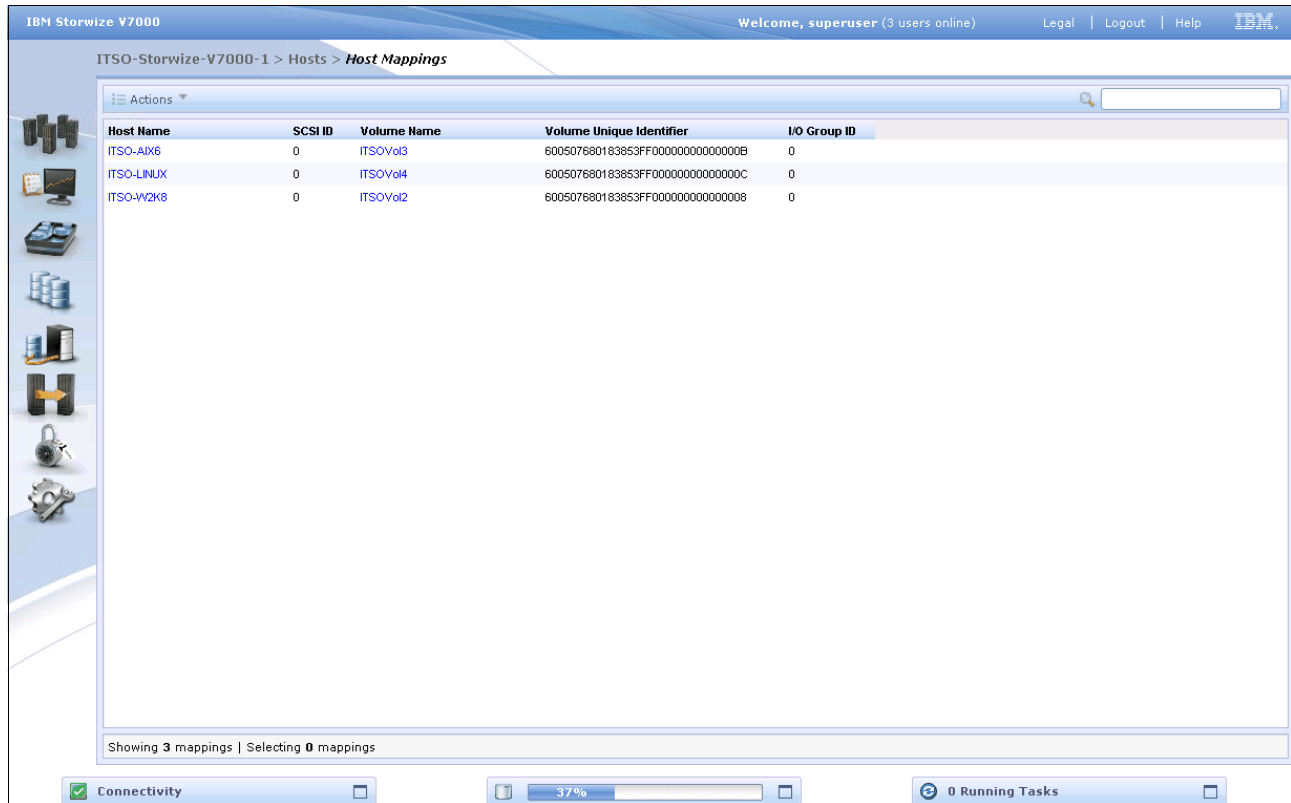


Figure 3-49 Host Mapping window

You can use the command buttons shown in Figure 3-50 or you can select a host and right-click it to access the commands.

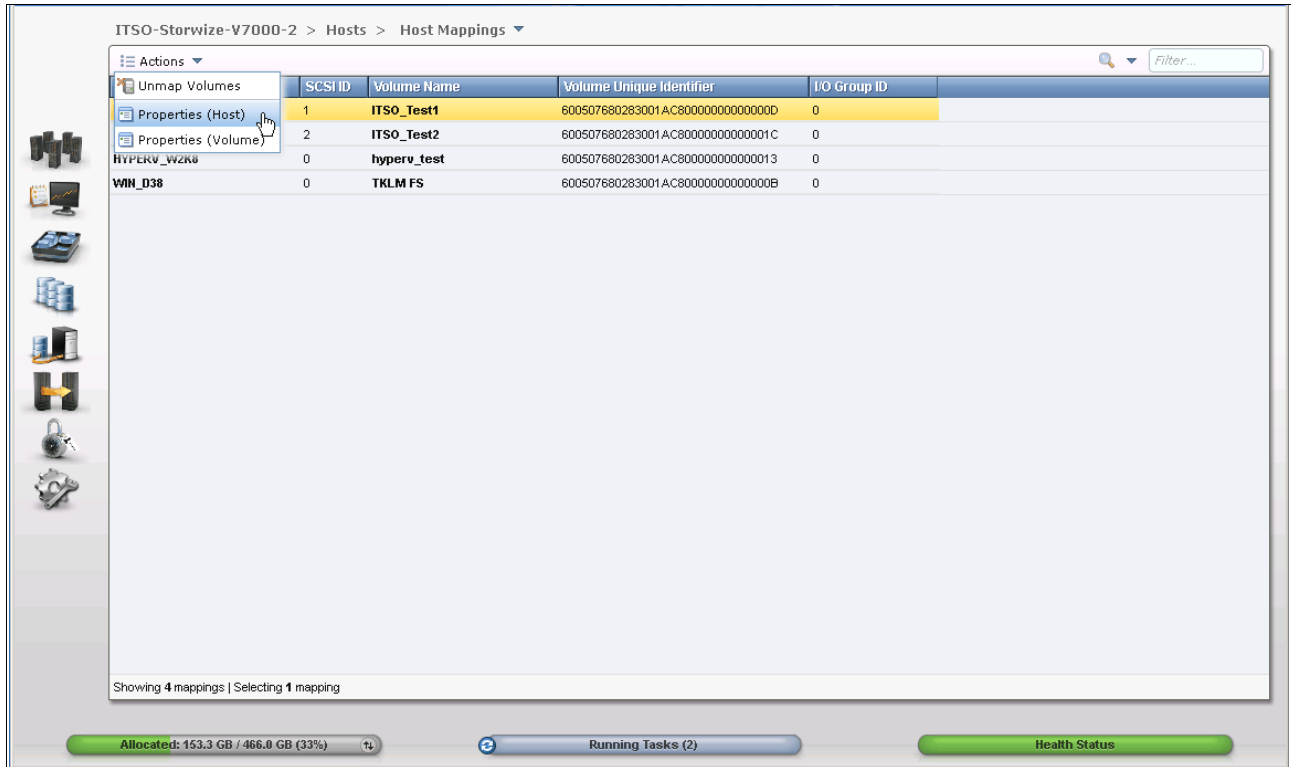


Figure 3-50 Actions for a single host from the Host Mapping window

## 3.7 Copy Services menu

In this section, we describe the Copy Services menu and its options. If you hover the cursor over the Copy Services function icon, the window shown in Figure 3-51 opens.

