IBM Spectrum Control Base Edition
Version 2.2.1

User Guide

SC27-5999-14

Note
Before using this document and the product it supports, read the information in "Notices" on page 161.

Edition notice

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About this guide

This guide describes how to install, configure, and use IBM® Spectrum Control Base Edition and its solution components.

Who should use this guide

This guide is intended for system administrators who are familiar with the VMware vCenter and vSphere environments, and with the specific IBM storage system that is in use.

Conventions used in this guide

These notices are used in this guide to highlight key information.

Note: These notices provide important tips, guidance, or advice.

Important: These notices provide information or advice that might help you avoid inconvenient or difficult situations.

Attention: These notices indicate possible damage to programs, devices, or data. An attention notice appears before the instruction or situation in which damage can occur.

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You can find additional information and publications related to IBM Spectrum Control Base on the following information sources.

- IBM Knowledge Center (ibm.com/support/knowledgecenter)
- IBM DS8000® on IBM Knowledge Center (ibm.com/support/knowledgecenter/STUVMB)
- IBM DS8800 on IBM Knowledge Center (ibm.com/support/knowledgecenter/STXN8P)
- IBM DS8870 on IBM Knowledge Center (ibm.com/support/knowledgecenter/ST8NCA)
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- IBM Storwize V7000 Unified on IBM Knowledge Center (ibm.com/support/knowledgecenter/ST5Q4U)
- IBM XIV® Storage System on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJTAG)
- IBM Spectrum Accelerate on IBM Knowledge Center (ibm.com/support/knowledgecenter/STZSWD)
- VMware Documentation (vmware.com/support/pubs)
- VMware Product Support (vmware.com/support)
- VMware Knowledge Base (kb.vmware.com)

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Procedure

To submit any comments about this guide:

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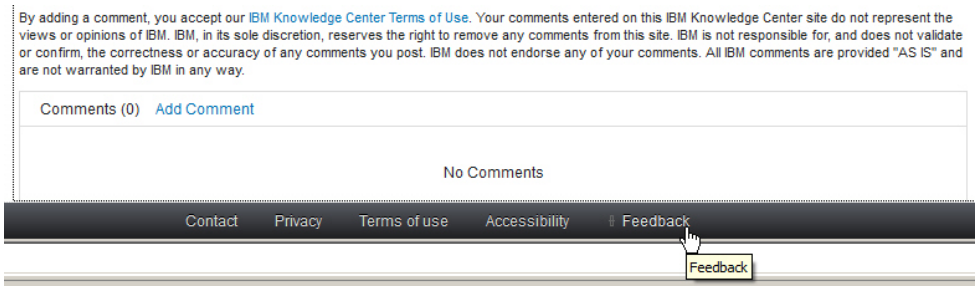

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  - Publication form number (for example: SC01-0001-01)
  - Page, table, or illustration numbers that you are commenting on
  - A detailed description of any information that should be changed

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Chapter 1. Introduction

IBM Spectrum Control Base Edition is a centralized cloud integration system that consolidates a range of IBM storage provisioning, virtualization, cloud, automation, and monitoring solutions through a unified server platform.

IBM Spectrum Control Base Edition provides a single-server backend location and enables centralized management of IBM storage resources for different virtualization and cloud platforms, including:

- VMware vCenter Server
- VMware vSphere Web Client (vWC)
- VMware vSphere APIs for Storage Awareness (VASA)
- VMware vCenter Operations Manager (vCOps)
- VMware vCenter Orchestrator (vCO)

Through its user credential, storage system, storage space and service management options, IBM Spectrum Control facilitates the integration of IBM storage system resources with the supported virtualization and cloud platforms, while providing the foundation for integration with future IBM systems and Independent Software Vendor (ISV) solutions.

IBM Spectrum Control Base Edition can be managed through a standard web browser and a graphical user interface (GUI), or through terminal and a command-line interface (CLI).

Included cloud interfaces

The following cloud interfaces, referred to as applications, are included in the IBM Spectrum Control Base Edition software package:

- IBM Storage Provider for VMware VASA
- IBM Storage Enhancements for VMware vSphere Web Client
- IBM Storage Plug-in for VMware vCenter Orchestrator
- IBM Storage Management Pack for VMware vCenter Operations Manager

IBM Storage Provider for VMware VASA

The IBM Storage Provider for VMware VASA improves the ability to monitor and automate storage-related operations on VMware platforms.

From its Spectrum Control Base host, the IBM Storage Provider for VMware VASA provides a standard interface for any connected VMware vCenter server using the VMware vSphere APIs for Storage Awareness (VASA). It delivers information about IBM storage topology, capabilities, and state, together with storage events and alerts to vCenter server in real time.

To visualize how this cloud interface is integrated in a virtualized environment, see “Concept diagram” on page 3.

IBM Storage Enhancements for VMware vSphere Web Client

The IBM Storage Enhancements for VMware vSphere Web Client integrate into the VMware vSphere Web Client platform and enable VMware administrators to independently and centrally manage their storage resources on IBM storage systems.

Depending on the IBM storage system in use, VMware administrators can self-provision volumes (LUNs) in selected storage pools that were predefined by the storage administrators. The volumes are mapped to ESXi hosts, clusters, or datacenters as logical drives that can be used for storing VMware datastores (virtual machine data containers).

As opposed to the IBM Storage Management Console for VMware vCenter, which is individually installed on each vCenter server, the IBM Storage Enhancements for vSphere Web Client are installed only on the vSphere Web Client Server, allowing multiple vCenter servers to utilize IBM storage resources. In addition, storage pool attachment and detachment operations are performed on the Spectrum Control Base side, rather than on the vSphere Web Client side.

The IBM Storage Enhancements for VMware vSphere Web Client are automatically deployed and enabled for each and every vCenter server that is registered for vSphere Web Client services on the connected Spectrum Control Base.

To visualize how this cloud interface is integrated in a virtualized environment, see "Concept diagram" on page 3.

IBM Storage Plug-in for VMware vCenter Orchestrator

The IBM Storage Plug-in for VMware vCenter Orchestrator allows VMware administrators to include IBM storage discovery and provisioning in their vCenter Orchestrator (vCO) automation workflows.

Note: In version 2.2.1, the IBM Storage Plug-in for VMware vCenter Orchestrator supports only XIV storage systems.

The plug-in package can be downloaded from Spectrum Control Base and can then be deployed on the vCenter Orchestrator server. The deployment includes the matching of a unique token key that is set on both servers.

Through vCenter Orchestrator Client, dedicated IBM Storage control elements become available, allowing the issuing of workflows with storage pools that are attached to the vCenter Orchestrator server.

Rather than issuing volume operations manually and being limited to one manual operation at a time, VMware administrators can preplan and automate storage operations in their virtualized cloud environments, either directly from vCenter Orchestrator or through the VMware vCloud Automation Center (vCAC) platform.

To visualize how this cloud interface is integrated in a virtualized environment, see "Concept diagram" on page 3.

IBM Storage Management Pack for VMware vCenter Operations Manager

The IBM Storage Management Pack for VMware vCenter Operations Manager allows Operations Manager users to obtain comprehensive monitoring information about the IBM storage resources that are utilized in their virtualized environment.

Note: In version 2.2.1, the IBM Storage Management Pack for VMware vCenter Operations Manager supports only XIV storage systems.

The management pack can be downloaded from Spectrum Control Base and can then be deployed on the vCenter Operations Manager server.

After a VMware vCenter Operations Manager server is registered on Spectrum Control Base that is configured with storage systems, storage spaces, services, and vCenter servers, storage-related data is pushed to the Operations Manager server every five minutes by default.

The dedicated IBM storage system adapter deployed on the vCenter Operations Manager server enables monitoring the XIV Storage System via the vCOps Manager. This adapter reports the XIV system-related information, such as monitoring data of all logical and physical elements, covering storage systems, storage domains, storage pools, volumes, hosts, modules, target ports, disks, health status, events, thresholds, and performance. It also provides the dashboards that display detailed status, statistics, metrics, and analytics data alongside hierarchical flowcharts with graphic representation of XIV Storage System elements.

Relationships between the IBM Storage elements (storage systems, ports, storage pools, volumes, host, host initiator, modules, domain) and datastores, virtual machines, and hosts are displayed graphically in a drill-down style, providing VMware administrators a complete and up-to-date picture of their utilized storage resources.

To visualize how this cloud interface is integrated in a virtualized environment, see “Concept diagram.”

Concept diagram

The following concept diagram illustrates how IBM storage systems are accessed and utilized from the VMware environment through IBM Spectrum Control Base Edition.

The storage administrator uses Spectrum Control Base to select which IBM storage systems (arrays) and what storage pools should be available for use in the VMware environment, and control which specific vCenter servers can utilize the IBM storage resources.

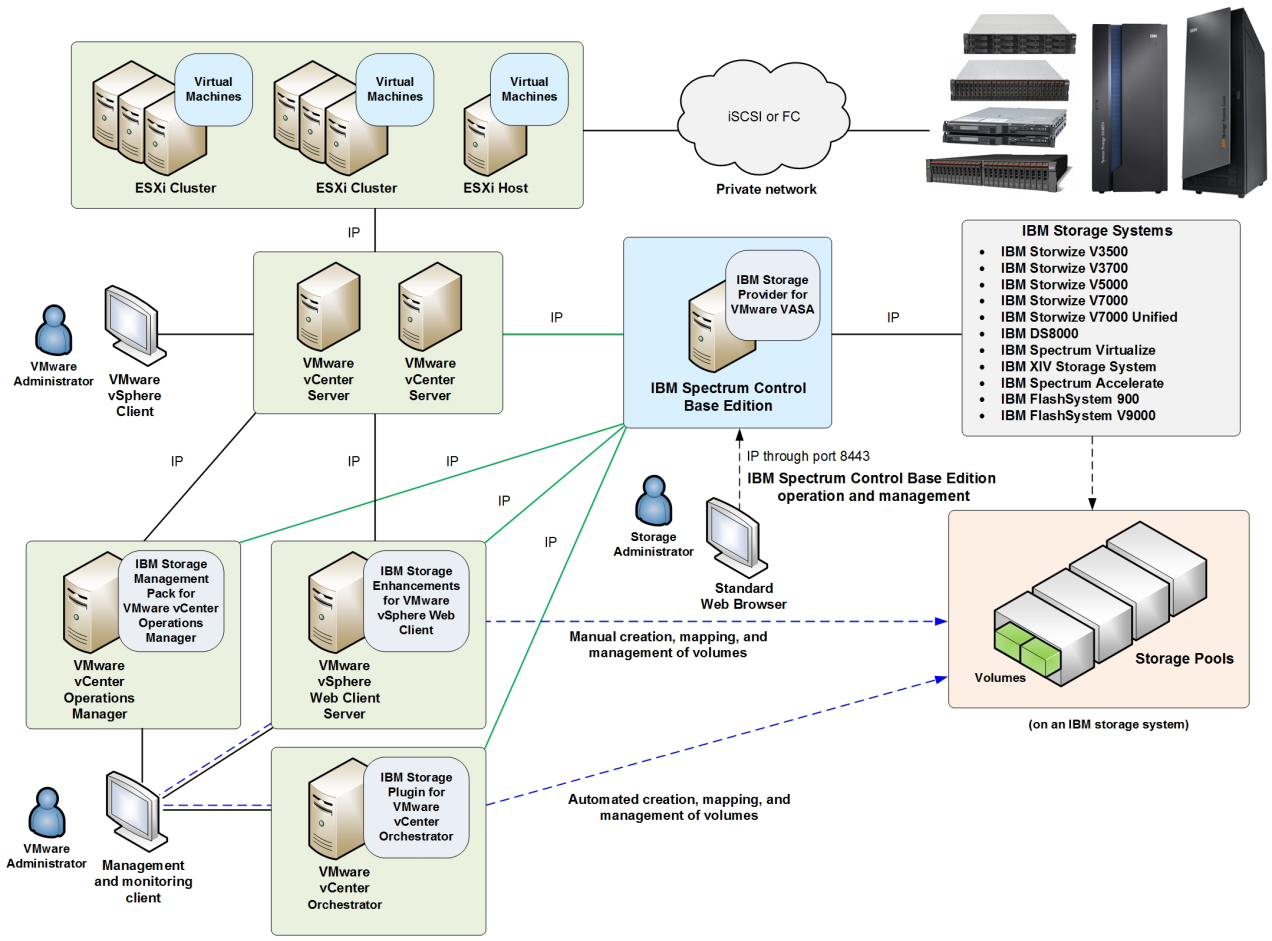


Figure 1. Integration of IBM storage systems with a VMware environment

Spectrum Control Base allows registered VMware vCenter servers to utilize its VASA functions, which can be monitored on the vSphere Web Client station.

In parallel, the following operations are enabled on the VMware environment side:

- Through vSphere Web Client, administrators can manually create, map, and fully control storage volumes on the available storage systems and storage pools.
- Through vCenter Orchestrator, administrators can issue workflows for automating the same volumes operations that are available through vSphere Web Client. The automation is run by the VMware vCloud Automation Center (vCAC) platform.
- Through vCenter Operations Manager, administrators can obtain comprehensive monitoring information about the IBM storage resources that are utilized in their virtualized environment.

Note: New storage pools can be created in advance through the dedicated storage system management tools or from Spectrum Control Base. New pools cannot be added from the VMware environment.

Virtual volumes

IBM Spectrum Control Base Edition delivers comprehensive storage virtualization support that use VMware vSphere Virtual Volume (VVol) technology.

Note: The virtual volume technology is supported by the IBM XIV (11.5.1 or later) and storage systems that run IBM Spectrum Virtualize™ (7.6 or later).

The VVol architecture, introduced in VMware VASA 2.0, preserves the concept of a traditional datastore, maintaining familiarity and compatibility with previous data storage implementations. However, the virtual disks in a VVol datastore can use different storage attributes (services), which includes thin/thick provisioning, snapshot support, encryption, and so on. Moreover, each VVol can be managed independently. VVol usage improves system scalability, ensures granular management, leverages hardware features and performance of storage systems at the VM level, providing complete end-to-end cloud solution. An additional entity, a storage space, includes one or more services, and can be assigned to different storage customers.

The IBM Storage Provider for VMware VASA implements the VMware Virtual Volume API, providing an out-of-band management bridge between vSphere and the storage system. Out-of-band link separates the management path from the data path, which connects the ESXi servers to the virtual disks in a VVol datastore through a Protocol Endpoint (PE). Instead of presenting a LUN to the hypervisor and allowing an ESXi host to perform data operations, a storage system takes on itself a bulk of storage-related functions.

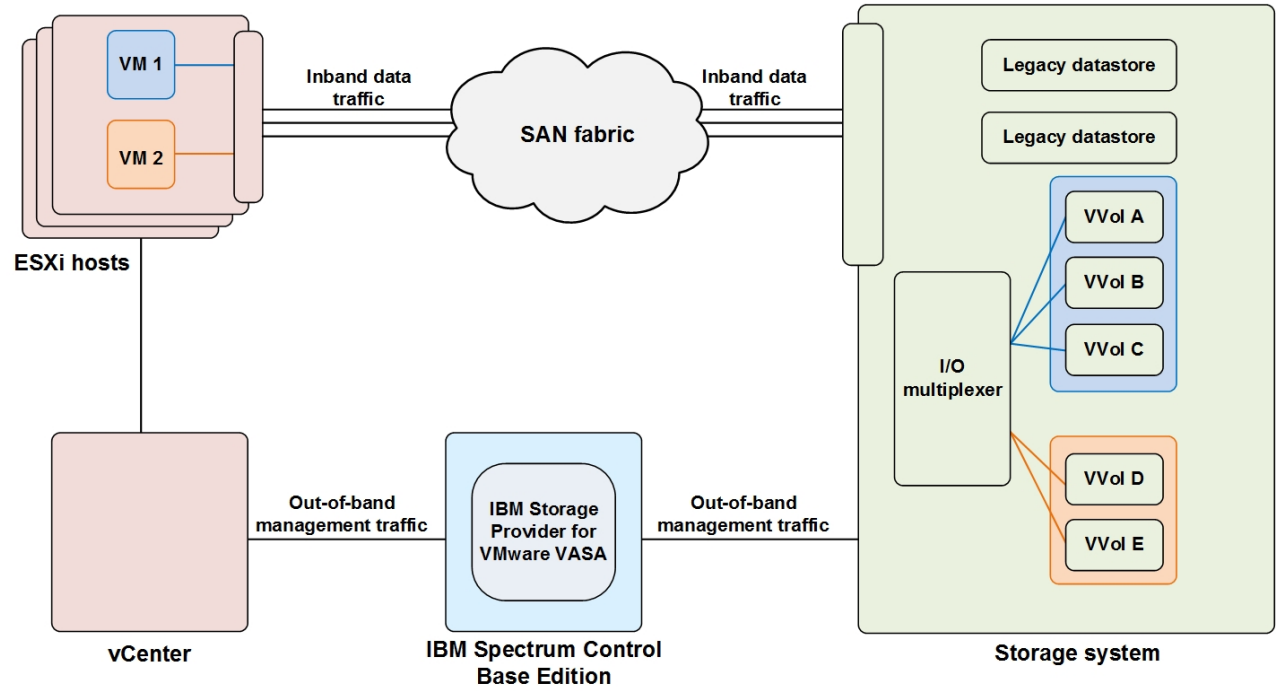


Figure 2. VVol concept

For instructions about how to configure a VVol-enabled storage service, see "Creating a VVol-enabled service" on page 147.

Storage Policy Based Management (SPBM)

IBM Spectrum Control Base Edition uses VMware vSphere Storage Policy Based Management (SPBM) technology for optimizing the virtual machine provisioning process.

Delivering only one service level, the traditional storage provisioning models fail to match storage consumer needs with storage provider capabilities. This results in misalignment between the system capacities and application requirements, leading to over-provisioning and waste of IT resources.

The SPBM approach allows dynamic definition of storage policies with their subsequent delivery on a per-VM basis. In this case, the storage consumer can pair an application with existing storage policies and provision storage resources exactly according to application requirements. Storage policies, referred to as storage services in this user guide, combine storage capacity with a set of attributes (encryption, provisioning type, etc.) to define storage spaces, which are used as virtual datastores to suit requirements of a specific VM, as illustrated below.

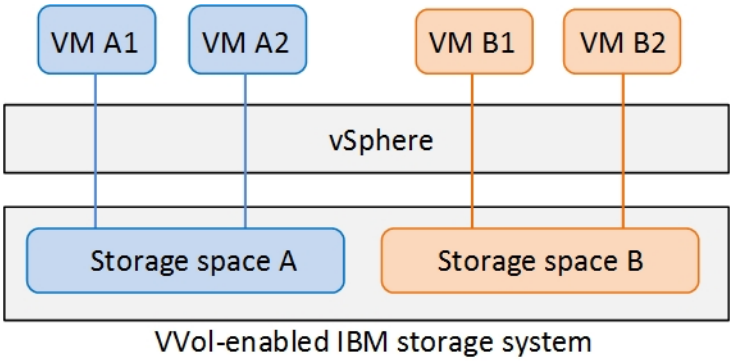


Figure 3. Storage Policy Based Management (SPBM) concept

Note: The virtual volume functionality is supported by the IBM XIV (11.5.1 or later) and storage systems that run IBM Spectrum Virtualize (7.6 or later).

Storage space and service management

After deployment and storage system attachment, the IBM Spectrum Control Base Edition administrators define the virtual entities, resulting in simpler and more flexible storage management.

Note: The virtual volume functionality is supported by the IBM XIV (11.5.1 or later) and storage systems that run IBM Spectrum Virtualize (7.6 or later).

The virtual storage entities include:

- **Storage service** – A combination of assigned storage resources (pools) and user-defined policies. The storage pools which are assigned to the service may reside on any storage system, as illustrated below. The policies are additional capabilities, such as compression, encryption, etc.
- **Storage space** – A group of services. Usually, a single space is assigned to a specific organization (storage tenant).

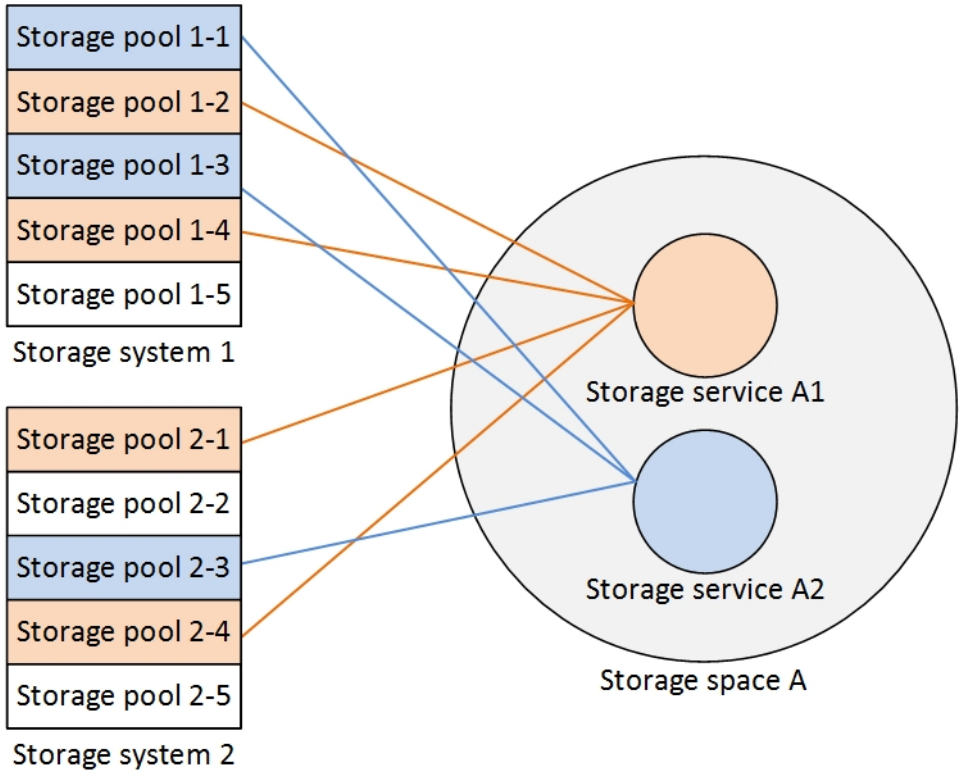


Figure 4. Storage elements without VVol utilization

When the use of VMware virtual volumes (VVols) is enabled for a service, it is assigned to a space which must reside on a single storage system (see drawing below). Such system holds a storage resource (XIV group pool or child pool on storage systems that run IBM Spectrum Virtualize) connected to the service. For XIV storage systems, the storage resource consists of the following pools:

- Thin pool for thin provisioning.
- Thick pool for thick provisioning.
- Meta pool for holding VM-related management metadata.

Thus, in addition to its set of attributes (compression, encryption, etc), each service receives a user-defined storage capacity.

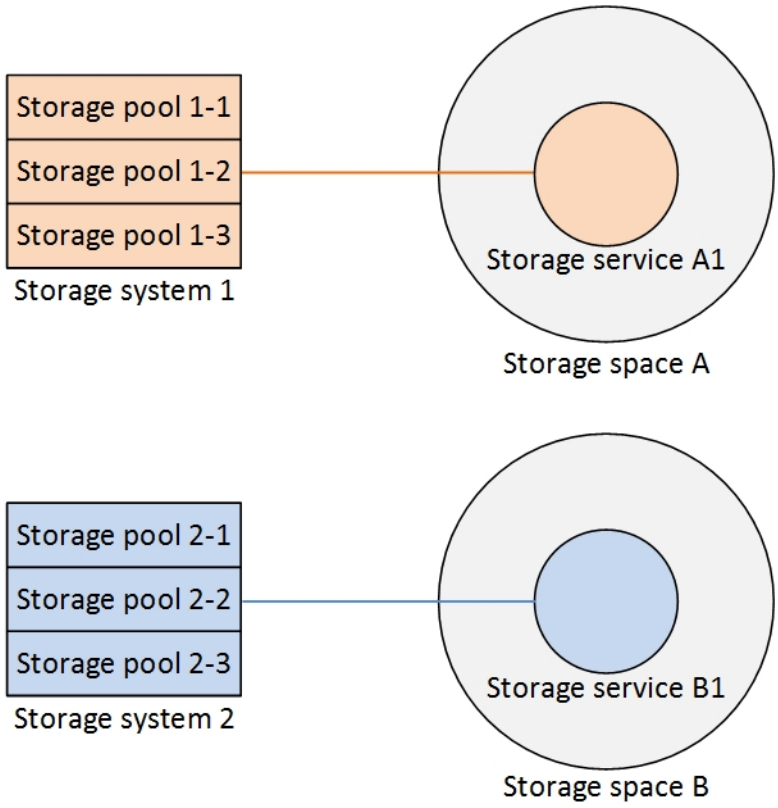


Figure 5. Storage elements with VVol utilization

Management options

IBM Spectrum Control Base Edition can be managed using the following methods:

- Graphical user interface (GUI).
- Command line interface (CLI).

Graphical user interface (GUI)

IBM Spectrum Control Base Edition includes a simple user-friendly web-based graphical user interface (GUI) for storage management.

The Spectrum Control Base GUI simplifies storage provisioning, delivering a single control instance for all available resources. The GUI has the following management capabilities:

- Addition and management of the physical storage resources (storage systems and pools).
- Creation and configuration of virtual storage entities (spaces and services).
- Integration with cloud interfaces (VMware VASA, vWC, vCO and vCOps).
- User administration.
- Certificate management.

Command line interface (CLI)

IBM Spectrum Control Base Edition can be managed via a command line interface (CLI).

The Spectrum Control Base CLI is used for user and storage system management, as well as for integration of the cloud interfaces, or applications. The CLI tool is supplied as a part of the Spectrum Control Base package. It can be run locally from the Linux command prompt environment, or from a remote terminal connection.

Chapter 2. Installation

Download and install IBM Spectrum Control Base Edition software package as described in the following sections.

- "Compatibility and requirements"
- "Downloading IBM Spectrum Control Base Edition software"
- "Upgrading an existing installation" on page 12
- "Extracting and installing the IBM Spectrum Control Base Edition software package" on page 15

For information about uninstallation, see "Uninstalling the Spectrum Control Base Edition software" on page 17.

Compatibility and requirements

For the complete and up-to-date information about the compatibility and requirements of IBM Spectrum Control Base Edition, refer to its latest release notes.

You can find the latest release notes on IBM Knowledge Center (www.ibm.com/support/knowledgecenter) or on IBM Fix Central (www.ibm.com/support/fixcentral).

Note: Refer to the relevant VMware documentation for information about how to install the compatible versions of vSphere Web Client Server. You should also refer to the latest installation and configuration instructions for ESXi and vCenter servers.

Downloading IBM Spectrum Control Base Edition software

IBM Spectrum Control Base Edition is available as a free software solution.

About this task

You can download the latest version of the Spectrum Control Base at any time from the IBM Fix Central (www.ibm.com/support/fixcentral). Fix Central provides fixes and updates for your systems software, hardware, and operating system. This procedure describes how to locate the Spectrum Control Base package on the website.

Procedure

To download the Spectrum Control Base software:

1. Go to the Spectrum Control Base welcome page on IBM Knowledge Center (www.ibm.com/support/knowledgecenter/STWMS9).
2. Click **Download the latest Spectrum Control package from IBM Fix Central**. The IBM Fix Central page for Spectrum Control Base is displayed.
3. Download the required software version.

Upgrading an existing installation

If you are already using a version 1.2.x or 1.5.x of IBM Storage Integration Server or earlier releases of IBM Spectrum Control Base Edition, you can upgrade to the newer version without having to uninstall the previous one.

Before you begin

- If needed, back up the current Integration Server or Spectrum Control Base database, by entering one of the following commands:
  - **isis_configuration backup -f /var/tmp/backup -k <key value>** for IBM Storage Integration Server
  - **sc_configuration backup -f /var/tmp/backup -k <key value>** for IBM Spectrum Control Base Edition
- Verify that the following communication ports are open to ensure network connectivity between VMware resources, Spectrum Control Base and IBM storage systems:
  - 8443 and 443 (vCenter, vCOps and vCO servers)
  - 7778 (XIV, Spectrum Accelerate)
  - 22 (storage systems that run IBM Spectrum Virtualize)
  - 8452 (DS8000)
- Make sure that the '**ibmsc**' user can access the `/opt/ibm` and `/var/log/sc` folders.

Procedure

Perform the following procedure to upgrade Spectrum Control Base:

1. Log out of the Spectrum Control Base GUI and close the browser.
2. On the Spectrum Control Base side: download the newer installation package and the `IBM_Spectrum_Control_Signing_Key_Pub.key` file, used for the package validation. See "Downloading IBM Spectrum Control Base Edition software" on page 11).
3. Copy the installation package and the public key files to a local folder on a current Spectrum Control Base server.
4. Go to the local folder and then use the **gpg --import IBM_Spectrum_Control_Signing_Key_Pub.key** to import the IBM GNU Privacy Guard (GPG) public key to validate the installation files. This ensures that the files were received from IBM and were not manipulated in any way by a third party.

Note: Downloading the install package from a trusted, SSL-protected resource, such as Fix Central, ensures its authenticity and integrity. However, you can mark the key as trusted by entering **gpg --edit-key "IBM Spectrum Control Signing Key"**, typing the **trust** command and selecting option 5.

5. Extract the installation package file ('* ' represents the build number) :

```
# tar -xzvf IBM_Spectrum_Control_Base_Edition-2.2.1-*-x86_64.tar.gz
```

   The following files are extracted:

   - `nginx-1.6.2-1.el6.ngx.x86_64.rpm`
   - `postgresql92-9.2.10-1PGDG.rhel6.x86_64.rpm`
   - `postgresql92-contrib-9.2.10-1PGDG.rhel6.x86_64.rpm`

- postgresql92-libs-9.2.10-1PGDG.rhel6.x86_64.rpm
- postgresql92-server-9.2.10-1PGDG.rhel6.x86_64.rpm
- uuid-1.6.1-10.el6.x86_64.rpm
- ibm_spectrum_control-2.2.1-*.bin – product BIN file.
- ibm_spectrum_control-2.2.1-xxxx-x86_64.bin.asc– digital signature file for the BIN file verification.

6. Enter **# gpg --verify ibm_spectrum_control-2.2.1-xxxx-x86_64.bin.asc ibm_spectrum_control-2.2.1-xxxx-x86_64.bin** to verify the digital signature of the installation files.
7. Go to the extracted directory and then use the **rpm -U *.rpm** command to run and install all the complementary RPM files.
8. Enter **chmod +x ibm_spectrum_control-2.2.1-*.bin** to authorize the installation of the product BIN file.
9. Enter **./ibm_spectrum_control-2.2.1-*.bin** to start the upgrade.

Note: During the upgrade:

- The **ibm_storage_integration_server** service and other related services are stopped and the new service **ibm_spectrum_control** starts automatically after the installation (for more information, see "Checking and controlling the Spectrum Control Base service" on page 135).
- The following entities are renamed:
  - Username **isis** to **ibmsc**. The user ID is preserved. The upgrade may fail, if you create a new user (**ibmsc**) in the system prior to the procedure. This occurs because the user ID is already stored in the operating system database.
  - Group name **isis** to **ibmsc**. The group ID is preserved.
  - Log directory name **/var/log/isis** to **/var/log/sc**
  - User home directory name **/home/isis** to **/home/ibmsc**
- Several configuration files are overwritten by newer versions (as illustrated by the screen output below). If these files were changed in the previous versions, you must apply the same changes to the new files, if you want to preserve the settings.

---

10. Review the license agreement which is displayed after you run the installation file.
11. Enter 1 to accept the license agreement and complete the installation:

```
Press Enter to continue viewing the license agreement, or enter "1" to accept
the agreement, "2" to decline it, "3" to print it, "4" to read non-IBM terms,
or "99" to go back.

1

Preparing to upgrade [ibm_storage_integration_server] to the new [ibm_spectrum_control]
Stopping service ibm_storage_integration_server...
Renaming old user isis to ibmsc
Renaming old group isis to ibmsc
Upgrading [ibm_storage_integration_server] to the new [ibm_spectrum_control]
Moving rpm configuration files to IBM Spectrum Control
   3 configuration files replaced by newer versions. The original files moved to:
      /opt/ibm/ibm_spectrum_control/conf.d/ibmsyslog.conf.saverpm
      /opt/ibm/ibm_spectrum_control/conf.d/nginx/sc_nginx.conf.saverpm
      /opt/ibm/ibm_spectrum_control/conf.d/vasa1/vasa_config.ini.saverpm
Moving Django key to IBM Spectrum Control
Moving SSL Certificate to IBM Spectrum Control
Configuring rsyslog
Setting up nginx
Migrating database to IBM Spectrum Control
Configuring new service [ibm_spectrum_control]
Update SC_UUID
Upgrading the extension of all registered vCenter servers...
Adding a default vCO server instance...
Starting Celery services ... [OK]
Starting Django service ... [OK]
Unconfiguring old service [ibm_storage_integration_server]

Installation completed successfully.
```

12. Log in (see "GUI – Logging in" on page 26) and click **Settings** > **About** to verify that the Spectrum Control Base version number has been updated.

Figure 6. Spectrum Control Base version number

13. To avoid unauthorized access to Spectrum Control Base, it is strongly recommended to change the default password for the '**ibmsc**' user as soon as possible, as described in "CLI – Switching to 'IBMSC' user mode" on page 75. After the upgrade, Spectrum Control Base:

- Adds a service for each existing storage resource (pool) that was connected to a vCenter or a vCO server. The new services are placed under default storage space. See “GUI – Managing storage spaces and services” on page 47 for details on how to configure storage spaces and services.
- With the Spectrum Control Base update, the IBM Storage Enhancements for VMware vSphere Web Client is upgraded automatically for all connected vCenter servers. However, the IBM Storage Plug-in for VMware vCenter Orchestrator and the IBM Storage Management Pack for VMware vCenter Operations Manager must be upgraded manually. See “GUI – Managing integration with vCenter Orchestrator” on page 65 and “GUI – Managing integration with vCenter Operations Manager” on page 68 for the instructions.

Extracting and installing the IBM Spectrum Control Base Edition software package

You can install the IBM Spectrum Control Base Edition software on a compatible version of Red Hat Enterprise Linux (RHEL). For more information, refer to the release notes.

Before you begin

- Verify that the following communication ports are open to ensure network connectivity between VMware resources, Spectrum Control Base and IBM storage systems:
  - 8443 and 443 (vCenter, vCOps and vCO servers)
  - 7778 (XIV, Spectrum Accelerate)
  - 22 (storage systems that run IBM Spectrum Virtualize)
  - 8452 (DS8000)
- Make sure that the '**ibmsc**' user can access the `/opt/ibm` and `/var/log/sc` folders.

Procedure

Follow these steps to install Spectrum Control Base:

1. Download the installation package and the `IBM_Spectrum_Control_Signing_Key_Pub.key` file, used for the package validation. See “Downloading IBM Spectrum Control Base Edition software” on page 11).
2. Copy the installation package and the public key files to a local folder on the Linux host that will be used as Spectrum Control Base.
3. Go to the local folder and then use the **gpg --import IBM_Spectrum_Control_Signing_Key_Pub.key** to import the IBM GNU Privacy Guard (GPG) public key to validate the installation files. This ensures that the files were received from IBM and were not manipulated in any way by a third party.

Note: Downloading the install package from a trusted, SSL-protected resource, such as Fix Central, ensures its authenticity and integrity. However, you can mark the key as trusted by entering **gpg --edit-key "IBM Spectrum Control Signing Key"**, typing the **trust** command and selecting option 5.

4. Extract the installation package file ('* ' represents the build number) :

```
# tar -xzvf IBM_Spectrum_Control_Base_Edition-2.2.1-*-x86_64.tar.gz
```

The following files are extracted:

- nginx-1.6.2-1.el6.ngx.x86_64.rpm
- postgresql92-9.2.10-1PGDG.rhel6.x86_64.rpm
- postgresql92-contrib-9.2.10-1PGDG.rhel6.x86_64.rpm
- postgresql92-libs-9.2.10-1PGDG.rhel6.x86_64.rpm
- postgresql92-server-9.2.10-1PGDG.rhel6.x86_64.rpm
- uuid-1.6.1-10.el6.x86_64.rpm
- ibm_spectrum_control-2.2.1-*.bin – product BIN file.
- ibm_spectrum_control-2.2.1-xxxx-x86_64.bin.asc– digital signature file for the BIN file verification.

5. Enter **# gpg --verify ibm_spectrum_control-2.2.1-xxxx-x86_64.bin.asc ibm_spectrum_control-2.2.1-xxxx-x86_64.bin** to verify the digital signature of the installation files.
6. Go to the extracted directory and then use the **rpm -iv *.rpm** command to run and install all the complementary RPM files. The IBM Storage Provider service starts automatically after the installation (for more information, see "Checking and controlling the Spectrum Control Base service" on page 135) and a new Linux username – **ibmsc** – is created so that you can use it for the Spectrum Control Base management operations.

Note: If needed, you can customize the user ID for **ibmsc** by adding a Linux user (**useradd** command in RHEL) prior to the package installation.

7. Enter **chmod +x ibm_spectrum_control-2.2.1-*.bin** to authorize the installation of the product BIN file.
8. Enter **./ibm_spectrum_control-2.2.1-*.bin** to start the installation.
9. Review the license agreement which is displayed after you run the installation file.
10. Enter 1 to accept the license agreement and complete the installation:

```
Press Enter to continue viewing the license agreement, or enter "1" to accept
the agreement, "2" to decline it, "3" to print it, "4" to read non-IBM terms,
or "99" to go back.

1

Preparing for new installation...
Creating system user ibmsc...
Configuring rsyslog...
Setting up nginx...
Generating SSL certificate...
Configuring postgresql database...
Creating IBM Spectrum Control user...
Configuring IBM Spectrum Control...
Adding iptables rules...
Starting Celery services... [OK]
Starting Django service... [OK]
NOTE: An initial username 'admin' with an initial password 'admin1!'
has been defined for the initial access (via the CLI or GUI) to the
IBM Spectrum Control.
IMPORTANT: To avoid unauthorized access to the IBM Spectrum Control,
the password for this username should be changed as soon as possible.
You can control IBM Spectrum Control services using the
'service ibm_spectrum_control {start|stop|status}' command.

Installation completed successfully.
```

11. To avoid unauthorized access to Spectrum Control Base, it is strongly recommended to change the default password for the '**ibmsc**' user as soon as possible, as described in “CLI – Switching to 'IBMSC' user mode” on page 75.

Uninstalling the Spectrum Control Base Edition software

If you want to completely remove the IBM Spectrum Control Base Edition software from the Linux host upon which it is installed, follow the steps in the following procedure.

Before you begin

Important:

- Before removing Spectrum Control Base software, remove all vCenter servers that were registered for vSphere Web Client, as explained in “GUI – Removing a vCenter server” on page 62. If any vCenter server is not removed prior to the uninstallation, the IBM Storage Enhancements will remain visible but not functional for that vCenter server.
- To avoid loss of user accounts, credentials, storage system configurations, storage pool attachments, and vCenter server associations – always back up the Spectrum Control Base configuration before any uninstallation.
- Uninstalling the software on the Spectrum Control Base side causes the following features to cease functioning:
  - All CLI and GUI management options on the Spectrum Control Base side.
  - IBM Storage Enhancements on the vSphere Web Client side.
  - VASA-related operations on the vCenter server side.

Procedure

To uninstall the Spectrum Control Base software from the Linux host:

1. Log on to the Linux command prompt environment as a root user.

2. Stop the Spectrum Control Base service, as explained in “Checking and controlling the Spectrum Control Base service” on page 135.
3. Run the standard Linux uninstallation command for each installed package (as detailed in “Extracting and installing the IBM Spectrum Control Base Edition software package” on page 15).

Chapter 3. Operation and management

This chapter describes the initial operation tasks, as well as the full range of management options that are available on IBM Spectrum™ Control Base Edition.

- "Required and optional initial tasks"
- "Configuring LDAP-based directory user access" on page 21
- "Managing Spectrum Control Base from the command-line interface (CLI)" on page 75
- "Managing Spectrum Control Base from the graphical user interface (GUI)" on page 26

Required and optional initial tasks

After IBM Spectrum Control Base Edition is installed, different tasks are required before the server can become fully operational.

Refer to the following tables for information about the required and optional management tasks.

Note: Unless specified otherwise in the 'Management method' column, you can initiate tasks from either the command-line interface (CLI) or graphical user interface (GUI).

Table 1. Required tasks in sequential order

Step	Required task	Management method	Relevant cloud interface	Refer to
1.	Set a password for the '**ibmsc**' user if necessary (a Linux root user action), and then switch to the '**ibmsc**' user.	CLI	All	• "CLI – Switching to 'IBMSC' user mode" on page 75
2.	Log in to the GUI and then change the password of the initial **admin** user.	GUI	All	• "GUI – Logging in" on page 26 • "GUI – Changing the password of a Spectrum Control Base user" on page 38
3.	Define a high-availability group	GUI	IBM Storage Provider for VMware VASA	• "GUI – Managing high-availability groups" on page 31
4.	Add SSL certificate for the Spectrum Control Base server	CLI or GUI	All	• "CLI – Managing server certificates" on page 77 • "GUI – Managing server certificates" on page 33
5.	Add the storage system access credentials	CLI or GUI	All	• "CLI – Adding or removing storage system credentials" on page 79 • "GUI – Entering the storage system credentials" on page 40

Table 1. Required tasks in sequential order (continued)

Step	Required task	Management method	Relevant cloud interface	Refer to
6.	Add the storage systems to be used	CLI or GUI	All	• "CLI – Adding or removing storage systems" on page 81 • "GUI – Adding a storage system" on page 42

Table 2. Optional tasks

Step	Optional task	Management method	Relevant cloud interface	Refer to
1.	Set the VASA access credentials ("VASA Secret") to allow connection of vCenter servers that require VASA functions.	CLI or GUI	IBM Storage Provider for VMware VASA	• "CLI – Setting the VASA credentials" on page 83 • "GUI – Setting the VASA credentials" on page 46
2.	Define storage spaces and services.	GUI	• IBM Storage Enhancements for VMware vSphere Web Client • IBM Storage Plug-in for VMware vCenter Orchestrator • IBM Storage Provider for VMware VASA (VASA 2.0)	• "GUI – Adding a storage space" on page 48 • "GUI – Adding a storage service" on page 50 • "GUI – Defining and attaching storage resources" on page 55
3.	Add vCenter servers.	CLI or GUI	IBM Storage Enhancements for VMware vSphere Web Client	• "GUI – Adding a vCenter server" on page 60
4.	If you want to use vWC plug-in for managing volumes created on storage resources attached to specific services, assign the services to the previously added vCenter servers.	CLI or GUI	IBM Storage Enhancements for VMware vSphere Web Client	• "GUI – Attaching storage services to a vCenter server" on page 63
5.	Establish integration with vCenter Orchestrator (vCO). **Note:** Applicable only to XIV systems.	GUI	IBM Storage Plug-in for VMware vCenter Orchestrator	• "GUI – Managing integration with vCenter Orchestrator" on page 65
6.	Attach storage services to the previously added vCO server. **Note:** Applicable only to XIV systems.	GUI	IBM Storage Plug-in for VMware vCenter Orchestrator	• "GUI – Managing integration with vCenter Orchestrator" on page 65

Table 2. Optional tasks (continued)

Step	Optional task	Management method	Relevant cloud interface	Refer to
7.	Establish integration with vCenter Operations Manager (vCOps). **Note:** Applicable only to XIV systems.	CLI or GUI	IBM Storage Management Pack for VMware vCenter Operations Manager	• "CLI – Managing integration with vCenter Operations Manager" on page 84 • "GUI – Managing integration with vCenter Operations Manager" on page 68
8.	Configure LDAP-based directory user access to Spectrum Control Base	CLI	-	• "Configuring LDAP-based directory user access"
9.	Manage the Spectrum Control Base users	CLI	-	• "CLI – Managing Spectrum Control Base users" on page 76 • "GUI – Managing Spectrum Control Base users" on page 36
10.	Back up or restore a Spectrum Control Base configuration, including the data of all existing user accounts, credentials, storage systems, and storage resources	CLI	-	• "CLI – Backing up or restoring a Spectrum Control Base configuration" on page 88

Configuring LDAP-based directory user access

You can allow external directory users to connect to Spectrum Control Base and manage it without having a locally-defined user account.