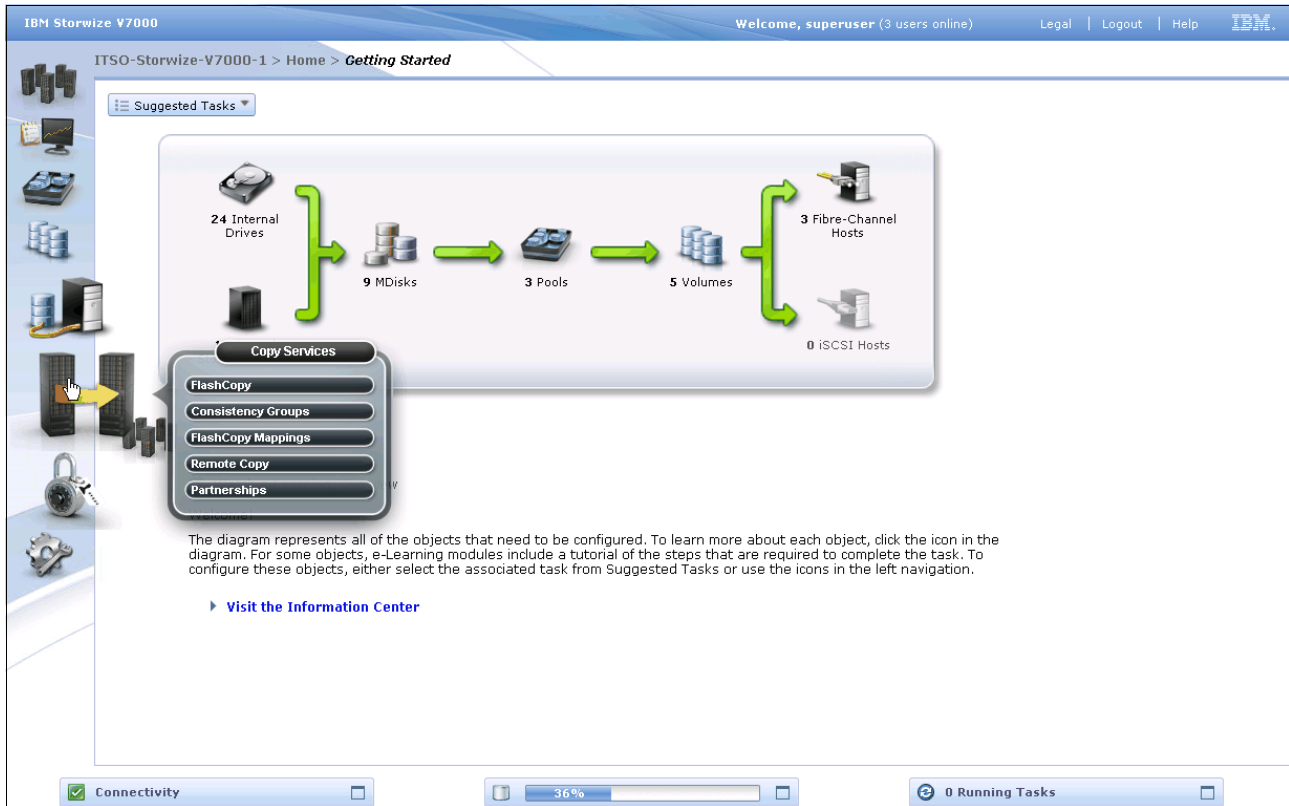


Figure 3-51 Navigate to the Copy Services menu

### 3.7.1 FlashCopy menu

Clicking **FlashCopy** opens the window shown in Figure 3-52. This window shows the volumes that are available. If you right-click a volume, a list of operations opens. From here you can perform tasks such as initiate a new snapshot, and clone or back up a volume, just by clicking the volume name.

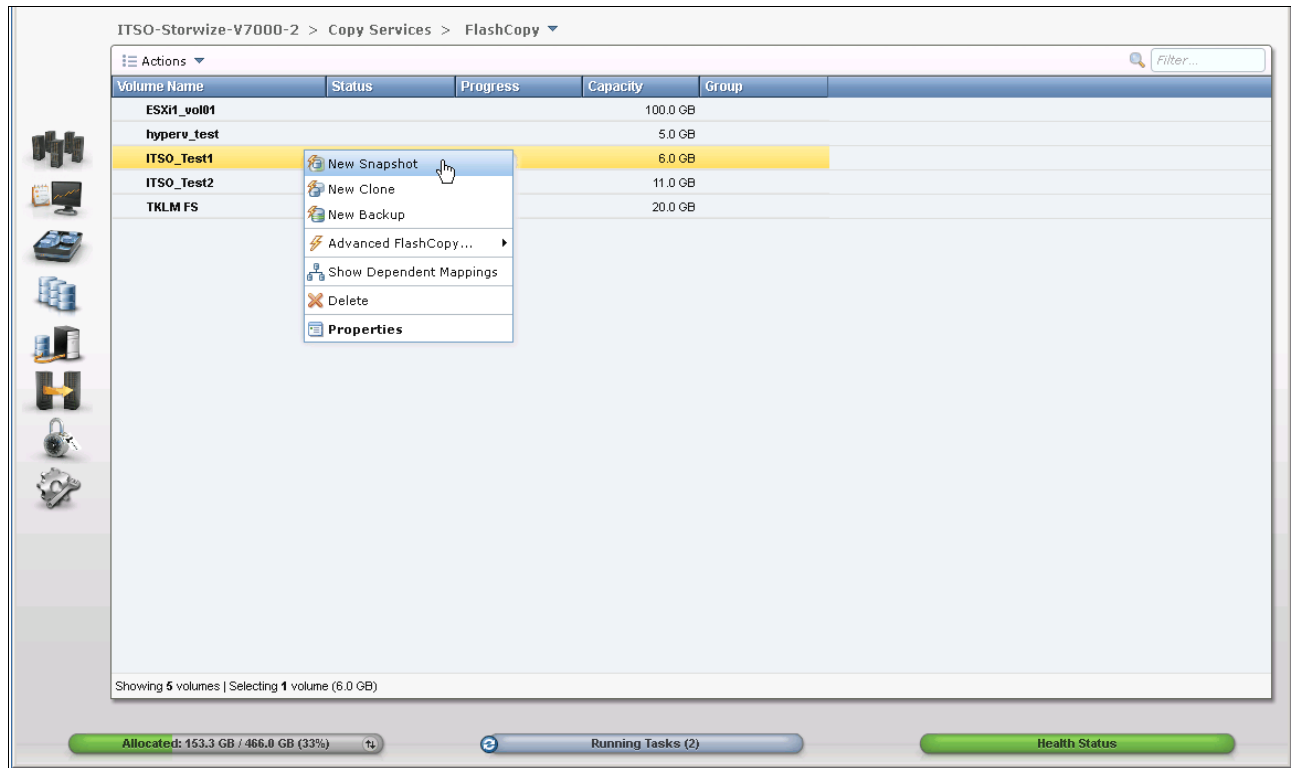


Figure 3-52 FlashCopy menu

Clicking the volume name opens the window shown in Figure 3-53. From here, you can click the tabs at the top of the window to display additional information, such as the hosts that the volume or FlashCopy volume is mapped to and its dependant MDisks.

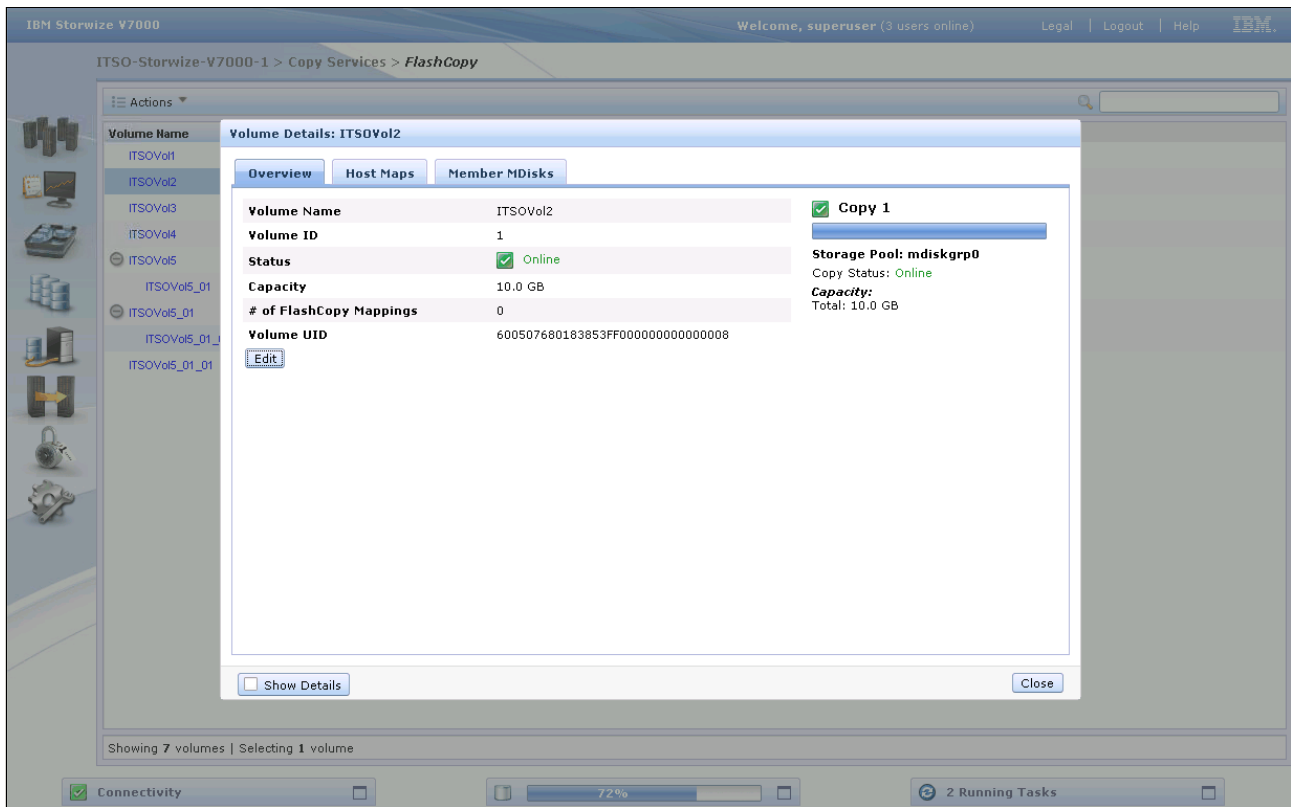


Figure 3-53 FlashCopy volume details

Clicking the **Action** button initiates a mirrored copy of the volume or migrates it to a different storage pool.

### 3.7.2 FlashCopy Consistency Group menu

Clicking **FlashCopy Consistency Group** opens the window shown in Figure 3-54. This window enables FlashCopy relationships to be placed into a consistency group. You can also use start and stop commands against the FlashCopy consistency group from this window by right-clicking the relationship.

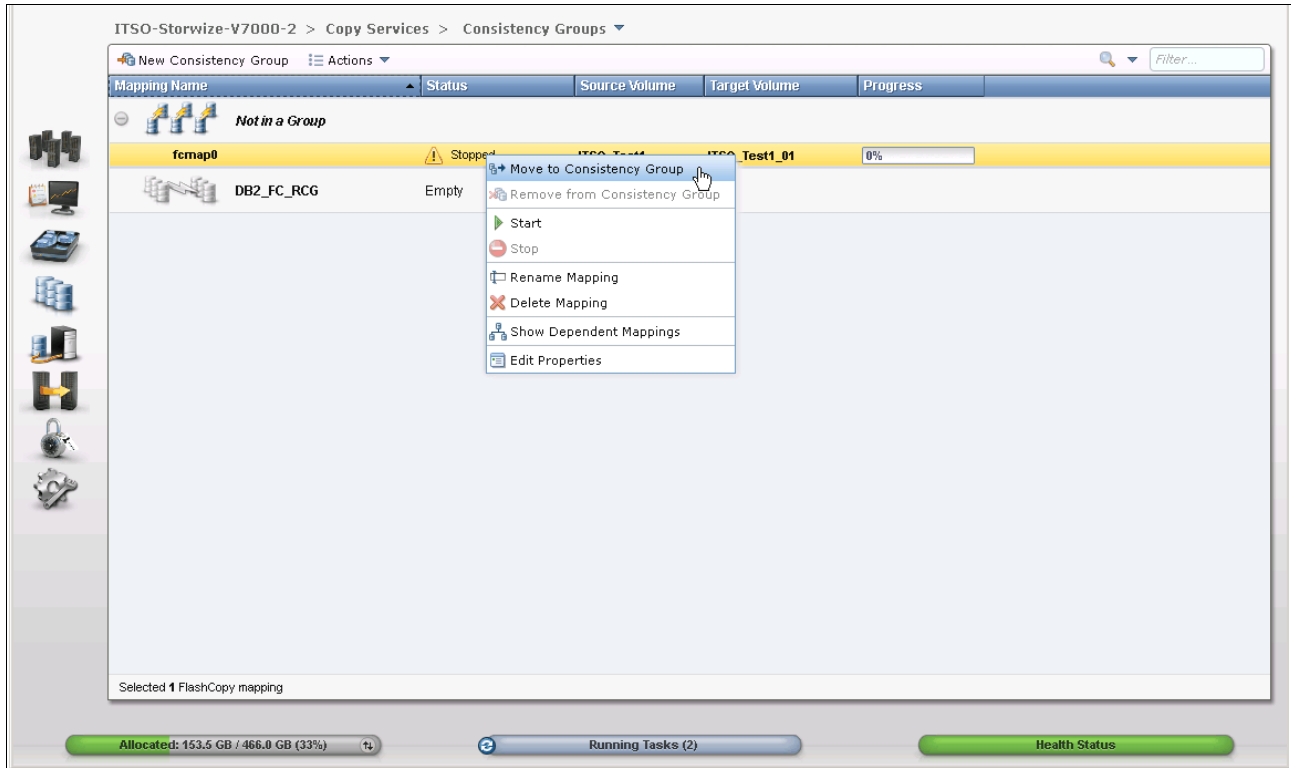


Figure 3-54 FlashCopy Consistency Group window

### 3.7.3 FlashCopy Mapping menu

Clicking **FlashCopy Mapping** opens the window shown in Figure 3-55. From this window, you can start, stop, delete, and rename the FlashCopy mappings. There is also an option to move the relationship into a consistency group.

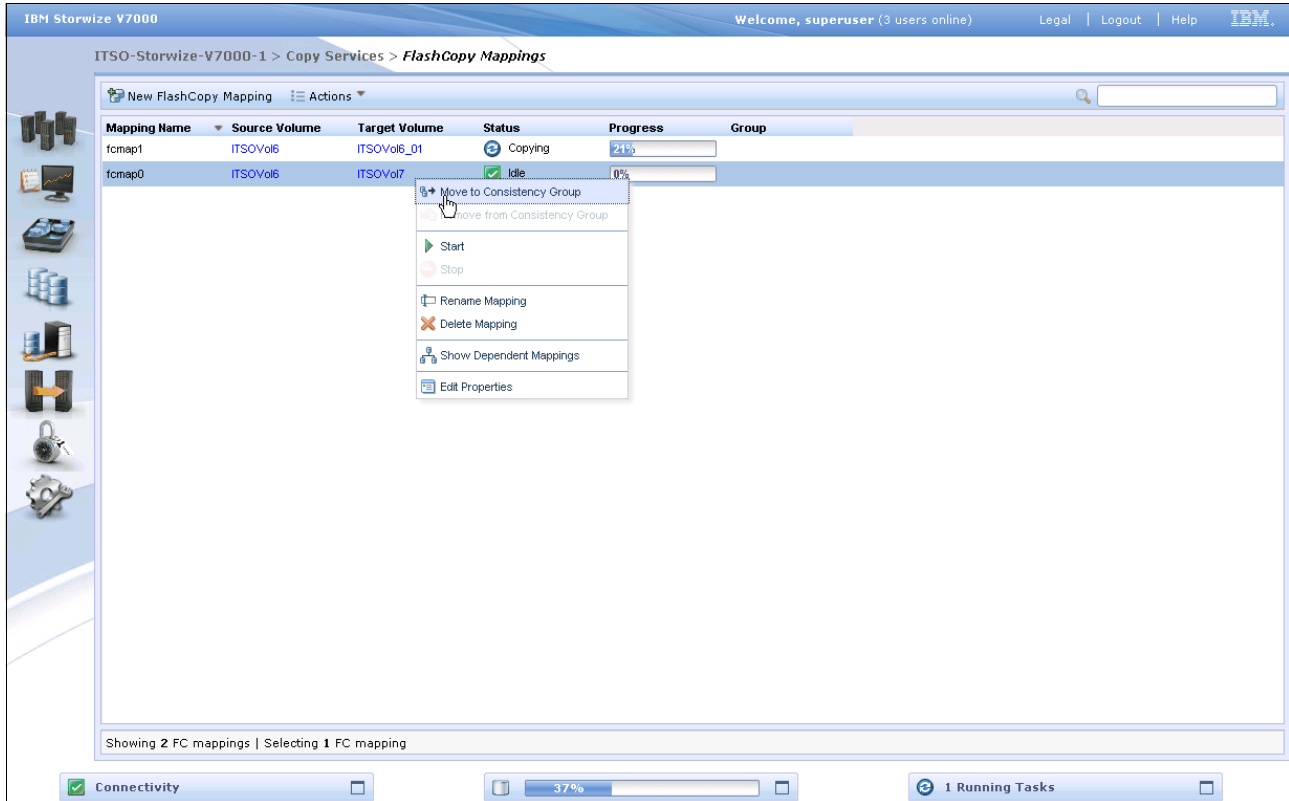


Figure 3-55 FlashCopy Mapping window



### 3.7.4 Remote Copy menu

Clicking **Remote Copy** opens the window shown in Figure 3-56. This window shows the existing Remote Copy relationships and allows you to set up and modify consistency groups. From this window, you can also start and stop relationships, add relationships to a consistency group, and switch the direction of the mirror.