The connection to the directory server is established through Lightweight Directory Access Protocol (LDAP) authentication. When directory server access is enabled, any login attempt (attempt to log in to Spectrum Control Base) is authenticated against the defined directory server.

Use the **sc_ldap** CLI command to configure LDAP-based directory user access to Spectrum Control Base. Use the required argument after the command, as specified in the following table.

Note:

- When directory user access is enabled and configured through **sc_ldap**, the directory users can access and manage only Spectrum Control Base. A separate and unrelated authentication system may be used on the storage system side for directory-based management of the storage system. For more information, refer to "CLI – Adding or removing storage system credentials" on page 79 and to your storage system documentation.
- Once the connection is established, all users that are defined on the directory server can access and manage Spectrum Control Base.

Table 3. Arguments for **sc_ldap**

Argument	Use after sc_ldap to:

configure -e -a
 	
-s <server URI>
 	
-t <directory server type>
 	
-r <user search DN>
 	
-k <user search key>
 	
-g <user group DN>
 	
-o <user group object class
 	
-n <user group authentication DN>
 	
or
 	
configure --enable --anonymous
 	
--server_uri <server URI>
 	
--server_type <directory server type>
 	
--user_search_dn <user search DN>
 	
--user_search_key <user search key>
 	
--group_search_dn <user group DN>
 	
--group_object_class <user group object class>
 	
--authentication_group_dn <user group authentication DN>
	Enable directory access and establish a connection to a directory server **as an anonymous user** with the following parameters specified after the **-a** argument on the command line:
	• Server URI (**-s**; **--server_uri**) – Uniform resource identifier (URI) of the directory server. This parameter determines which directory server should be accessed and used for directory user management of Spectrum Control Base.
	• Server type (**-t**; **--server_type**) – Type of the directory server. One of the following types can be specified:
	– Active Directory (**ACTIVE_DIRECTORY**)
	– Open LDAP (**OPEN_LDAP**)
	– Custom (**CUSTOM**)
	• User search DN (**-r**; **--user_search_dn**) – Distinguished name (DN) to be used for the user search.
	• User search key (**-k**; **--user_search_key**) – Search key of the directory user. Valid only if the specified server type (**-t**; **--server_type**) is '**CUSTOM**'.
	• Group search DN (**-g**; **--group_search_dn**) – Distinguished name (DN) of the user group for search purposes.
	• Group object class (**-o**; **--group_object_class**) – Object class of the user group. Valid only if the specified server type (**-t**; **--server_type**) is '**CUSTOM**'.
	• Authentication group DN (**-n**; **--authentication_group_dn**) – Distinguished name (DN) used for the user group authentication.
	
	For example:
	`sc_ldap configure -e -a -s ldap://ad1.ibm.com -t ACTIVE_DIRECTORY -r "CN=Users,DC=mydomain,DC=test,DC=com" -g "CN=sc_TestGrp,CN=Users,DC=mydomain,DC=test,DC=com" -n "CN=sc_TestGrp,CN=Users,DC=mydomain,DC=test,DC=com"`
	
	When prompted to enter a password, **press Enter without entering any password**:
	`Please enter the BIND_DN password (password not shown):`
	`The following changes were applied to the LDAP configuration:`
	`ENABLED`
	`Please restart the IBM Spectrum Control to apply the new configuration.`
	
	After enabling the directory access, you can test the directory connection by using the **test** option (see below). Then, restart the Spectrum Control Base service as explained in "Checking and controlling the Spectrum Control Base service" on page 135.

Table 3. Arguments for **sc_ldap** *(continued)*

Argument	Use after **sc_ldap** to:

configure -e -u <Bind DN username>
 	
-p <Bind DN password>
	Enable directory access and establish a connection to a directory server by using the Bind DN user account that was predefined on the directory server (predefined by the directory server administrator). For this command, specify these two parameters in addition to the entries listed for the anonymous user:
	• Bind DN username (**-u**; **--bind_dn**) – Username of the Bind DN user through which access to the directory server is established. Spectrum Control Base uses this username to log in to the directory server and establish the connection with it.
	• Bind DN password (**-p**; **--bind_password**) – Password of the Bind DN username.
	
	For example:
	`sc_ldap configure -e -s ldap://myad1.ibm.com -t ACTIVE_DIRECTORY -r "CN=Users,DC=sc,DC=test,DC=com" -g "CN=Users,DC=sc,DC=test,DC=com" -n "CN=SC_TestGrp,CN=Users,DC=sc,DC=test,DC=com" -u mybinduser -p mypassw0rd`
	
	When prompted to enter a password, enter the directory server's Bind DN user password:
	`Please enter the BIND_DN password (password not shown): ****** The following changes were applied to the LDAP configuration: ENABLED Please restart the IBM Spectrum Control to apply the new configuration.`

configure -d or **configure --disable**	Disable directory user access. After disabling the directory access, restart the Spectrum Control Base service as explained in "Checking and controlling the Spectrum Control Base service" on page 135.
list	Display the current directory server configuration status (on Spectrum Control Base) and Bind DN username.
test -u <directory username> -p <password>	Test a directory user account by specifying the username and password of that account. You can test any user account that is defined on the directory server (the test is not for the Bind DN user account, but for an actual directory account). For example: `sc_ldap test -u mytestuser -p mytestuserpassw0rd IBM Spectrum Control LDAP configuration has been verified successfully.`
-h or **--help**	Display help information that is relevant to **sc_ldap**. You can also display help for the **configure**, **list**, or **test** argument if it is typed on the command line as well.

Adding a directory server certificate

If the directory server uses Transport Layer Security (TLS), you must edit the `ldap.conf` file and specify the trusted certificate directory location and filename on Spectrum Control Base. Complete the following steps to update Spectrum Control Base:

1. Log in to the directory server and issue the following command: **`certutil -ca.cert client.crt`**. This command generates the server certificate.
2. Go to the `/etc/openldap/` directory and edit the `ldap.conf` file by setting the value for the `TLS_CACERT` parameter. The following example shows the contents of the `ldap.conf` file:

   ```
   #LDAP Defaults
   #
   #BASE   dc=example,dc=com
   #URI    ldap://ldap.example.com ldap://ldap-master.example.com:port#
   #SIZELIMIT      12
   #TIMELIMIT      15
   #DEREF          never
   TLS_CACERT /etc/openldap/certs/trusted_ldap.pem
   ```

   Make sure that the `TLS_CACERT` parameter has the directory and file name of the new certificate that you generated. After editing the `ldap.conf` file, the `ldap.ini` file is automatically updated.

Editing the `ldap.ini` configuration file

In addition to using the **`sc_ldap`** CLI command (see Table 3 on page 22), you can edit the `ldap.ini` configuration file to manually change the directory user access settings.

Attention: Do not edit the `ldap.ini` file if you are not familiar with directory setting conventions.

The following example shows the editable parameters and their values specified after the '=' sign:

```
enable_ldap = True
server_uri = ldap://servername.domainname:389
server_type = OPEN_LDAP
user_search_dn = ou=users,dc=dcname,dc=com
user_search_key =
group_search_dn = dc=dcname,dc=com
group_object_class =
authentication_group_dn = cn=authenticating-group,dc=dcname,dc=com
bind_dn =
bind_password = <enctypted password>=
bind_pwd_verification = <encrypted key>=
```

The following table summarizes the parameters and their indication. Refer to Table 3 on page 22 for more detailed information.

Table 4. `ldap.ini` configuration parameters

Parameter	Indication
`enable_ldap`	`True` or `False`. When `True` and enabled, the login attempt is authenticated against the directory server.

Table 4. `ldap.ini` configuration parameters (continued)

Parameter	Indication
server_uri	Uniform resource identifier (URI) of the directory server.
server_type	Type of the directory server: • Active Directory • Open LDAP • Custom
user_search_dn	Distinguished name (DN) to be used for user search.
user_search_key	Search tag for obtaining a unique relative distinguished name (RDN). Commonly used values: `uid`, `preferredId`
group_search_dn	Distinguished name (DN) to be used for user group search.
group_object_class	Type of the user group. Commonly used values: `GroupOfNames`, `NestedGroupOfNames`, `GroupOfUniqueNames`, `NestedGroupOfUniqueNames`, `ActiveDirectoryGroup`, `NestedActiveDirectoryGroup`
authentication_group_dn	Distinguished name (DN) of the authentication user group.
bind_dn	Username of the Bind DN user through which access to the directory server is established.
bind_password	Password of the Bind DN username. The password is displayed in its encrypted form.
bind_pwd_verification	Verification string for the Bind DN password. The string is displayed in its encrypted form.

Note:

- **user_search_key** and **user_search_dn** return unique results. For example:

  ```
  user_search_key=uid
  user_search_dn=ou=users,dc=dcname,dc=com
  ```

  In this case, if the user name is "`John`", the resulting DN for matching the user over LDAP would be: `uid=John,ou=users,dc=dcname,dc=com`
- If **authentication_group_dn** is set, only users that belong to that group are authenticated. You can remove this parameter from the `ldap.ini` file to disable group authentication.
- When **server_type** type is Active Directory, the following parameters are used by default:

  ```
  user search key = sAMAccountName
  user group object class = ActiveDirectoryGroup
  ```
- When **server_type** type is Open LDAP, the following parameters are used by default:

  ```
  user search key = uid
  user group object class = GroupOfUniqueNames
  ```

Managing Spectrum Control Base from the graphical user interface (GUI)

You can log in to Spectrum Control Base through a web browser and use the configuration and management options that are available from the web-based graphical user interface (GUI).

The following sections describe all the GUI configuration and management functions:

- "GUI – Logging in"
- "Spectrum Control Base GUI" on page 28
- "GUI – Managing storage systems" on page 39
- "GUI – Managing Spectrum Control Base users" on page 36
- "GUI – Managing and monitoring VASA access" on page 45
- "GUI – Managing storage spaces and services" on page 47
- "GUI – Managing integration with vSphere Web Client" on page 59
- "GUI – Managing integration with vCenter Orchestrator" on page 65
- "GUI – Managing integration with vCenter Operations Manager" on page 68

GUI – Logging in

To log in to Spectrum Control Base from a browser, you need to enter the web address (URL) of the Linux host upon which Spectrum Control Base is installed.

The secure IP connection to Spectrum Control Base is established through port number 8443. Accordingly, the web address should be entered in the web browser address bar in the following format:

```
https://[controller IP address]:8443
```

If your web browser displays a connection security message after entering the web address, see "GUI – Managing server certificates" on page 33.

The Spectrum Control Base login page is loaded and you can log in by entering your Spectrum Control Base username and password.

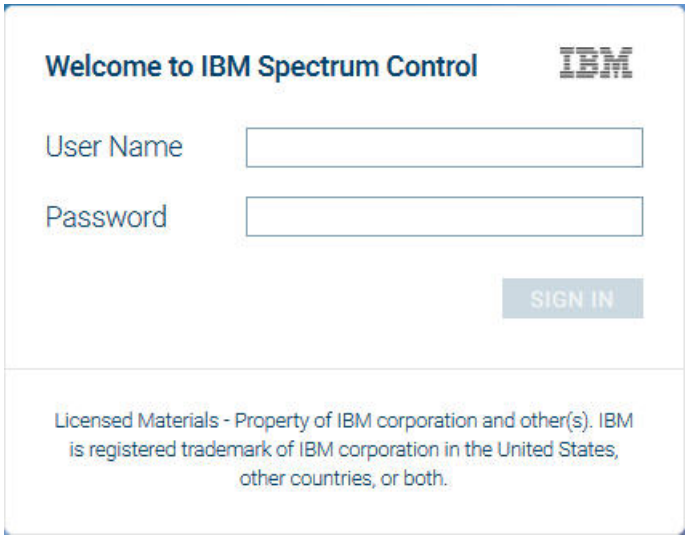


Figure 7. Spectrum Control Base login box in a standard web browser

---

Attention:

- After the instillation, the initial username is **admin** and the initial password is **admin1!**. To avoid unauthorized access to Spectrum Control Base, it is strongly recommended to change this password as soon as possible, or create a new user account and then delete the **admin** account (see "GUI – Managing Spectrum Control Base users" on page 36).
- If the Spectrum Control Base service is stopped on the Linux host (see "Checking and controlling the Spectrum Control Base service" on page 135), it is not possible to log in or perform any GUI operation.

After login is completed, Spectrum Control Base displays the Welcome page. The Welcome page gives an overview of the main interface elements and principles of operation.

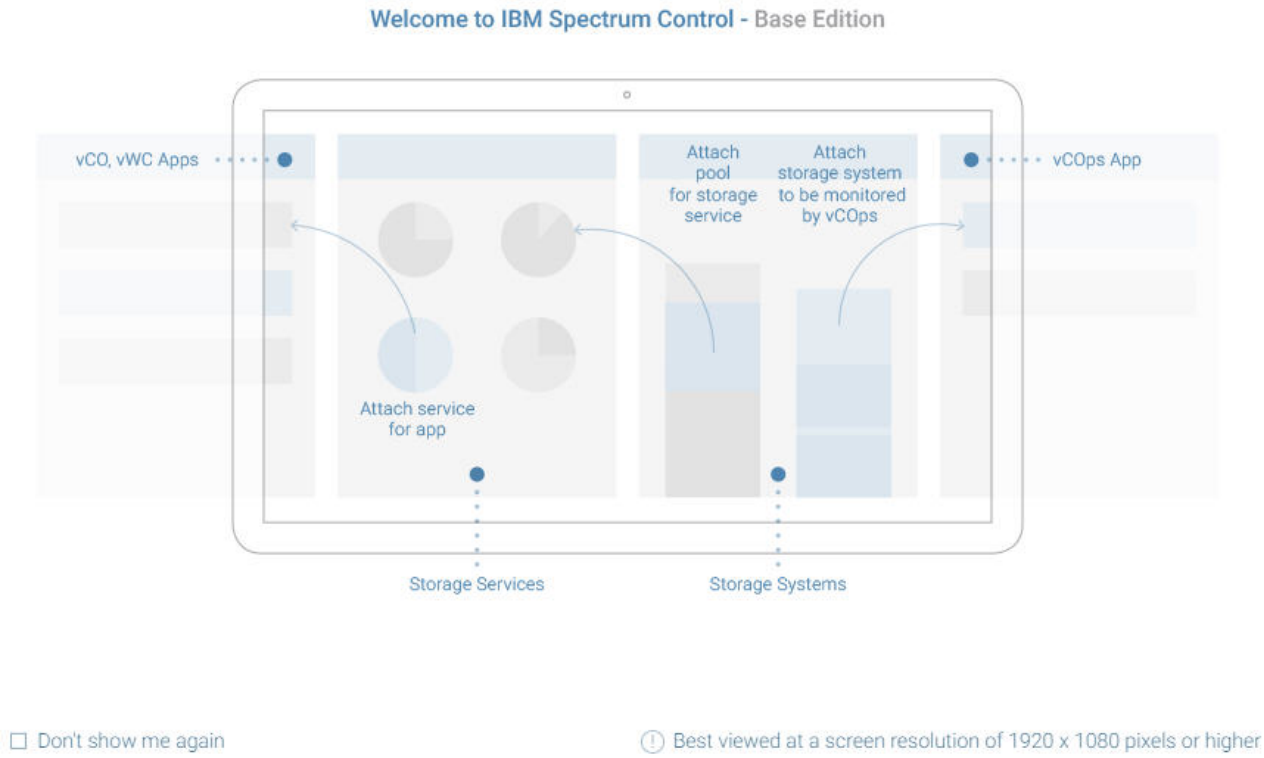


Figure 8. Spectrum Control Base Welcome page

Spectrum Control Base GUI

The IBM Spectrum Control Base Edition GUI provides an intuitive easy-to-use browser-based interface for managing IBM storage resources.

The Spectrum Control Base GUI consists of the four panes:

- **Applications** – integration with vCenter and vCO servers.
- **Spaces/Services** – handling storage spaces and services.
- **Storage Systems** – management of storage systems and storage resources.
- **Monitoring** integration with vCOps server.

After successful login, the Spaces/Services and Storage Systems panes are displayed.

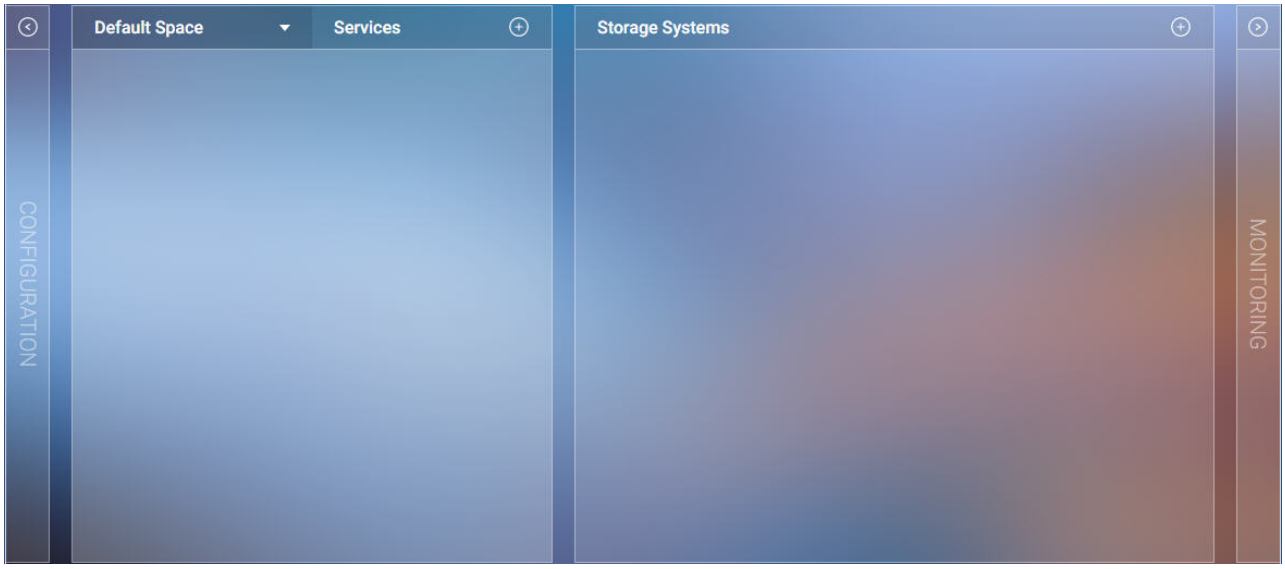


Figure 9. Spaces/Services and Storage Systems panes

Click **Configuration** on the left of the screen to go to the Applications pane, or click **Monitoring** on the right to display the Monitoring pane. When the Applications pane is displayed, click **Allocation** to return to the initial view (Spaces/Services and Storage Systems panes).

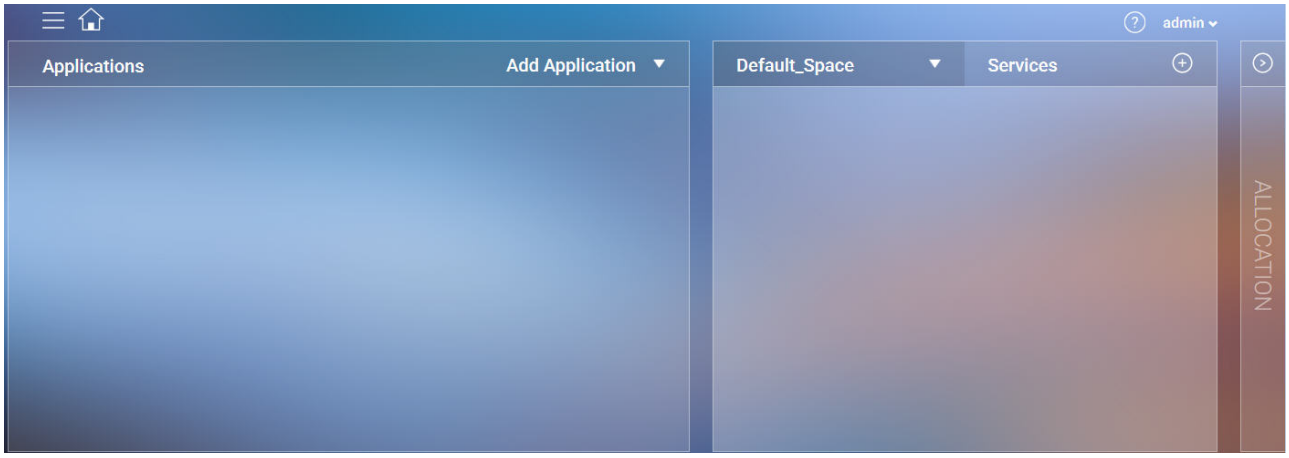


Figure 10. Applications and Spaces/Services panes

To return to the initial view from the Monitoring pane, click **Storage Space**.

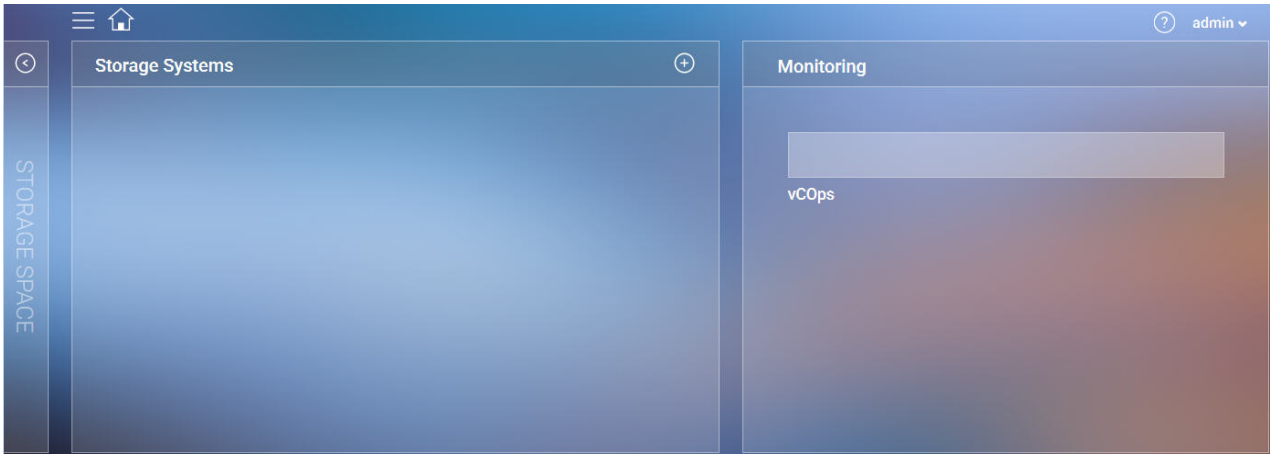


Figure 11. Storage Systems and Monitoring panes

The table below summarizes functionality of the GUI elements.

Table 5. Spectrum Control Base GUI elements

GUI Element	Description
	**Add** button. Click this button to add a new object (server, storage service, system, etc).
	**Edit** button, which is displayed when the mouse pointer is moved over an object. Click this button to configure the object (system, pool, server, etc) or remove it.
	**Home** button. Click this button to display the home screen (Spaces/Services and Storage Systems panes).
	**Settings** button. Use this button to access the Settings menu to: • Define storage credentials • Manage certificates • Add and change the Spectrum Control Base users • Add and edit storage spaces • Collect logs • Display version number of Spectrum Control Base and included applications • Access product documentation
	**Remove** button. Click this button to remove a storage element or delete a user from the User List.
	**Help** button. Click this button to display the Welcome page, which is also available after login.
	Right and left navigation pointers. They indicate if additional panes are available to the right or to the left of the current display.
	**Resource Attach** button. It is available, when an unattached storage resource is selected in a Storage Resources table. Click this button to attach the storage resource to a previously selected storage service.

Table 5. Spectrum Control Base GUI elements (continued)

GUI Element	Description
⊖	**Resource Detach** button. It is available, when an attached storage resource is selected in a Storage Resources table. Click this button to detach the storage resource from a previously selected storage service.

GUI – Managing high-availability groups

IBM Spectrum Control Base Edition implements VMware's high-availability architecture for multiple VASA providers.

Multiple Spectrum Control Base instances that manage the same storage system can be combined into high-availabilty (HA) groups for VASA provider redundancy. The HA technology is implemented in the active/passive mode. In this mode, one Spectrum Control Base acts as active and the other acts as standby for transfer of responsibility if the active Spectrum Control Base fails or becomes unreachable, as illustrated below.

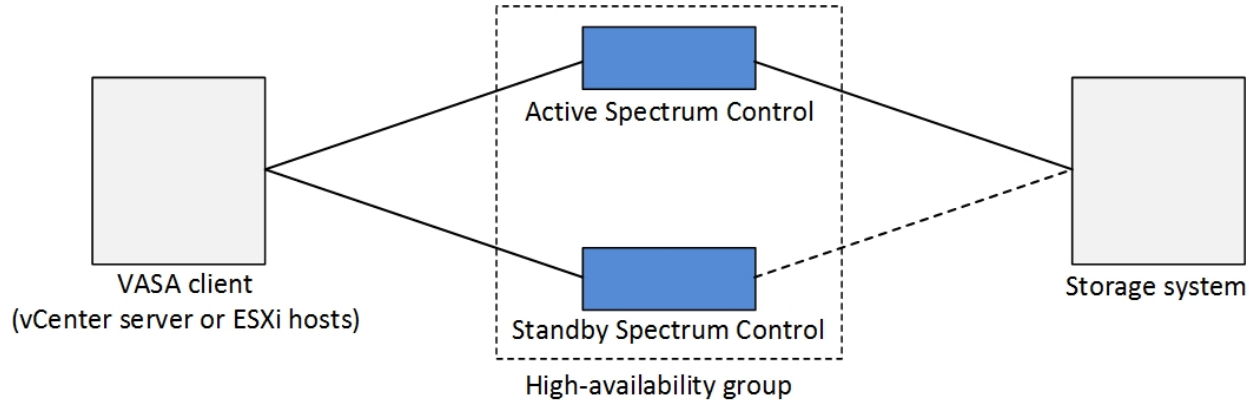


Figure 12. High-availability group concept

To configure HA groups, open the **Settings** menu. For configuration instructions, see "GUI – Defining a high-availability group" on page 32.

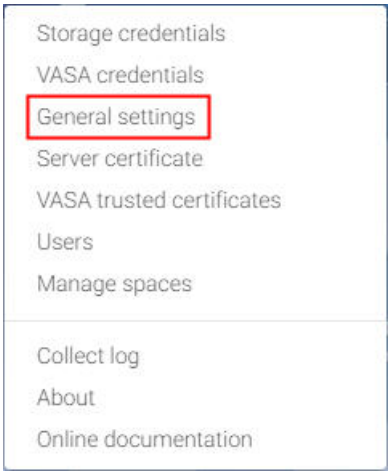


Figure 13. General Settings option on the Settings menu

GUI – Defining a high-availability group

To ensure continuous storage management, multiple Spectrum Control Base instances must be activated and combined into high-availability (HA) groups.

Before you begin

You must define HA groups before adding storage systems to Spectrum Control Base.

About this task

An HA group is a combination of two or more Spectrum Control Base instances, operating in the active/passive mode. Active Spectrum Control Base instances are backed up by the standby ones to provide uninterruptible service if one of them becomes unavailable. A default HA group (default_ha_group) is created automatically during Spectrum Control Base installation.

Procedure

1. Click **General settings** on the Settings menu. The General Settings dialog box is displayed.
2. Enter the FQDN of the first Spectrum Control Base and the name of the HA group that you want to create, and then click **Apply**. The HA group is created and the Spectrum Control Base server is added as an active member.

Note:

- The FQDN, which you enter, is automatically copied to the Hostname field of the Server Certificate dialog box during the generation of the Spectrum Control Base server certificate, as explained in "GUI – Managing server certificates" on page 33.
- If you intend to change the default HA group name, any XIV storage system with microcode 11.5, defined on the default HA group member, must be removed from Spectrum Control Base before the group name change.

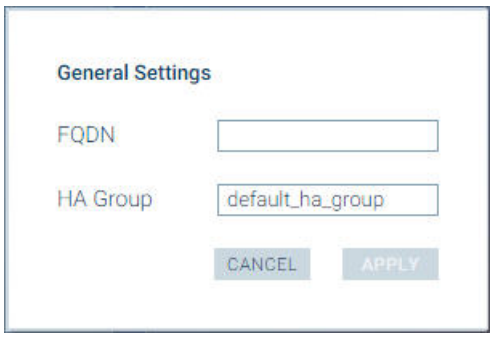


Figure 14. General Settings dialog box

3. Log in to the standby instance of Spectrum Control Base and add its FQDN, as explained above. The HA group name must be identical to the value that was provided when registering the active Spectrum Control Base instance.

Important: The Spectrum Control Base software must be installed and configured separately for each HA group member. This is required for obtaining a unique VASA key which is generated during installation.

Do not clone an existing instance of an active Spectrum Control Base for use as a standby member. However, cloning the VM which will host Spectrum Control Base **prior** to installation is acceptable.

---

4. Define storage credentials for all Spectrum Control Base instances, as explained in "GUI – Entering the storage system credentials" on page 40.
5. Add the same storage system for all Spectrum Control Base instances. Spectrum Control Base redundancy is available only if active and standby members manage the same storage system. See "GUI – Adding a storage system" on page 42.
6. Configure the server certificates. See "GUI – Managing server certificates."
7. Register all HA group members as storage providers in the vCenter server. See "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91.
8. Add storage spaces and services to the active Spectrum Control Base. There is no need to configure these settings for a standby HA member. See "GUI – Managing storage spaces and services" on page 47.Storage spaces and services defined on an active instance of Spectrum Control Base do not appear on the standby instance immediately. Any VVol-enabled storage services defined on the active Spectrum Control Base are populated on the standby server's GUI during system failover.

   A failover to a standby HA group member occurs when the active Spectrum Control Base service is stopped or reset. See "Checking and controlling the Spectrum Control Base service" on page 135.

GUI – Managing server certificates

During the installation, a self-signed Secure Sockets Layer (SSL) certificate is generated to create a secure communication channel for servers and clients. If you already have a trusted certificate that you want to use, you can replace the self-signed certificate with an existing trusted certificate or generate a new certificate.

About this task

A self-signed certificate file, **vp.crt**, and a certificate key file, **vp.key**, are stored in the following directory:

`/opt/ibm/ibm_spectrum_control/settings/ssl_cert`.

Because the self-signed certificate is not automatically recognized by the web browser that you use to log in to Spectrum Control Base, you might encounter a connection security warning before you can access the Spectrum Control Base login page (see "GUI – Logging in" on page 26).

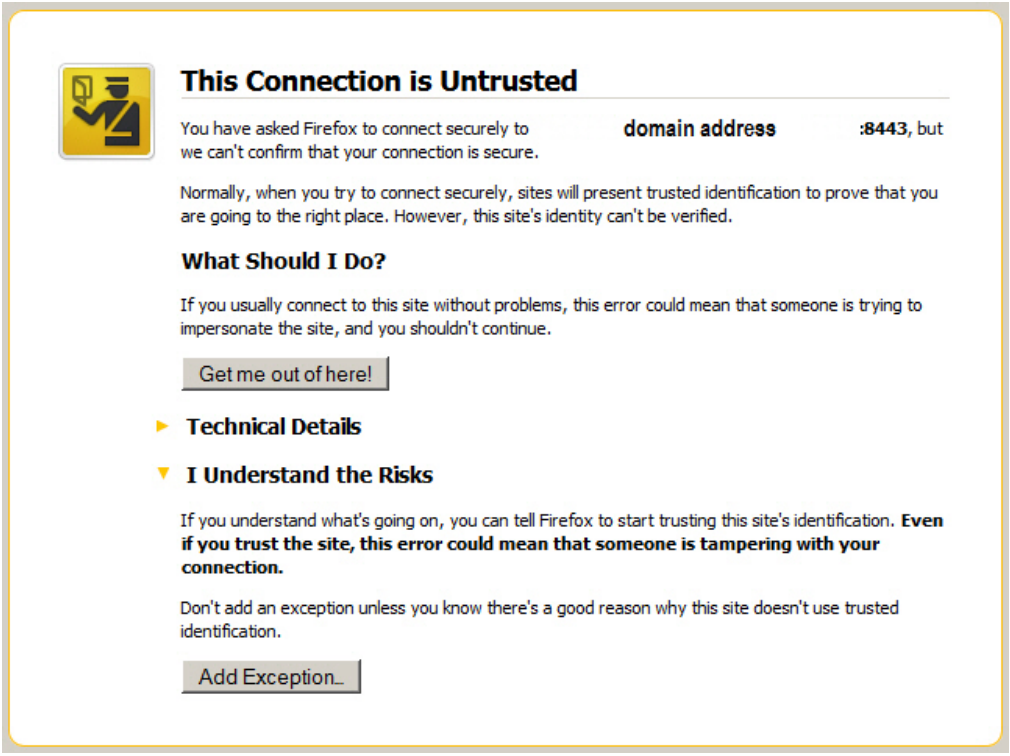


Figure 15. Connection security warning in the Mozilla FireFox web browser

To avoid such warning messages, you need to upload a server certificate which is signed by a public certificate authority (CA), such as VeriSign, or by a CA whose root certificate was imported to your web browser. In addition, you can generate an SSL certificate.

Procedure

1. Click **Server certificate** in the Settings menu. The Server Certificate dialog box is displayed.

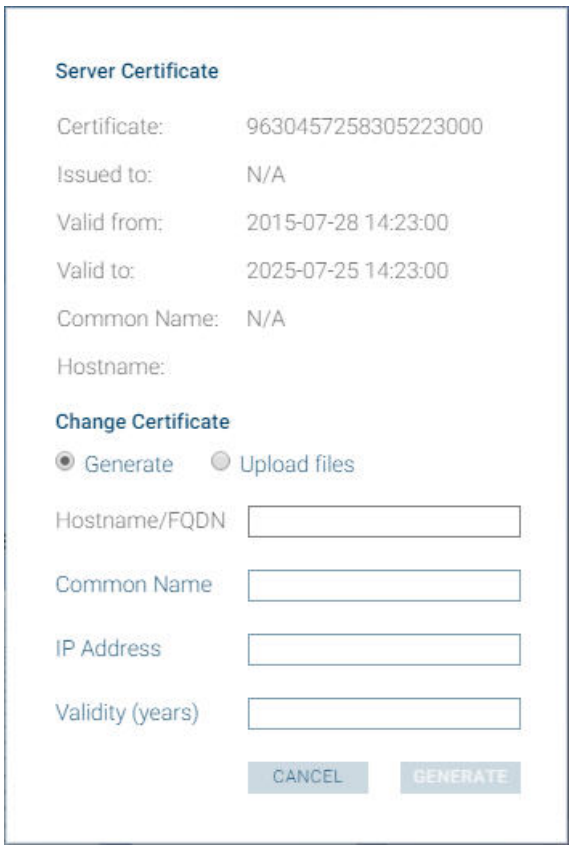


Figure 16. Generate option on Server Certificate dialog box

2. Enter the hostname/FQDN, common name, IP address of the Spectrum Control Base server and certificate validity period, and then click **Generate**.

Note: The Spectrum Control Base hostname is automatically copied from the FQDN field of the Settings menu. The value is entered during high-availability group definition, as explained in "GUI – Defining a high-availability group" on page 32.

Spectrum Control Base generates the SSL certificate and key files, restarts the Nginx process and refreshes the web browser.

3. Log out and log into Spectrum Control Base to complete the certificate generation.
4. To upload a certificate and a certificate key files, select **Upload files** on the Server Certificate dialog box.

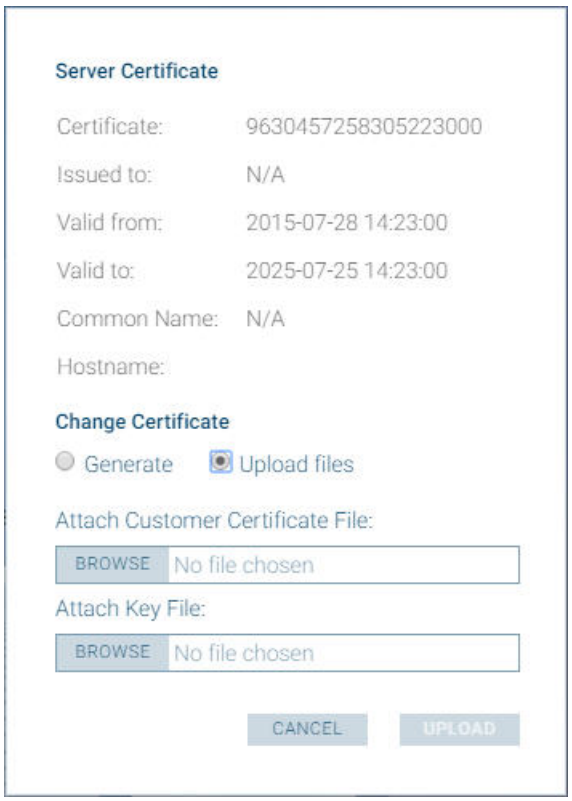


Figure 17. Upload files option on Server Certificate dialog box

5. Click **Browse** and attach your certificate **vp.crt**, and a certificate key files, **vp.key**, and then click **Upload**. Spectrum Control Base overwrites the existing SSL certificate and key files, restarts the Nginx process and refreshes the web browser.
6. Log out and log into Spectrum Control Base to complete the procedure.

GUI – Managing Spectrum Control Base users

At any time, you can add new Spectrum Control Base user accounts, change user account passwords, or delete existing user accounts.

To access the user management options, click the **Settings** button and select **Users** in the Settings menu. You can then view, add, and manage the Spectrum Control Base users as explained in the following sections.

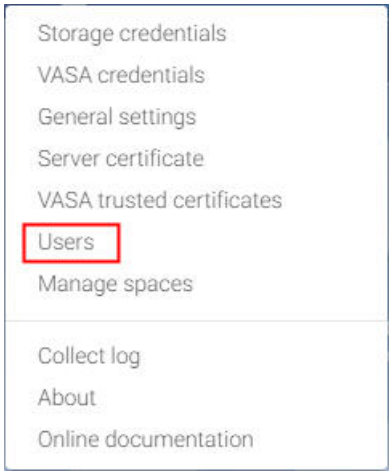


Figure 18. Users option in the Setting menu

Note: The same operations are available from the CLI as well, as explained in "CLI – Managing Spectrum Control Base users" on page 76.

- "GUI – Adding a new user"
- "GUI – Changing the password of a Spectrum Control Base user" on page 38
- "GUI – Deleting a user" on page 39

GUI – Adding a new user

You can add a user account for any authorized user that requires access to Spectrum Control Base.

About this task

In addition to storage system credentials, you can define a user for logging into Spectrum Control Base and performing GUI or CLI management actions.

Note: All Spectrum Control Base users have the same permission level, and can undo any setting or action made by another user.

Procedure

1. Click **Users** in the Settings menu. The User List is displayed, which details all existing users.
2. Click **Add User**. The New User dialog box is displayed.

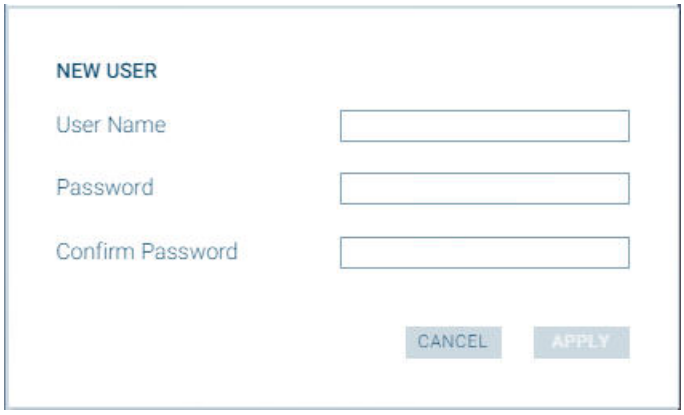


Figure 19. New User dialog box

3. Enter the username and password for the account that you want to create, and then click **Apply**. The minimum password length is seven characters and it must include at least one letter and one digit. The username of the created account is added to the Users list.

Figure 20. List of added users (user names)

GUI – Changing the password of a Spectrum Control Base user

At any time, you can change the password of a Spectrum Control Base user account.

About this task

You can modify a user account only by changing its password. Periodic password change is recommended on a regular basis.

Note: Spectrum Control Base user names cannot be changed. Instead, you can delete a user account (see "GUI – Deleting a user" on page 39) and then create a new one (see "GUI – Adding a new user" on page 37).

Procedure

1. Click **Users** on the Settings menu. The **Spectrum Control Base User List** is displayed, which details all existing users.

2. Click **Edit** on the row of the user account that you want to update. The **Change Password** dialog box is displayed.