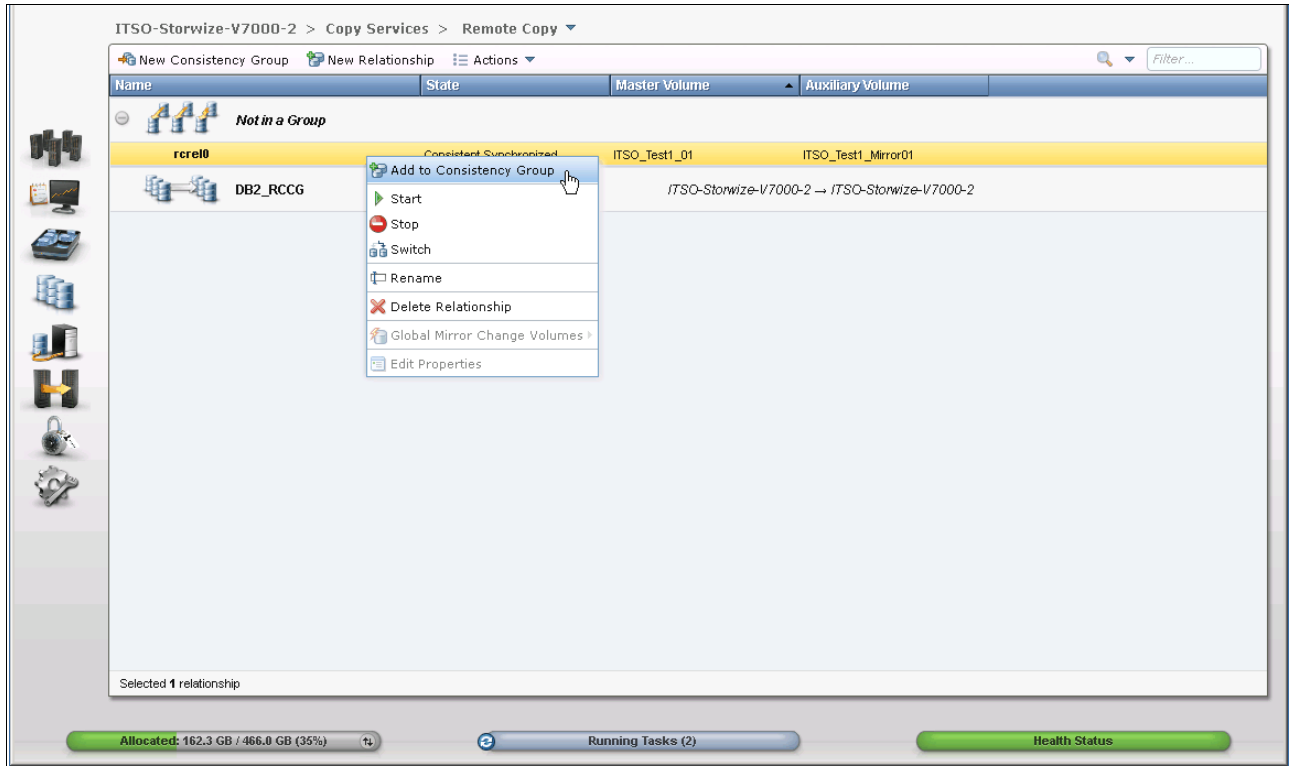


Figure 3-56 Remote Copy window

### 3.7.5 Partnerships menu

Clicking **Partnerships** opens the window shown in Figure 3-57. This window allows you to set up a new partnership or delete an existing partnership with another IBM Storwize V7000 system for the purposes of remote mirroring.

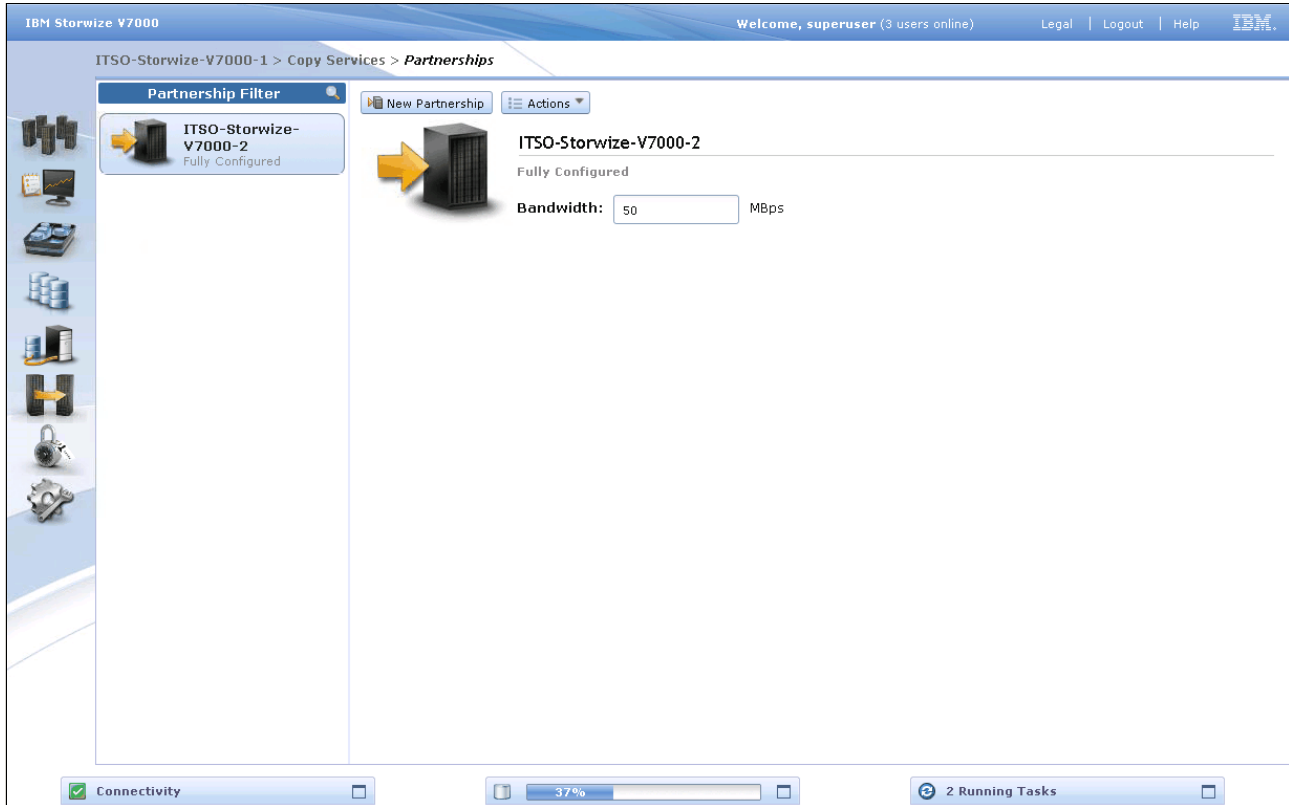


Figure 3-57 Partnerships window

From this window, we can also set the background copy rate. This rate specifies the bandwidth, in megabytes per second (MBps), that is used by the background copy process between the clusters.