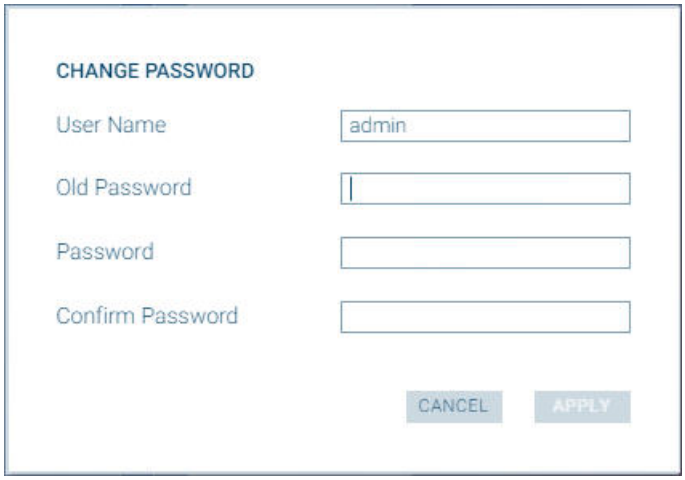


Figure 21. Update User page

3. Enter the current password of the user account, and then the new password as required. The minimum password length is seven characters and it must include at least one letter and one digit. Then, click **Apply**.

GUI – Deleting a user

When necessary, you can delete any user account.

About this task

After you delete a *Spectrum Control admin* user account from the GUI, the specific user can no longer log in to the Spectrum Control Base server from either the GUI or the CLI. Although the user deletion is a non-reversible operation, you can redefine the same username as explained in "GUI – Adding a new user" on page 37.

If you delete a *VASA admin* user account, Spectrum Control Base cannot be registered as storage provider on VMware vCenter server.

Note: Deleting a Spectrum Control Base or VASA user does not affect the storage credentials.

Procedure

1. Click **Users** in the Settings menu. The **User List** is displayed, which details all existing users.
2. Click the **Remove** button on the row of the user account that you want to remove.

   A confirmation message appears.
3. Click **Yes** to delete the user, or **No** to cancel the operation.

GUI – Managing storage systems

All IBM storage systems that provide storage resources to your VMware platforms must be defined as storage systems on IBM Spectrum Control Base Edition.

To access the storage system management options, go to the **Storage Systems** pane of the Spectrum Control Base GUI, illustrated below. You can then view, add, manage the storage systems and their resources, as explained in the following sections.

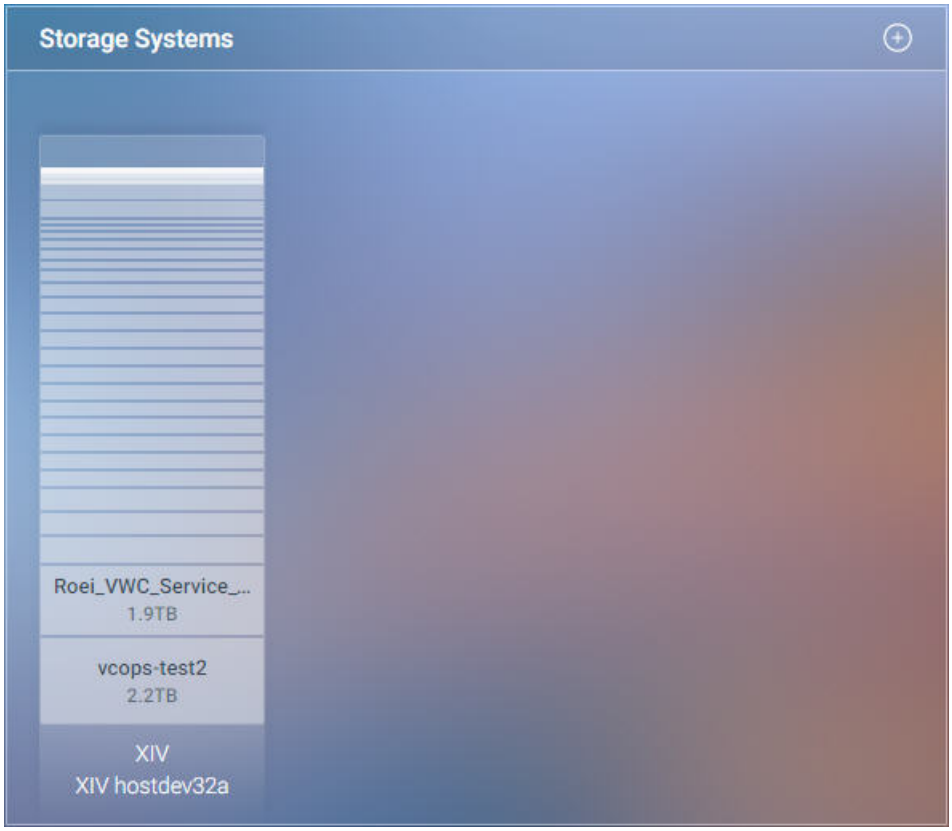


Figure 22. Storage Systems pane

Note: The same operations are available from the CLI as well, as explained "CLI – Adding or removing storage system credentials" on page 79 and in "CLI – Adding or removing storage systems" on page 81.

- "GUI – Entering the storage system credentials"
- "GUI – Adding a storage system" on page 42
- "GUI – Modifying the IP address or hostname of a storage system" on page 44
- "GUI – Removing a storage system" on page 44

GUI – Entering the storage system credentials

The storage system credentials are used to connect to the IBM storage system or systems, which your VMware platforms use for storage provisioning.

About this task

From the Spectrum Control Base GUI you can set or change the current storage system access credentials that are used for accessing all the IBM storage systems.

Important:

- An identical storage admin user account with identical credentials (the same username and password) must already be predefined on all the IBM storage systems that you intend to use. Spectrum Control Base can use only **a single system management account** for accessing all the different storage systems that you use. For storage systems running Spectrum Virtualize, ensure that the credentials belong to a user account with *VASAProvider* role.

  For more information about how to define a storage admin account on your IBM storage systems, refer to the relevant storage system management tools documentation.
- Setting the storage credentials on Spectrum Control Base allows you to add the IBM storage systems on the next step.
- If the system management account is defined on a directory server, see "Checking the format of directory-based storage system credentials" on page 141.

Note: The same operations are available from the CLI as well, as explained in "CLI – Adding or removing storage system credentials" on page 79.

Procedure

1. Click the **Settings** button and select **Storage credentials** from the Settings menu. The **Storage Credentials** dialog box is displayed. The dialog box presents the currently defined storage system username in the **User name** configuration box.

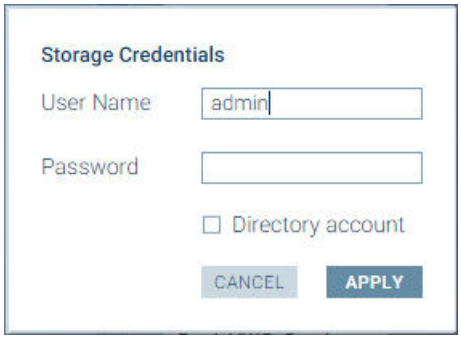


Figure 23. Current storage system username (for all storage systems)

2. Enter the username and password of the storage admin user that was defined on all your IBM storage systems.
3. If the storage admin user account is defined on a directory server, select the **Directory account** check box. If the storage admin user account is locally-defined on the storage system, clear the check box.
4. Click **Apply**.

What to do next

You can now start adding storage systems. Spectrum Control Base will use the credentials that you have set in order to connect to the storage systems that you add.

Attention: During regular operation, whenever a directory-based storage admin fails to log in (from the Spectrum Control Base side) to any storage system that is in use, Spectrum Control Base immediately locks the storage admin user account and all storage systems become inaccessible on the Spectrum Control Base side. This is to prevent repeated login attempt failures after which the directory server blocks that user account. In such a case, set the storage system credentials again to unlock the storage admin account on the Spectrum Control Base side, with either the same credentials or with updated credentials. The equivalent action in the Spectrum Control Base CLI is to use the force credentials options, as described in "CLI – Adding or removing storage system credentials" on page 79.

GUI – Adding a storage system

After the storage system credentials are set, you can start adding storage systems to Spectrum Control Base.

About this task

The storage systems that you add can be used by the solution components that are included in the Spectrum Control Base package (see "Included cloud interfaces" on page 1). You can add each individual storage system separately, as described in the following procedure.

Procedure

1. Click **Add** button on the Storage Systems pane. The **Add New Array** dialog box is displayed.

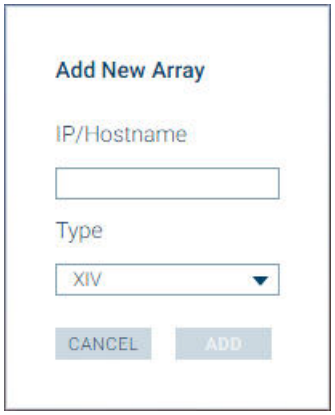


Figure 24. Add New Array dialog box

2. Enter the management IP address or hostname of the array and select the storage system type (XIV, DS8000, or a storage system that runs IBM Spectrum Virtualize).
3. Click **Add**. If the credentials are correct (as previously defined; see "GUI – Entering the storage system credentials" on page 40) and the IP connection is established, the storage system is added to the **Storage Systems** pane.

   If the storage system includes previously defined storage pools, you can view their names and sizes on the system. If no pools exist on the system, you can define them, as explained in "GUI – Defining and attaching storage resources" on page 55. You can display detailed information for all storage resources defined on a storage system by moving the mouse pointer over a system on which you want zoom, clicking the **Edit** button, and then clicking **List pools**.

Spectrum Control Base fetches information about storage resources on a system every ten minutes by default. You can refresh the storage resource information immediately by moving the mouse pointer over a system that you want to refresh, clicking the **Edit** button, and then clicking **Refresh**.

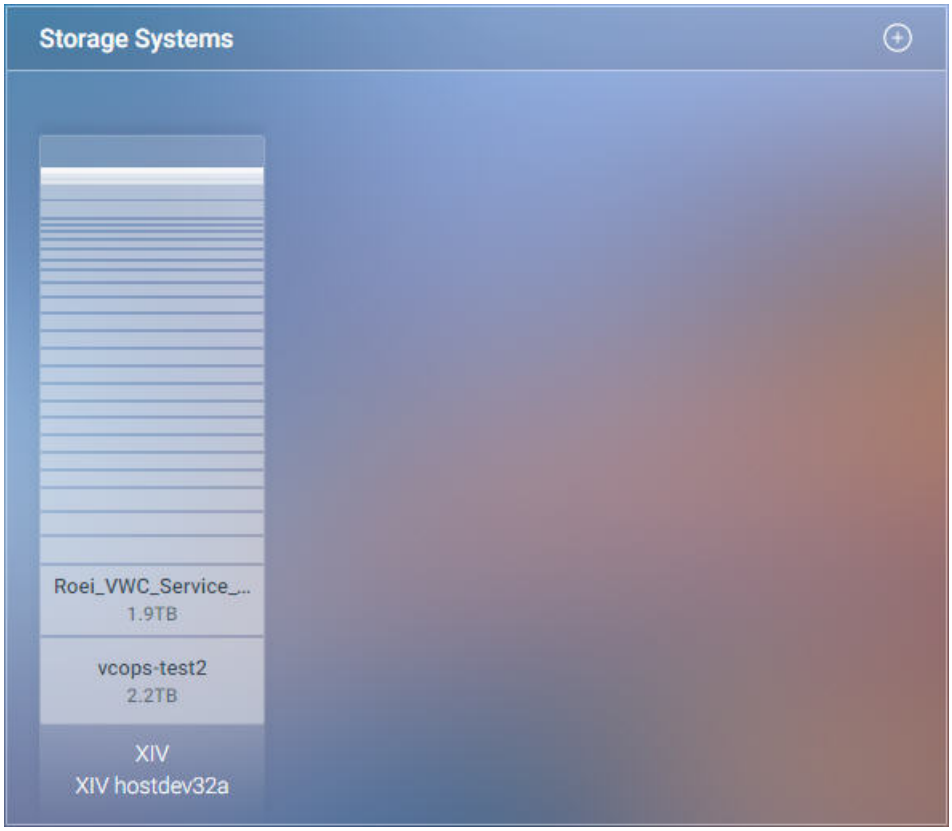


Figure 25. Storage Systems pane

If a storage system connectivity problem occurs, Spectrum Control Base displays a red frame around the system. Move the mouse pointer over the system, and click the red triangle to display the error message.

Figure 26. Storage system error indication

GUI – Modifying the IP address or hostname of a storage system

At any time, you can modify the IP address or hostname of an added storage system.

About this task

If the management IP address or hostname of a storage system changes, you can update this change on Spectrum Control Base without having to remove or re-add the storage system.

Procedure

1. In the Storage Systems pane, move the mouse pointer over a system that you want to update, click the **Edit** button, and then click **Modify**. The **Array Settings** dialog box is displayed.

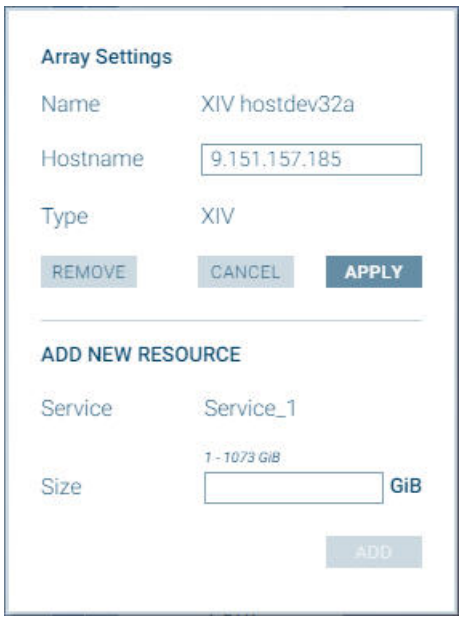


Figure 27. Array Settings dialog box

Note: If a storage system has multiple management IP addresses, you can display all of them by moving the mouse pointer over the **Hostname** field in the **Array Settings** dialog box.

2. Enter the new management IP address or hostname of the storage system, and then click **Apply**.

GUI – Removing a storage system

If a storage system is no longer needed, you can remove and disconnect it from Spectrum Control Base.

About this task

- A removed storage system, along with its storage pools and volumes, can no longer be managed by the included solution components (see "Included cloud interfaces" on page 1).
- If the removed storage system contains working storage pools and volumes, the information of these storage pools and volumes is no longer displayed in

vSphere Web Client. However, **vSphere data access and service level for these storage pools and volumes is not affected**. In addition, the removed system and its storage pools and volumes can be managed from the standard IBM storage system management tools.

- After the removal, you can add the storage system back again to fully restore its management.

Procedure

1. In the **Storage Systems** pane, move the mouse pointer over a system that you want to remove, click the **Edit** button, and then click **Modify**. The **Array Settings** dialog box is displayed.

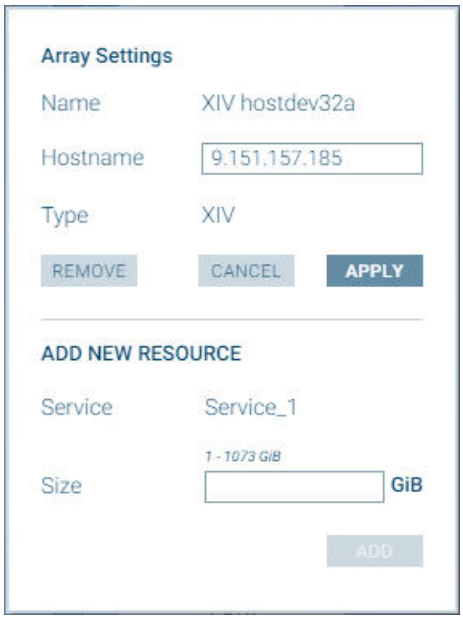


Figure 28. Array Settings dialog box

2. Click **Remove** to remove the storage system.

GUI – Managing and monitoring VASA access

You can control and monitor the utilization of the IBM Storage Provider for VMware VASA, which is part of the IBM Spectrum Control Base Edition solution.

To display a list of all vCenter servers that are currently registered and are utilizing VASA functions, go to the **VASA Trusted Certificates** dialog box (**Settings** > **VASA trusted certificates**). Instructions on adding Spectrum Control Base as a storage provider to the VMware vCenter Server are detailed in the "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91 section. During Spectrum Control Base registration, the certificate validity is verified for VMware VASA 1.0 and VASA 2.0. Also, for VMware VASA 2.0, it is verified that the certificate is signed by the VC root CA (when working with VMCA) or it is uploaded as a trusted certificate.

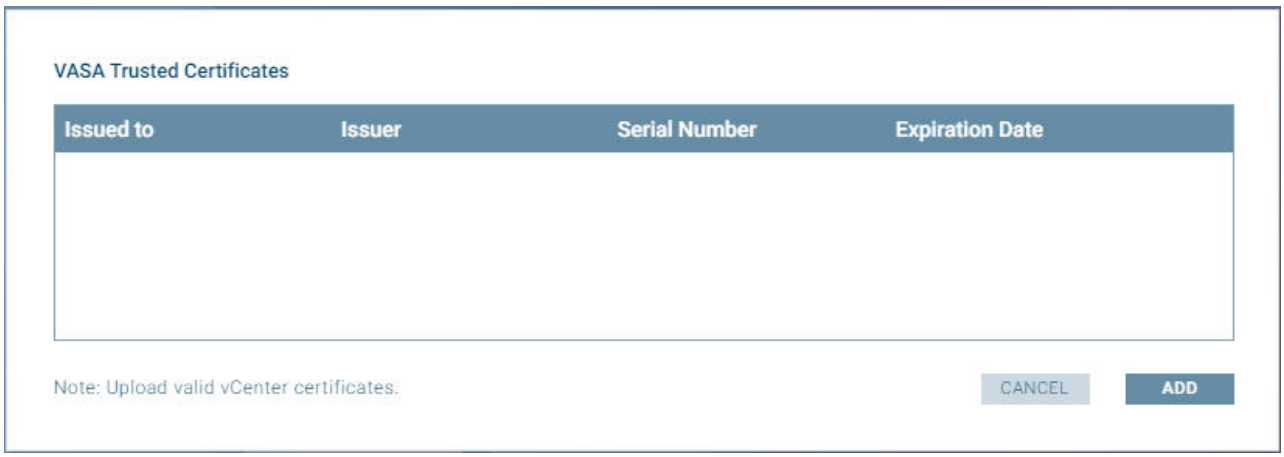


Figure 29. Registered VASA servers (vCenter servers that employ VASA services)

If you want to disconnect a vCenter server, click and highlight the row of the vCenter server that you want to disconnect, and then click the **Remove** button.

If you want to upload a new certificate, click **Add** > **Upload Certificate** > **Browse** and attach your certificate file.

Before any vCenter server can be registered and start utilizing the IBM Storage Provider, you must first set the VASA credentials, as explained in the following section.

GUI – Setting the VASA credentials

The VASA credentials comprise a username and a password that is set separately from the Spectrum Control Base user accounts, and separately from the storage system credentials.

About this task

VMware vCenter servers can use the VASA credentials to connect to Spectrum Control Base and utilize VASA functions, as explained in "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91.

From the Spectrum Control Base GUI you can set, change, or display these VASA credentials at any time.

Note:

- Only one set of a username and a password can be used for the VASA credentials, which applies to all vCenter servers that require VASA functions and connect to Spectrum Control Base.
- The same operations are available from the CLI as well, as explained in "CLI – Setting the VASA credentials" on page 83.

Procedure

1. Click **VASA credentials** on the Settings menu. The **VASA Credentials** dialog box is displayed.

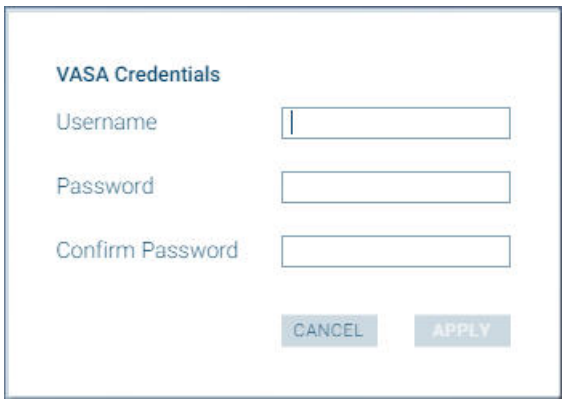


Figure 30. VASA Credentials dialog box

2. Enter the username and password that you want to set, confirm the password and then click **Apply**.

Note: The VASA username must be different from any username stored in the Spectrum Control Base user database. See "GUI – Managing Spectrum Control Base users" on page 36

GUI – Managing storage spaces and services

After defining physical storage resources on Spectrum Control Base you must add virtual storage elements: spaces and services.

Spectrum Control Base administers storage at the virtual level, using spaces and services. This simplifies storage provisioning, and allows users to allocate their own storage resources to suit requirements of a specific VM. For description of storage spaces and services, see "Storage space and service management" on page 6.

Storage spaces are added and managed, using the **Manage Spaces** option in the Settings menu. You can also add a new space via the drop-down menu of the Default Space tab on the **Spaces/Services** pane.

Storage services are added and configured via the Spaces/Services pane of the Spectrum Control Base GUI.

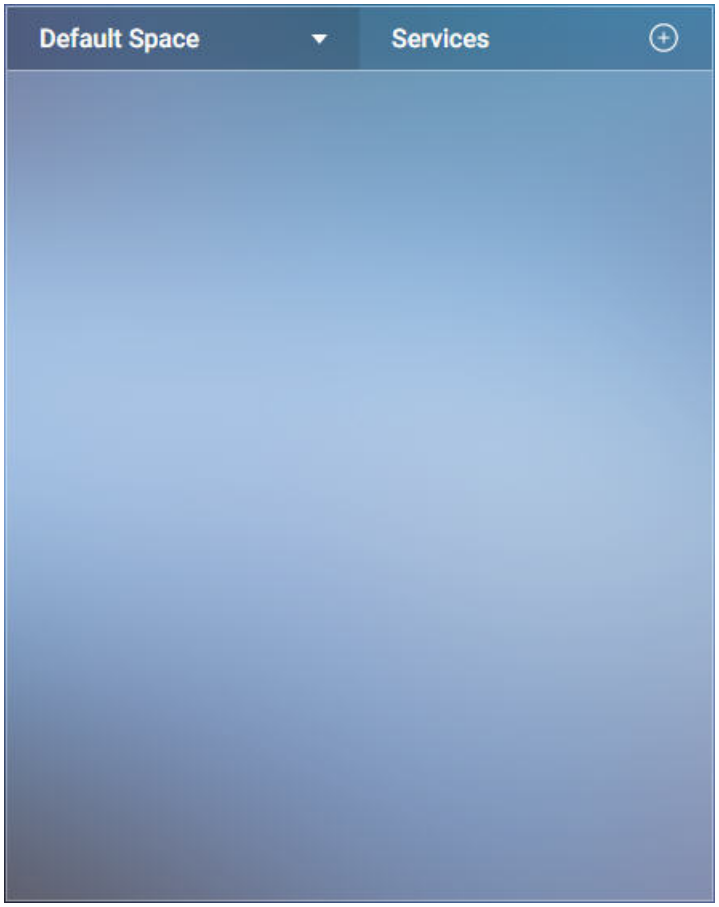


Figure 31. Spaces/Services pane

- "GUI – Adding a storage space"
- "GUI – Removing a storage space" on page 49
- "GUI – Adding a storage service" on page 50
- "GUI – Removing a storage service" on page 54
- "GUI – Defining and attaching storage resources" on page 55
- "GUI – Detaching storage resources from services" on page 59

GUI – Adding a storage space

Once physical storage elements are defined in the IBM Spectrum Control Base Edition, you can continue by adding the first virtual entity – a storage space.

About this task

A storage space is a logical grouping of storage services and underlying physical pools. This combination determines the storage that is available when a user requests a storage service provisioning.

A storage space is added by providing it with a meaningful name and description.

Procedure

1. Click the **Settings** button and select **Manage spaces** from the Settings menu. The list of storage spaces is displayed.

2. Click **Add** . The **New Space** dialog box is displayed.

Figure 32. New Space dialog box

3. Enter the name and description of the storage space that you want to create, and then click **Apply**. The name and description of the created storage space is added to the Spaces list.

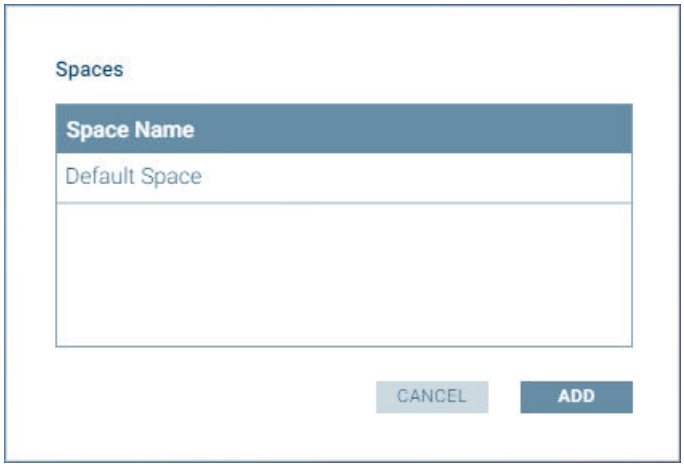
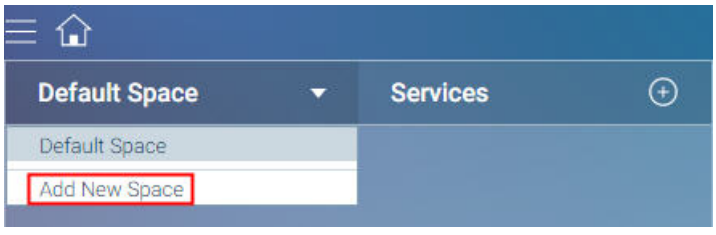


Figure 33. List of storage spaces

Note: You can also add a new space by clicking **Add New Space** in the drop-down menu of the **Default Space** tab on the **Spaces/Services** pane.



GUI – Removing a storage space

If a storage space is no longer needed, you can remove it from Spectrum Control Base.

Before you begin

Before removing a storage space, delete all services that are defined on this space. See "GUI – Removing a storage service" on page 54

About this task

A removed storage system, along with its services and pools, can no longer be available for storage service provisioning.

Procedure

1. Click the **Settings** button and select **Manage spaces** from the Settings menu. The Spectrum Control Base space list is displayed, detailing all existing storage spaces.
2. Click the **Remove** button on the row of the storage space that you want to remove. A confirmation message appears.
3. Click **OK** to remove the space, or **Cancel** to cancel the operation.

GUI – Adding a storage service

After a storage space is defined, you can start adding storage services to the space.

About this task

Storage services contain one or more physical storage pools. In addition to storage capacity, a service has a set of capabilities, defining the storage quality, such as thin/thick provisioning, compression, snapshots, encryption, etc.

The services that you add become available for the solution components included in the Spectrum Control Base package (see "Included cloud interfaces" on page 1). When provisioning storage, the end users consume it from the spaces and services without dealing underlying physical storage infrastructure.

You can add each individual storage service separately, as described in the following procedure.

Procedure

1. In the Spaces tab of the **Spaces/Services** pane, select a space on which you want to create a new service.
2. Click **Add** button on the Spaces/Services pane. The **New Service** dialog box is displayed.

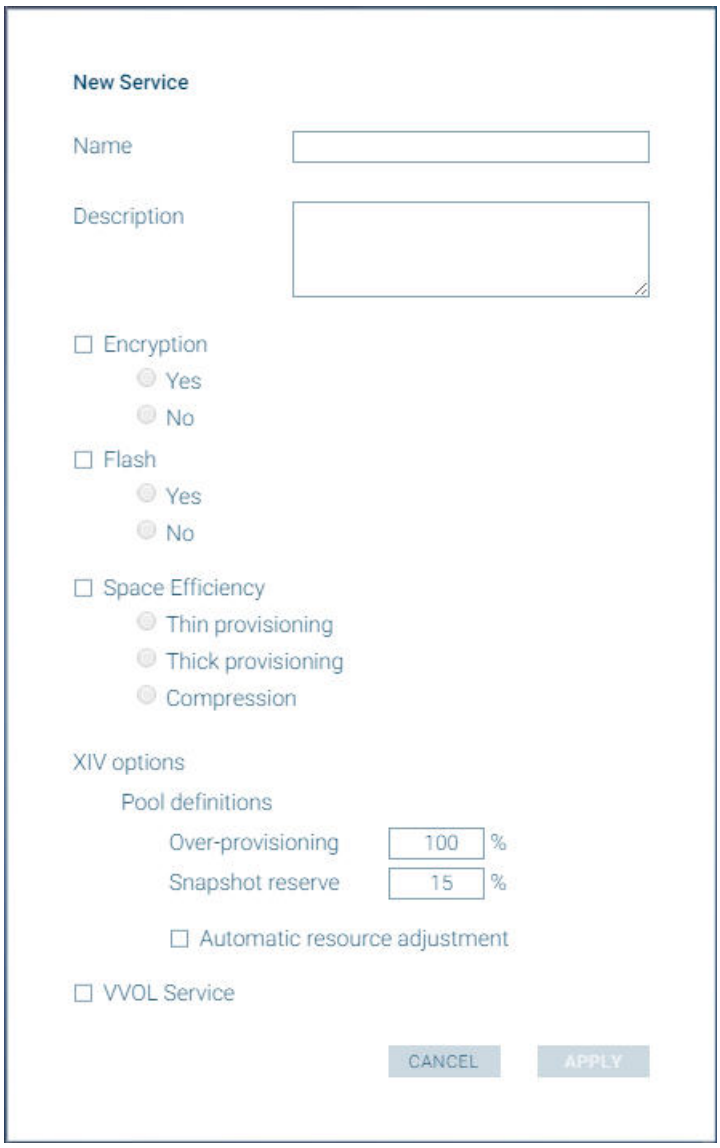


Figure 34. New Service dialog box

3. Enter parameters for the new service, according to the table below.

Table 6. Service parameters

Parameter	Description and values
Name	Alphanumeric string for service identification. This is a mandatory field.
Description	Alphanumeric string for service description.
Encryption	Enables or disables encryption for the service. If disabled, you can attach any storage resource (encrypted or not) to the service.
Flash	Enables or disables utilization of a storage resource, located on a flash-based storage resource. This can be one of the following storage systems: FlashSystem™ 900, FlashSystem V9000, Storwize Family.

Table 6. Service parameters (continued)

Parameter	Description and values
Space Efficiency	Enables storage space efficiency features for the service. When enabled, you can configure the service to be thick- or thin-provisioned or make it use IBM Real-time Compression™. If disabled, you can attach any storage resource (thin, thick, compressed or not) to the service. **Configuration considerations** A service with enabled IBM Real-time Compression will be able to support the compression-compatible (thin-provisioned) storage resources on XIV and Spectrum Accelerate systems. For the FlashSystem V9000, Storwize Family storage systems, a storage resource must have the data compression enabled prior to service attachment (via product CLI or GUI). Currently, DS8000 storage systems do not support IBM Real-time Compression.

Table 6. Service parameters (continued)

Parameter	Description and values
Over-provisioning	Percentage of over-provisioned storage space on the service, defining the ratio between logical and physical storage capacity. For example, when configured to 100, it sets a 1:1 ratio between the two values, while a value of 200 defines the logical capacity (soft size) to be twice the physical capacity (hard size). **Configuration considerations** The recommended over-provisioning value for a VVol-enabled service with XIV storage systems is 400®%. The recommended over-provisioning value for a service with IBM Real-time Compression is 200%.The XIV utilizes thin provisioning for all VM configuration volumes. When creating a regular VM on an XIV disk, you can choose the provisioning mode, according to your application requirements. For other cases, you can choose any value: • 100%, if you do not want to utilize thin provisioning. • Above 100%, if you want to take a risk of allocating resources that the XIV storage system may not have. In addition, when utilizing the over-provisioning, XIV storage systems must be also configured to allow support for this feature. When used with the XIV domains, the domain must be also configured with matching soft and hard capacity settings. To enable the VVol functionality at the XIV side, see "Creating a VVol-enabled service" on page 147. **Important** The managed domain that you created cannot be used for traditional volumes without virtualization. You must create a separate regular domain for them. This domain must have the same user and the ESXi hosts that you intend to manage. However, you need to create a separate storage resource and a new service on the regular domain via Spectrum Control Base for subsequent use by the VMware vWC. The over-provisioning is not relevant for the storage systems that run IBM Spectrum Virtualize and DS8000. **Configuration examples** • Storage pools in a regular service with over-provisioning at 100% are created as thick pools. • Storage pools in a regular service with over-provisioning at 150% are created as thin pools. If a hard pool size is 500 GiB, its soft size is 750 GiB. • Group storage pools in a VVol-enabled service with over-provisioning at 400% are created as thin pools with their soft sizes to be four time bigger than their hard sizes.
Snapshot reserve	Percentage of storage space on the service reserved for snapshots.

Table 6. Service parameters (continued)

Parameter	Description and values
Automatic resource adjustment	Controls automatic adjustment of a storage resource, according to the settings of a service, to which the resource is attached. For example, when adding existing storage pools to a service with certain over-provisioning and snapshot settings, the pool sizes will be changed to match the service requirements. To prevent this, disable the automatic resource adjustment. This parameter is always On for VVol-enabled services.
VVOL Service	Enables virtual volume functionality for the service. The virtual volume functionality is supported by the IBM XIV (11.5.1 or later) and storage systems that run IBM Spectrum Virtualize (7.6 or later). An XIV VVol-enabled service does not support IBM Real-time Compression.

Important: The following requirements apply to the VVol-enabled services:

- All storage pools attached to a VVol-enabled service must reside on the same system.
- Only one VVol-enabled service is allowed per storage system and per storage space.

4. Click **Apply** to finish the procedure. A new service is added to the current Spaces tab.
5. You can edit the service properties by moving the mouse pointer over a service which you want configure, clicking the **Edit** button, and then clicking **Settings**.

What to do next

Define and attach storage pools to the service, as explained in "GUI – Defining and attaching storage resources" on page 55.

GUI – Removing a storage service

If a storage service is no longer needed, you can remove it.

About this task

- A removed storage service, along with its pools, can no longer be managed by the included solution components.
- If the removed storage service contains working storage pools, these pools become available for allocation by other existing services.

Procedure

1. On the **Spaces/Services** pane, move the mouse pointer over a service that you want to remove, and then click the **Edit** button. The **Service Settings** dialog box is displayed.

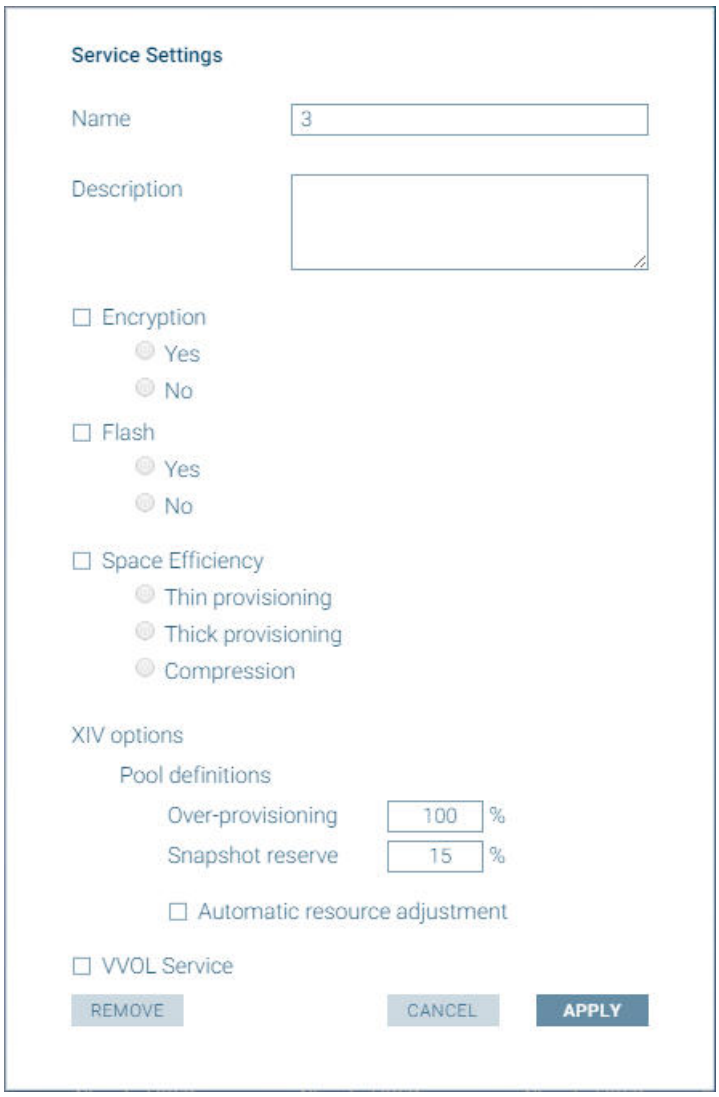


Figure 35. Service Settings dialog box

2. Click **Remove** to remove the service.

GUI – Defining and attaching storage resources

After the storage systems and services are added, you can start defining resources on the systems.

Before you begin

Verify that the storage resource, which you intend to define and attach, will be compatible with the service in terms of space efficiency and compression modes.

About this task

If no resources (pools) exist on the storage systems, you can define the resources and attach them to a service to make the physical storage available for the Spectrum Control Base components and end users. You can attach several resources to a single service. However, a specific resource can be added to one service only.

Note: For VVol-enabled services, the minimum recommended storage resource size is 500 GiB.

Procedure

1. On the **Spaces/Services** pane, select the storage space from which you want to choose storage services. The available services that reside on the selected storage space are immediately displayed.
2. Click on a service to which you want to attach a resource. The service color changes to green to indicate selection.
3. On the Storage Systems pane, move the mouse pointer over a storage system on which you want to define a new resource, click the **Edit** button, and then click **Modify**. The Array Settings dialog box is displayed.

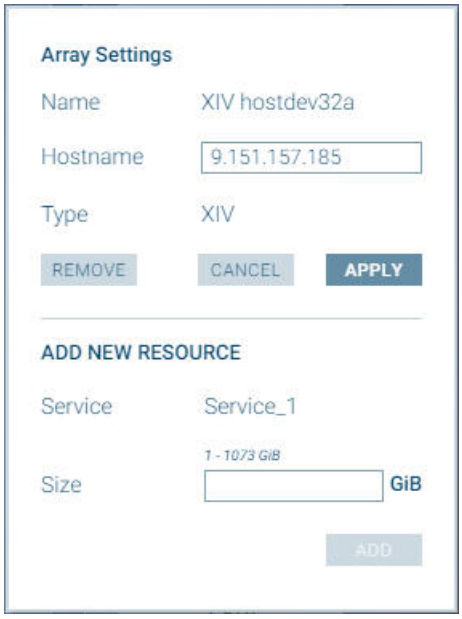


Figure 36. Array Settings dialog box

4. In the **Add New Resource** section of the dialog box, enter a management domain of the pool IBM XIV systems, or a parent pool for storage systems that run IBM Spectrum Virtualize (7.6 or later), and its size in GB.

Note: Management domains are available for the XIV systems with microcode version 11.5.x and above. To use this feature, verify that:

- Domains are already defined on your storage system.
- Default credentials of a storage admin user are assigned to the domain.

5. Click **Add**. The storage resource is created on the storage system and attached to the service. The resource color changes to green to indicate the successful attachment.

   The resources defined on the system before the system was attached to Spectrum Control Base, can be allocated to a service by selecting the service and clicking an unattached resource.

   A storage service provides indication for the allocated and used storage space.

- Allocated – amount of storage space available on all pools connected to the service.
- Used – amount of storage space used by all storage elements connected to the service (datastores, servers, etc).

Important:

- When attaching a resource to an over-provisioned service, verify that a storage system which hosts the pool has enough capacity to accommodate the service space requirements.
- Datastores created on VVol-enabled services always display the meta and thick pools of its group pool to be 100% full. You can disregard this alert.
- When creating a stretched volume (a volume with mirrored copy) in a stretch cluster on storage systems that run IBM Spectrum Virtualize (7.6 or later), attach the primary and secondary pools to the same storage service.

You can also add a new storage resource by clicking the **Add** button on the upper right-hand corner of the storage system Storage Resources table, described below.

6. You can display detailed information for all storage resources defined on a storage system by moving the mouse pointer over a system on which you want zoom, clicking the **Edit** button, and then clicking **List pools**. The **System Storage Resources** table is displayed.

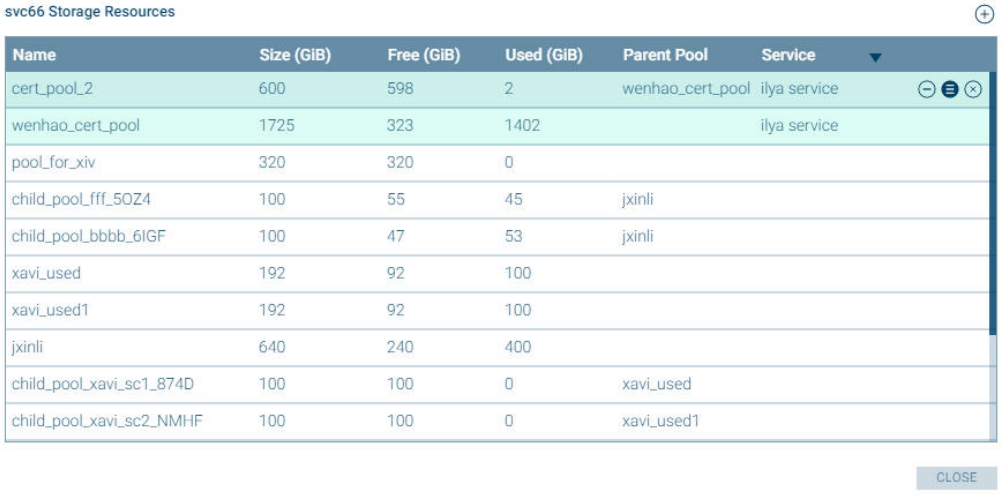


Figure 37. System Storage Resources table

The table lists all storage resources defined on the storage system, including their sizes, free and used storage space, parent pool for storage systems that run IBM Spectrum Virtualize , and a service that the resource is attached to. When you click on a storage resource row to select it, you can complete the following:

- Click the **Resource Attach** button to attach the storage resource to a previously selected storage service.
- Click the **Resource Detach** button to detach the storage resource from a previously selected storage service.
- Click the **Edit** button to resize the resource or remove it.
- Click the **Remove** button to delete child pools or XIV pools. This option does not exist for parent pools or DS8000 pools.

7. You can display detailed information for all storage resources attached to a service on a storage system by moving the mouse pointer over the service on which you want zoom, clicking the **Edit** button, and then clicking **Resources**. The **Service Storage Resources** table is displayed.

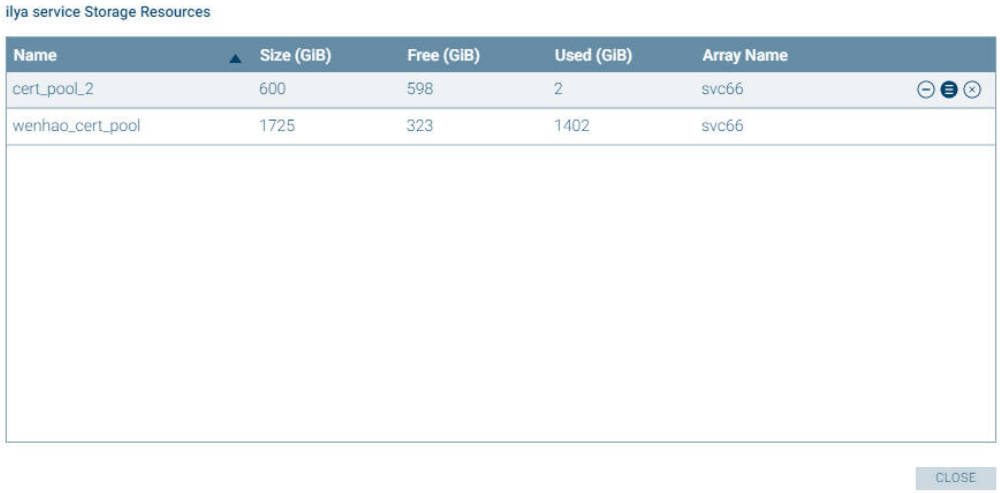


Figure 38. Service Storage Resources table

The table lists all storage resources attached to the storage service, including their sizes, free and used storage space and a system that the resource was created on. When you click on a storage resource row to select it, you can complete the following:

- Click the **Resource Attach** button to attach the storage resource to a previously selected storage service.
- Click the **Resource Detach** button to detach the storage resource from a previously selected storage service.
- Click the **Edit** button to resize the resource or remove it.
- Click the **Remove** button to delete child pools or XIV pools. This option does not exist for parent pools or DS8000 pools.

GUI – Resizing storage resources

If needed, you can change a size of any resource (pool) defined on a storage system.

About this task

Storage pools can be resized to match the requirements of the connected services, as described in the following procedure.

Note: Pools, defined on DS8000 storage systems, cannot be resized.

Procedure

1. On the **Storage Systems** pane, move the mouse pointer over a pool which you intend to resize and click the **Edit** button. The **Resource Settings** dialog box is displayed.

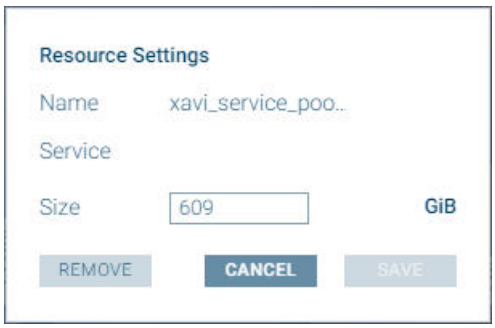


Figure 39. Resource Settings dialog box

2. In the **Size** text box of the dialog box, enter the new size for the pool.
3. Click **Save** to save the change.

Note: You can also access the **Resource Settings** dialog box by selecting a storage resource row in the **System Storage Resource** or **Service Storage Resource** table, and clicking the **Edit** button. Refer to "GUI – Defining and attaching storage resources" on page 55 for details.

GUI – Detaching storage resources from services

When required, you can detach a storage resource (pool) from a service to which it is attached.

About this task

- A detached storage pool can no longer be managed by the included solution components.
- A detached storage pool becomes available for allocation by other existing services.
- After the detachment, you can attach the pool again to fully restore its management.

Procedure

1. On the **Spaces/Services** pane, click the service from which you want to detach one or more pools. The pools that are currently attached to the service are highlighted on the Storage Systems pane.
2. Click on the pool that you want to detach. The pool color changes to gray to indicate the successful detachment.

   You can continue the process by clicking the other pools attached to the selected service.

GUI – Managing integration with vSphere Web Client

Before you can use the IBM Storage Enhancements for VMware vSphere Web Client on the web client side, you need to define on the Spectrum Control Base side the vCenter servers for which you want to provide storage resources. Then, you can attach storage services that you want to make available to each vCenter server.

The storage services that you attach on the Spectrum Control Base side become visible on vSphere Web Client, and can be used for volume creation by using the

IBM Storage Enhancements for vSphere Web Client (for more information, see Chapter 5, "Using the IBM Storage Enhancements for VMware vSphere Web Client," on page 95).

- "GUI – Adding a vCenter server"
- "GUI – Updating the credentials of a vCenter server" on page 61
- "GUI – Removing a vCenter server" on page 62
- "GUI – Attaching storage services to a vCenter server" on page 63
- "GUI – Detaching storage services from a vCenter server" on page 64

GUI – Adding a vCenter server

Add the VMware vCenter servers for which you want to provide storage resources through IBM Spectrum Control Base Edition.

Before you begin

Log out of any vSphere Web Client application connected to a vCenter Server that you want to add to Spectrum Control Base. If you stay logged in, you will be able to use the extension only after you log out and log into vCenter after the connection.

About this task

You need to connect to and add the vCenter servers for which you can later attach storage services that would be visible and accessible on the vSphere Web Client side. You can add a single vCenter server at a time, as described in the following procedure.

Note: For any vCenter server that you add, the IBM Storage Enhancements for VMware vSphere Web Client (see Chapter 5, "Using the IBM Storage Enhancements for VMware vSphere Web Client," on page 95) are automatically deployed and enabled on the vSphere Web Client Server side.

Procedure

1. Click the **Add** button on the **Applications** pane. The **Add New vCenter Server** dialog box is displayed.

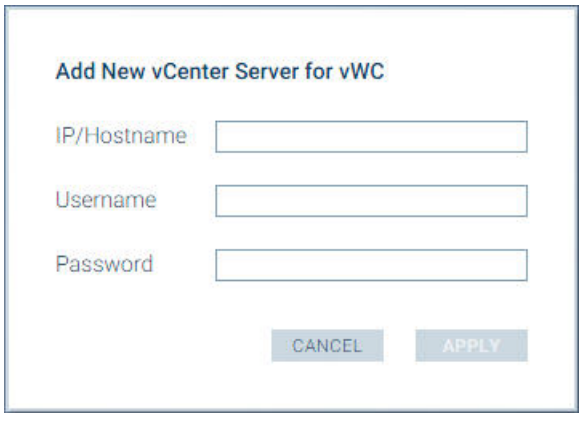


Figure 40. Add vCenter Server dialog box

2. Enter the IP address or hostname of the vCenter server, as well as the username and password for logging into that vCenter server. If the provided IP

address and credentials are accepted by the vCenter server, it is added to the list of servers on the **Applications** pane.

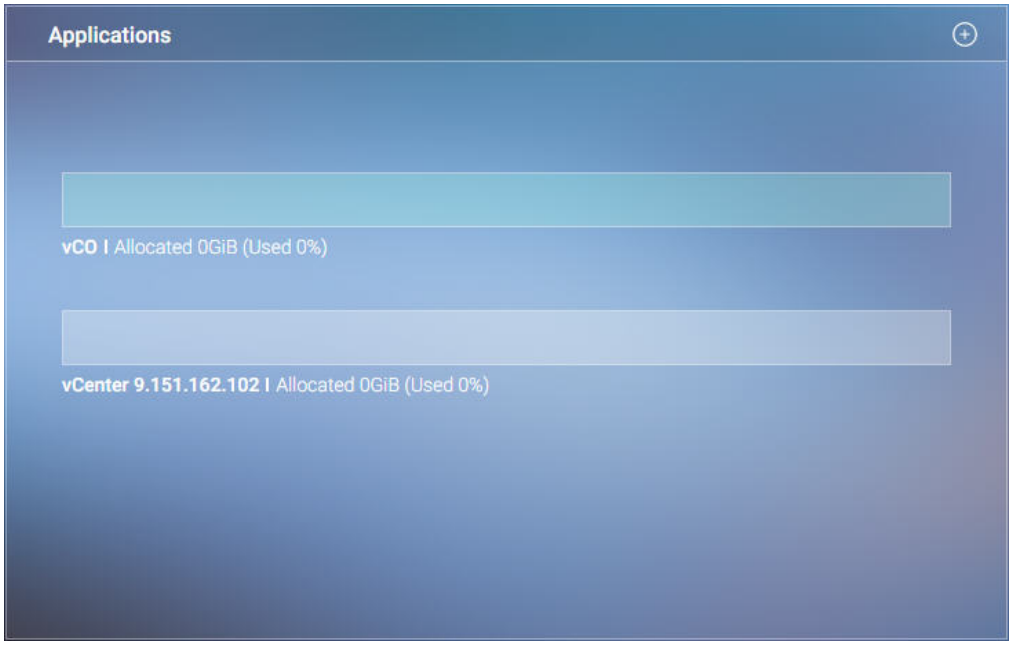


Figure 41. Applications pane

GUI – Updating the credentials of a vCenter server

At any time, you can update the credentials that are used by Spectrum Control Base to access a vCenter server.

About this task

Whenever the credentials on the vCenter server side change, you can update these credentials on the Spectrum Control Base side to allow continued management of storage resources on the vSphere Web Client side.

Note: Prior to changing the vCenter credentials on the Spectrum Control Base side, verify that the vCenter user has sufficient access level to complete this procedure.

Procedure

1. On the **Applications** pane, move the mouse pointer over the vCenter server for which you want to update the credentials, and then click the **Edit** button. The **vCenter Server Settings** dialog box is displayed.

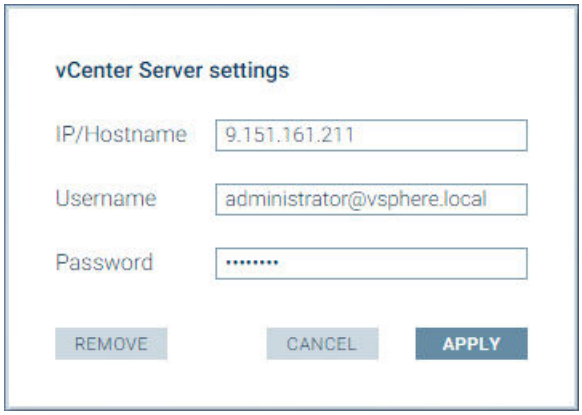


Figure 42. vCenter Server Settings dialog box

2. Enter the new username and password for accessing the vCenter server. Then, click **Apply**.

GUI – Removing a vCenter server

When a vCenter server is no longer needed, you can disconnect it from Spectrum Control Base by removing it from the Applications pane.

About this task

- A removed vCenter server, along with the storage services attached to it, can no longer be managed by the IBM Storage Enhancements for VMware vSphere Web Client. Following the removal, the IBM Storage Enhancements become disabled for that vCenter on the vSphere Web Client Server side.
- If the removed vCenter server is attached to active storage service, the information for these services, as well as their pools is no longer displayed in vSphere Web Client. However, vSphere data access and service level for the services and pools is not affected.
- After the removal, you can add the vCenter server again to fully restore its management.

Procedure

1. On the Applications pane, move the mouse pointer over the vCenter server that you want to remove, and then click the **Edit** button. The **vCenter Server Settings** dialog box is displayed.

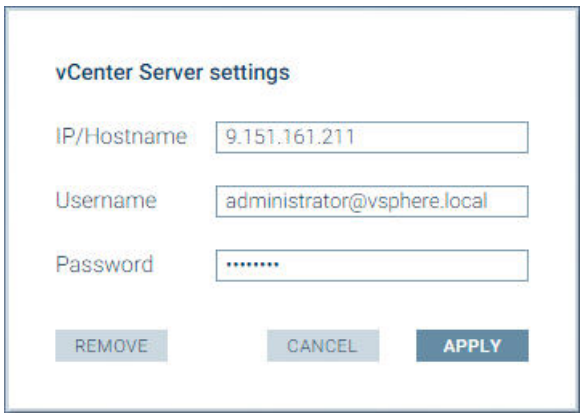


Figure 43. vCenter Server Settings dialog box

2. Click **Remove** to remove the vCenter server.

GUI – Attaching storage services to a vCenter server

You must attach to the vCenter server any storage service that you want to use for volume management operations on the vSphere Web Client side.

Before you begin

- Storage services can be attached only with *Spectrum Control Admin*, *Storage Admin*, *System Admin*, or *Security Admin* storage credentials (see "GUI – Entering the storage system credentials" on page 40).
- When working with DS8000, services can be attached only with *Spectrum Control Admin* or *Logical Operator* storage credentials.
- Working with VMware VVols requires the *Storage Integration Admin* access level configured at the XIV storage system side.

Any other type of storage credentials (read-only, application admin) cannot perform service attachment. If your credentials are not sufficient, contact your storage administrator for assistance.

About this task

The service attachment is done on the Spectrum Control Base side, providing more control to storage administrators as opposed to the VMware administrators on the vSphere environment side. After the attachment, the services and their pools become visible and manageable on the vSphere Web Client side (by using the IBM Storage Enhancements).

Procedure

1. On the **Applications** pane, click the vCenter server to which you want to attach one or more services.
2. On the **Spaces/Services** pane, select the storage space from which you want to choose storage services. The available services that reside on the selected storage space are immediately displayed.
3. Click on a service that you want to attach to the vCenter server. The service color changes to green to indicate the successful attachment, as illustrated below.

You can continue the process by clicking unattached services under the current storage space.

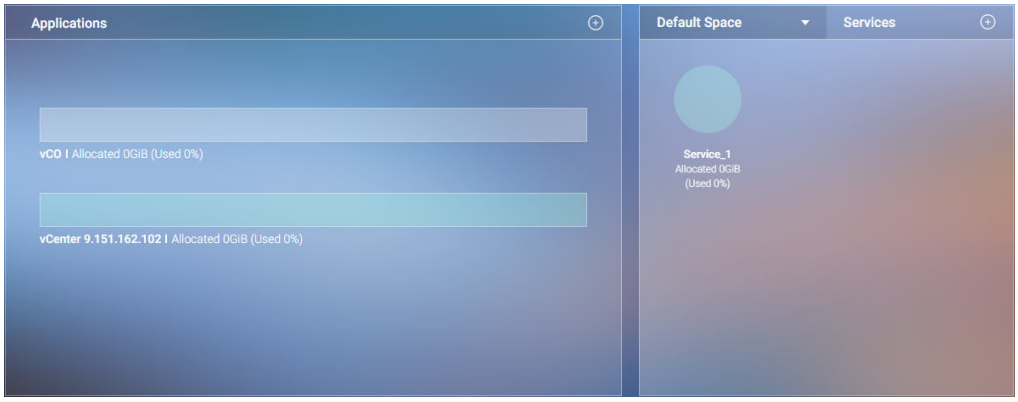


Figure 44. vCenter server with attached services

The vCenter server provides indication for the allocated and used storage space.

- Allocated – amount of storage space available on all pools connected to the attached services.
- Used – amount of storage space used by volumes on all pools connected to the attached services. The volumes are created using IBM Storage Enhancements for VMware vSphere Web Client.

GUI – Detaching storage services from a vCenter server

When required, you can detach a storage service with all its pools from the vCenter server to which it is attached.

About this task

- A detached storage service, along with its pools, can no longer be managed by the included solution components (see "Included cloud interfaces" on page 1).
- If the pools on the detached service contain working volumes, the information of these volumes is no longer displayed in vSphere Web Client. However, **vSphere data access and service level for these volumes is not affected**. In addition, the removed storage pools (including its volumes) can be managed from the standard IBM storage system management tools.
- The detached working volumes remain visible in vSphere Web Client, as long as they are mapped to ESXi hosts. However, these volumes cannot be managed via vWC.
- After the detachment, you can attach the storage service again to fully restore its management.

Procedure

1. On the **Applications** pane, click a vCenter server from which you want to detach one or more storage services. The services that are currently attached to the vCenter server are highlighted on the **Spaces/Services** pane.
2. Click on the service that you want to detach. The service color changes to gray to indicate the successful detachment.

   You can continue the process by clicking attached services under the current space.

GUI – Managing integration with vCenter Orchestrator

The IBM Storage Plug-in for the VMware vCenter Orchestrator is used for discovery of the IBM storage resources and provisioning automation workflows in the vCenter Orchestrator (vCO).

Note: This functionality is applicable only to XIV storage systems.

To access the vCO management options, select the vCO server on the **Applications** pane. You can then manage the integration with vCO as explained in the following sections:

- "GUI – Attaching storage services to the vCO server."
- "GUI – Detaching storage services from a vCO server" on page 66
- "GUI – Downloading and installing the plug-in package for vCO" on page 66.
- "GUI – Regenerating the vCO token" on page 68.

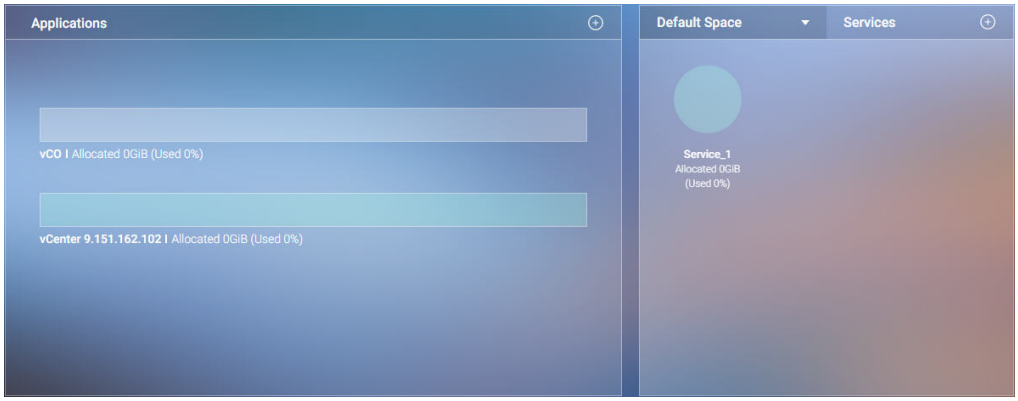


Figure 45. vCO server on the Applications pane

GUI – Attaching storage services to the vCO server

Before you can use the IBM Storage Plug-in for VMware vCenter Orchestrator on the vCenter Orchestrator (vCO) server side, you must attach the storage services that you want to make available for vCenter Orchestrator.

About this task

The services and their pools that you attach on Spectrum Control Base can be used for issuing volume workflows through vCenter Orchestrator (for more information, see Chapter 6, "Using the IBM Storage Plug-in for VMware vCenter Orchestrator," on page 117).

Procedure

To attach storage services to the vCO server:

1. On the **Applications** pane, click the vCO server to select it.
2. On the **Spaces/Services** pane, select the storage space from which you want to choose storage services. The available services that reside on the selected storage space are immediately displayed.
3. Click on a service that you want to attach to the vCO server. The service color changes to green to indicate the successful attachment.

You can continue the process by clicking unattached services under the current space.

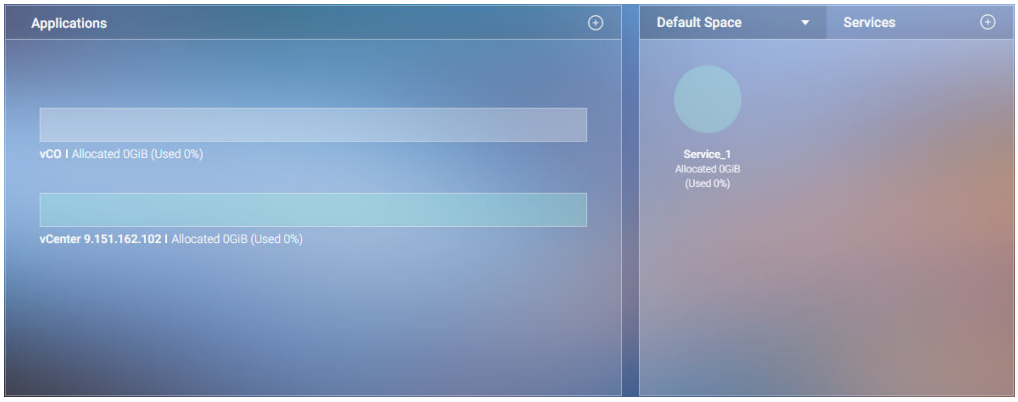


Figure 46. vCO server with attached services

The vCO server provides indication for the allocated and used storage space.

- Allocated – amount of storage space available on all pools connected to the attached services.
- Used – amount of storage space used by workflows on all pools connected to the attached services.

GUI – Detaching storage services from a vCO server

When required, you can detach a storage service from the vCO server to which it is attached.

About this task

Detached storage services and their pools are removed from the vCO inventory and cannot be used for workflows. Any scheduled workflows, involving detached elements, will fail to run.

Procedure

1. On the **Applications** pane, click the vCO server. The services that are currently attached to the vCO server are highlighted on the Spaces/Services pane.
2. Click on the service that you want to detach. The service color changes to gray to indicate the successful detachment.

   You can continue the process by clicking attached services under the current space.

GUI – Downloading and installing the plug-in package for vCO

To enable the IBM Storage workflows in vCenter Orchestrator, you must first download the IBM Storage plug-in package from Spectrum Control Base and install it on the vCenter Orchestrator server.

Before you begin

To allow the IBM Storage Plug-in to securely identify Spectrum Control Base and work properly, the SSL certificate that is automatically created on Spectrum Control Base upon installation must be replaced with a new one. For more information about how to replace the certificate, see “GUI – Managing server certificates” on page 33.

Important: After the IBM Storage Plug-in is installed on vCenter Orchestrator, the Java™ security APIs validate that the hostname received from Spectrum Control Base is identical to the common name (CN) value that is in the server certificate.

About this task

The following procedure details how to download, install, and properly configure the IBM Storage Plug-in for VMware vCenter Orchestrator.

Procedure

1. On the **Applications** pane, click the **Edit** button of the vCO server. The **vCO Settings** dialog box is displayed.
2. On the bottom of the dialog box, click **Download plug-in package**.

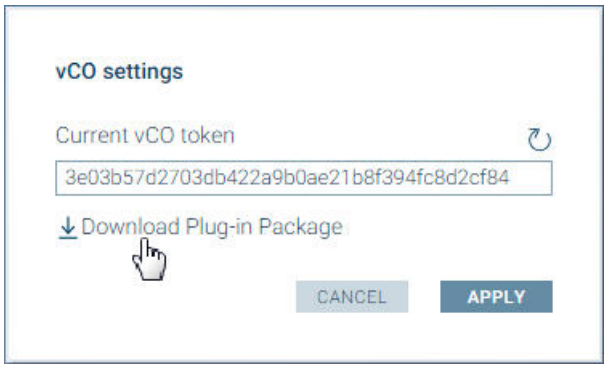


Figure 47. Download plug-in package button

Alternatively, you can download the package from the following directory on the Spectrum Control Base:

`/opt/ibm/ibm_spectrum_control/downloads/static/o11nplugin-ibm-storage.vmoapp`

3. Copy the current vCO token key from the Current vCO Token box.

Figure 48. Current vCO Token

4. Launch the VMware vCenter Orchestrator configuration interface.
5. On the **Network** tab, click **SSL Trust Manager** and then import the Spectrum Control Base certificate. The certificate URL format should be: `https://IP_address:8443`
6. On the **Plug-ins** tab, click **Install New Plug-in**, locate and choose the downloaded plug-in file, and then click **Upload and Install**. Accept the license agreement. The message `'IBM Storage (2.0.0 build 0) New plug-in installed.'` is displayed, and a new **IBM Storage** tab is created under the Plug-ins tab.

7. On the IBM Storage tab, enter the Spectrum Control Base IP address or hostname, and also the token key (REST API token) that you obtained earlier.

Figure 49. vCenter Orchestrator – IBM Storage Plug-in Configuration

8. Click **Apply Changes**.
9. Restart both the vCO Configuration Server service and vCO Server service.

What to do next

See Chapter 6, "Using the IBM Storage Plug-in for VMware vCenter Orchestrator," on page 117.

GUI – Regenerating the vCO token

The vCO token used during installation of the IBM Storage Plug-in for vCO can be regenerated.

About this task

If the communication link between the vCenter Orchestrator server and Spectrum Control Base has been compromised, you can regenerate the vCO token and reinstall the IBM Storage Plug-in for vCO. For the plug-in installation instructions, see "GUI – Downloading and installing the plug-in package for vCO" on page 66.

Procedure

To regenerate the vCO token:

1. On the **Applications** pane, click the **Edit** button of the vCO server. The **vCO Settings** dialog box is displayed.
2. Click the **Regenerate vCO token** button ( ). A new vCO token is regenerated and can be used during installation of the IBM Storage Plug-in for vCO.

GUI – Managing integration with vCenter Operations Manager

Before you can use the IBM Storage Management Pack for VMware vCenter Operations Manager, you must set a connection to at least one vCenter Operations Manager (vCOps) server, and then define which storage systems should be monitored in vCOps.

After a vCOps server connection is defined and storage systems are associated with the vCOps server, detailed monitoring information for these storage systems

becomes available in vCOps (for more information, see Chapter 7, "Using the IBM Storage Management Pack for VMware vCenter Operations Manager," on page 121).

Note: This functionality is applicable only to XIV storage systems.

To access these options, go to the **Monitoring** pane of Spectrum Control Base GUI. You can then manage the integration with vCOps as explained in the following sections:

- "GUI – Downloading the vCOps management package" on page 70.
- "Deploying the management package on vCOps" on page 70.
- "Describing the management package on vCOps" on page 72.
- "GUI – Connecting the vCOps server to Spectrum Control Base" on page 73.
- "GUI – Attaching and detaching storage systems on the vCOps server" on page 74.

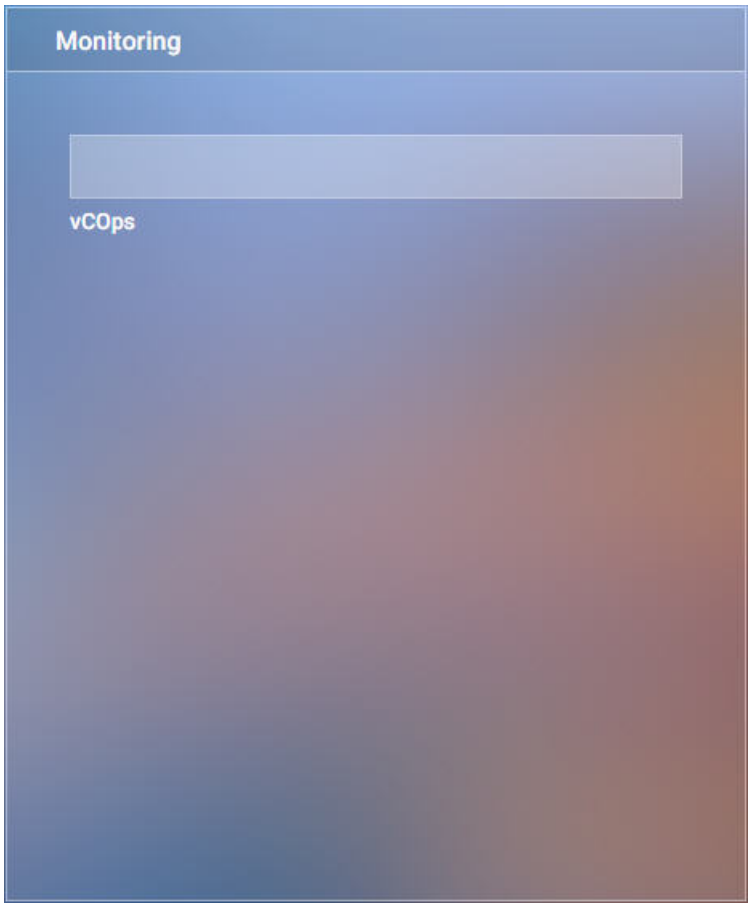


Figure 50. Monitoring pane

The vCOps integration, except for the management package operations, can be performed from the CLI as well, as explained in "CLI – Managing integration with vCenter Operations Manager" on page 84.

GUI – Downloading the vCOps management package

IBM Spectrum Control Base Edition provides management package in the form of a PAK file which can be deployed on the vCenter Operations Manager.

About this task

Although vCOps can display IBM Storage information even without the management package (storage adapter) installation, the IBM Storage adapter is required for displaying the dedicated dashboards, graphic icons, and user-friendly attribute names for the IBM storage elements. The adapter is provided through a PAK file that you need to download, as described in the following procedure.

Procedure

To download the PAK file from IBM Spectrum Control Base:

1. Go to **Monitoring** pane of the Spectrum Control Base GUI.
2. Click the **Edit** button. The **Set vCOPs Server** dialog box is displayed.
3. On the bottom of the dialog box, click **Download PAK file**.

Figure 51. Download PAK File button

   Alternatively, you can download the package from the following directory on Spectrum Control Base:

   `/opt/ibm/ibm_spectrum_control/downloads/static/IBM_Storage_Adapter-2.0.0.pak`

4. Save the file to your computer to later upload it to the vCenter Operations Manager.

What to do next

See “Deploying the management package on vCOps.”

Deploying the management package on vCOps

After the management package is downloaded to the computer, it must be deployed on the vCenter Operations Manager.

About this task

The vCenter Operations Manager must be registered with vCenter server, and then the management package is deployed on the vCOps. The registration and deployment procedures are described below.

Procedure

To deploy the management package on the vCOps:

1. After the management package is downloaded to the computer, access the vCenter Operations Manager administrative web console using `https://hostname or IP address of the vCOps UI/admin`.
2. If the vCenter Operations Manager is configured for the first time, follow the initial configuration wizard to configure vCenter Operations Manager on the

vCenter server.

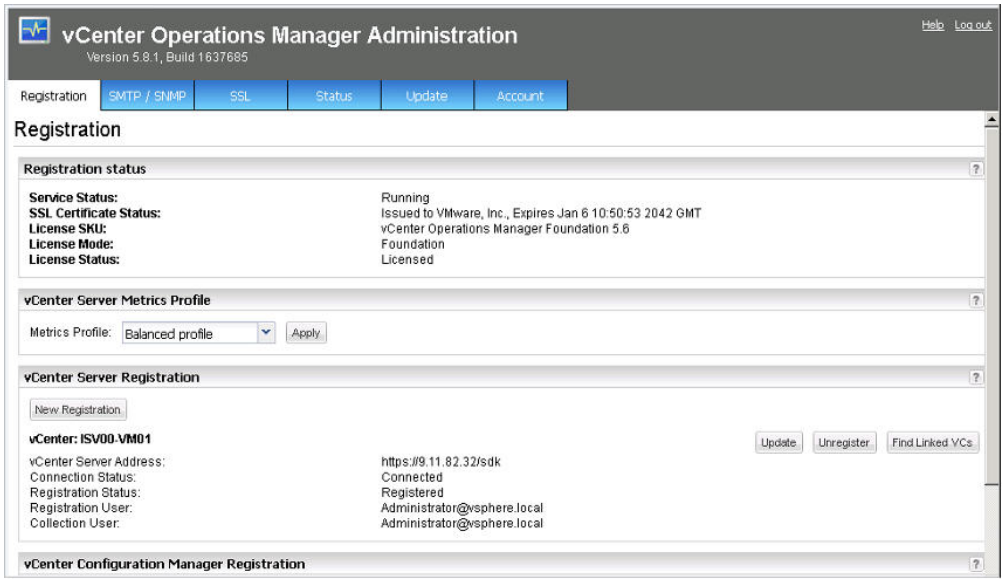


Figure 52. Registering the vCOps on the vCenter server

3. After the vCenter Operations Manager is registered with vCenter server, click the **Update** tab and then click **Browse** and select the management package downloaded from Spectrum Control Base. After that, click **Update** to deploy the management package on the vCOps.
   The IBM license agreement is displayed.

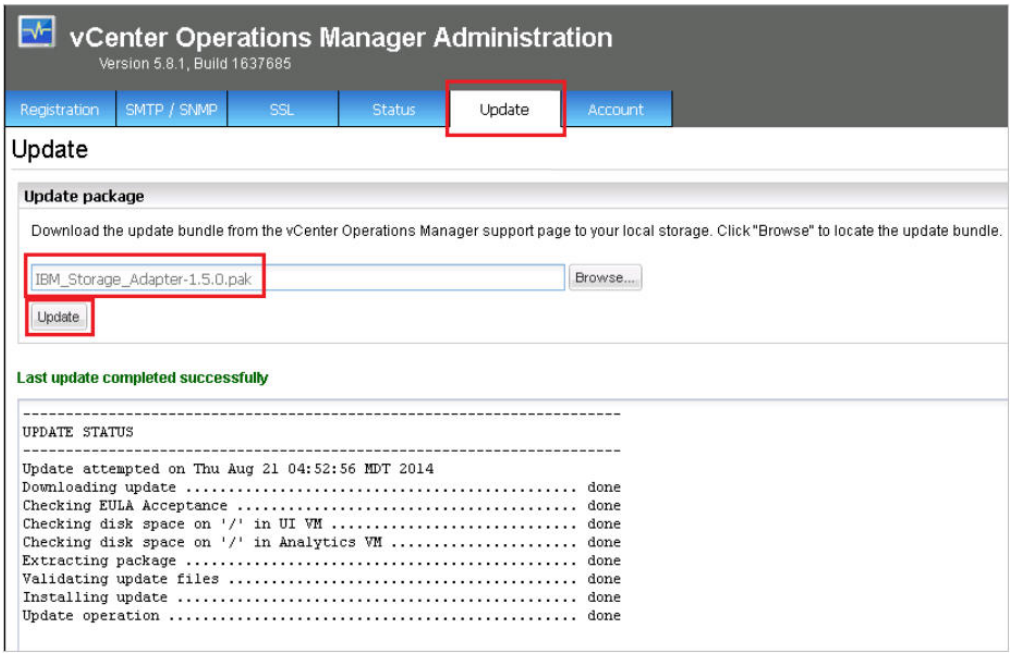


Figure 53. Deploying the management package on the vCOps

4. Accept the IBM license agreement, click **OK** to continue. The confirmation message is displayed.
5. Click **OK** to confirm the update. The vCOps Manager displays a confirmation message after the management package is deployed successfully.

What to do next

See "Describing the management package on vCOps."

Describing the management package on vCOps

After the management package is downloaded and deployed to the computer, it must be described on the vCenter Operations Manager.

About this task

The management package must be described on the vCOps, using the vCenter Operations Manager web-based custom user interface.

Procedure

To describe the management package on the vCOps:

1. Log on to the vCOps via `https://IP address or fully qualified domain name(FQDN) of vCOps server/vcops-custom`, using valid credentials.
2. On the custom user interface main dashboard, click **ADMIN** and then click **SUPPORT** to open the Support page.
3. On the Support page, click the **Info** tab and then click **Describe** to start describing the management pack.

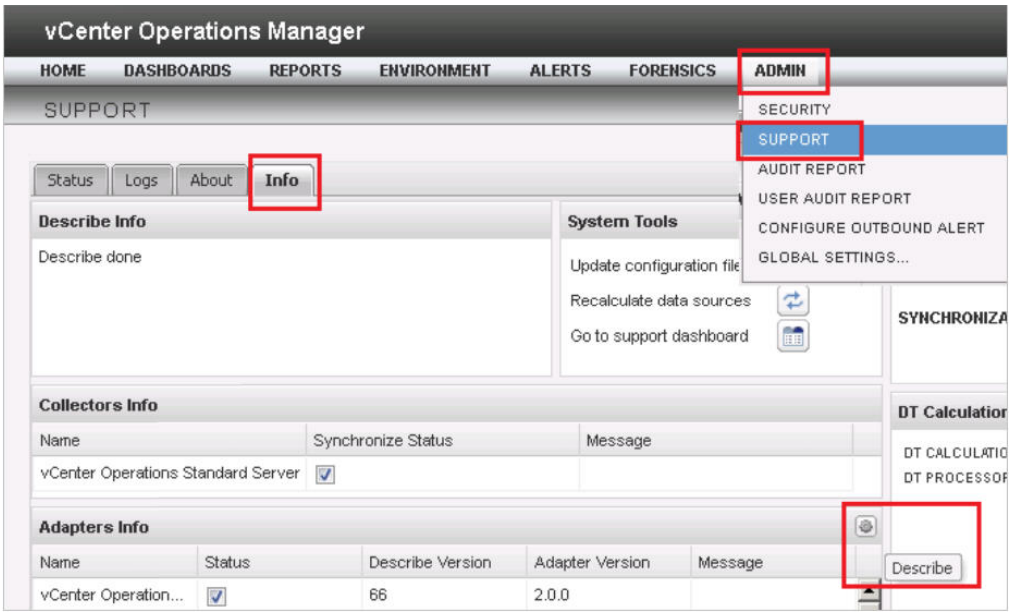


Figure 54. Describing the management package on the vCOps

4. After the description process is completed successfully, refresh the custom user interface and verify that the IBM Storage Adapter is displayed under the **Adapters Info** section.

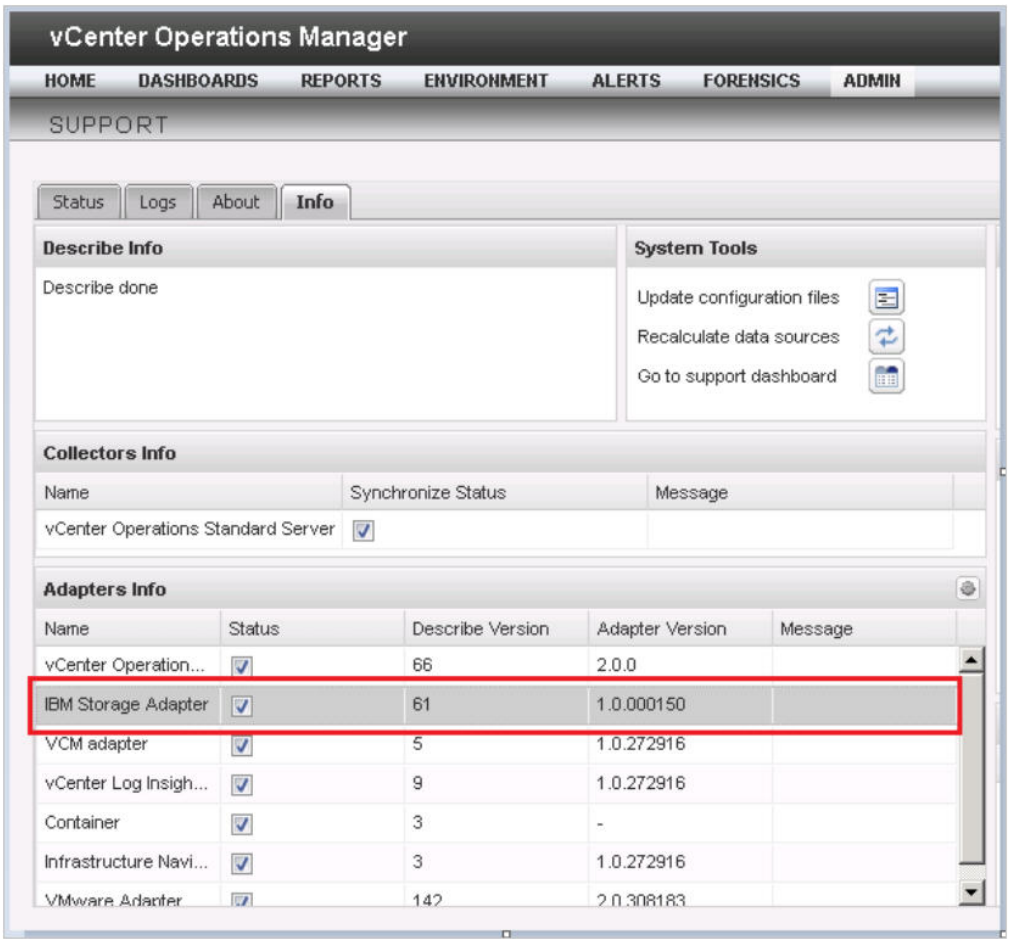


Figure 55. Verifying successful description of the management package on the vCOps

Note: Do not define an adapter instance for the IBM Storage Adapter. It is an external adapter that is managed by Spectrum Control Base.

What to do next

See "GUI – Connecting the vCOps server to Spectrum Control Base."

GUI – Connecting the vCOps server to Spectrum Control Base

After the management package is successfully deployed and described, you must add the vCOps Manager server to IBM Spectrum Control Base Edition.

About this task

The vCenter Operations Manager server must be connected to Spectrum Control Base, as explained below.

Procedure

1. On the **Monitoring** pane, move the mouse pointer over the vCOps server, and then click the **Edit** button. The **Set vCOps Server** dialog box is displayed.
2. Enter IP address or FQDN of the vCenter Operations Manager server, user name, password and select the check box to confirm you have installed the

PAK file on the vCOps Manager server; click **Apply** to save the settings. If the vCOps server connection is successful, its color changes from gray to

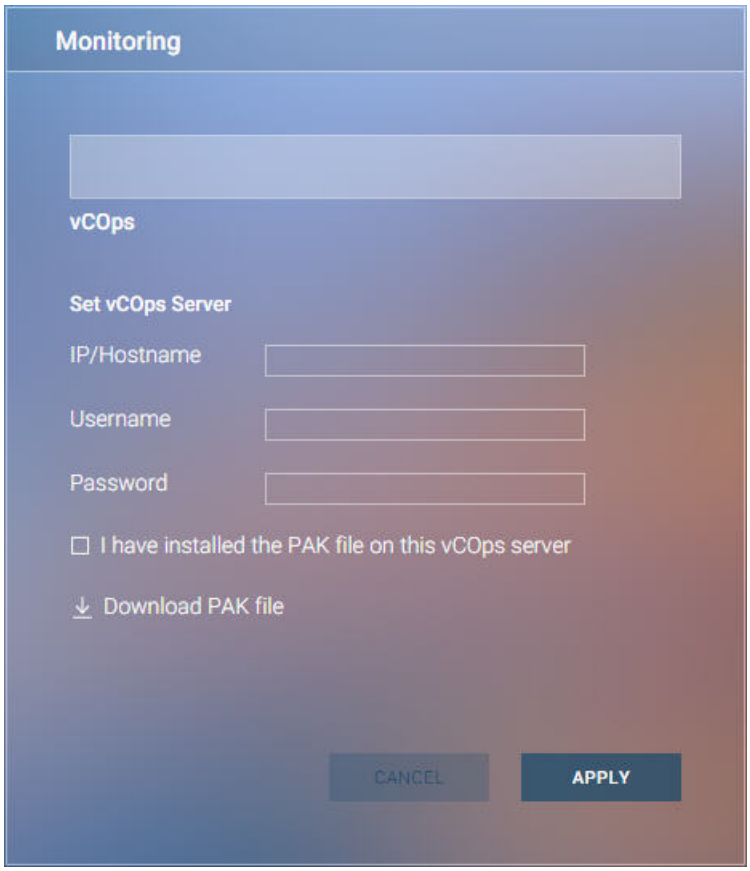


Figure 56. Adding the vCOps server to Spectrum Control Base

green.