### 3.8 Access menu

In this section, we describe the Access menu and its options. If you hover the cursor over the Access function icon, a menu opens (Figure 3-58).

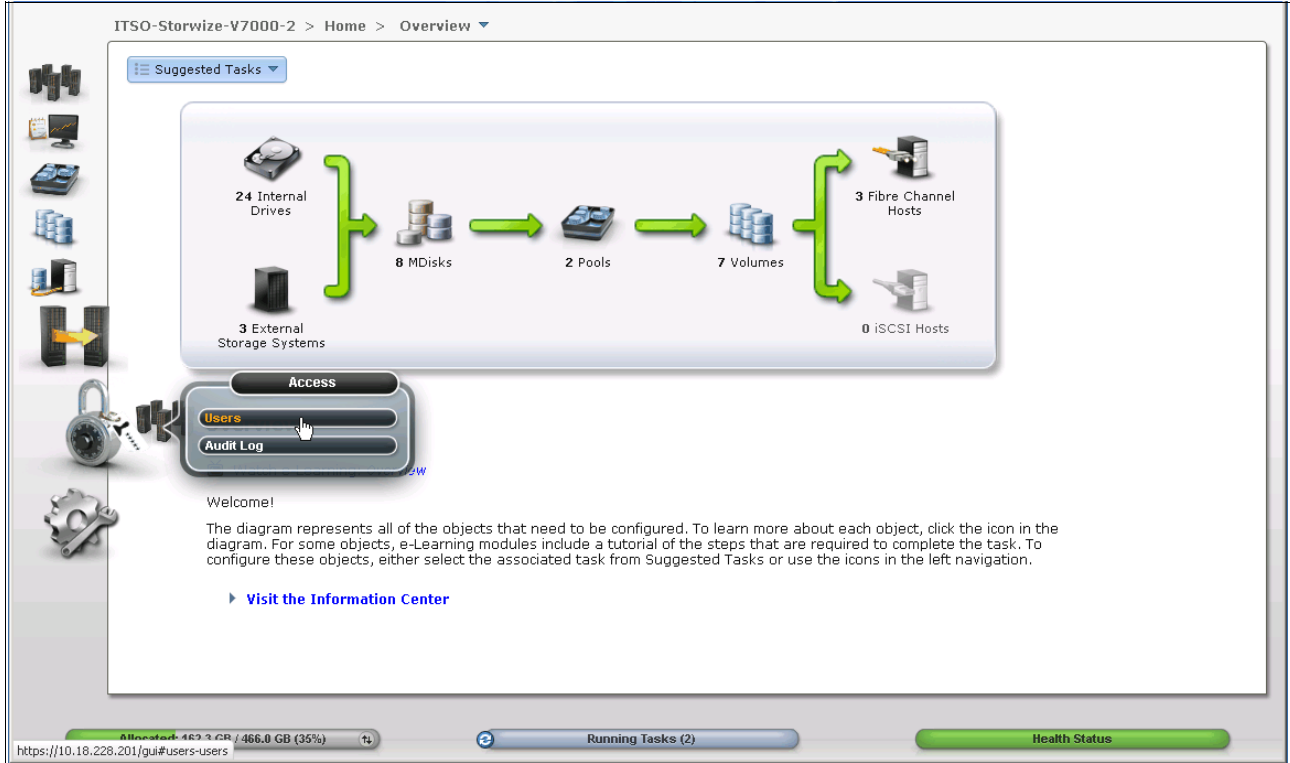


Figure 3-58 Access window

### 3.8.1 Users menu

Figure 3-59 shows the Users window. This window enables you to create and delete new users, change and remove passwords, and add and remove SSH keys.

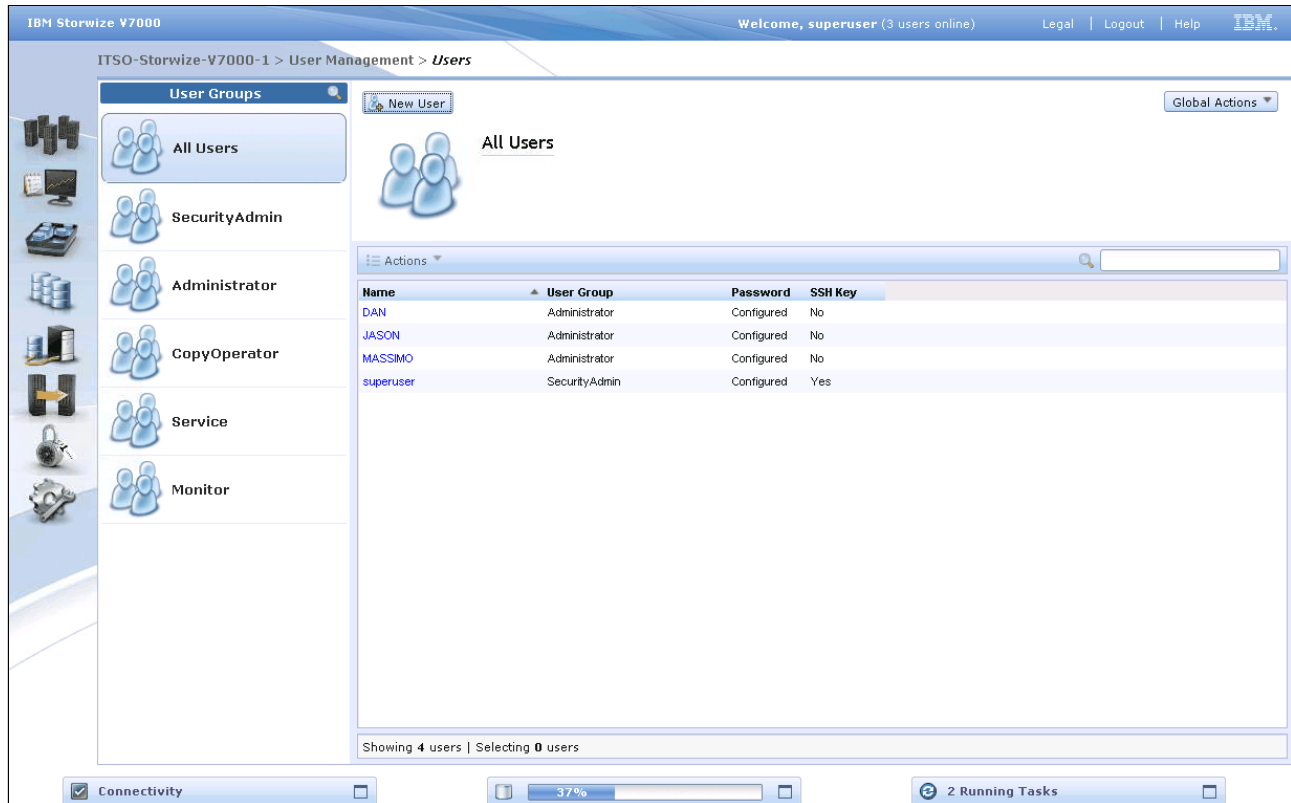


Figure 3-59 Users window

Clicking **New User** opens the window shown in Figure 3-60. From here you can enter the name of the user and the password, and load the SSH key (if the SSH key has been generated). Starting with SAN Volume Controller V6.3m the SSH key is not required for CLI access, and you can choose either to use SSH or password for CLI authentication.