What to do next

See "GUI – Attaching and detaching storage systems on the vCOps server."

GUI – Attaching and detaching storage systems on the vCOps server

The IBM storage systems connected to Spectrum Control Base must be added to the vCOps Manager as well.

About this task

To enable monitoring of the IBM storage systems, they must be attached to the vCOps server. You can also detach the systems that do not require monitoring by the vCOps.

Procedure

To manage the storage systems on the vCOps server:

1. On the **Monitoring** pane, click the vCOps server to which you want to attach storage systems.

2. In the **Storage Systems** pane, click a system that you intend to attach to the defined vCOps server. The attached system color changes to green to indicate the connection to the vCOps server. Spectrum Control Base starts pushing the information to vCenter Operations Manager, using HTTP post requests.

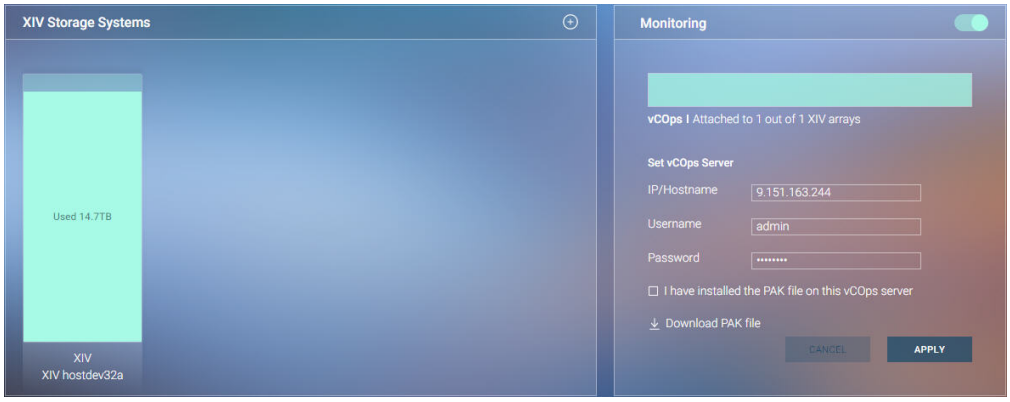


Figure 57. Storage system attached to the vCOps server

You can detach a storage system from the vCOps server by clicking the attached system. When detached, the system color changes to gray.

You can prevent the vCOps server from collecting performance data from the XIV systems by toggling the **Activate** switch ( ).The legend below the vCOps server specifies how many XIV storage systems are attached to the server out of total number of systems defined on Spectrum Control Base. The color of the vCOps server changes from dark to bright green in accordance with the number of attached systems.

Managing Spectrum Control Base from the command-line interface (CLI)

You can access and control Spectrum Control Base by using its command-line interface (CLI) functions locally from the Linux command prompt environment, or from a remote terminal connection.

The following sections describe all the CLI configuration and management functions:

- "CLI – Switching to 'IBMSC' user mode"
- "CLI – Managing Spectrum Control Base users" on page 76
- "CLI – Adding or removing storage system credentials" on page 79
- "CLI – Adding or removing storage systems" on page 81
- "CLI – Setting the VASA credentials" on page 83
- "CLI – Managing integration with vCenter Operations Manager" on page 84

CLI – Switching to 'IBMSC' user mode

To start configuring IBM Spectrum Control Base Edition, you must be logged in as the **ibmsc** user in the Linux command prompt environment.

About this task

ibmsc is a user account that is automatically created after the installation, allowing you to carry out the Spectrum Control Base CLI-based configuration and management operations.

If needed, you can set the password for accessing the **ibmsc** user account externally (for example, from a remote computer over SSH), as described in the following procedure.

Procedure

To set a password for the **ibmsc** user:

1. Log in to the Linux command prompt environment as a root user.
2. Enter **passwd ibmsc** and then enter the password for the user account:

```
[root]# passwd ibmsc
Changing password for user ibmsc.
New password: **********
Retype new password: **********
passwd: all authentication tokens updated successfully.
[root]#
```

What to do next

To switch to the IBMSC user, enter the **su - ibmsc** command:

```
[root]# su - ibmsc
```

CLI – Managing Spectrum Control Base users

All user accounts that can be used to access the IBM Spectrum Control Base Edition must be individually defined.

You can either define (add) a single Spectrum Control Base user account, or define multiple user accounts to be used separately.

Use the **sc_users** CLI command to add, delete, or display user accounts, and also to change the password of any specific account. Use the required argument after the command, as specified in the following table. In addition, you can configure the password reuse policy, using the **sc_setting** CLI command.

Note:

- All CLI command arguments are case-sensitive.
- The same operations are available from the GUI as well, as explained in "GUI – Managing Spectrum Control Base users" on page 36.
- The **sc_users** utility cannot define or affect external directory users. For more information about how to configure directory user access, see "Configuring LDAP-based directory user access" on page 21.

Table 7. Arguments for **sc_users**

Argument	Use after sc_users to:
add -n <username> -p <password> or **add --user_name <username> --user_password <password>**	Add the username and password of the user that may access Spectrum Control Base. You can add more than one user. The minimum password length is seven characters and it must include at least one letter and one digit. For example: `sc_users add -n johnvc -p ********`
change_password -n <username> -p <new password> or **change_password --user_name <username> --user_password <password>**	Change the password of a user account that was already added. The password that you type for the specified username is set as the new password. The minimum password length is seven characters and it must include at least one letter and one digit. For example: `sc_users change_password -n johnvc -p **********`
delete -n <username> or **delete --user_name <username>**	Delete a user account from the server. For example: `sc_users delete -n johnvc`

list	Display the names of currently defined user accounts.
	
	For example:
	`sc_users list`
	`User list:`
	`john_vc`
	`zivkal_vc`
	`lihit_vc`

-h or **--help**	Display help information that is relevant to **sc_users**. You can also display help for the **add_user**, **change_password**, or **delete_user** argument if it is typed on the command line as well.

Table 8. User-related arguments for **sc_setting**

Argument	Use after sc_setting to:
modify -n USER_PASSWORD_HISTORY_LEN -v <password retention number>	Prevent the user to submit a new password that is the same as any of the prior passwords for that account. For example, to prevent the user to submit a new password that is the same as the last four prior passwords, enter: `sc_setting modify -n USER_PASSWORD_HISTORY_LEN -v 4`

CLI – Managing server certificates

During the installation, a self-signed Secure Sockets Layer (SSL) certificate is generated to create a secure communication channel for servers and clients. If you

already have a trusted certificate that you want to use, you can replace the self-signed certificate with an existing trusted certificate or generate a new certificate.

A self-signed certificate file, **vp.crt**, and a certificate key file, **vp.key**, are stored in the following directory:

`/opt/ibm/ibm_spectrum_control/settings/ssl_cert`.

Because the self-signed certificate is not automatically recognized by the web browser that you use to log in to Spectrum Control Base, you might encounter a connection security warning before you can access the Spectrum Control Base login page (see "GUI – Logging in" on page 26).

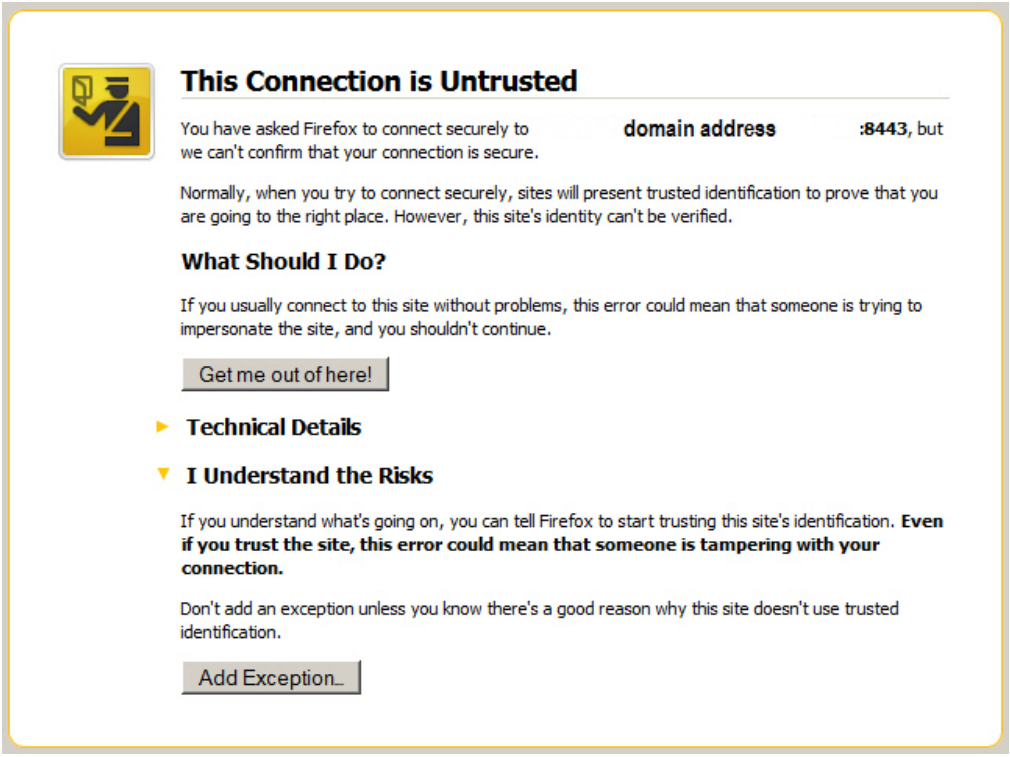


Figure 58. Connection security warning in the Mozilla FireFox web browser

To avoid such warning messages, use the **import** option of the **sc_ssl** command to upload a server certificate which is signed by a public certificate authority (CA), such as VeriSign, or by a CA whose root certificate was imported to your web browser. In addition, you can use the other options of the **sc_ssl** command to generate or to trust an SSL certificate.

Note:

- All CLI command arguments are case-sensitive.
- The same operations are available from the GUI as well, as explained in "GUI – Managing server certificates" on page 33.

Table 9. Arguments for **sc_ssl**

Argument	Use after **sc_ssl** to:
generate -c <common_name> -n <host_name> -i <ip_address> -e <expiration_period>	Enter the hostname, common name, IP address of the Spectrum Control Base server and certificate validity period (in days). For example: `sc_ssl generate -c mycommonname -n "sc_serverhostname" -i 1.0.0.200 -e 5000`
trust -c <certificate_path>	Select an SSL certificate to be trusted, by providing a path to its location. For example: `sc_ssl trust -c CA_certificate.crt`
import -c <certificate_path> -k <key_path>	Import a SSL certificate and a key file, by providing paths to their locations. For example: `sc_ssl import -c self_signed_certificate.crt -k private_key.key`
-h	Display help information that is relevant to **sc_ssl**. You can also display help for the **generate**, **trust**, or **import** argument if it is typed on the command line as well.

CLI – Adding or removing storage system credentials

This section explains how to set the credentials that will be used to connect to the IBM storage system, or systems, that your VMware platforms use for storage provisioning.

Important:

- An identical storage admin user account with identical credentials (the same username and password) must already be predefined on all the IBM storage systems that you intend to use. Spectrum Control Base can use only **a single system management account** for accessing all the different storage systems that you use. For more information about how to define a storage admin account on your IBM storage systems, refer to the relevant storage system management tools documentation.
- Setting the storage credentials on Spectrum Control Base allows you to add the IBM storage systems on the next step.
- If the storage system management account is defined on a directory server, see "Checking the format of directory-based storage system credentials" on page 141.

Use the **sc_storage_credentials** CLI command to set (add), remove, or display the current storage system access credentials that Spectrum Control Base uses in order to access all the IBM storage systems. Use the required argument after the command, as specified in the following table.

Note:

- All CLI command arguments are case-sensitive.
- The same operations are available from the GUI as well, as explained in "GUI – Entering the storage system credentials" on page 40.

Table 10. Arguments for **sc_storage_credentials**

Argument	Use after **sc_storage_credentials** to:

set -u <storage system username>
 	
-p <storage system password>
 	
-f
 	
-a <user type>
 	
or
 	
set --user <storage system username>
 	
--password <storage system password>
 	
--force
 	
--user_account <user type>
	Set the username and password for accessing all the relevant IBM storage systems, and specify whether the storage admin user is locally-defined on the storage system or on a directory server. For storage systems running Spectrum Virtualize, ensure that the credentials belong to a user account with *VASAProvider* role.
	
	For example, if the storage admin user is locally defined on the storage system, enter:
	`sc_storage_credentials set -u john21 -p ******** -a local`
	
	And if the storage admin user is defined on a directory server, enter:
	`sc_storage_credentials set -u john21 -p ******** -a directory`
	
	Attention: During regular operation, whenever a directory-based storage admin fails to log in (from the Spectrum Control Base side) to any storage system that is in use, Spectrum Control Base immediately locks the storage admin user account and all storage systems become inaccessible on the Spectrum Control Base side. This is to prevent repeated login attempt failures after which the directory server blocks that user account. In such a case, use the **-f** or **--force** argument on the command line to unlock the storage admin account on the Spectrum Control Base side, with either the same credentials or with updated credentials. For example:
	`sc_storage_credentials set -u john21 -p ******** -f -a directory`
	
	The equivalent action in the Spectrum Control Base GUI is to update the account credentials, as described in "GUI – Entering the storage system credentials" on page 40.
	
	If the storage credentials are defined on a directory server, see "Checking the format of directory-based storage system credentials" on page 141.

remove	Delete the existing storage system user account definition from the server. For example: `sc_storage_credentials remove` **Attention:** If you already added storage systems to the server, deleting the user account disconnects all these storage systems.

Table 10. Arguments for **sc_storage_credentials** *(continued)*

Argument	Use after **sc_storage_credentials** to:

list	Display the username of the existing storage system user account definition.
	
	The following example shows the command output when the storage admin user account is defined locally on the storage system:
	
	`sc_storage_credentials list`
	
	`Username  Array Alias  User Category  Account Source`
	`----------  ----------------  ---------------  ----------------`
	`admin  XIV hostdev31b  storageadmin  local`
	`admin  XIV hostdev32a  storageadmin  local`
	`admin  XIV hostdev31a  storageadmin  local`
	
	The following example shows the command output when the storage admin user account is defined on a directory server:
	
	`sc_storage_credentials list`
	
	`Username  Array Alias  User Category  Account Source`
	`----------  ----------------  ---------------  ----------------`
	`admin  XIV hostdev31b  storageadmin  directory`
	`admin  XIV hostdev32a  storageadmin  directory`
	`admin  XIV hostdev31a  storageadmin  directory`

-h or **--help**	Display help information that is relevant to **sc_storage_credentials**. You can also display help for the **set** argument if it is typed on the command line as well.

CLI – Adding or removing storage systems

All IBM storage systems that provide storage resources to your VMware platforms must be defined as storage systems on the IBM Spectrum Control Base Edition.

Use the **sc_storage_array** CLI command to add, remove, or list these IBM storage systems (referred to as *arrays* in the command syntax and output). Use the required argument after the command, as specified in the following table.

Important:

- IBM storage systems can be added only after the storage credentials are set, as explained in "CLI – Adding or removing storage system credentials" on page 79.
- If you want to remove existing storage systems:
  - A removed storage system, along with its storage pools and volumes, can no longer be managed by the included solution components (see "Included cloud interfaces" on page 1).
  - If the removed storage system contains working storage pools and volumes, the information of these storage pools and volumes is no longer displayed in vSphere Web Client. However, **vSphere data access and service level for these storage pools and volumes is not affected**. In addition, the removed system and its storage pools and volumes can be managed from the standard IBM storage system management tools.
  - After the removal, you can add the storage system back again to fully restore its management.

Note:

- All CLI command arguments are case-sensitive.
- The same operations are available from the GUI as well, as explained in "GUI – Managing storage systems" on page 39.

Table 11. Arguments for **sc_storage_array**

Argument	Use after **sc_storage_array** to:

add -i <management IP address> -t <storage system type> -a <system alias name>
 	
or
 	
add --mgmt_ip <management IP address> --storage_type <storage system type> --alias <system alias name>
	Add a storage system specified by an IP address or DNS, and its type.
	
	For the **-t** argument, specify the storage system type as follows:
	• **xiv** for XIV
	• **svc** for storage systems that run IBM Spectrum Virtualize
	• **ds8k** for DS8000
	
	For example:
	`sc_storage_array add -i 10.100.155.200 -t xiv`
	
	Optional: you can define an alias for the added XIV system, by adding **-a <alias name>** or **--alias <alias name>** to the command.
	
	For example:
	`sc_storage_array add -i 10.100.155.200 -t xiv -a mystorage1`
	
	Note: If you choose not to define an alias, the alias that is already defined (if one was defined) on the IBM storage system side is automatically assigned as the alias.

remove -a <system alias name> or **remove --alias <system alias name>**	Remove a storage system specified by its alias (alias that was given by you or was automatically assigned). For example: `sc_storage_array remove -a mystorage1`
list	List the names and details of all the IBM storage systems that are currently added (and were not removed). The displayed information includes: • Array alias • Array identifier • Management IP address • Elapsed time since last update • Connected • Notes See the example after this table.
refresh	Refresh information about all managed IBM storage systems.

Table 11. Arguments for **sc_storage_array** *(continued)*

Argument	Use after **sc_storage_array** to:
-h or **--help**	Display help information that is relevant to **sc_storage_array**. You can also display help for the **add** or **remove** argument if it is typed on the command line as well.

The following example shows the displayed information and format of the **sc_storage_array list** command output.

```
sc_storage_array list

 Array       Array             Management       Elapsed time
 Alias       Identifier        IP Addresses     since last update    Connected    Notes
 ----------  ----------------  -------------    ------------------   ----------   --------------------------------
 array1000   2810-114-MN65026  9.100.150.155    16 minutes           False        Failed to log in to array 2810
                                                                                  with the provided credentials.

 array2000   2810-114-MN65027  9.200.155.155    27 minutes           True
```

CLI – Setting the VASA credentials

The VASA credentials comprise a user name and a password that VMware vCenter servers can use to connect to the IBM Spectrum Control Base Edition and employ VMware vSphere APIs for Storage Awareness (VASA) functions.

Use the **sc_vasa_admin** CLI command to set or display the VASA credentials. vCenter servers can then use these credentials to connect to Spectrum Control Base and utilize VASA functions, as explained in "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91. Use the required argument after the command, as specified in the following table.

Note:

- Only one set of a username and a password can be used for the VASA credentials, which applies to all vCenter servers that require VASA functions.
- All CLI command arguments are case-sensitive.
- The same operations are available from the GUI as well, as explained in "GUI – Setting the VASA credentials" on page 46.

Table 12. Arguments for **sc_vasa_admin**

Argument	Use after **sc_vasa_admin** to:

set_secret -n <username> -p <password>
 	
or
 	
set_secret --user_name <username> --user_password <password>
	Set the username and password that the VASA credentials should comprise.
	
	For example:
	`sc_vasa_admin set_secret -n johnvasa -p ********`
	`The secret key for the VASA Provider has been set successfully.`

Table 12. Arguments for **sc_vasa_admin** *(continued)*

Argument	Use after **sc_vasa_admin** to:

list_secret	Display the username of the currently defined VASA credentials.
	
	For example:
	`sc_vasa_admin list_secret`
	`Secret key username for the VASA Provider:`
	`johnvasa`

-h or **--help**	Display help information that is relevant to **sc_vasa_admin**. You can also display help for the **set_secret** argument if it is typed on the command line as well.

CLI – Managing integration with vCenter Operations Manager

Before you can use the IBM Storage Management Pack for VMware vCenter Operations Manager, you must set a connection to at least one vCenter Operations Manager (vCOps) server, and then define which storage systems should be monitored in vCOps.

After a vCOps server connection is defined and storage systems (referred to as *arrays* in the command syntax and output) are associated with the vCOps server, detailed monitoring information for these storage systems becomes available in vCOps (for more information, see Chapter 7, "Using the IBM Storage Management Pack for VMware vCenter Operations Manager," on page 121).

Use the **sc_vcops_server** CLI command to add, remove, or disable connections to vCOps servers, or to list the current server connections. An HTTP POST adapter is automatically created for each vCOps server that you add.

Use the **sc_vcops_adapter** command to attach storage systems to any created HTTP POST adapter. A storage system that is attached to an HTTP POST adapter can be monitored by the vCOps server for which the HTTP POST adapter was created. You can use the **sc_vcops_adapter** command for additional options as described below.

Use the required argument after each command, as specified in the following tables.

Important:

- Storage systems can be attached to HTTP POST adapters only after the storage systems have been added to Spectrum Control Base, as explained in "CLI – Adding or removing storage systems" on page 81.
- If the IBM Storage PAK file was not deployed on the vCOps server, IBM Storage monitoring information is not displayed with dedicated dashboards, graphic icons, and user-friendly attribute names in vCOps. For information about how to deploy the IBM Storage PAK file, see "GUI – Downloading the vCOps management package" on page 70.
- If you want to detach storage systems:
  - A detached storage system can no longer be monitored through vCenter Operations Manager.
  - After the detachment, you can reattach the storage system to fully restore its monitoring through vCenter Operations Manager.

Note:

- All CLI command arguments are case-sensitive.
- Apart from the ability to add more than one vCOps server and additional HTTP POST adapters from the CLI, the same operations are available from the GUI as well, as explained in "GUI – Managing integration with vCenter Operations Manager" on page 68.

Table 13. Arguments for **sc_vcops_server**

Argument	Use after **sc_vcops_server** to:
add -n <hostname> -u <username> -p <password> or **add --hostname <hostname> --username <username> --password <password>**	Add a vCOps server connection by specifying the following parameters on the command line: • IP address or hostname of the vCOps server that you want to add (connect to). • Username for accessing the vCOps server. • Password for accessing the vCOps server. For example: `sc_vcops_server add -n vcops1.domain -u johnl -p ********` **Note:** The local HTTP POST adapter is added automatically after the vCOps server is added.
remove -n <hostname> or **remove --hostname <hostname>**	Remove a vCOps server connection by specifying its IP address or hostname on the command line. For example: `sc_vcops_server remove -n vcops1.domain` **Note:** A removed vCOps server ceases to receive monitoring information regarding IBM storage resources that are in use. You can add a vCOps server back by using the **add** option (see above).

Table 13. Arguments for **sc_vcops_server** *(continued)*

Argument	Use after **sc_vcops_server** to:
disable -n <hostname> or **disable --hostname <hostname>**	Disable reporting to a vCOps server (without removing its connection) by specifying its IP address or hostname on the command line. For example: `sc_vcops_server disable -n vcops1.domain` **Note:** A vCOps server for which reporting is disabled ceases to receive monitoring information regarding IBM storage resources that are in use. You can resume reporting to a vCOps server by using the **enable** option (see below).
enable -n <hostname> or **enable --hostname <hostname>**	Resume reporting to a vCOps server by specifying its IP address or hostname on the command line. For example: `sc_vcops_server enable -n vcops1.domain`

list	List all the currently connected (added) vCOps servers and their operation status (enabled or disabled).
	
	For example:
	`sc_vcops_server list`
	
	`vCOps Hostname  Status`
	`--------------  -------`
	`vcops1.domain  Enabled`
	`vcops2.domain  Disabled`

-h or **--help**	Display help information that is relevant to **sc_vcops_server** . You can also display help for the **add**, **remove**, **enable**, or **disable** argument if it is typed on the command line as well.

Table 14. Arguments for **sc_vcops_adapter**

Argument	Use after **sc_vcops_adapter** to:
array_attach -a <alias> -n <hostname> or **array_attach --alias <alias> --hostname <hostname>**	Attach a storage system to a vCOps HTTP POST adapter (of a vCOps server) by specifying the following parameters on the command line: • Alias name of the storage system that you want to attach. • IP address or hostname of the storage system that you want to attach. For example: `sc_vcops_adapter array_attach -a myXIV -n 9.150.200.100` **Note:** The storage system must already be added to Spectrum Control Base, as explained in "CLI – Adding or removing storage systems" on page 81.

Table 14. Arguments for **sc_vcops_adapter** *(continued)*

Argument	Use after **sc_vcops_adapter** to:
array_detach -a <alias> -n <hostname> or **array_detach --alias <alias> --hostname <hostname>**	Detach a storage system from a vCOps HTTP POST adapter (of a vCOps server) by specifying the following parameters on the command line: • Alias name of the storage system that you want to detach. • IP address or hostname of the storage system that you want to detach. For example: `sc_vcops_adapter array_detach -a myXIV -n 9.150.200.100`
add -s <server> -n <hostname> or **add --server <server> --hostname <hostname>**	Add an HTTP POST adapter for a vCOps server by specifying the following parameters on the command line: • IP address or hostname of a currently added (connected) vCOps server. • IP address or hostname of the HTTP POST adapter that you want to add. For example: `sc_vcops_adapter add -s vcops1.domain -n adapter2.domain`
remove -n <hostname> or **remove --hostname <hostname>**	Remove an HTTP POST adapter by specifying its IP address or hostname on the command line. For example: `sc_vcops_adapter remove -n adapter2.domain`
report_thresholds -n <hostname> or **report_thresholds --hostname <hostname>**	Report the thresholds to a vCOps server by specifying its IP address or hostname on the command line. For example: `sc_vcops_adapter report_thresholds -n vcops1.domain`
report_thresholds -a or **report_thresholds -all**	Report the thresholds to all vCOps servers that are currently added (connected). Usually, this command can be omitted, because the thresholds are defined by default, when a vCOps server is added. `sc_vcops_adapter report_thresholds -a`

list	List all the currently defined HTTP POST adapters and display their associated vCOps server, alias name of attached storage systems, last report time (report to the vCOps server), and indication regarding whether the adapter is remote or locally defined.
	
	For example:
	`sc_vcops_adapter list`
	
	`vCOps Hostname  HTTP POST Hostname  Remote  Last Reported  Array alias`
	`--------------  ------------------  ------  -------------  -----------`
	`vcops1.domain   adapter1.domain     No      5 minutes ago  myXIV`
	`vcops2.domain   adapter2.domain     Yes     8 minutes ago  myXIV`

Table 14. Arguments for **sc_vcops_adapter** *(continued)*

Argument	Use after **sc_vcops_adapter** to:
-h or **--help**	Display help information that is relevant to **sc_vcops_adapter**. You can also display help for the **array_attach**, **array_detach**, **add**, **remove**, or **report_thresholds** argument if it is typed on the command line as well.

CLI – Backing up or restoring a Spectrum Control Base configuration

At any point, you can back up the current Spectrum Control Base configuration and save it to a file, or load a previously saved configuration to restore a configuration.

The configuration includes storage credentials, storage systems, vCenter credentials, and storage resource attachments.

Use the **sc_configuration** CLI command to save the existing configuration, or load a saved configuration to replace the existing one. Use the required argument after the command, as specified in the following table.

Note:

- All CLI command arguments are case-sensitive.
- The backup and restore operations are not available on the Spectrum Control Base GUI.

Attention:

- Before using the **restore** option, the IBM VASA Provider service must be stopped as explained in "Checking and controlling the Spectrum Control Base service" on page 135. Start the service again after the configuration has been loaded.
- **restore** should be used only with a freshly installed Spectrum Control Base that has not yet been configured.

Table 15. Arguments for **sc_configuration**

Argument	Use after **sc_configuration** to:
backup -f <file name> -k <32characters> or **backup --file <file name> --key <32 characters>**	Save the current IBM Storage Provider configuration to the specified file using an AES-256 encryption key that comprises 32 characters. For example: `sc_configuration backup -f confbackup -k abcdefghijklmnop` **Important:** You will need to provide this key in any restore operation (see below).

Table 15. Arguments for **sc_configuration** *(continued)*

Argument	Use after **sc_configuration** to:
restore -f <file name> -k <32 characters> or **restore --file <file name> --key <32 characters>**	Load a configuration from a specified file by providing the file name and the encryption key that was used in the creation of the file. **Attention:** See the notes above this table. For example: `sc_configuration restore -f confgbackup -k abcdefghijklmnop`
restore -f ./vasa115exported.db	Restore an existing Spectrum Control Base configuration that was made with IBM Storage Provider for VMware VASA version 1.1.5 (applicable only to XIV systems). For this restore operation, you do not need to provide an encryption key: `sc_configuration restore -f ./vasa115exported.db`
-h or **--help**	Display help information that is relevant to **sc_configuration**. You can also display help for the **backup** or **restore** argument if it is typed on the command line as well.

Chapter 4. Using the IBM Storage Provider for VMware VASA

This chapter focuses on how to use the IBM Storage Provider for VMware VASA after the required configuration on IBM Spectrum Control Base Edition has been completed.

After the IBM storage systems have been added to Spectrum Control Base, and after the VASA access credentials were set (see "Required and optional initial tasks" on page 19), you can start using the IBM Storage Provider for VMware VASA by registering Spectrum Control Base in the relevant vCenter server or servers.

Registering Spectrum Control Base as a storage provider in vCenter server

To use the IBM Storage Provider for VMware VASA solution component, you need to register IBM Spectrum Control Base Edition as a storage provider on VMware vCenter server.

Before you begin

- When the IBM Storage Provider for VMware VASA and the IBM Tivoli® Storage Productivity Center (TPC) storage provider are registered on the same VMware vCenter server, while the same storage system is configured for both, vCenter uses IBM Tivoli Storage Productivity Center provider **as the only source of information** for that system's storage views on vSphere Web Client.

  In such a case, determine whether the IBM Tivoli Storage Productivity Center capabilities are sufficient for replacing the IBM Storage Provider for VMware VASA. If the IBM Storage Provider for VMware VASA is still needed, IBM TPC 5.2 (or later) provides a method of excluding storage systems from a specific storage provider, allowing you to remove the system association with the IBM TPC provider.
- The **date and time** that are defined on both the vCenter server and on Spectrum Control Base must be identical. To accurately synchronize the date and time between the two servers, you can connect both to a Network Time Protocol (NTP) server.

Note: VMware VASA 2.0 is required for implementing virtual volume functionality.

About this task

The following procedure describes how to register Spectrum Control Base on a single vCenter server by using vSphere Web Client.

Procedure

To register Spectrum Control Base in VMware vCenter Server, complete the following steps.

1. In vSphere Web Client, click **vCenter** > **vCenter Servers**, and click on vCenter server, which has been already connected to Spectrum Control Base.
2. On the **Manage** tab, click **Storage Providers**.

3. Click the plus sign to add a new storage provider.

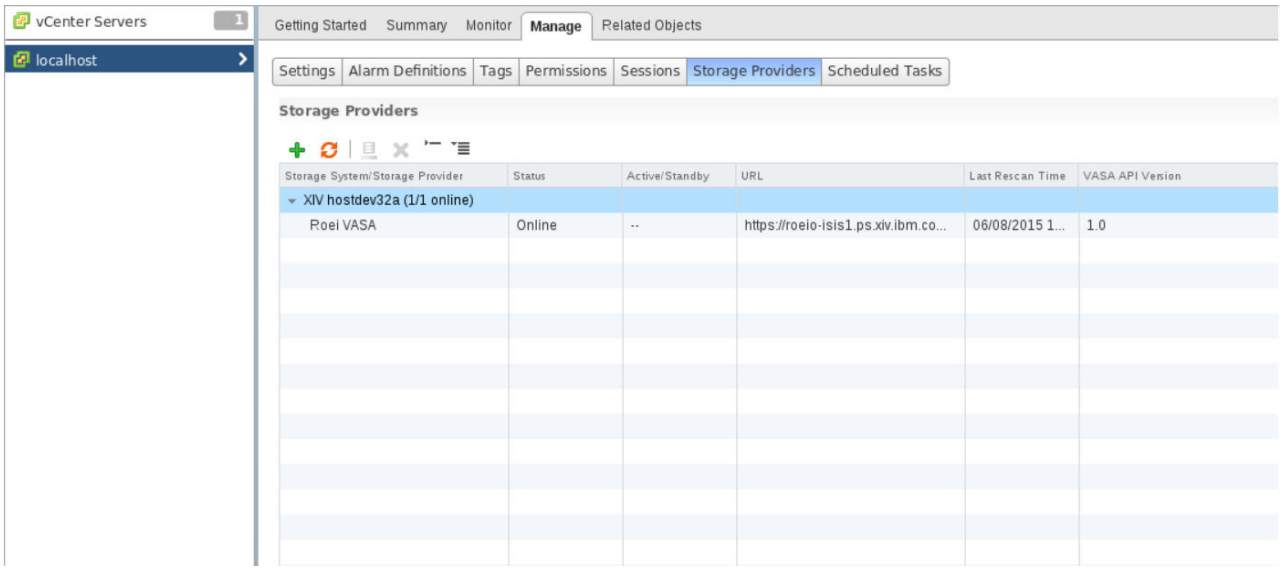


Figure 59. vSphere Web Client – Storage Providers list

The New Storage Provider dialog box is displayed.

4. Enter the name, URL, and pre-configured username and password (VASA Secret) for accessing Spectrum Control Base (the VASA Secret is predefined as explained in "GUI – Adding a new user" on page 37). The URL should be entered in the *ip:port* format, specifying the relevant IP address and port number of Spectrum Control Base:
   - `https://[Spectrum Control Base IP address]:8443/services/vasa1` for VASA 1.0
   - `https://[Spectrum Control Base IP address]:8443/services/vasa` for VASA 2.0

Note: In this example, "`Spectrum Control Base IP address`" stands for the IP address or domain namespace of Spectrum Control Base .

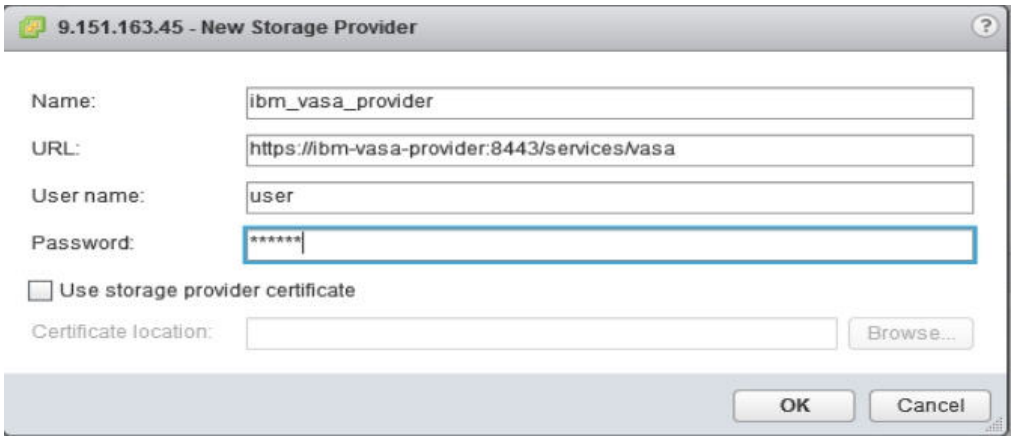


Figure 60. New Storage Provider dialog box for VASA 2.0

5. Click **OK**. A security alert dialog box is displayed.

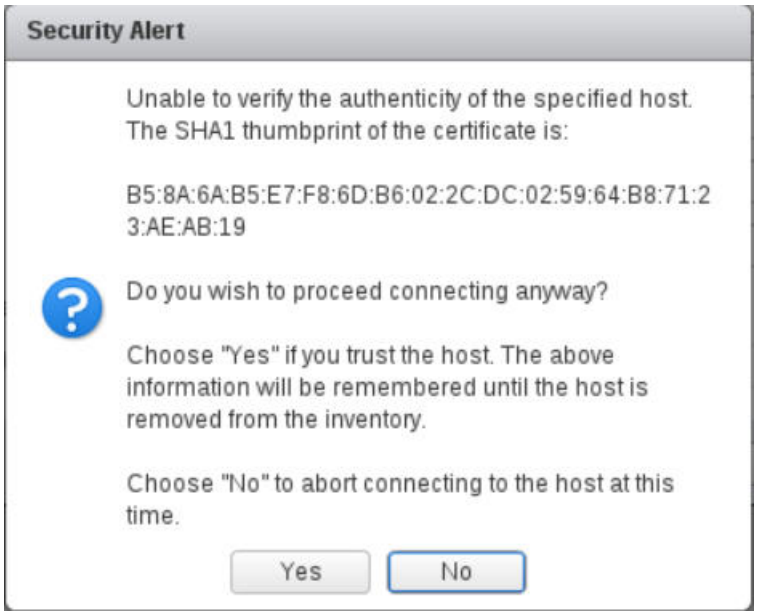


Figure 61. vCenter certificate thumbprint dialog box

6. Click **Yes** to accept the certificate. Spectrum Control Base is added to vCenter Server.

Note: The certificate provides improved security by adding server authentication.

If, during the registration process, you have an active Spectrum Control Base instance, restart your web browser or refresh the Spectrum Control Base GUI window to ensure the successful acquisition of the new server certificate.

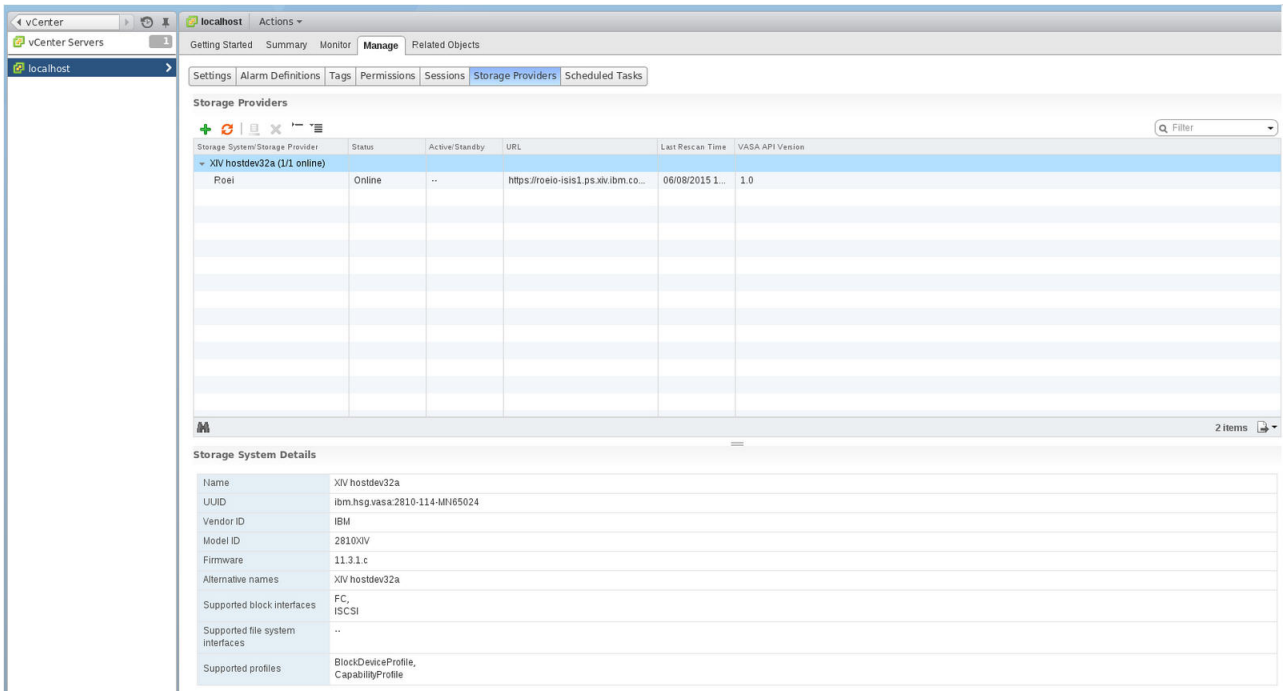


Figure 62. Storage Providers list displaying Spectrum Control Base

7. You can ensure continuous storage management by combining multiple Spectrum Control Base instances, registered as storage providers, into high-availability groups. This process is described in "GUI – Defining a high-availability group" on page 32.

Note: Storage spaces and services defined on an active storage provider do not appear on the standby Spectrum Control Base. The spaces and services become visible on the Spaces/Services pane of the Spectrum Control Base GUI, when it becomes active after system failover.

Some operations on a VVol-based VM with deployed Spectrum Control Base instance, such as hard disk removal, may result in the `Invalid Virtual Machine configuration` message, displayed by the vWC. This message is not relevant to the VM functionality and indicates a loss of connectivity between the Spectrum Control Base and the vCenter server.

Chapter 5. Using the IBM Storage Enhancements for VMware vSphere Web Client

Together with supported IBM storage systems that are managed by IBM Spectrum Control Base Edition, the deployed IBM Storage Enhancements enable the following management features on vSphere Web Client for registered vCenter servers:

- Full control over storage volumes, including volume creation, resizing, renaming, migration to a different storage pool, mapping, unmapping, multipath policy enforcement, and deletion.
- Easy and integrated allocation of volumes to VMware datastores, used by virtual machines that run on ESXi hosts, clusters, or datacenters.

Note:

- The IBM Storage Enhancements are automatically deployed and made available for the vCenter servers that were registered (added) on IBM Spectrum Control Base (see "GUI – Adding a vCenter server" on page 60).
- For information about the required vSphere user privileges, see "Required vSphere privileges."

See the following sections for more information:

- "Populating vCenter server information to Spectrum Control Base" on page 97
- "Viewing the IBM storage resource information" on page 99
- "Creating and mapping a new storage volume (LUN)" on page 103
- "Extending a volume" on page 110
- "Renaming a volume" on page 111
- "Setting multipath policy enforcement for a volume" on page 112
- "Moving a volume to another storage pool" on page 113
- "Unmapping a volume from one or more hosts" on page 114
- "Deleting an unused volume" on page 115

Required vSphere privileges

To operate the IBM Storage Enhancements for VMware vSphere Web Client, you must have the minimum required privileges defined in your vSphere user role.

Use the **Role Manager** extension in vSphere Web Client to define the required privileges for your user role as detailed in the following table.

Table 16. Required vSphere privileges

Task	Required vSphere user privilege
Adding a vCenter server to the IBM Spectrum Control Base (see "GUI – Adding a vCenter server" on page 60)	• **Extension** – In this category, select **Register extension**, **Unregister extension**, and **Update extension**. • **Global** – In this category, select **Log event** and **Cancel task**. • **Tasks** – In this category, select **Create task** and **Update task**. • **Sessions** – In this category, select **Impersonate user**. • **Host** – In this category, select **Configuration** > **Storage partition configuration**.
Storage provisioning (volume creation and management) from vSphere Web Client (see Chapter 5, "Using the IBM Storage Enhancements for VMware vSphere Web Client," on page 95)	

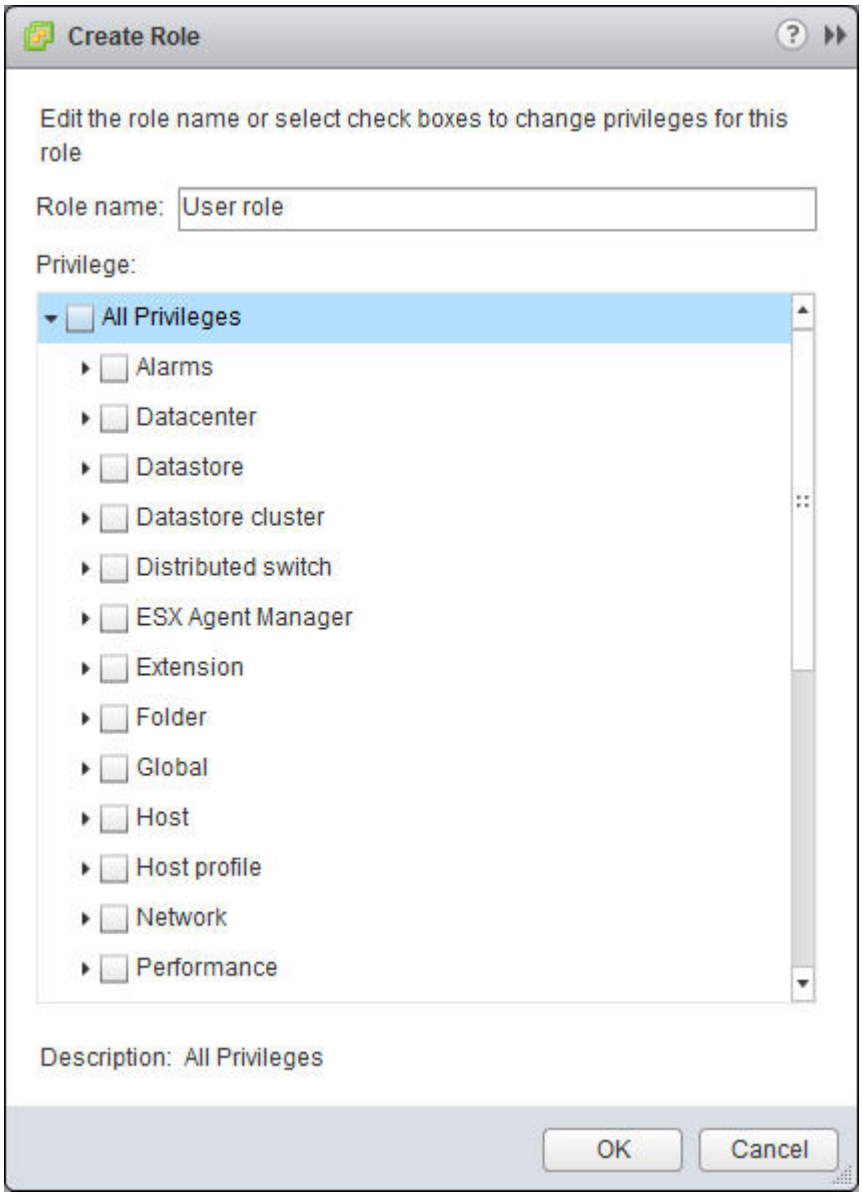


Figure 63. VMware vSphere Web Client – Create Role dialog box

For more detailed information about how to set the vSphere Web Client privilege types, refer to the VMware vSphere 5.1 Documentation Center (pubs.vmware.com/vsphere-51/index.jsp).

Populating vCenter server information to Spectrum Control Base

At any time and whenever needed, you can manually update the vCenter server information on the IBM Spectrum Control Base Edition side.

About this task

By default, the vCenter server information is automatically updated on Spectrum Control Base every 30 minutes (as defined in `vwc_config.ini`, see "Checking and modifying the configuration files" on page 136). If you want to run the update earlier without having to wait for the next automatic update, perform the following procedure.

Important: Before you can use this option, the relevant vCenter server must already be added on Spectrum Control Base, as explained in "GUI – Adding a vCenter server" on page 60.

Procedure

1. In vSphere Web Client, focus on the relevant vCenter server.
2. Refresh Spectrum Control Base, as follows:
   - In vSphere 6.0, go to **Manage** > **Settings** > **IBM Server**, and click **Refresh IBM Spectrum Control**.
   - In vSphere 5.5, go to the Actions menu, select **All IBM Storage Enhancements for...** > **Refresh IBM Spectrum Control**.

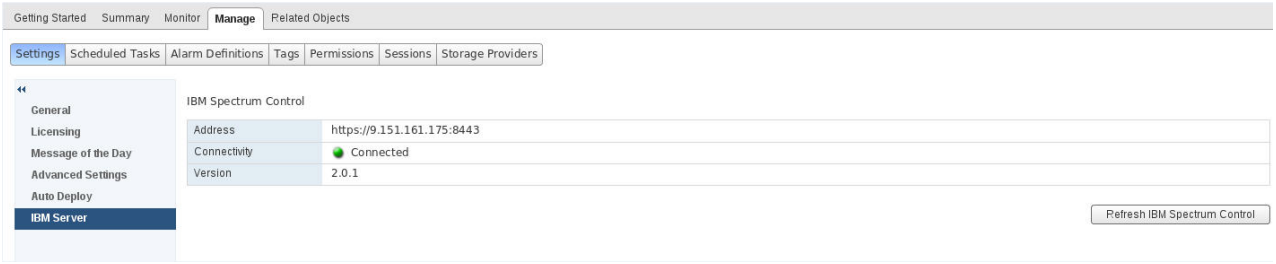


Figure 64. Populate vCenter Information option in vSphere 6.0

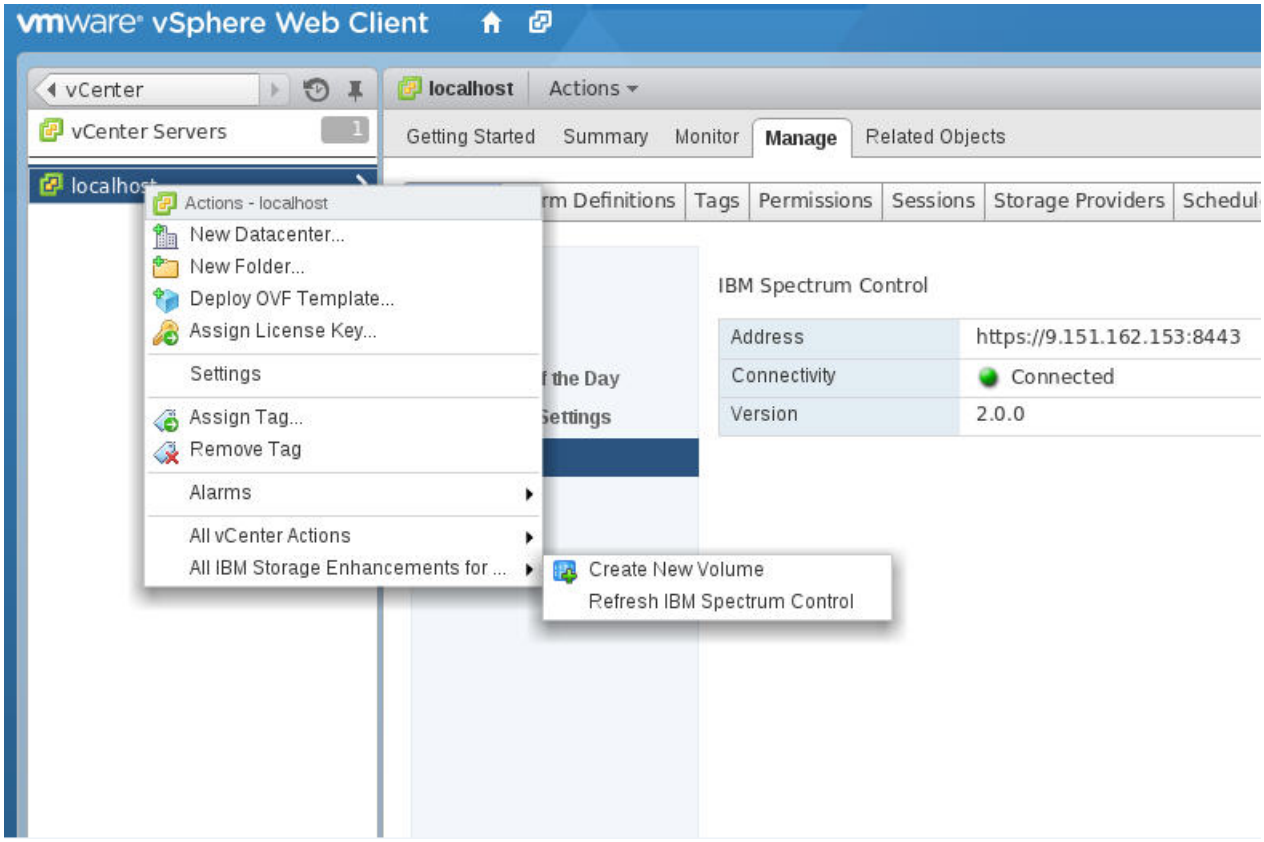


Figure 65. Populate vCenter Information option, vSphere 5.5

3. A confirmation message appears.

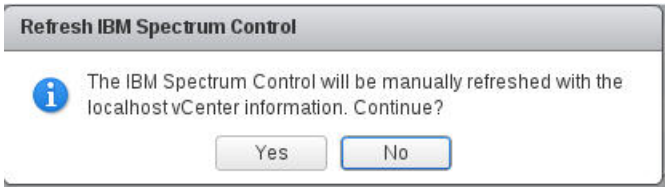


Figure 66. Populate vCenter confirmation message

4. Click **Yes** to send the specified vCenter information to Spectrum Control Base.

Viewing the IBM storage resource information

After the IBM Storage Enhancements for VMware vSphere Web Client are properly installed, the IBM Storage category is shown under the standard vSphere Web Client categories for each vCenter server, as shown in the following figure.

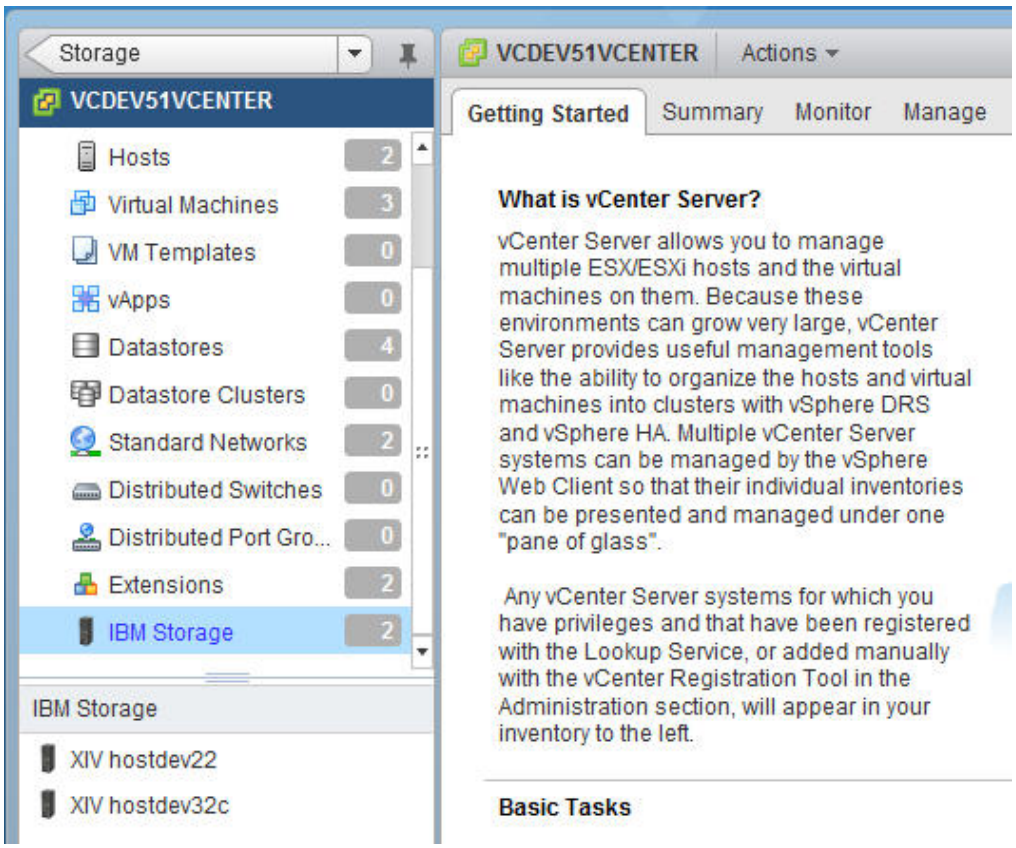


Figure 67. IBM Storage category in vSphere Web Client

For each vCenter server, the IBM Storage category shows how many IBM storage systems are available for that vCenter server. The number and type of available IBM storage systems is determined on the IBM Spectrum Control Base side, as explained in “GUI – Managing storage systems” on page 39 and “GUI – Managing integration with vSphere Web Client” on page 59.

You can click and open the IBM Storage category, and then click an IBM storage system to view the currently available storage volumes on that particular storage system, and also to check which VMware entities are currently using storage resources on that storage system.

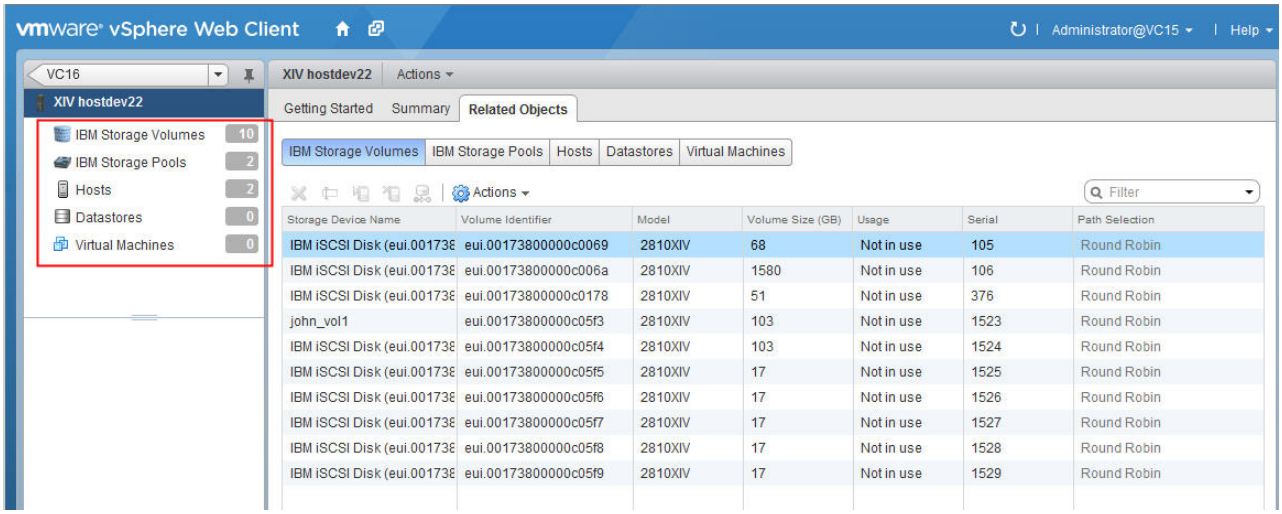


Figure 68. IBM Storage information per storage system

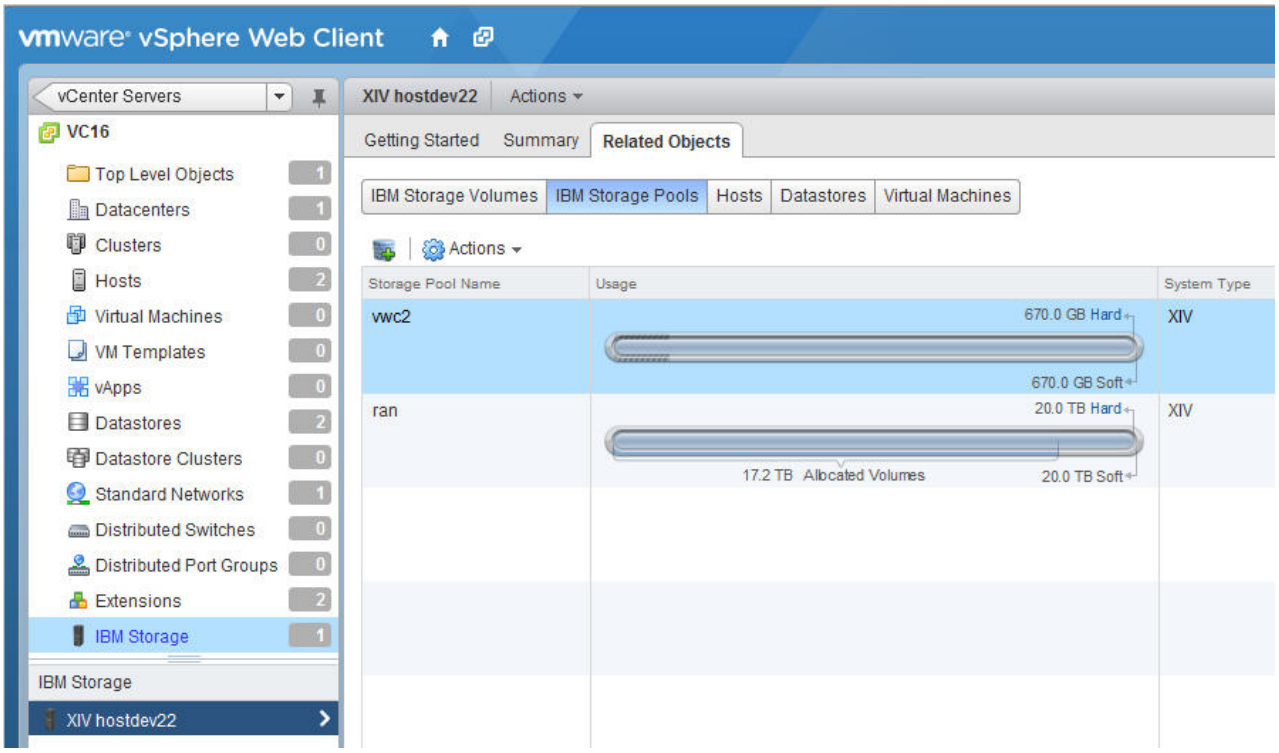


Figure 69. Currently available storage pools per storage system

In addition, IBM Storage information and functions are available per vCenter server in the different category views on the **Related Objects** tab, as shown in the following figures.

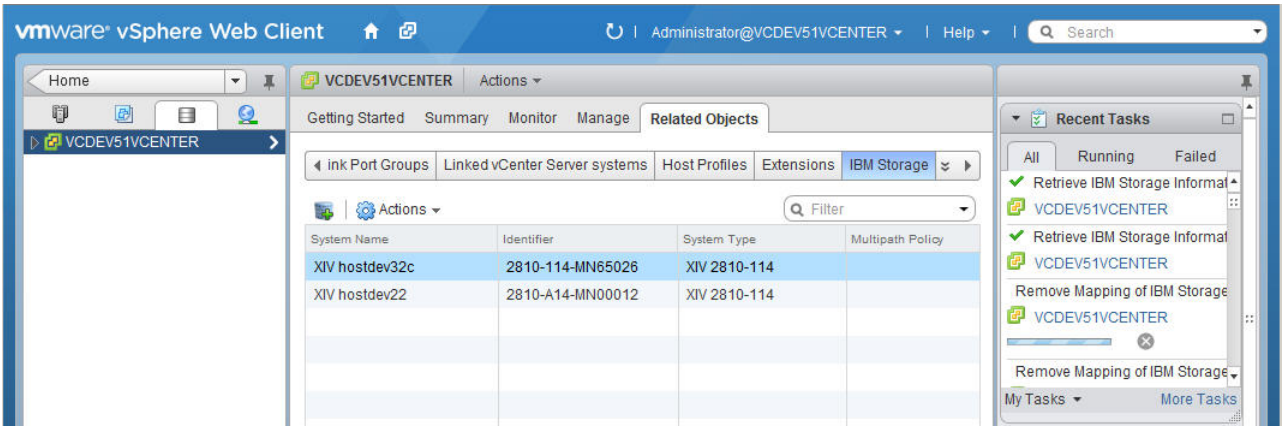


Figure 70. IBM Storage information per vCenter server

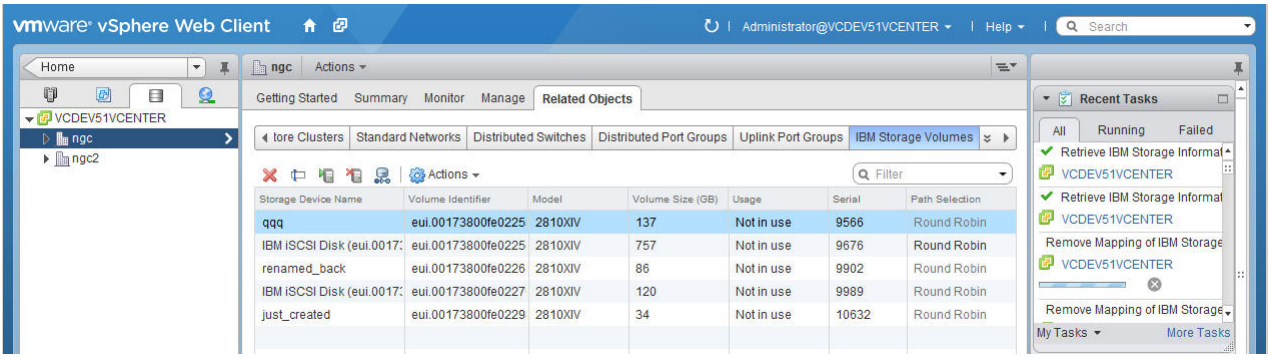


Figure 71. IBM Storage information per datacenter

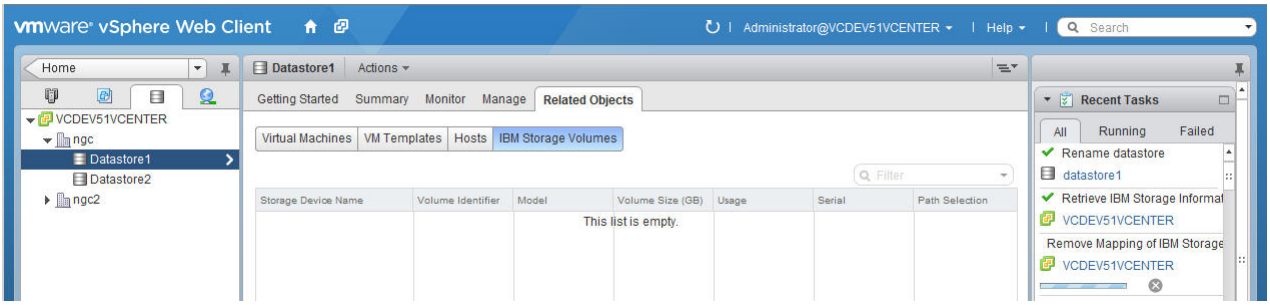


Figure 72. IBM Storage information per datastore

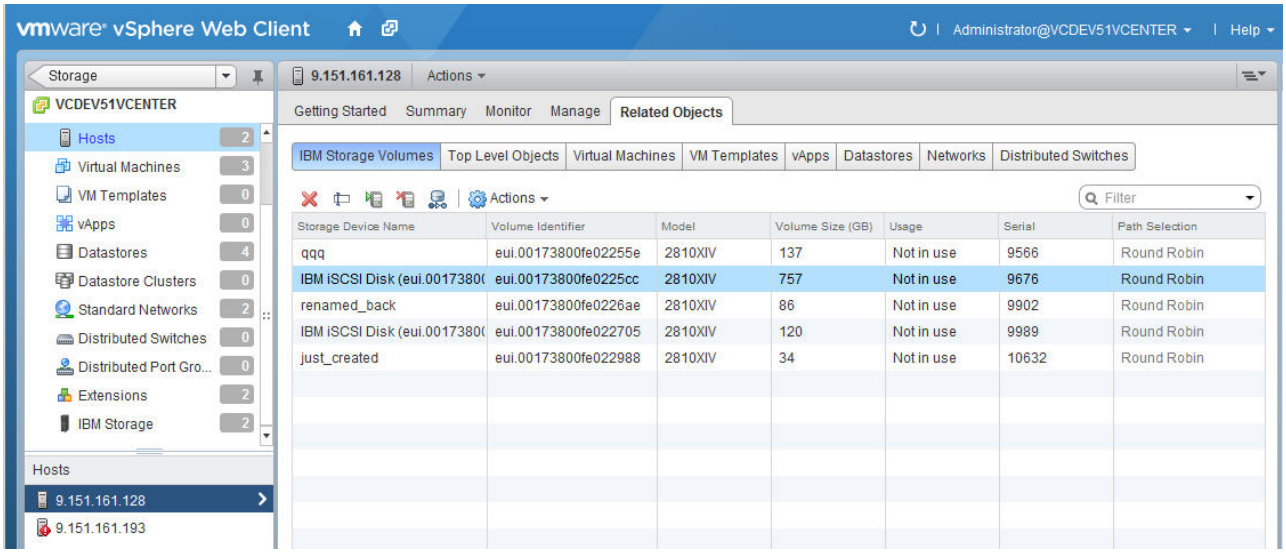


Figure 73. IBM Storage information per all ESXi hosts of a vCenter server

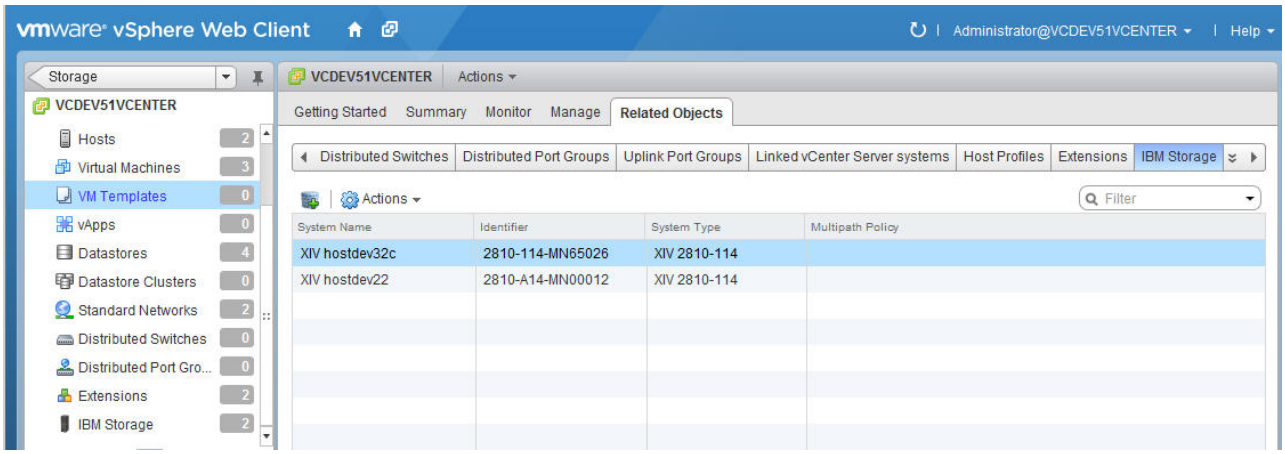


Figure 74. IBM Storage information per all VM templates of a vCenter server

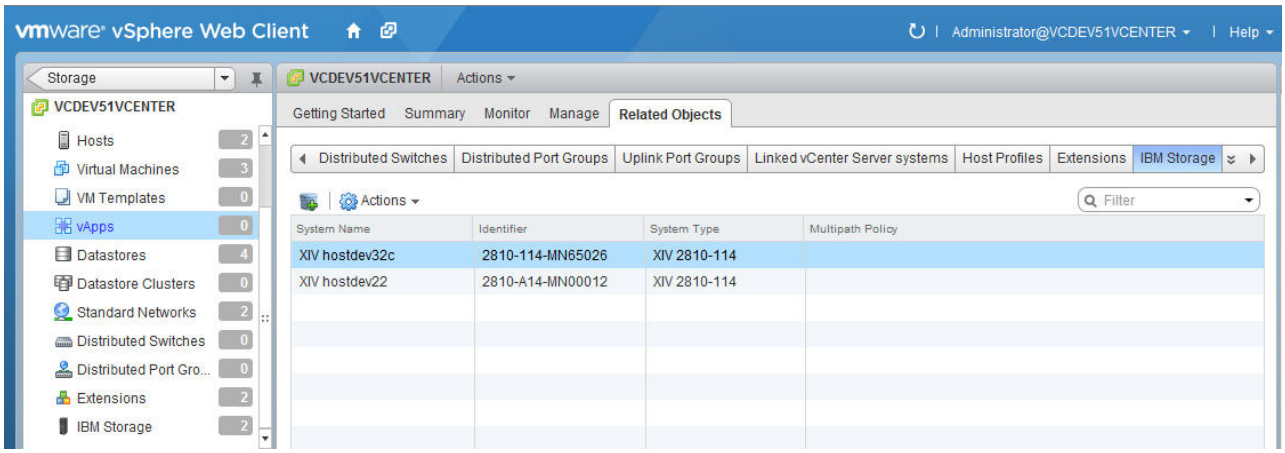


Figure 75. IBM Storage information per all vApps of a vCenter server

And so on, click the other information categories that are available in vSphere to view the relevant IBM Storage information in these categories as well.

Creating and mapping a new storage volume (LUN)

The IBM Storage Enhancements for VMware vSphere Web Client allow you to create new volumes (LUNs) directly from the vSphere Web Client interface. These volumes can be used as storage devices in the vSphere environment.

About this task

Any created volume is mapped to either ESXi hosts, clusters, or datacenters, so that the virtual machines on these hosts, clusters, or datacenters would be able to save datastore information on that volume.

In addition to single volume creation, you can create multiple volumes simultaneously. If you choose this option, the created volumes are appended with differently numbered suffixes that are automatically generated by the system in consecutive order.

Important:

- You can create volumes only on storage pools that have been attached to the relevant vCenter server on the Spectrum Control Base side. For more information, see "GUI – Managing integration with vSphere Web Client" on page 59
- The ESXi hosts and clusters to which you map the created volumes must be predefined on the storage system side. For more information, refer to your IBM storage system documentation.

Procedure

1. In vSphere Web Client, navigate to the relevant vCenter server and then to the specific IBM storage system on which you want to create the new volume. The IBM storage system and the relevant storage pools should already be associated with the vCenter server (see "Viewing the IBM storage resource information" on page 99).
2. Click **Actions** > **Create New Volume**. Alternatively, from the **Top Level Objects** view on the relevant vCenter server, click **Actions** > **All IBM Storage Enhancements for VMware vSphere Web Client Actions** > **Create New Volume**.

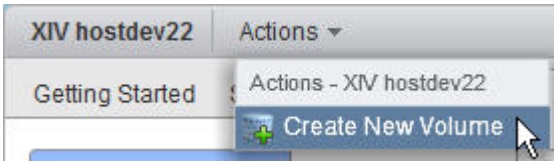


Figure 76. IBM storage system view – Clicking Create New Volume

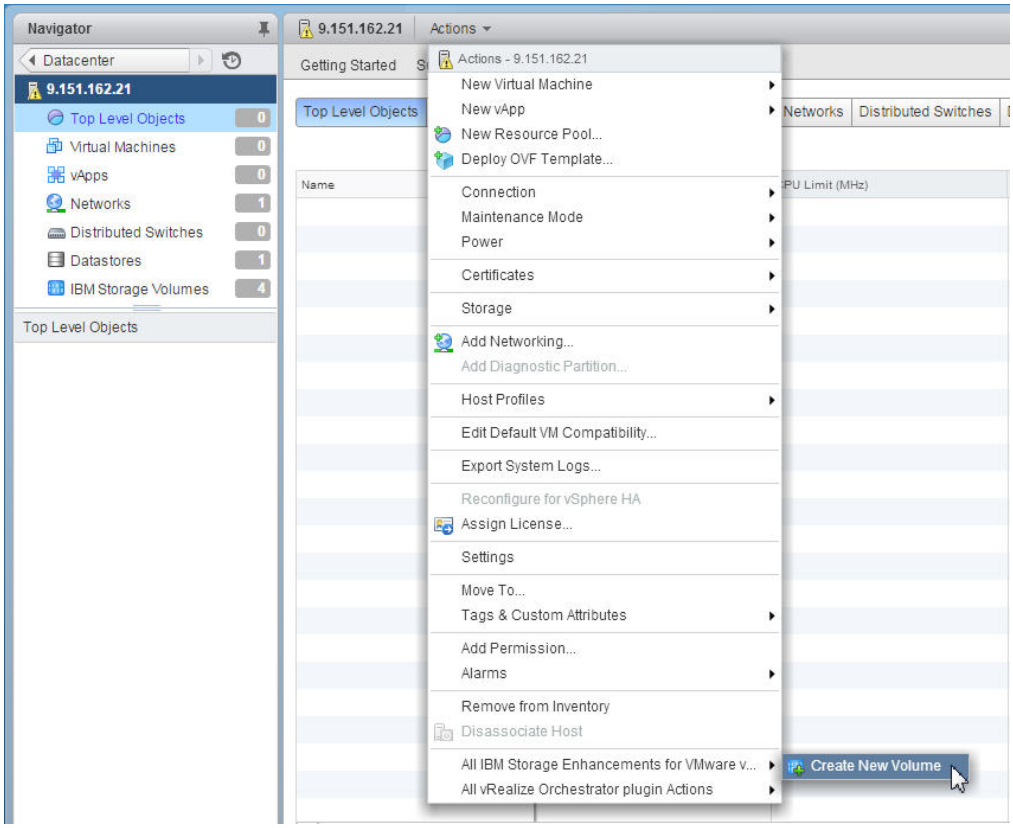


Figure 77. Top Level Objects view – Clicking Create New Volume

You can also right-click the storage system or click the dedicated icon in order to invoke the **Create New Volume** option.

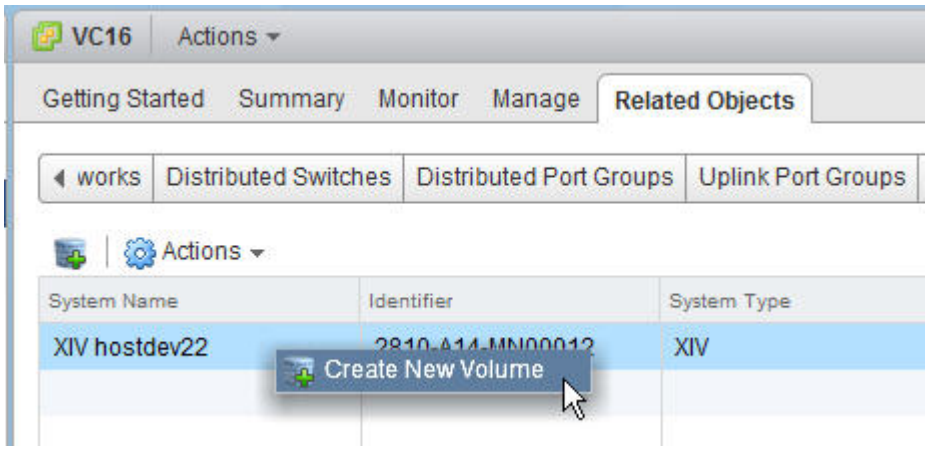


Figure 78. Right-clicking the storage system

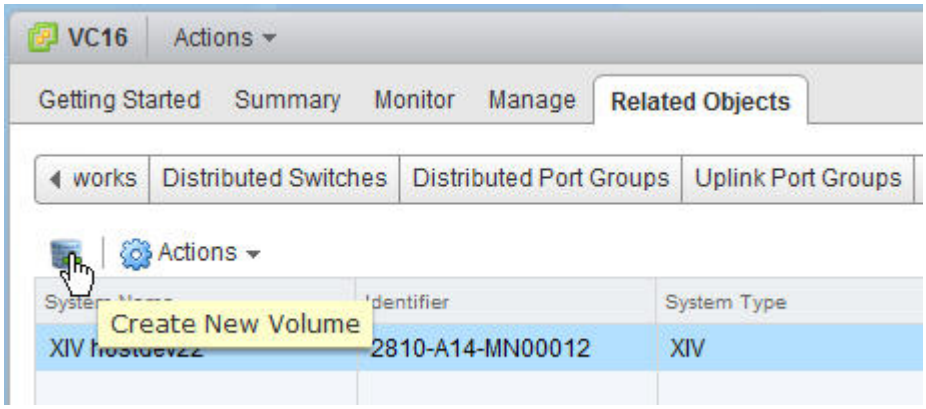


Figure 79. Clicking the Create New Volume icon

The Create New Volume dialog box is displayed.

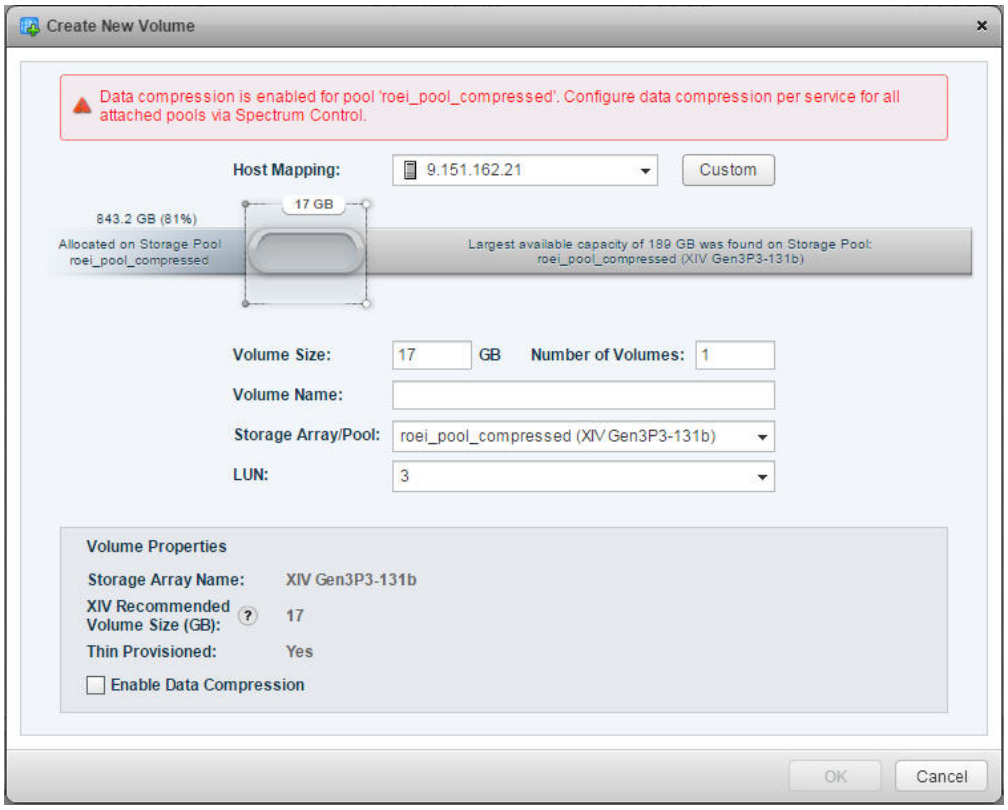


Figure 80. Create New Volume wizard (XIV example)

Note: When you create a single volume, a LUN (logical unit number) is assigned to that volume, and you can later change the LUN assignment. If you create multiple volumes, LUNs (logical unit numbers) are automatically assigned to those volumes and cannot be modified later.

3. In the **Volume Size** text box, enter the size for the new volume. Alternatively, place the mouse pointer on the graphic image of the storage pool, and then click and slide the space marker rightward to set the new volume size. The

numerical value in Volume Size is automatically updated accordingly.

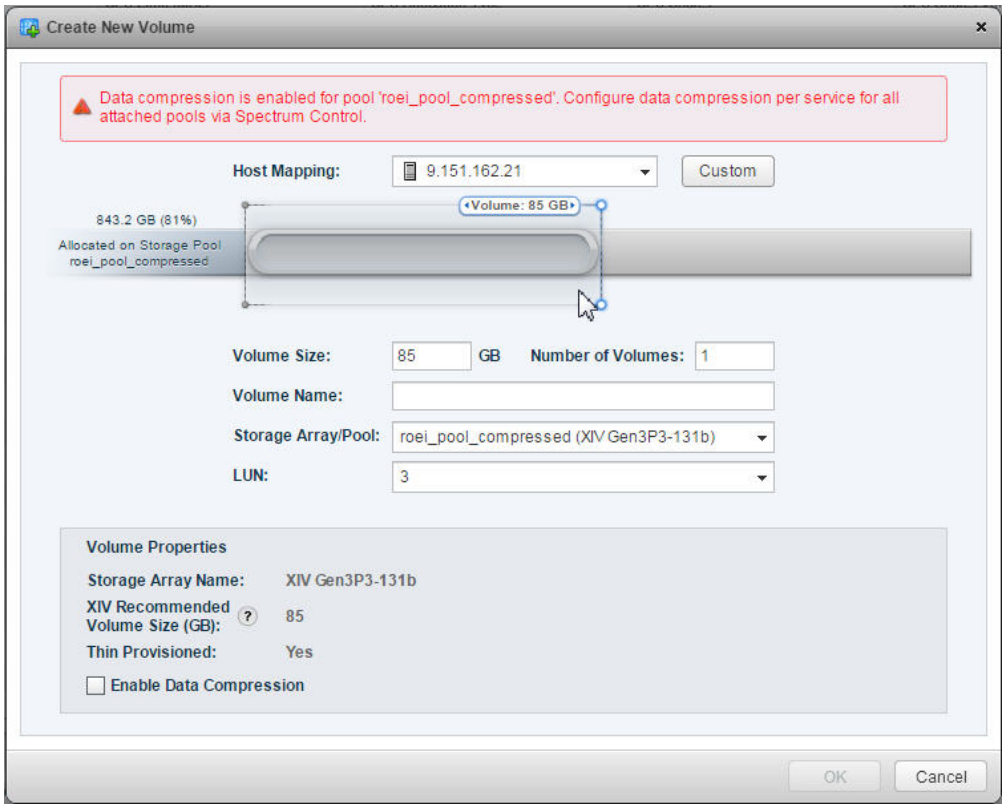


Figure 81. Setting the volume size with the graphic space marker

Note:

- It is recommended to define the size of an XIV volume in a multiple of 17 GB. The Volume Size box appears with a yellow rectangle around it if the size value is not a multiple of 17 GB. The **XIV Recommended Volume Size (GB)** information is displayed below.
- The largest available storage pool on the storage system is automatically selected.
- The minimum size for compressed XIV volumes is 87 GB, and their recommended size is 103 GB.