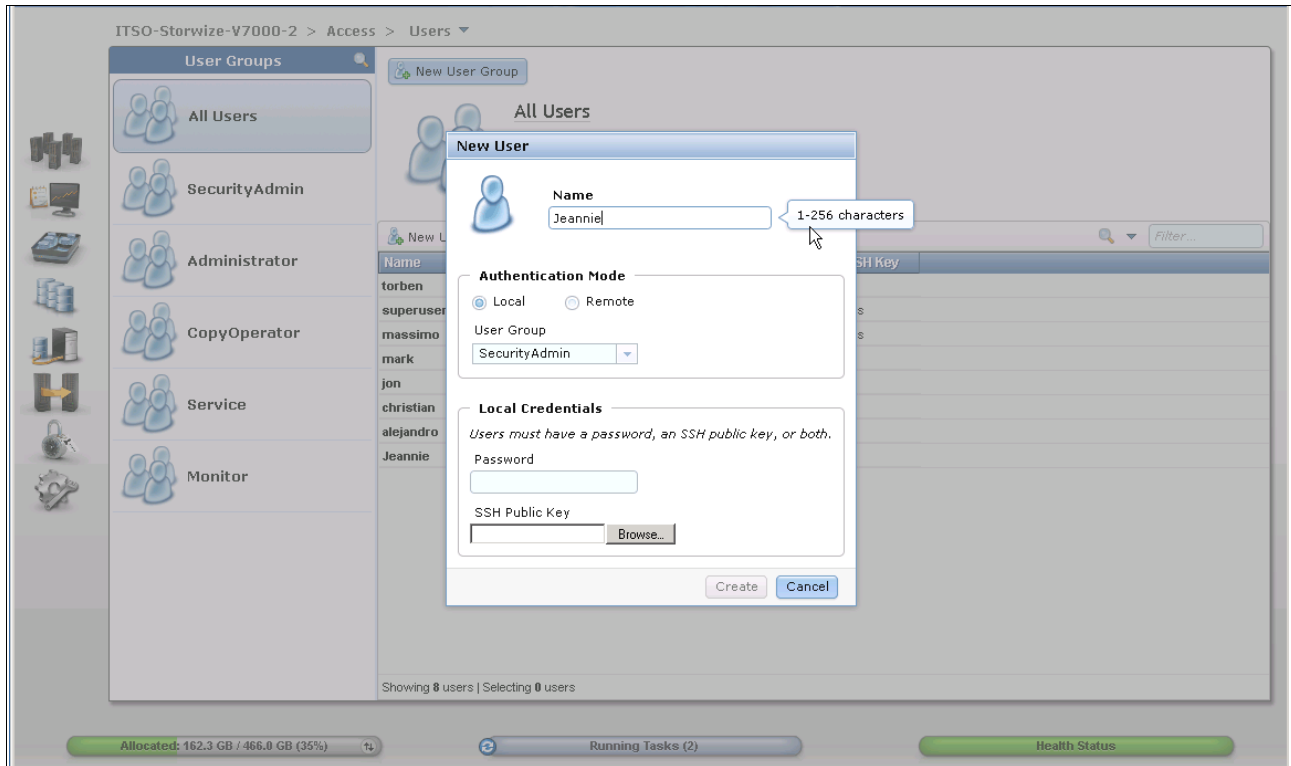


Figure 3-60 New User window

### 3.8.2 Audit Log menu

Clicking **Audit Log** opens the window shown in Figure 3-61. The cluster maintains an audit log of successfully executed commands, indicating which users performed particular actions at certain times.

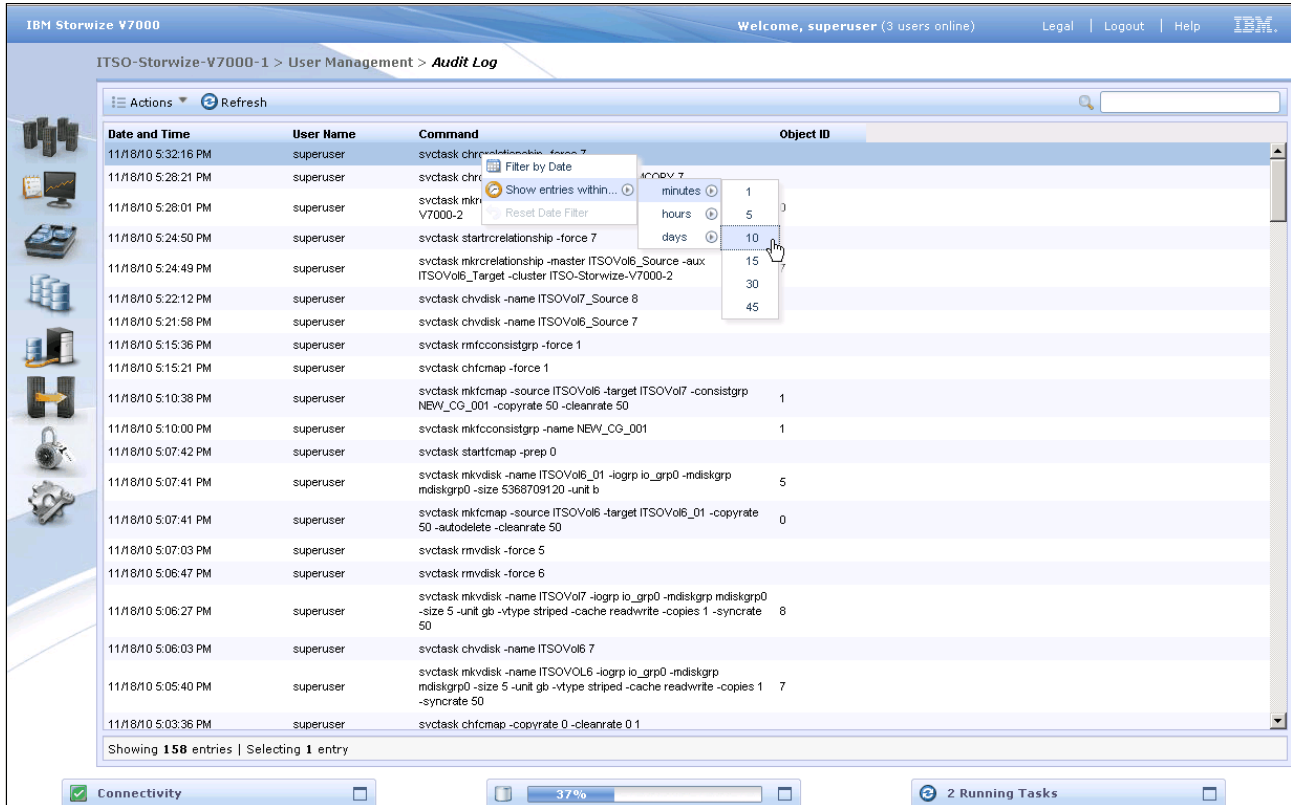


Figure 3-61 Audit Log menu

### 3.9 Settings menu

In the following section, we describe the Settings menu and its options. If you hover the cursor over the Settings function icon, the Settings menus opens (Figure 3-62).

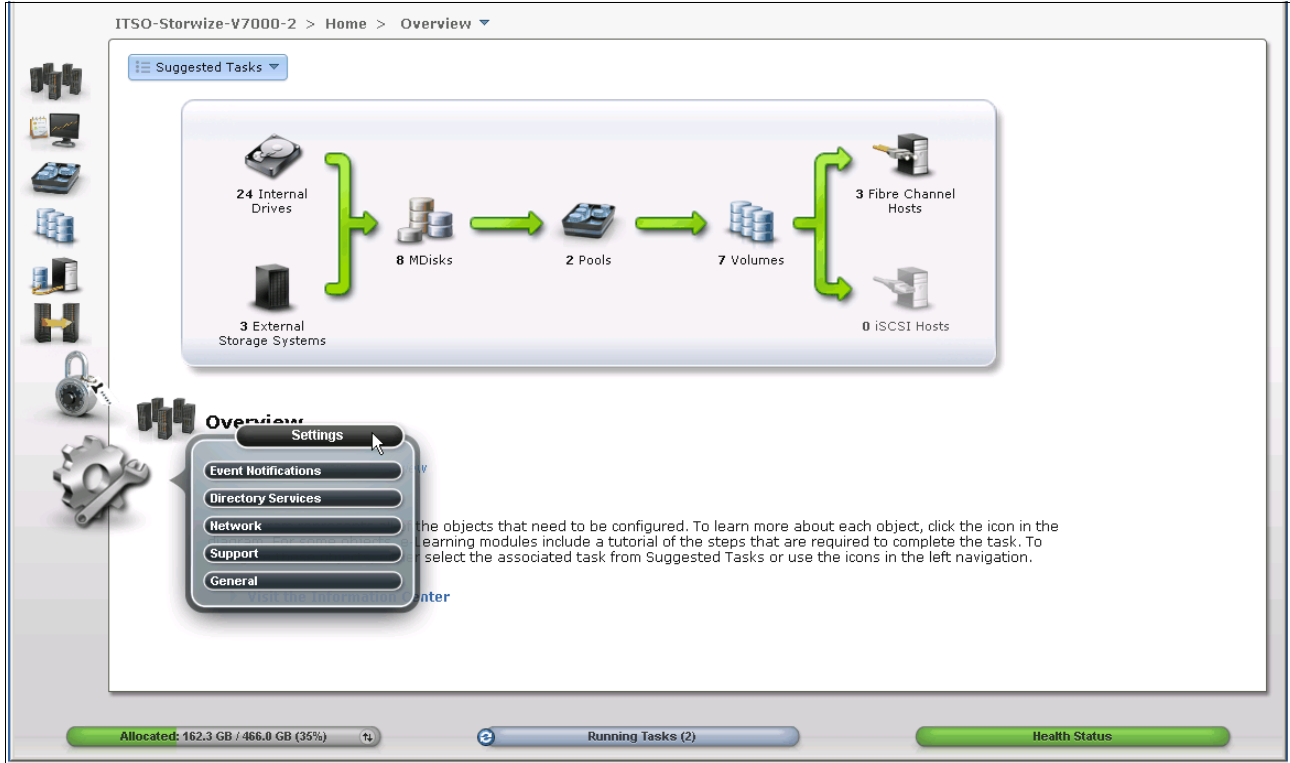


Figure 3-62 Navigate to the Settings menu

### 3.9.1 Network menu

Clicking **Network** opens the window shown in Figure 3-63. From here you can update the network configuration, set up iSCSI definitions, and view information about the Fibre Channel connections.

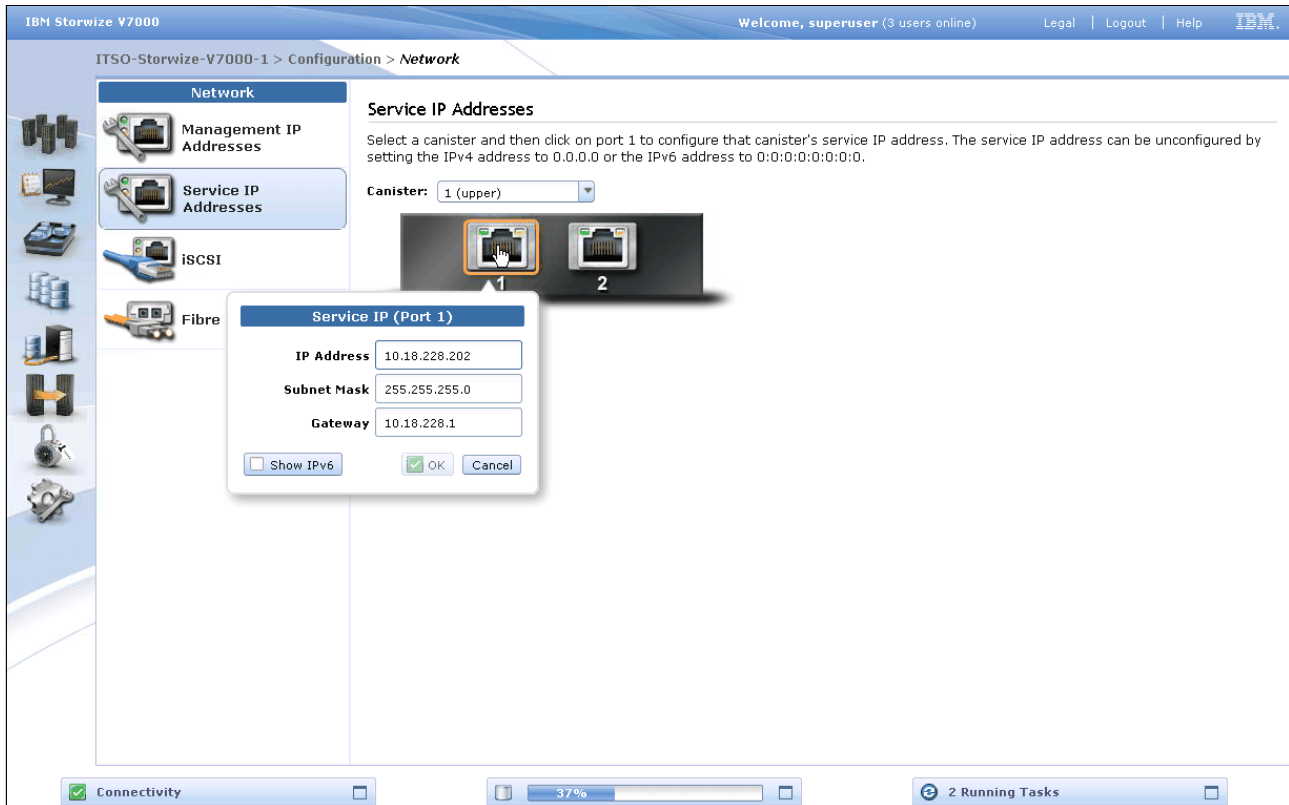


Figure 3-63 Network window



When you click **Fibre Channel** (Figure 3-64), some useful information is displayed. In this example, we click **Hosts** from the menu and then selected to display the details for one specific host, Hurricane, from the list of host systems. Other options that are available from the menu include displaying Fibre Channel details for all devices, for clusters, for nodes, for storage systems, or for hosts.

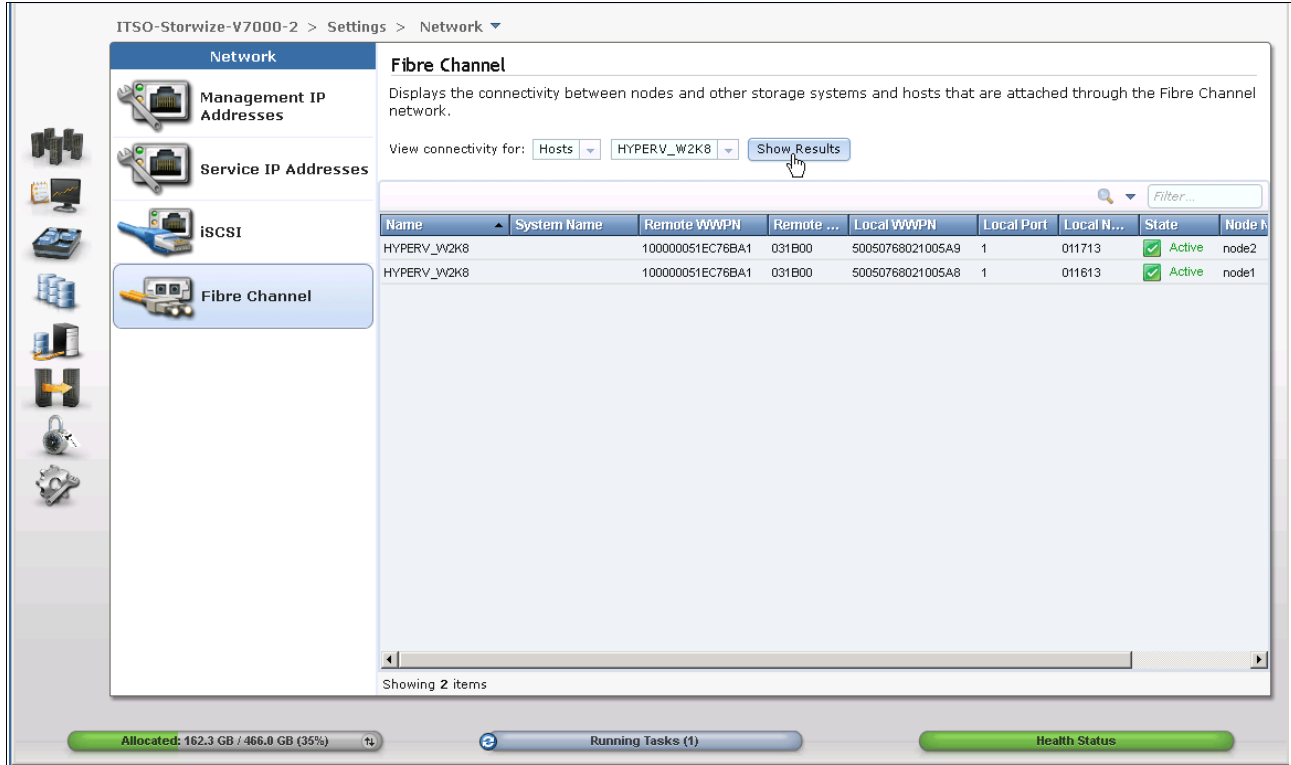


Figure 3-64 Fibre Channel window

### 3.9.2 Event Notification menu

Clicking **Event Notification** opens the window shown in Figure 3-65. From this window, you can configure email alerts (which is included in the Call Home function) and SNMP monitoring, and define syslog servers and the message types.