4. In the **Volume Name** text box, enter the name that you want to assign to the new volume.
5. If you want to create multiple volumes simultaneously (otherwise, go to step 6 on page 107): In the **Number of Volumes** text box, enter the number of volumes that you want to create simultaneously. The text box next to the **Volume Name** entry displays `vol_{1}` by default. The {1} represents the suffix value, and it must be kept as part of the volume name. You edit the volume name and also move the suffix value within the name (the {1} suffix does not have to be at the end of the volume name).

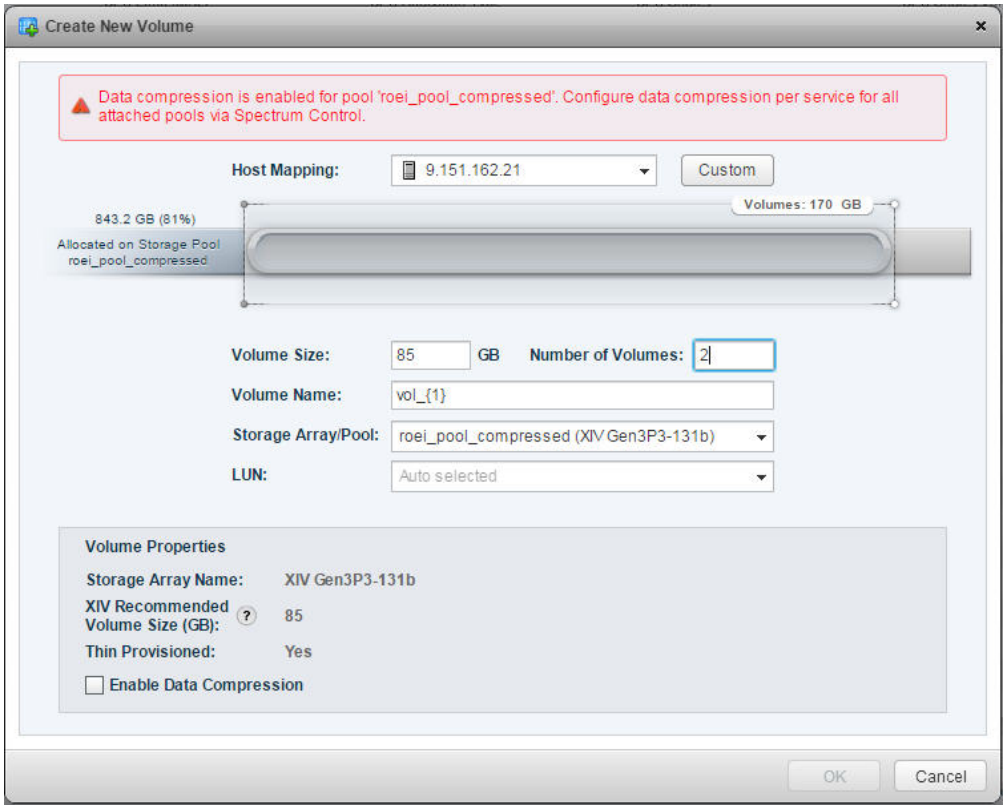


Figure 82. Creating multiple volumes

6. If you want to change the automatically selected storage pool (otherwise, skip to next step), select a different storage pool from the **Storage Array/Pool** list box. The list box displays the storage resources that were created on compatible services, as explained in "GUI – Adding a storage service" on page 50. Incompatible storage pools are grayed out and cannot be selected for volume creation.
7. If you are creating a single volume, you can select the LUN that should represent the new volume on the storage system, or keep the automatically selected LUN. The LUNs are automatically selected when creating multiple volumes.

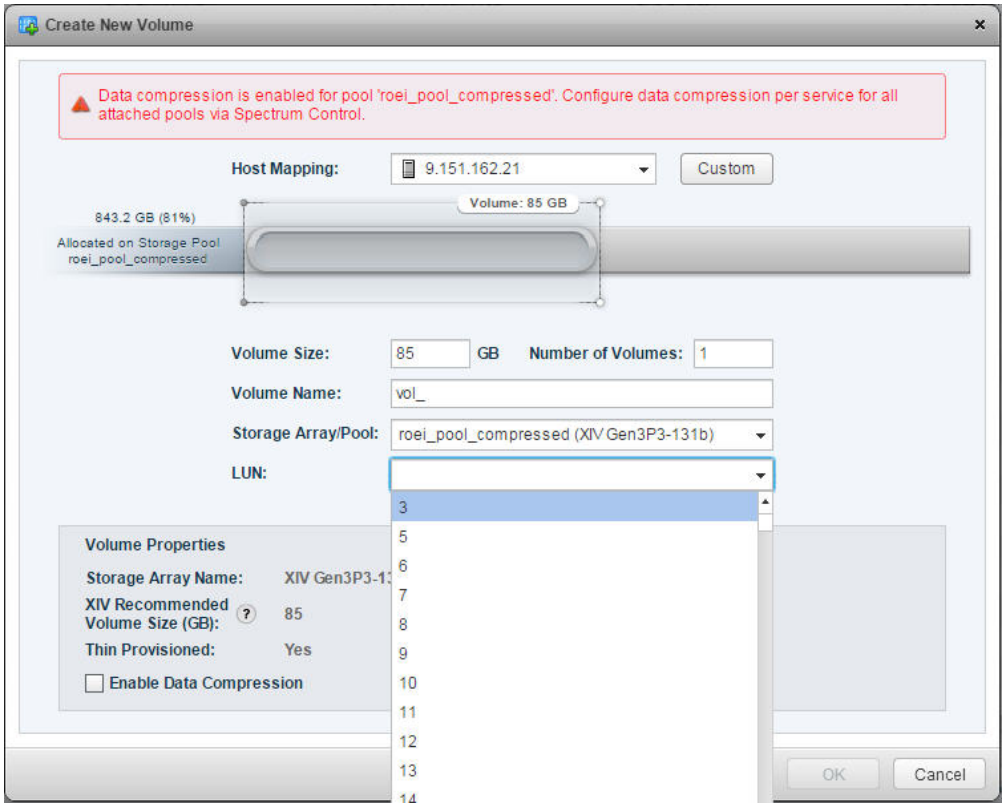


Figure 83. Selecting LUN

Note: After the volume is created, the specific LUN association cannot be changed, and the same number cannot be assigned to a different volume. The specific LUN can become available for reassignment only after its associated volume is deleted.

8. Only if you are creating the volume on an IBM FlashSystem®, DS8000, SAN Volume Controller, or Storwize storage system (otherwise, skip to the next step):
   - Select the **I/O Group** to which the volume should belong. Not applicable to DS8000.
   - Optional: Select **Enable Thin Provisioning** if you want the volume to be defined as thin provisioned and not as a fixed hard disk allocation. When this option is selected, the available capacity and total capacity are displayed based on the requested volume size. For DS8000, the over-provision ratio information is also displayed.
   - Optional: Select **Enable Data Compression** if you use data compression on SAN Volume Controller or Storwize V7000, on Storwize V3500 or Storwize V3700, or on Storwize V7000 Unified. Not applicable to DS8000.
   - Optional: Select **Enable Vdisk Mirroring** if you want to use virtual disk mirroring for the volume or volumes that you create. Not applicable to DS8000. If selected, a list of storage pools appears and you must select the secondary storage pool on which you want the mirrored volume or volumes to be created.

Note:

- XIV volumes are not associated with I/O groups and are thin-provisioned if created in a thin-provisioned storage pool.
- Compressed volumes of SAN Volume Controller or Storwize storage systems (if supported by the microcode) are always thin-provisioned.

9. From **Host Mapping**, select the host(s), cluster(s), or datacenter(s) to which you want to map the new volume. You can click **Custom** to specify a custom mapping in the **Advanced Host Mapping** dialog box.

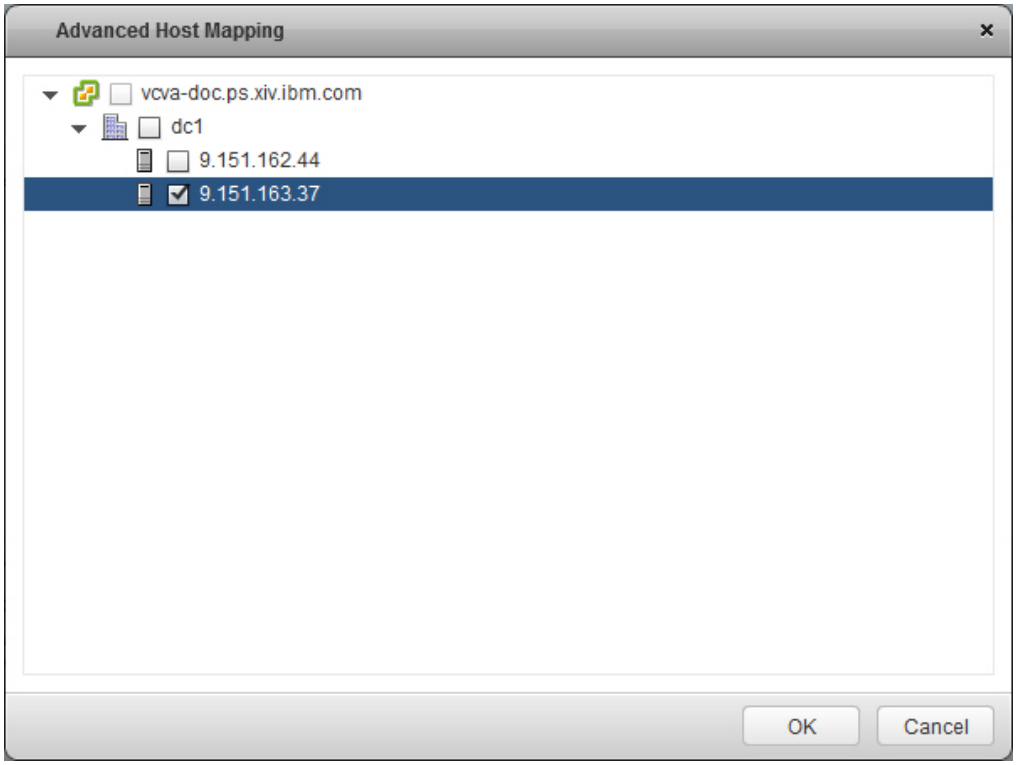


Figure 84. Advanced Host Mapping dialog box

Note: Any ESXi host that is connected to the storage system can be selected. Hosts that are not connected to the storage system are marked and a message notifies you about any connectivity problem. If you select a datacenter, its member clusters and hosts are automatically selected under it.

Important: You must map the volume to at least one ESXi host, cluster, or datacenter in order to enable vSphere management of the created volume.

10. Review the details of the new volume that is about to be created, and then click **OK** to confirm its creation as detailed.

Extending a volume

If enough free space is available on the relevant storage pool, you can extend the size of an existing volume.

Procedure

Complete the following procedure to extend the size of a volume.

1. In vSphere Web Client, navigate to the row of the volume that you want to extend.
2. Right-click the volume row and choose **Extend** or use the **Actions** menu to select **Extend**.

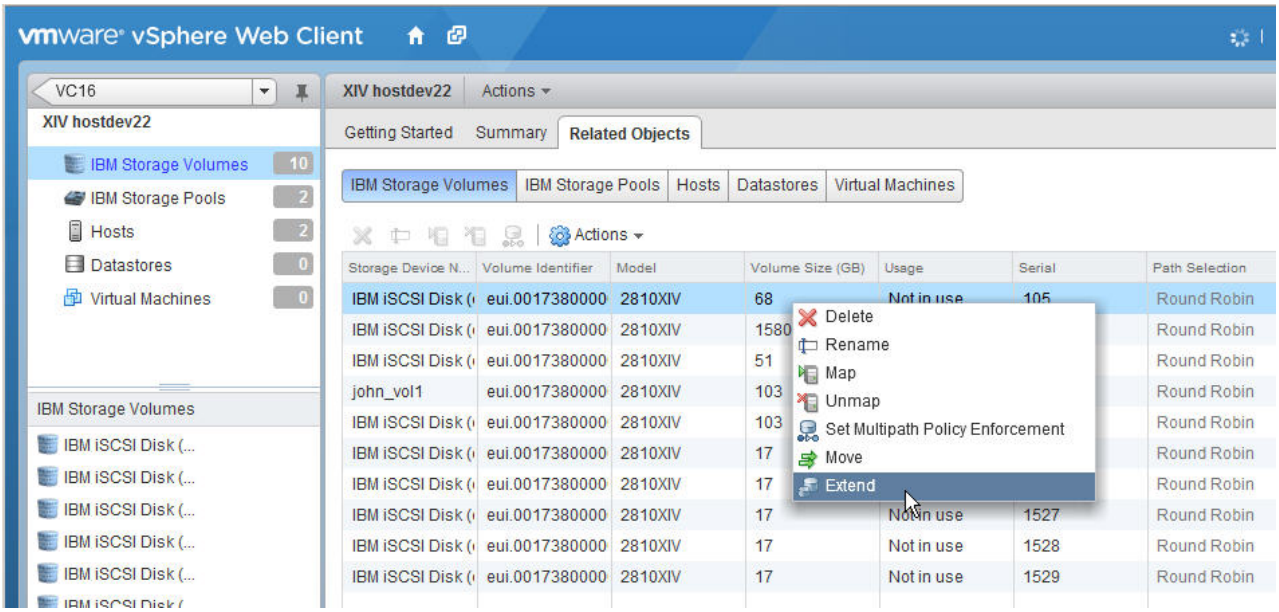


Figure 85. Clicking Extend on the pop-up menu

The Extend Volume dialog box is displayed.

3. In the **Volume Size** text box, enter the new size for the volume. Alternatively, place the mouse pointer on the graphic image of the storage pool, and then click and slide the space marker rightward to set the new volume size. The numerical value in Volume Size is automatically updated accordingly.
4. Click **Extend**.

Important: Extending the size of a volume does not automatically increase the datastore capacity.

Renaming a volume

Whenever required, you can rename any existing volume by performing the following procedure.

About this task

Renaming a volume is a logical action that does not have any physical effect on the volume or its logical connections. Renaming a volume also changes its displayed name in the vSphere environment.

Procedure

1. In vSphere Web Client, navigate to and then click the row of the volume that you want to rename, and then choose the **Rename** option by right-clicking the volume row or using the **Actions** menu.
   The Rename Volume dialog box is displayed.

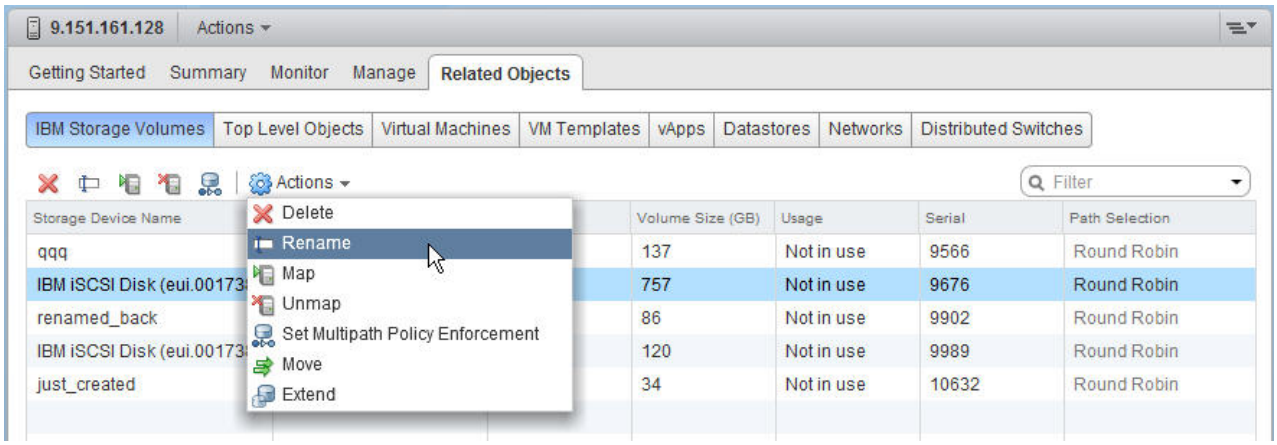


Figure 86. Rename volume option

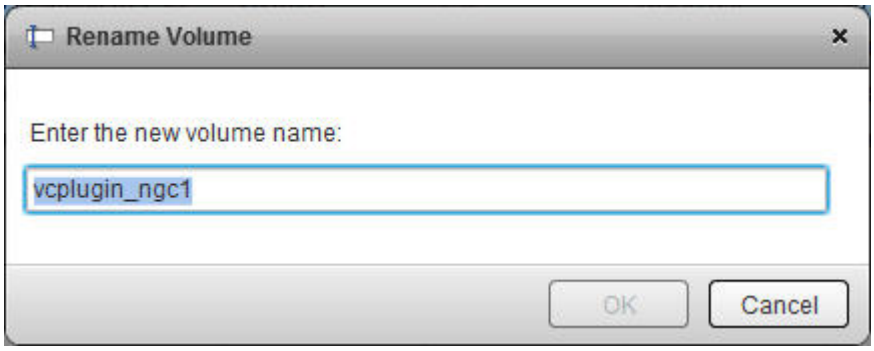


Figure 87. Rename Volume dialog box

2. Enter the new name that you want to assign to the volume, and then click **OK**.

Setting multipath policy enforcement for a volume

You can set the multipath policy enforcement for a single volume.

About this task

By default, the **Round Robin** multipath policy is enforced on volumes. You can disable or change this enforcement for a specific volume if needed.

Note: If you are using ESXi version 5.1 or earlier with DS8000 or Storwize Family systems, see "Setting the multipath policy for DS8000 and Storwize Family systems" on page 145.

Procedure

1. In vSphere Web Client, navigate to and then click the row of the volume for which you want to change the enforcement, and then choose the **Set Multipath Policy Enforcement** option by right-clicking the volume row or using the **Actions** menu.
   The Change Multipath Policy Enforcement dialog box is displayed.

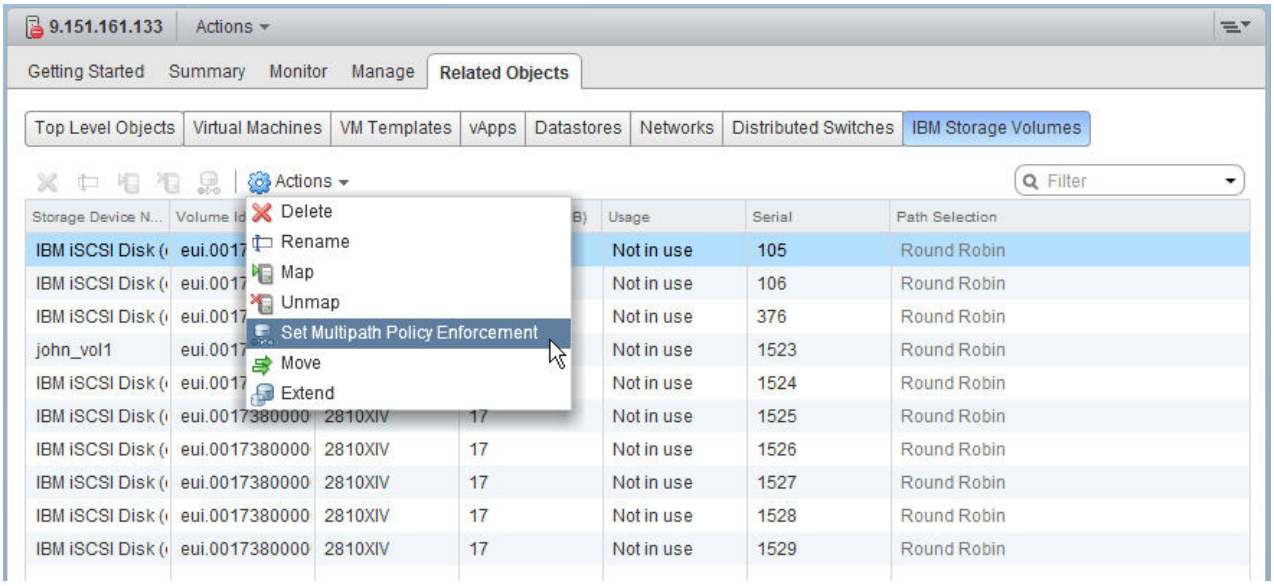


Figure 88. Set Multipath Policy Enforcement option

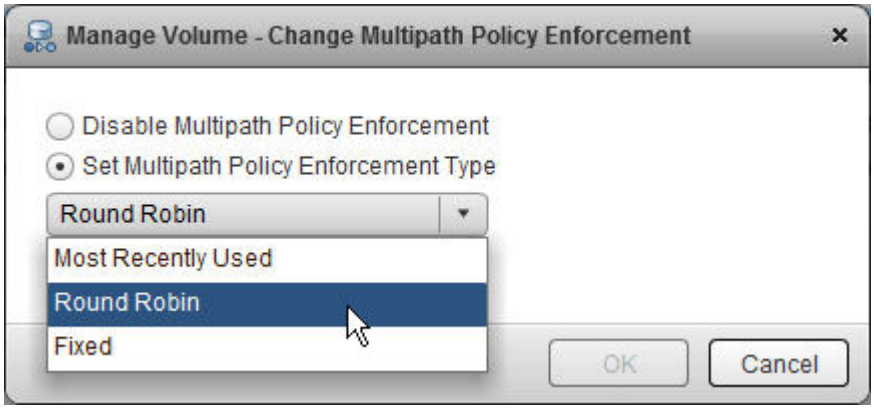


Figure 89. Change Multipath Policy Enforcement dialog box

2. Select the required option and then click **OK**.

Important: After the policy is set, it is enforced by overriding any existing policy for this volume.

Moving a volume to another storage pool

You can move a volume to a different storage pool, for example, when the current storage pool has run out of space.

About this task

Attention:

- On XIV storage systems, moving a volume to another storage pool is a logical action. No data is actually moved on physical disks as a result.
- On DS8000, Storwize, and SAN Volume Controller storage systems, moving a volume to another storage pool is a **physical** action that causes data to move to a different physical disk. This may cause some performance overhead.
- On DS8000, Storwize, and SAN Volume Controller storage systems, moving a volume to another storage pool is an **asynchronous** action. The capacity of the source and target storage pools may not be updated after the task is completed in vCenter.
- When using mirrored volumes on SAN Volume Controller systems, only the primary copy volumes can be moved. In addition, these volumes can be moved only to the primary storage pool copy (not to the secondary copy).

Procedure

1. In vSphere Web Client, navigate to and then click the row of the volume that you want to move, and then choose the **Move** option by right-clicking the volume row or using the **Actions** menu.

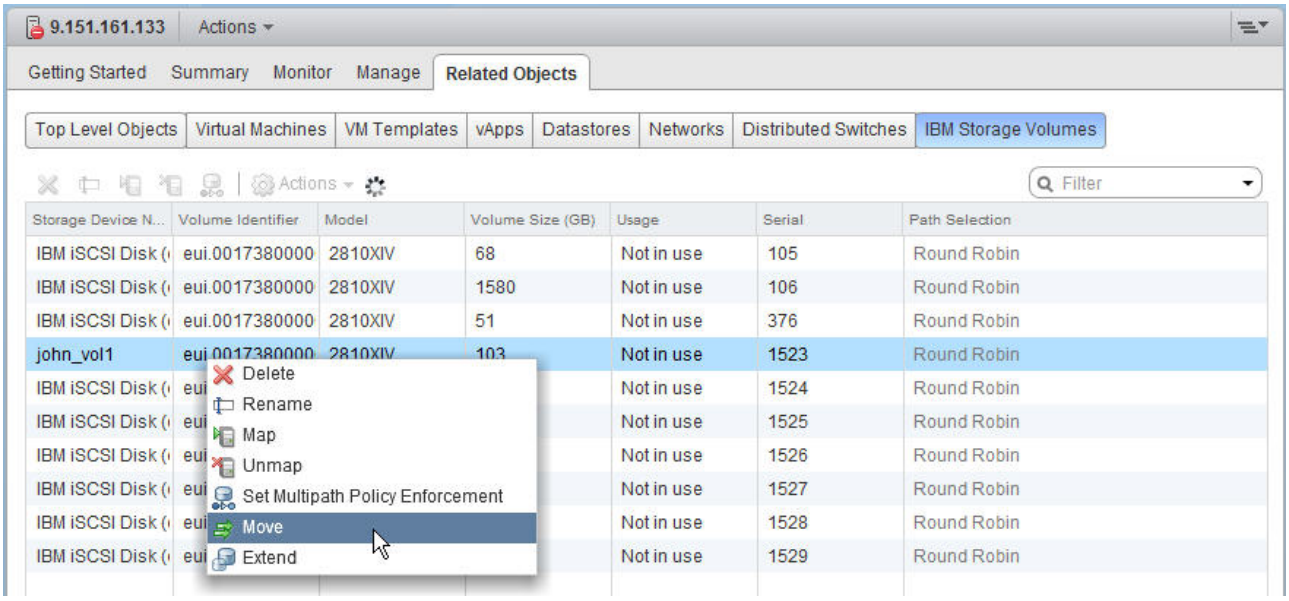


Figure 90. Move volume option

The Move Volume dialog box is displayed.

2. Select the storage pool to which you want to move the volume, and then click **OK**.

Unmapping a volume from one or more hosts

When volumes or ESXi hosts are no longer needed, or if new ones are to replace the current ones, you can unmap volumes from the hosts.

About this task

Important: A volume (LUN) must remain mapped to at least one host. Otherwise, you cannot view the volume or perform any actions on it from vSphere Web Client.

Procedure

1. In vSphere Web Client, navigate to and then click the row of the volume that you want to unmap, and then choose the **Unmap** option by right-clicking the volume row or using the **Actions** menu.

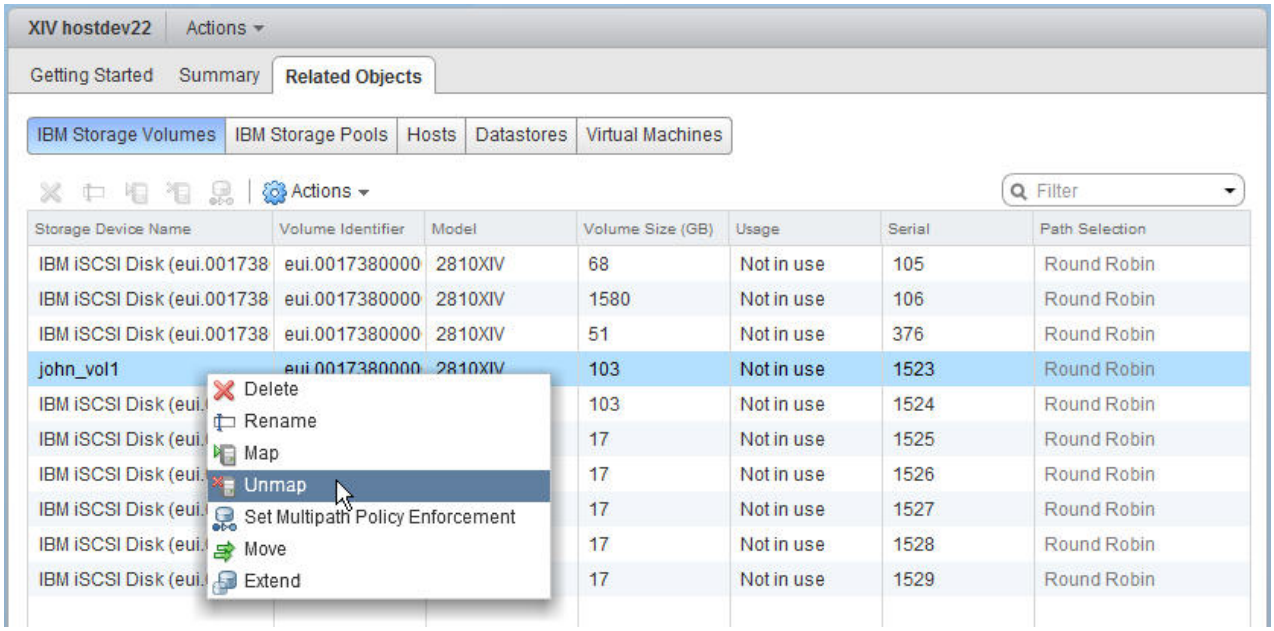


Figure 91. Unmap volume

The Unmap Volume dialog box is displayed.

2. Select the hosts or clusters from which you want to unmap the volume, and then click **OK**.

Deleting an unused volume

When a storage volume is unused and no longer required, you can delete it.

Before you begin

Important: You cannot delete volumes that are currently used by datastores or as a raw-mapped LUN.

Procedure

1. In vSphere Web Client, navigate to and then click the row of the volume that you want to delete, and then choose the **Delete** option by right-clicking the volume row or using the **Actions** menu.

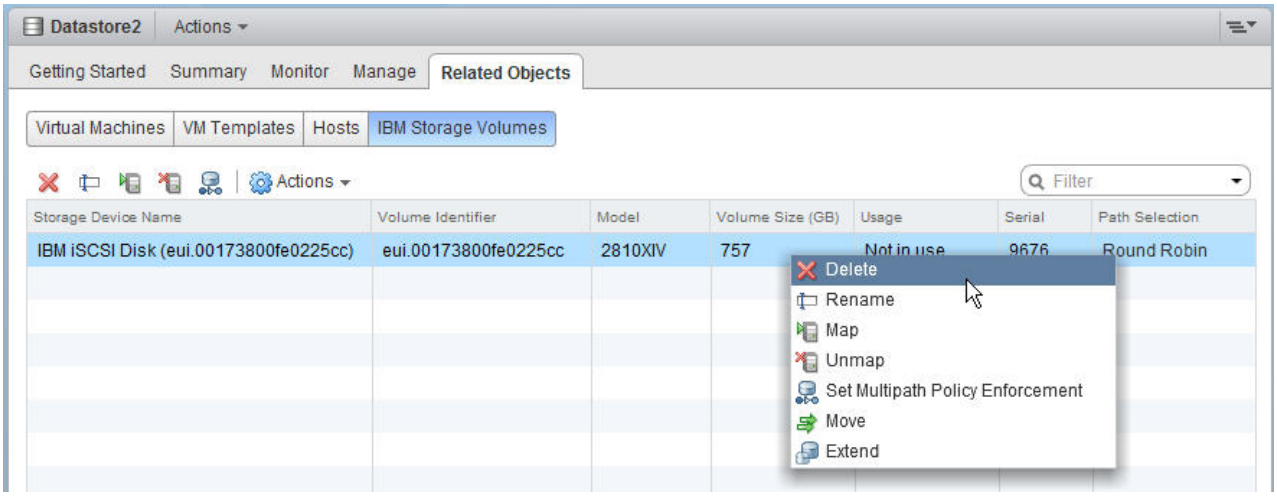


Figure 92. Delete volume

The Delete Volume confirmation message is displayed.

2. Click **OK** to confirm the deletion, or **Cancel** to exit without deleting the volume.

Note: A volume, whose deletion fails, disappears from the volume list. The volume reappears in the list after the next population.

Chapter 6. Using the IBM Storage Plug-in for VMware vCenter Orchestrator

Use the IBM Storage Plug-in for VMware vCenter Orchestrator to include IBM Storage discovery and provisioning in your vCenter Orchestrator (vCO) automation workflows.

Note: This functionality is applicable only to XIV storage systems.

After the IBM Storage Plug-in is deployed (see "GUI – Downloading and installing the plug-in package for vCO" on page 66), the IBM storage objects become available in the vCO, as detailed in the table below.

Table 17. IBM storage objects and events in vCO

Object	Attribute	Return type
IBMStorage:Pool	name	String
	poolId	String
	physicalSize	long
	logicalSize	long
	physicalFree	long
	logicalFree	long
	array	String
	domain	Integer
	getVolumes()	List<IBMStorage:Volume>
	addVolume(string name, integer size)	IBMStorage:Volume
	removeVolume(String id)	void
IBMStorage:Volume	name	String
	scsiIdentifier	String
	logicalCapacity	long
	physicalCapacity	long
	usedCapacity	long
	pool	String
	array	String
	extend(Integer newSize)	void
	map(String initiators)	List<IBMStorage:MappingError>
	unMap(String initiators)	List<IBMStorage:MappingError>
IBMStorage: MappingError	getHostName()	String
	getReason()	String

Note: Currently, storage systems cannot be used in workflows.

The Orchestrator workflows, supported by the IBM storage objects are as follows:

- Create a volume
- Map a volume
- Extend a volume
- Unmap a volume
- Delete a volume

Follow these guidelines for vCO workflows:

- Volume creation: the allowed volume sizes are set in whole numbers. Any number after a decimal point is ignored by the vCO. For example, when the volume size is set to 1.6 GB, the 1 GB volume is created.
- Volume extension: the allowed volume sizes are set in whole numbers. Any number after a decimal point is ignored by the vCO. For example, when the volume size is extended to 3.6 GB, the volume size is set to 3 GB.
- Volume mapping is performed by passing initiators to the workflow. If a host definition at the storage system includes two initiators, only one of them is passed by the workflow, when it is run. Also, a volume must be mapped to all hosts using the same LUN.

The following figures display the IBM Storage workflows and elements in vCO.

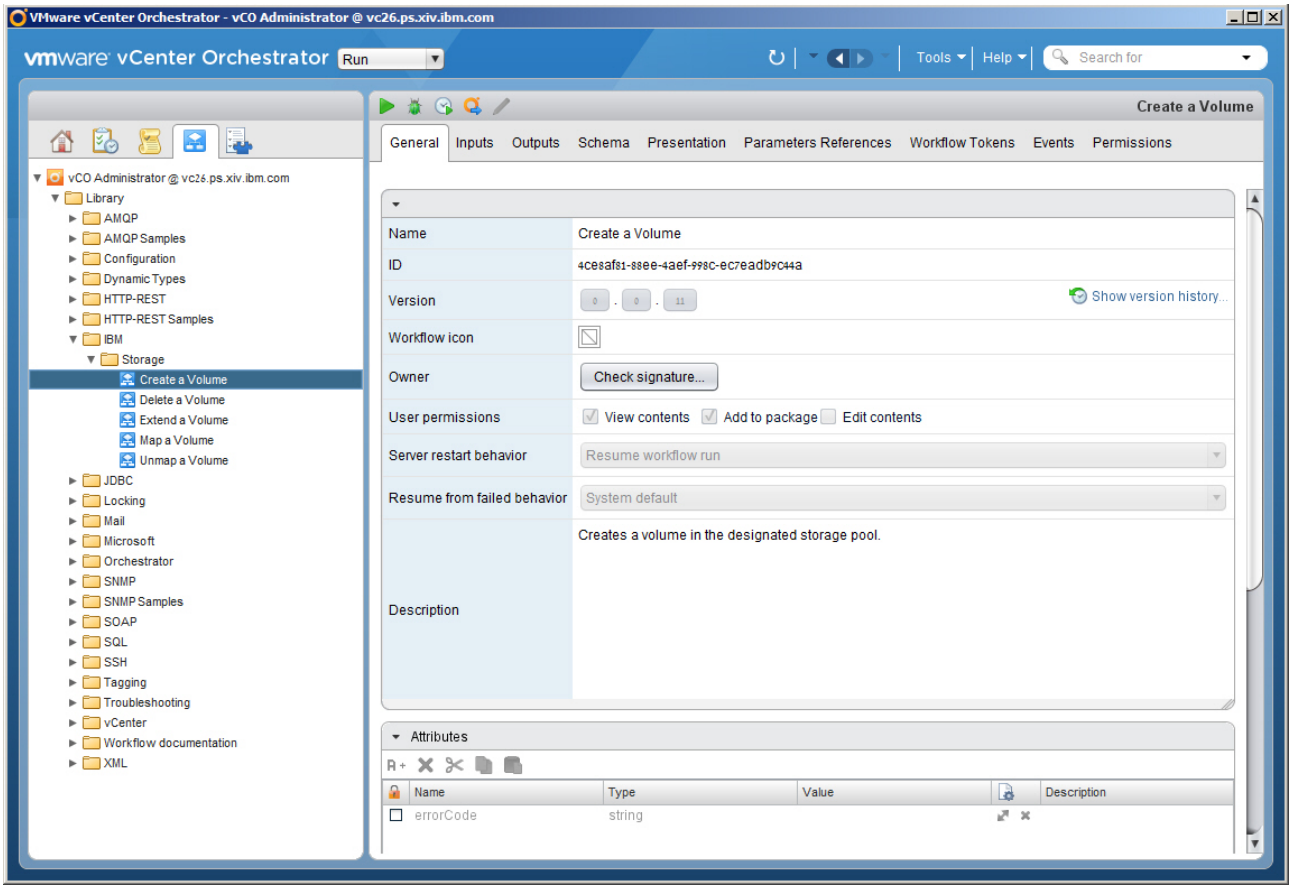


Figure 93. vCenter Orchestrator – Create New Volume workflow – General tab

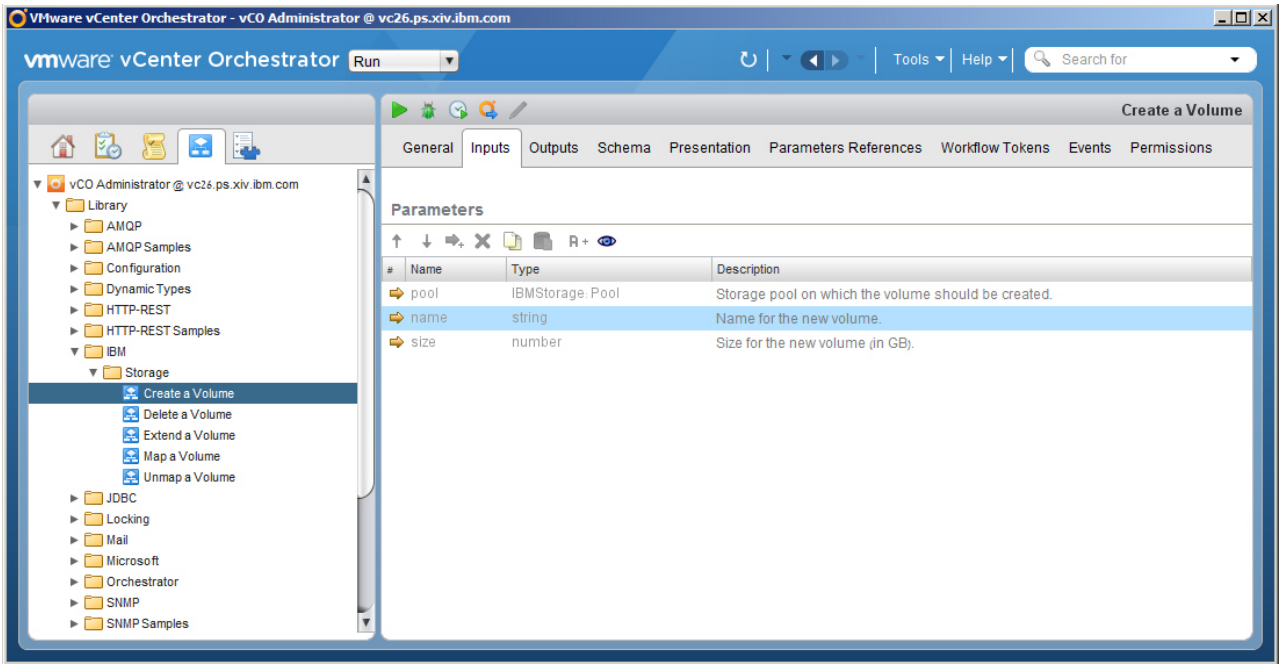


Figure 94. vCenter Orchestrator – Create New Volume workflow – Inputs tab

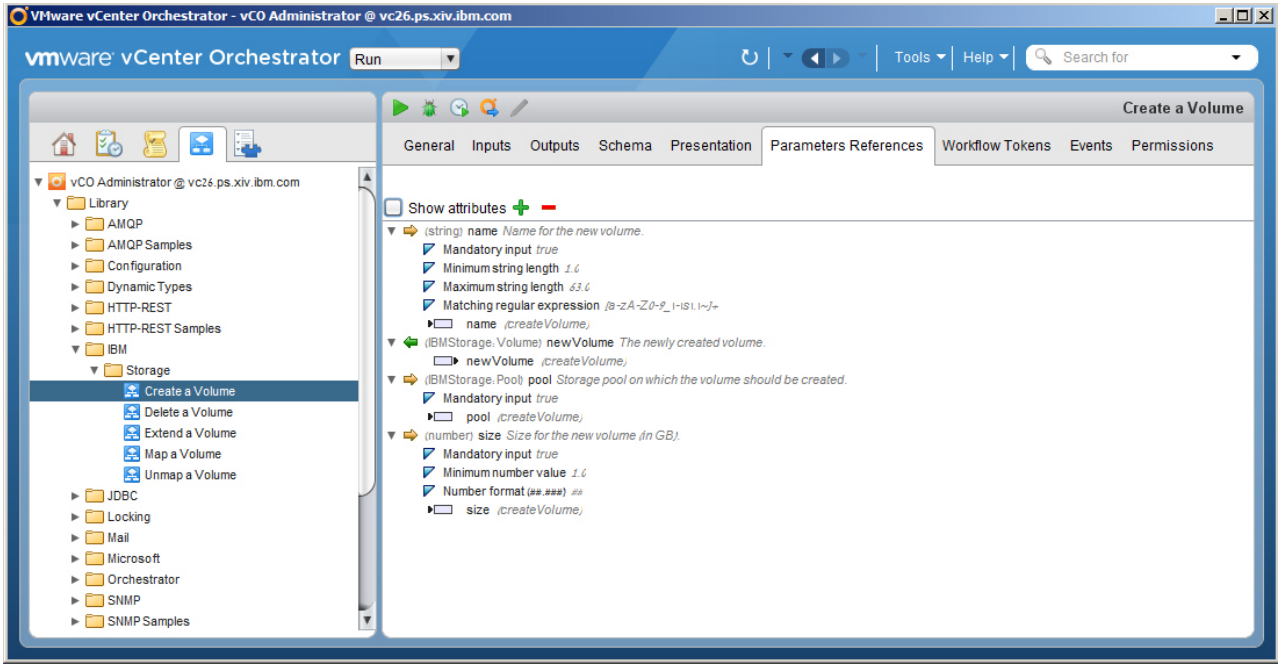


Figure 95. vCenter Orchestrator – Create New Volume workflow – Parameter References tab

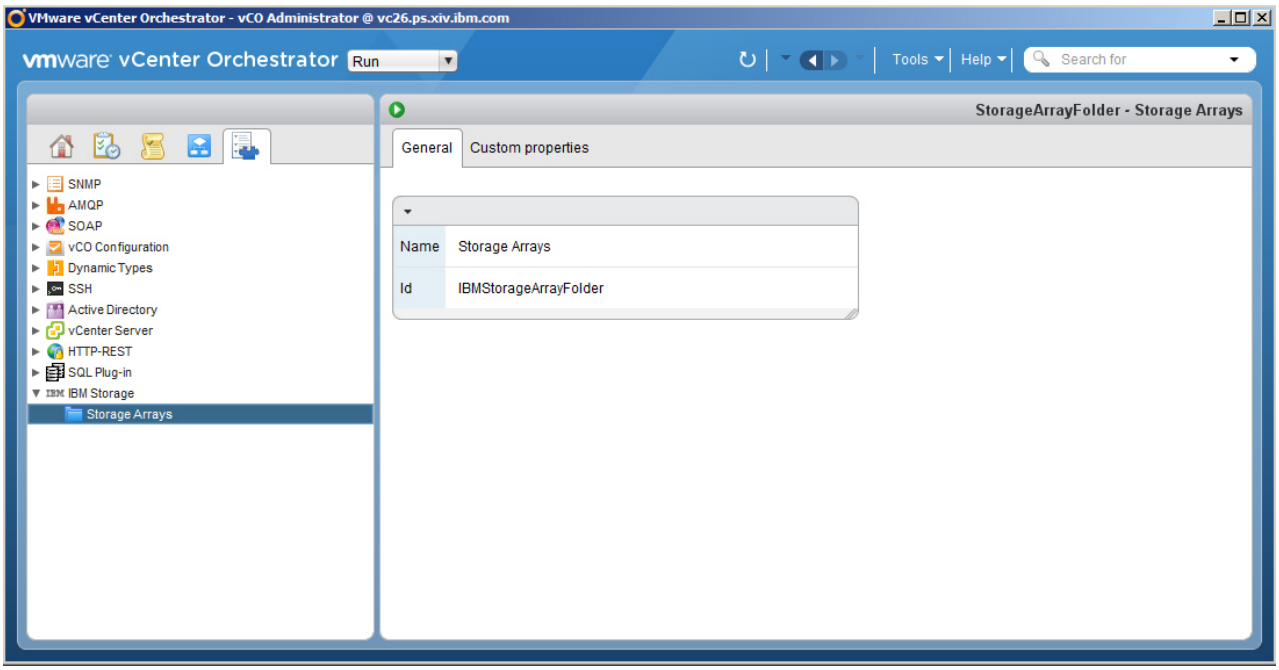


Figure 96. vCenter Orchestrator – Storage Arrays panel

The code sample below illustrates a script for finding a pool with the largest amount of logical free space.

```
var pools = Server.findAllForType("IBMStorage:Pool");
var largestLogicalFreePool = pools.reduce(function (p, v) {
    return ( p.logicalFree > v.logicalFree ? p : v );
});
```

For information about how to initiate workflows in vCenter Orchestrator, refer to the relevant VMware documentation.