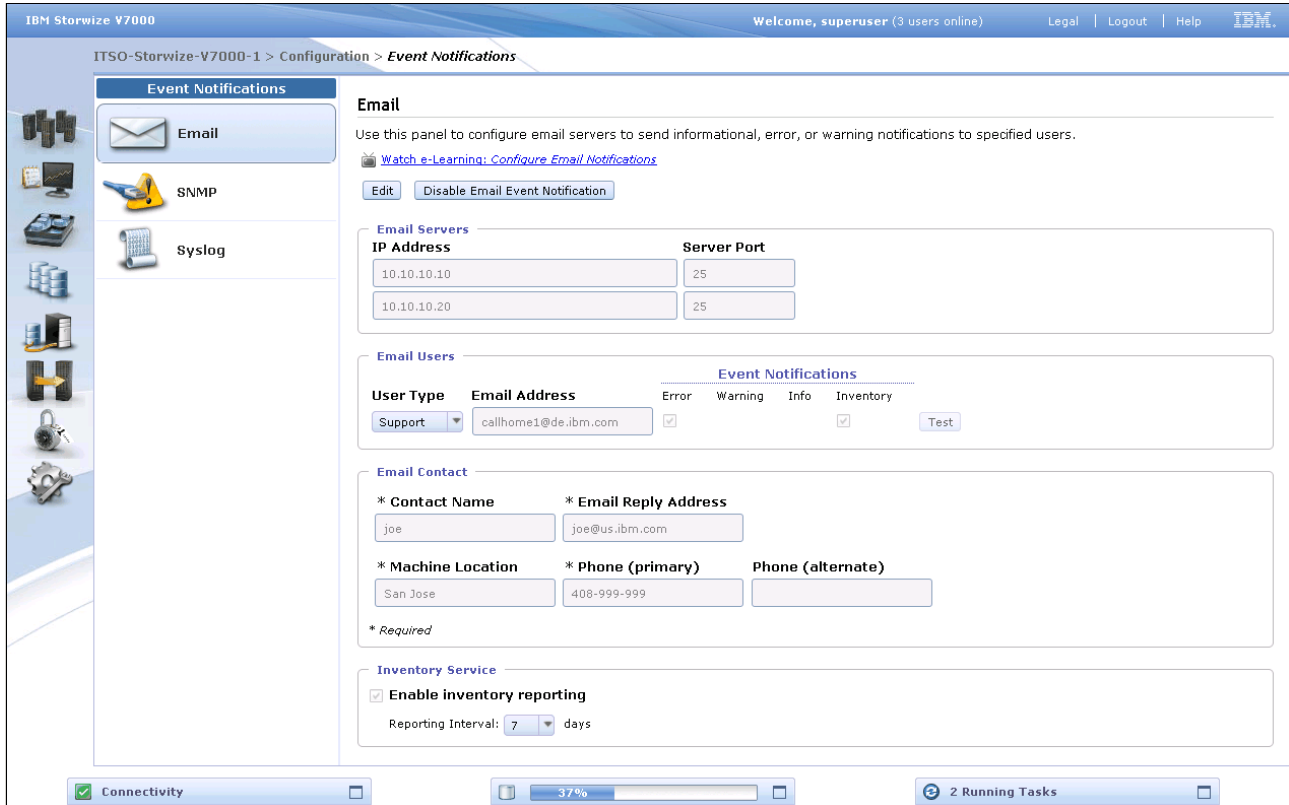


Figure 3-65 Event notification window

### 3.9.3 General menu

Clicking the **General** option opens the window shown in Figure 3-66. This window provides options to set the date and time, update the software licensing levels, upgrade the firmware, and set GUI preferences.

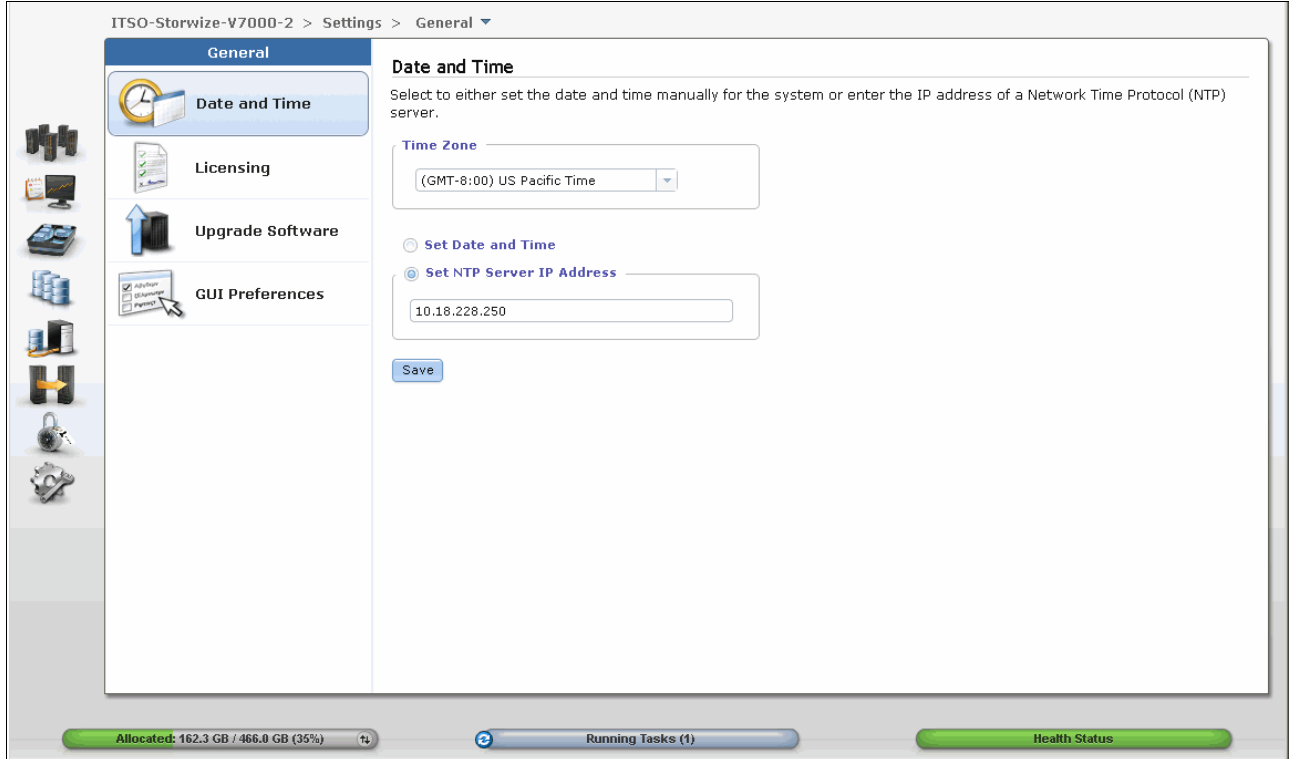


Figure 3-66 General window