Chapter 7. Using the IBM Storage Management Pack for VMware vCenter Operations Manager

Use the IBM Storage Management Pack for VMware vCenter Operations Manager to obtain comprehensive monitoring information about the IBM Storage resources that are utilized in your virtualized environment.

About this task

After successfully configuring Spectrum Control Base with vCenter Operations Manager, it periodically starts sending XIV systems information to vCenter Operations Manager. You can view the detailed IBM Storage dashboards, together with the graphical relationships between the storage elements (storage systems, ports, storage pools, volumes) and virtual elements (datastores, virtual machines, hosts) in a drill-down interactive style.

Note: This functionality is applicable only to XIV storage systems.

Three main dashboards are available for XIV storage systems:

- "Viewing the XIV Overview dashboard" on page 123
- "Viewing the XIV Performance dashboard" on page 125
- "Viewing the XIV Top 10 dashboard" on page 131

In addition, you can:

- Monitor storage system resources. See "Monitoring the XIV storage system resources" on page 131.
- Configure monitoring thresholds. See "Monitoring the XIV resources using thresholds" on page 132.

Procedure

To view the IBM XIV dashboards, complete the following steps.

1. Log in to vCenter Operations Manager custom user interface.
2. Click **DASHBOARDS > IBM STORAGE** and select the required dashboard.

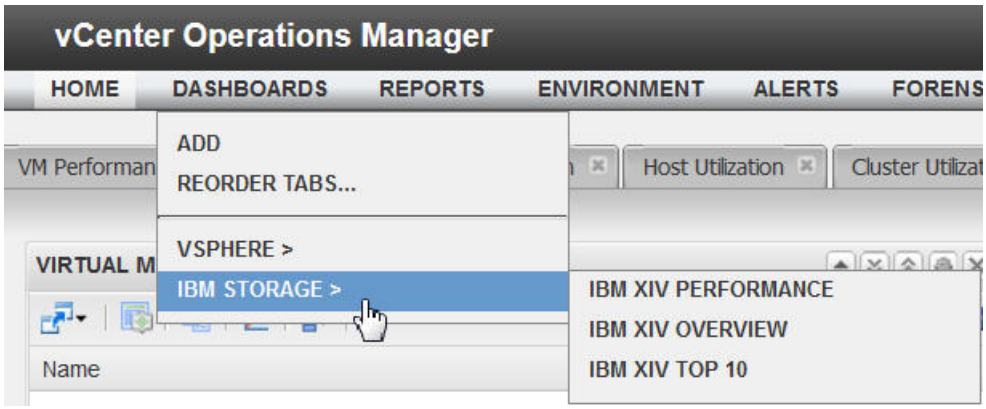


Figure 97. vCOps GUI – IBM STORAGE option

The selected dashboard is displayed. The following icons are used to represent the IBM storage elements.

Table 18. IBM Storage Icons in vCOps

Icon	Description
	IBM storage adapter
	IBM XIV array
	IBM XIV disk
	IBM XIV domain
	IBM XIV host
	IBM XIV Host Fibre Channel (FC) initiator
	IBM XIV host iSCSI initiator
	IBM XIV module
	IBM XIV module FC port
	IBM XIV module iSCSI port
	IBM XIV pool
	IBM XIV volume

Viewing the XIV Overview dashboard

IBM XIV Overview dashboard presents relationships between all virtual elements and storage elements that are in use.

Procedure

To display IBM XIV resource overview:

1. In the IBM XIV Overview dashboard, click a storage system in the **XIV STORAGE ARRAYS** pane. The list of all the resources related to the selected storage system are displayed in the in the right pane of the Overview dashboard. The resources include virtual machines, host systems, datastores, volumes, pools, storage systems (arrays), hosts, FC initiators, FC ports, iSCSI initiators, iSCSI ports, modules and disks.

   The XIV alert widget is detailed in "Using the alert widget" on page 124.

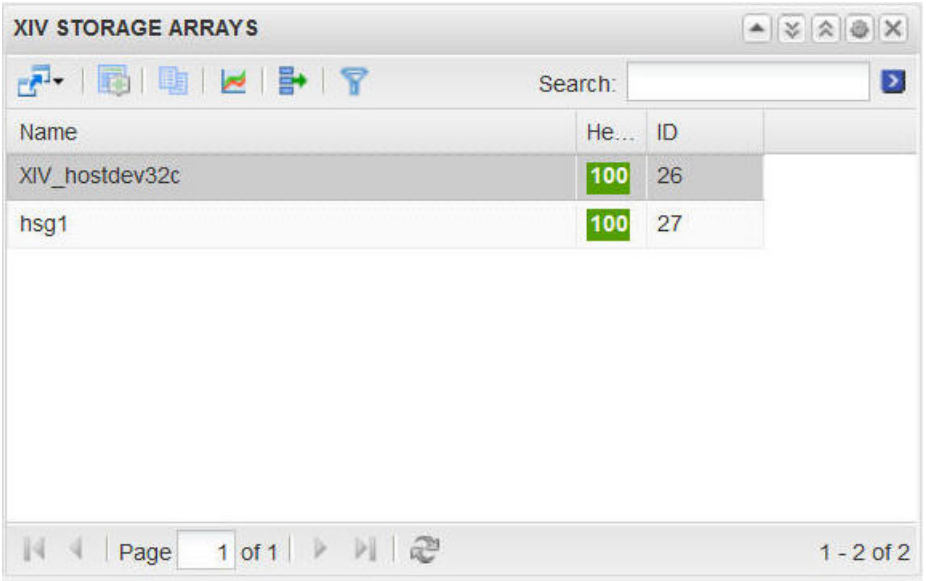


Figure 98. XIV Storage Arrays pane

2. Move the mouse pointer over a resource element or click on it to select it. A tooltip is displayed, detailing the element name and its health score. The health score is calculated automatically by the vCOps Manager, according to the number of alarms and statistic information. However, the IBM XIV Disk health score is based on the *health.requires service* metric.

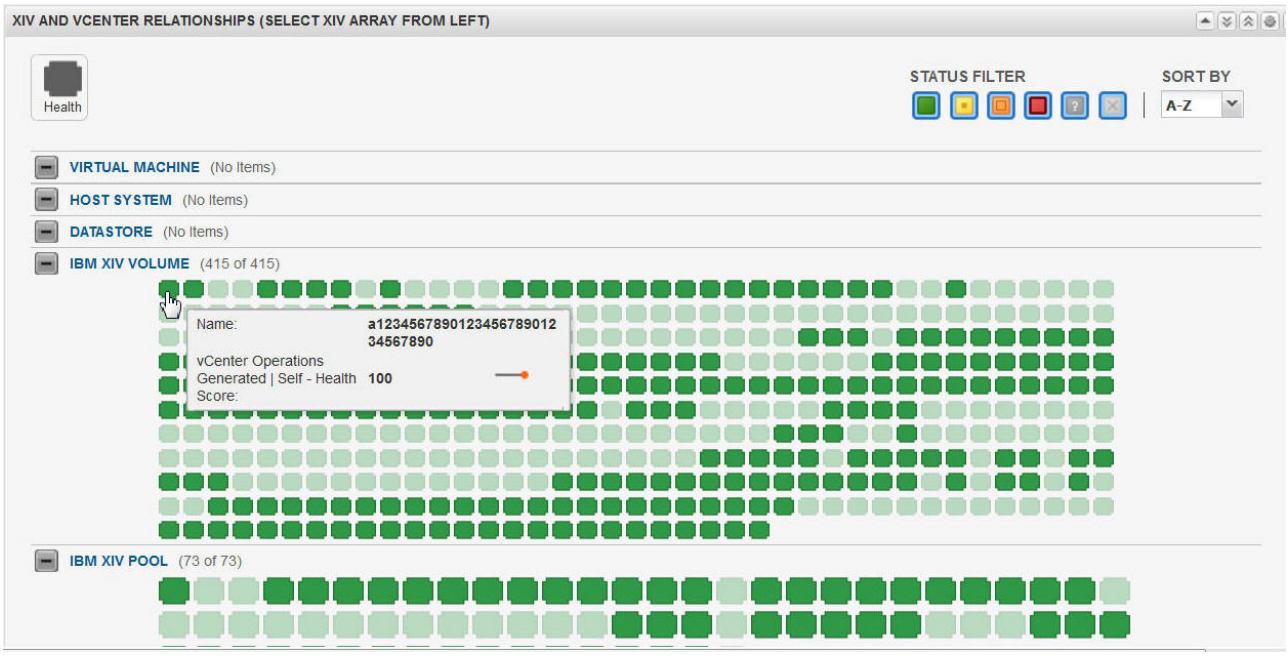


Figure 99. XIV volume health status

3. Double-click on a selected resource element to display the resource details (health tree, metrics, etc). These are detailed in the IBM XIV Performance dashboard below.

Using the alert widget

The XIV ARRAY ALERT (ALL ARRAYS) widget is located at the lower-left pane of the Overview dashboard. This widget displays alerts generated by all XIV systems, monitored by the vCOps server.

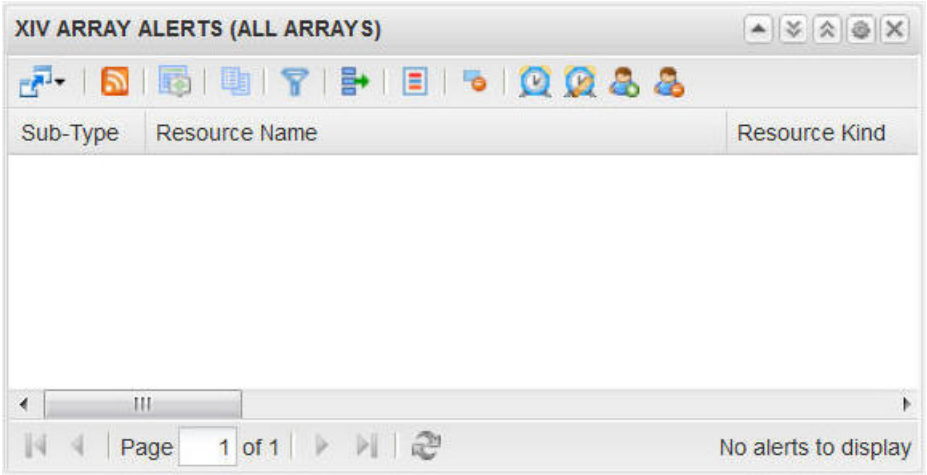


Figure 100. Alert widget

By default, the events are pushed by the IBM Storage adapter to the vCenter Operations Manager every 10 minutes.

Viewing the XIV Performance dashboard

The IBM XIV Performance dashboard provides health and performance information for the IBM XIV resources.

About this task

Performance information presented in the dashboard is collected for a time period defined by the **vcops_push_interval** parameter in the vcops_config.ini file (the default time period is 5 minutes).

Procedure

To display performance information:

1. In the **VIRTUAL MACHINES** pane of the IBM XIV Performance dashboard, locate a relevant virtual machine and select it.
2. In the **XIV AND VCENTER RELATIONSHIP** pane, select an object, which performance you intend to monitor.

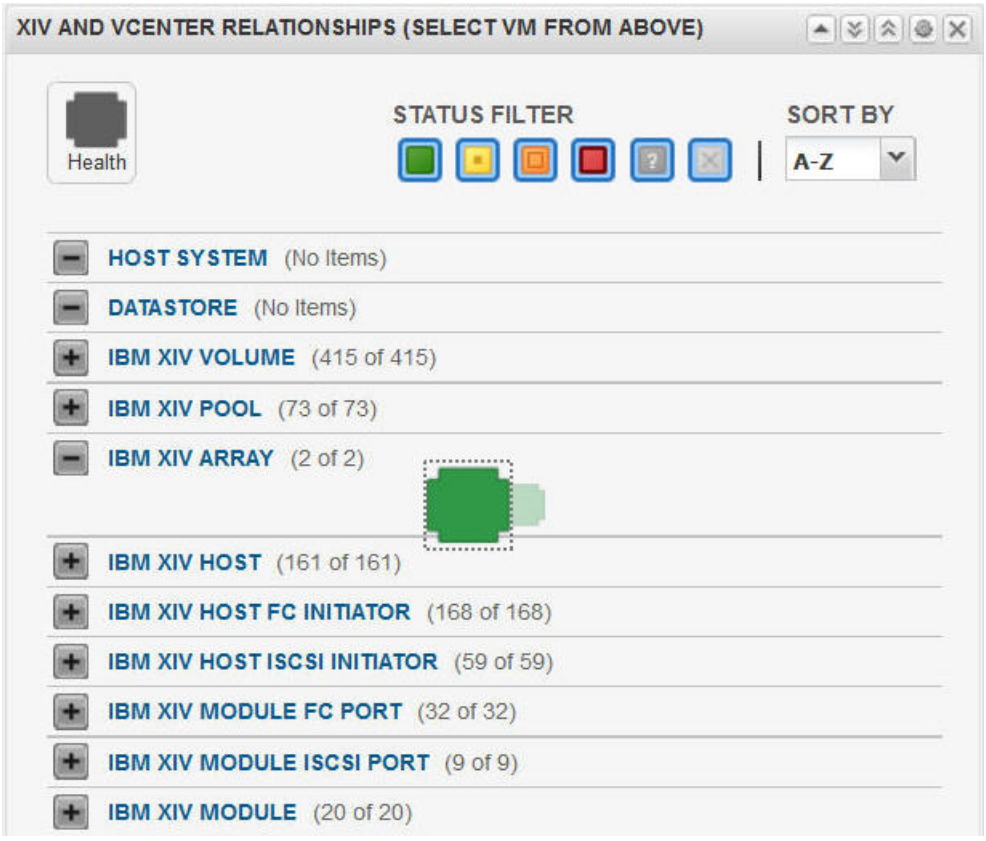


Figure 101. XIV AND VCENTER RELATIONSHIPS pane

The **HEALTH TREE** pane displays the selected element and its relation to other storage resources in an hierarchical manner.

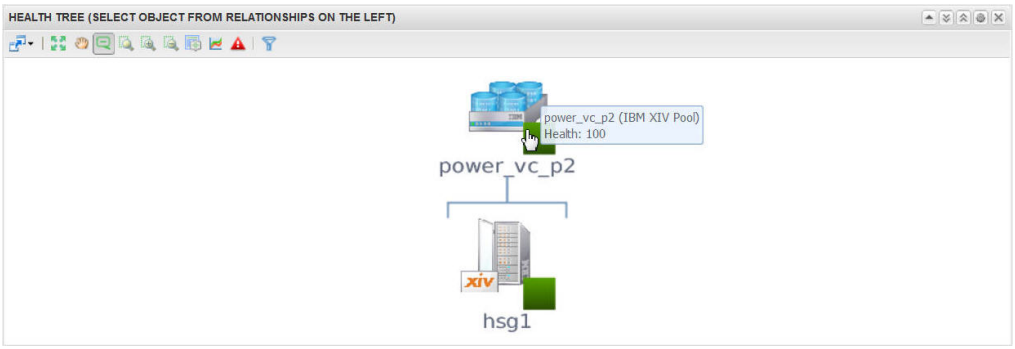


Figure 102. HEALTH TREE pane

3. In the **HEALTH TREE** pane, select a resource element to display all relevant performance metrics in the **METRIC SELECTOR** pane. Different metric types are available for different resource elements, as detailed in "XIV performance metrics" on page 127.
4. Select a metrics of an element to display its metric graph in the **METRIC GRAPH** pane.

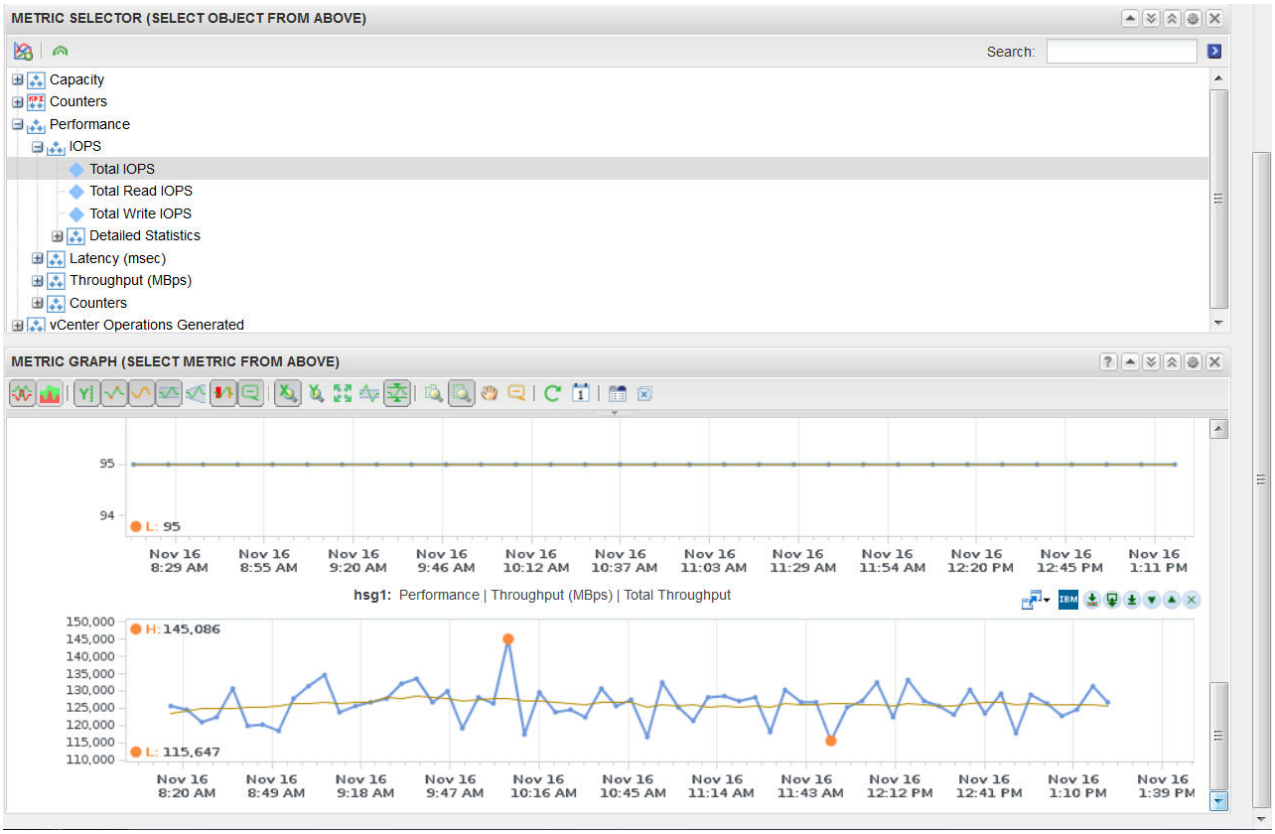


Figure 103. IBM XIV Performance dashboard, METRIC SELECTOR and METRIC GRAPH panes

XIV performance metrics

Metrics data available in the IBM XIV Performance dashboard provides health and performance information for the IBM XIV resources.

Different metric types are available for different resource elements, as detailed in tables below.

Table 19. Capacity metrics

Metrics	Description	Relevant IBM XIV resource
Hard (GB)	Hard size (actual physical capacity) of the resource	Volume, Pool, Array
Soft (GB)	Soft size (maximum size of capacity seen by the hosts) of the resource	
Free Hard (GB)	Free hard size of the storage system (array)	Array
Free Soft (GB)	Free soft size of the storage system	
Utilization Hard (%)	Utilization ratio of the hard capacity	Volume, Array
Utilization Soft (%)	Utilization ratio of the soft capacity	
Over Provisioning Ratio (%)	The ratio between virtual capacity and real capacity of the pool	Pool

Table 20. Health metrics

Metrics	Description	Relevant IBM XIV resource
Connected	Connection status of the resource	Host, Host FC Initiator, Host iSCSI Initiator
Status	Health status of the module	Module
Requires Service	Heath status of the disk. The REPLACE value indicates disk failure.	Disk
Online	Connection status of the resource	Module FC Port, Module iSCSI Port

Table 21. Counter metrics

Metrics	Description	Relevant IBM XIV resource
Hosts Count	Total number of hosts connected to the storage system	Array
Mirror Relations Count	Total number of mirror relations (master or slave) existing in the storage system	
Pools Count	Total number of pools existing in the storage system	
Snapshots Count	Total number of snapshots existing in the storage system	
Volumes and Snapshots Count	Total number of volumes and snapshots existing in the storage system	
Volumes Count	Total number of volumes existing in the storage system	

Table 22. Perfromance metrics

Metrics	Description	Relevant IBM XIV resource
Total IOPS	Total number of IOPS performed by the resource	Array, Host FC Initiator, Host iSCSI Initiator, Module FC Port, Module iSCSI Port
Total Read IOPS	Total number of read IOPS performed by the resource	
Total Write IOPS	Total number of write IOPS performed by the resource	
Read Hit Large IOPS	Number of IOPS for 64–512 KB packets read from cache	
Read Hit Medium IOPS	Number of IOPS for 8–64 KB packets read from cache	
Read Hit Small IOPS	Number of IOPS for 0–8 KB packets read from cache	
Read Hit Very Large IOPS	Number of IOPS for over 512 KB packets read from cache	
Read Miss Large IOPS	Number of IOPS for 64–512 KB packets read from disk	
Read Miss Medium IOPS	Number of IOPS for 8–64 KB packets read from disk	
Read Miss Small IOPS	Number of IOPS for 0–8 KB packets read from disk	
Read Miss Very Large IOPS	Number of IOPS for over 512 KB packets read from disk	
Write Hit Large IOPS	Number of IOPS for 64–512 KB packets written to cache	
Write Hit Medium IOPS	Number of IOPS for 8–64 KB packets written to cache	
Write Hit Small IOPS	Number of IOPS for 0–8 KB packets written to cache	
Write Hit Very Large IOPS	Number of IOPS for over 512 KB packets written to cache	
Write Miss Large IOPS	Number of IOPS for 64–512 KB packets written to disk	
Write Miss Medium IOPS	Number of IOPS for 8–64 KB packets written to disk	
Write Miss Small IOPS	Number of IOPS for 0–8 KB packets written to disk	
Write Miss Very Large IOPS	Number of IOPS for over 512 KB packets written to disk	
Average Latency	Average response time	
Average Write Latency	Average response time of a write operation	
Average Read Latency	Average response time of a read operation	
Read Hit Large Latency	Response time of cache read operations for 64–512 KB packets	
Read Hit Medium Latency	Response time of cache read operations for 8–64 KB packets	
Read Hit Small Latency	Response time of cache read operations for 0–8 KB packets	
Read Hit Very Large Latency	Response time of cache read operations for over 512 KB packets	

Table 22. Perfromance metrics (continued)

Metrics	Description	Relevant IBM XIV resource
Read Memory Hit Large Latency	Response time of DRAM cache read operations for 64–512 KB packets	Array
Read Memory Hit Medium Latency	Response time of DRAM cache read operations for 8–64 KB packets	
Read Memory Hit Small Latency	Response time of DRAM cache read operations for 0–8 KB packets	
Read Memory Hit Very Large Latency	Response time of DRAM cache read operations for over 512 KB packets	
Read Miss Large Latency	Response time of disk read operations for 64–512 KB packets	Array, Host FC Initiator, Host iSCSI Initiator, Module FC Port, Module iSCSI Port
Read Miss Medium Latency	Response time of disk read operations for 8–64 KB packets	
Read Miss Small Latency	Response time of disk read operations for 0–8 KB packets	
Read Miss Very Large Latency	Response time of disk read operations for over 512 KB packets	
Write Hit Large Latency	Response time of cache write operations for 64–512 KB packets	
Write Hit Medium Latency	Response time of cache write operations for 8–64 KB packets	
Write Hit Small Latency	Response time of cache write operations for 0–8 KB packets	
Write Hit Very Large Latency	Response time of cache write operations for over 512 KB packets	
Write Miss Large Latency	Response time of disk write operations for 64–512 KB packets	
Write Miss Medium Latency	Response time of disk write operations for 8–64 KB packets	
Write Miss Small Latency	Response time of disk write operations for 0–8 KB packets	
Write Miss Very Large Latency	Response time of disk write operations for over 512 KB packets	
Total Throughput	Total bandwidth	
Total Read Throughput	Total bandwidth used by read operations	
Total Write Throughput	Total bandwidth used by write operations	
Read Hit Large Throughput	Bandwidth used by cache read operations for 64–512 KB packets	
Read Hit Medium Throughput	Bandwidth used by cache read operations for 8–64 KB packets	
Read Hit Small Throughput	Bandwidth used by cache read operations for 0–8 KB packets	
Read Hit Very Large Throughput	Bandwidth used by cache read operations for over 512 KB packets	

Table 22. Perfromance metrics (continued)

Metrics	Description	Relevant IBM XIV resource
Read Memory Hit Large Throughput	Bandwidth used by DRAM cache read operations for 64–512 KB packets	Array
Read Memory Hit Medium Throughput	Bandwidth used by DRAM cache read operations for 8–64 KB packets	
Read Memory Hit Small Throughput	Bandwidth used by DRAM cache read operations for 0–8 KB packets	
Read Memory Hit Very Large Throughput	Bandwidth used by DRAM cache read operations for over 512 KB packets	
Read Miss Large Throughput	Bandwidth used by disk read operations for 64–512 KB packets	Array, Host FC Initiator, Host iSCSI Initiator, Module FC Port, Module iSCSI Port
Read Miss Medium Throughput	Bandwidth used by disk read operations for 8–64 KB packets	
Read Miss Small Throughput	Bandwidth used by disk read operations for 0–8 KB packets	
Read Miss Very Large Throughput	Bandwidth used by disk read operations for over 512 KB packets	
Write Hit Large Throughput	Bandwidth used by cache write operations for 64–512 KB packets	
Write Hit Medium Throughput	Bandwidth used by cache write operations for 8–64 KB packets	
Write Hit Small Throughput	Bandwidth used by cache write operations for 0–8 KB packets	
Write Hit Very Large Throughput	Bandwidth used by cache write operations for over 512 KB packets	
Write Miss Large Throughput	Bandwidth used by disk write operations for 64–512 KB packets	
Write Miss Medium Throughput	Bandwidth used by disk write operations for 8–64 KB packets	
Write Miss Small Throughput	Bandwidth used by disk write operations for 0–8 KB packets	
Write Miss Very Large Throughput	Bandwidth used by disk write operations for over 512 KB packets	
Aborts	Total number of I/Os aborted during the current mirroring operation	
Failures	Total number of I/Os failed during the current mirroring operation	

Viewing the XIV Top 10 dashboard

The IBM XIV Top 10 dashboard represents top ten IBM XIV volumes and hosts in all XIV system monitored by the vCOps Manager.

The IBM XIV Top 10 dashboard includes the following information:

- Top 10 XIV volumes by IOPS (last hour)
- Top 10 XIV volumes by IOPS (last 24 hours)
- Top 10 XIV volumes by throughput (last hour)
- Top 10 XIV volumes by throughput (last 24 hours)
- Top 10 XIV hosts by IOPS (last hour)
- Top 10 XIV hosts by IOPS (last 24 hours)
- Top 10 XIV hosts by throughput (last hour)
- Top 10 XIV hosts by throughput (last 24 hours)

You can double-click on any resource element (disk or host) to display its details.

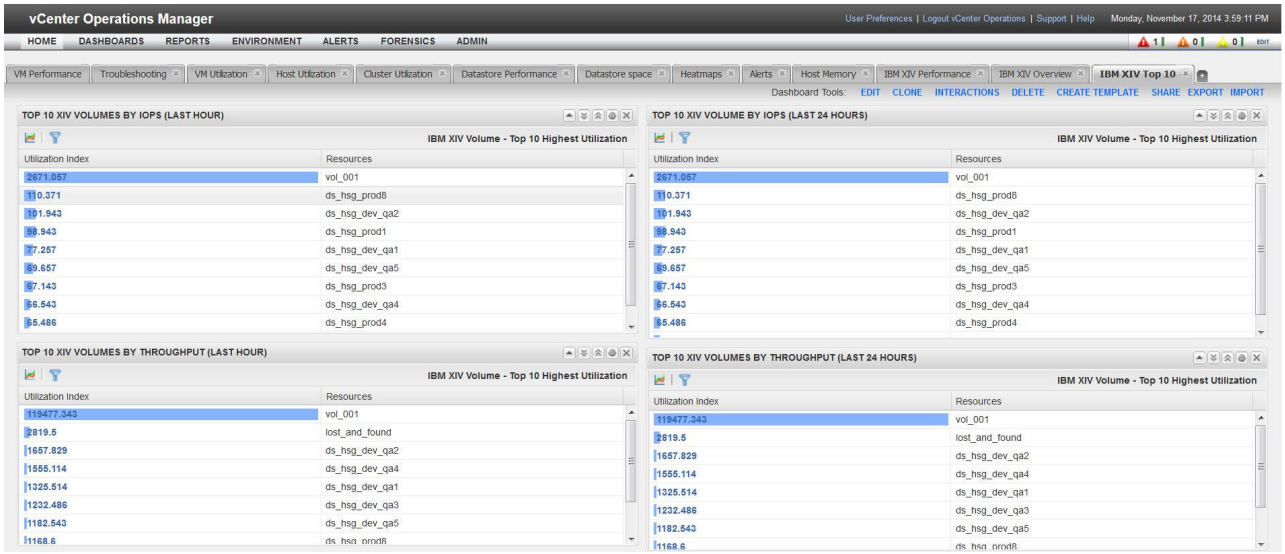


Figure 104. IBM XIV Top 10 dashboard

Monitoring the XIV storage system resources

You can view the health status of all XIV resources in a centralized manner, using the vCOps ENVIRONMENT OVERVIEW display.

Procedure

To display health status of all XIV resources:

1. Click **ENVIRONMENT** > **ENVIRONMENT OVERVIEW** and select Adapter Kinds in the left pane to display the adapter list.

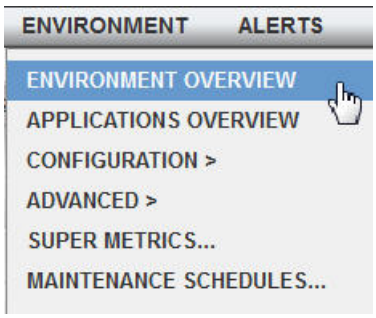


Figure 105. vCOps GUI – ENVIRONMENT OVERVIEW option

2. In the Adapter Kinds list, select IBM Storage Adapter to display the list of all XIV-related resources.

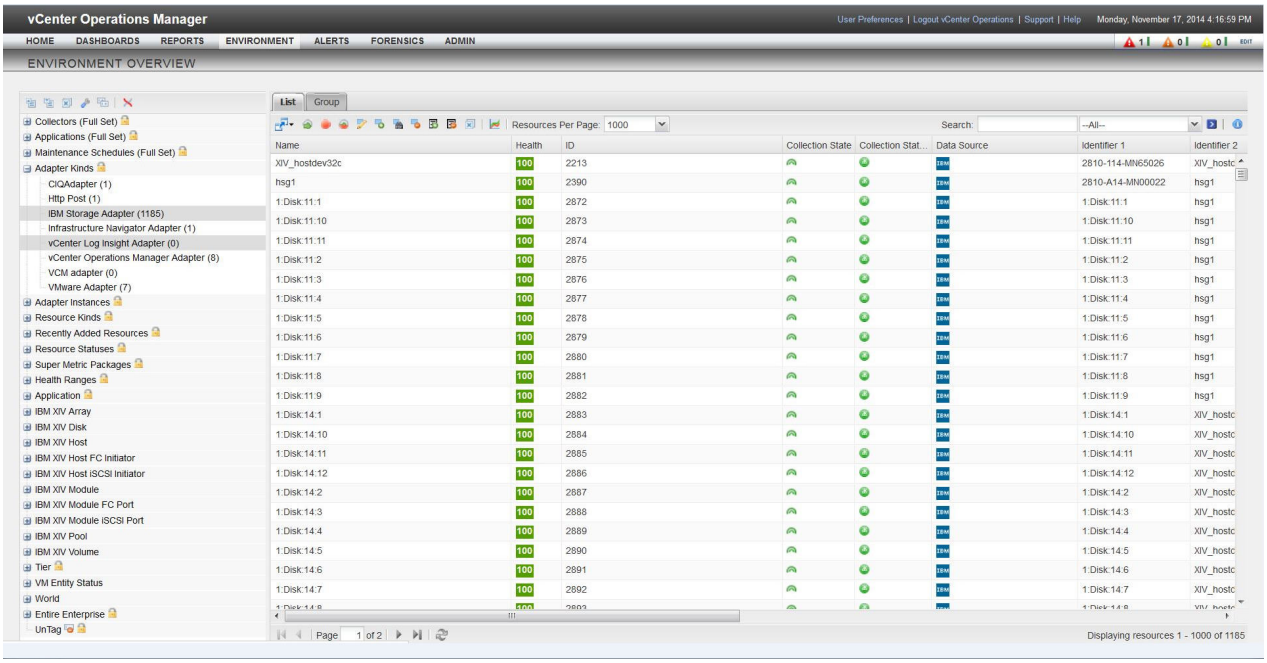


Figure 106. vCOps ENVIRONMENT OVERVIEW display

Monitoring the XIV resources using thresholds

The vCOps Manager maintains thresholds of normal behavior for each resource element.

About this task

The vCOps Manager alerts the user, when a metric violates threshold and generates an alarm. The default thresholds can be changed to fit the needs of the user.

Procedure

To change default thresholds:

1. Click **ENVIRONMENT** > **CONFIGURATION** > **ATTRIBUTE PACKAGES**. The Manage Attribute Packages dialog box is displayed.

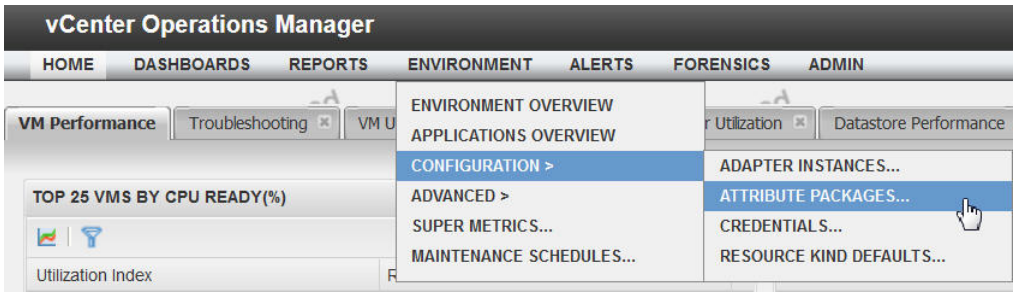


Figure 107. vCOps GUI – ATTRIBUTE PACKAGES option

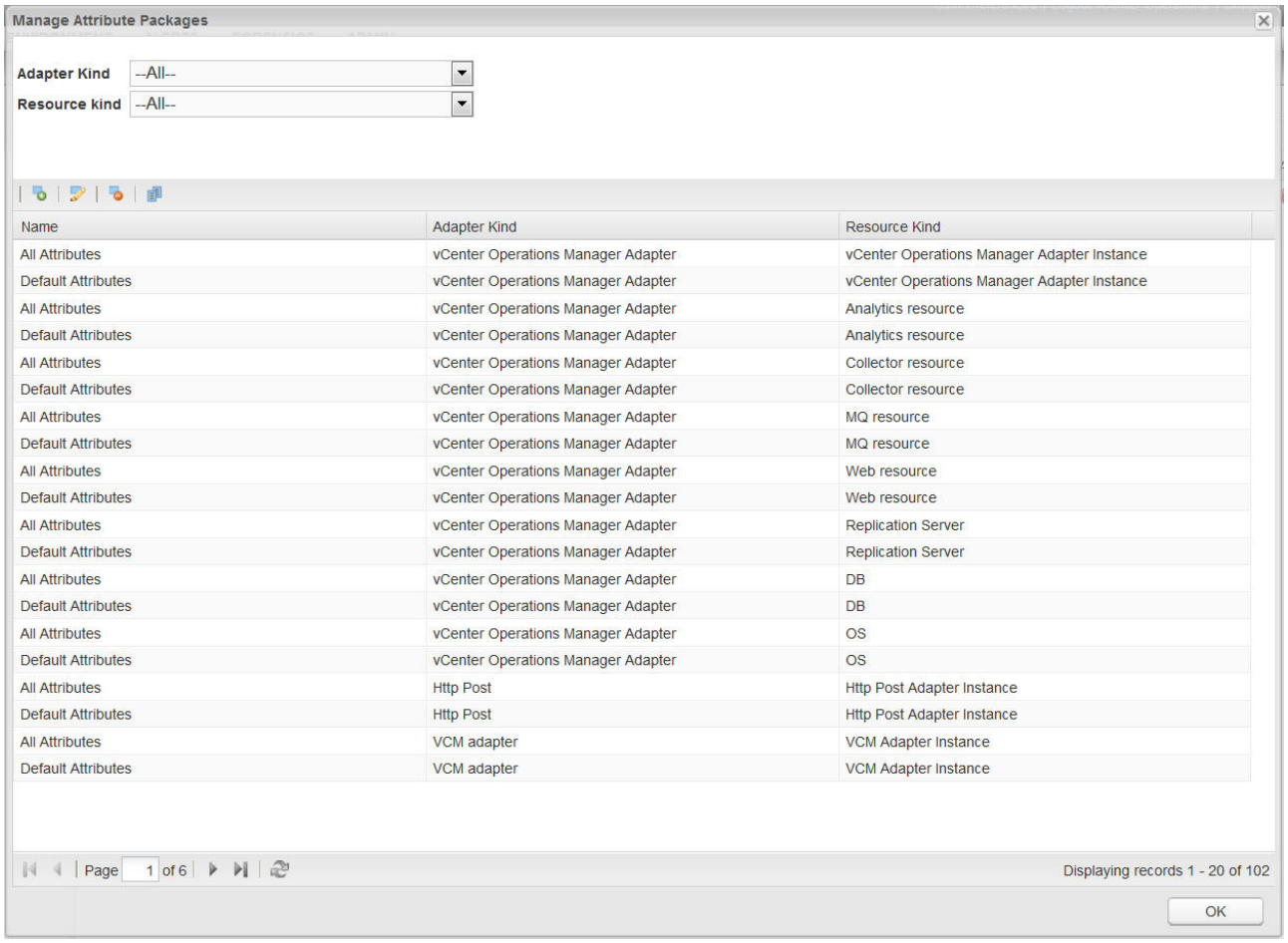


Figure 108. vCOps Manage Attribute Packages dialog box

2. In the **Adapter Kind** drop-down list, select **IBM Storage Adapter**.
3. In the **Resource Kind** drop-down list, select a storage resource, which thresholds you intend to change.
4. Double-click All Attributes to display the threshold related to the selected storage resource. The selected resource attributes are displayed.
5. In the **Attributes To Configure** pane, click on the '+' sign to display the list of metrics and select the attribute to be configured.

6. In the right-hand pane, expand the Advanced Configuration display.

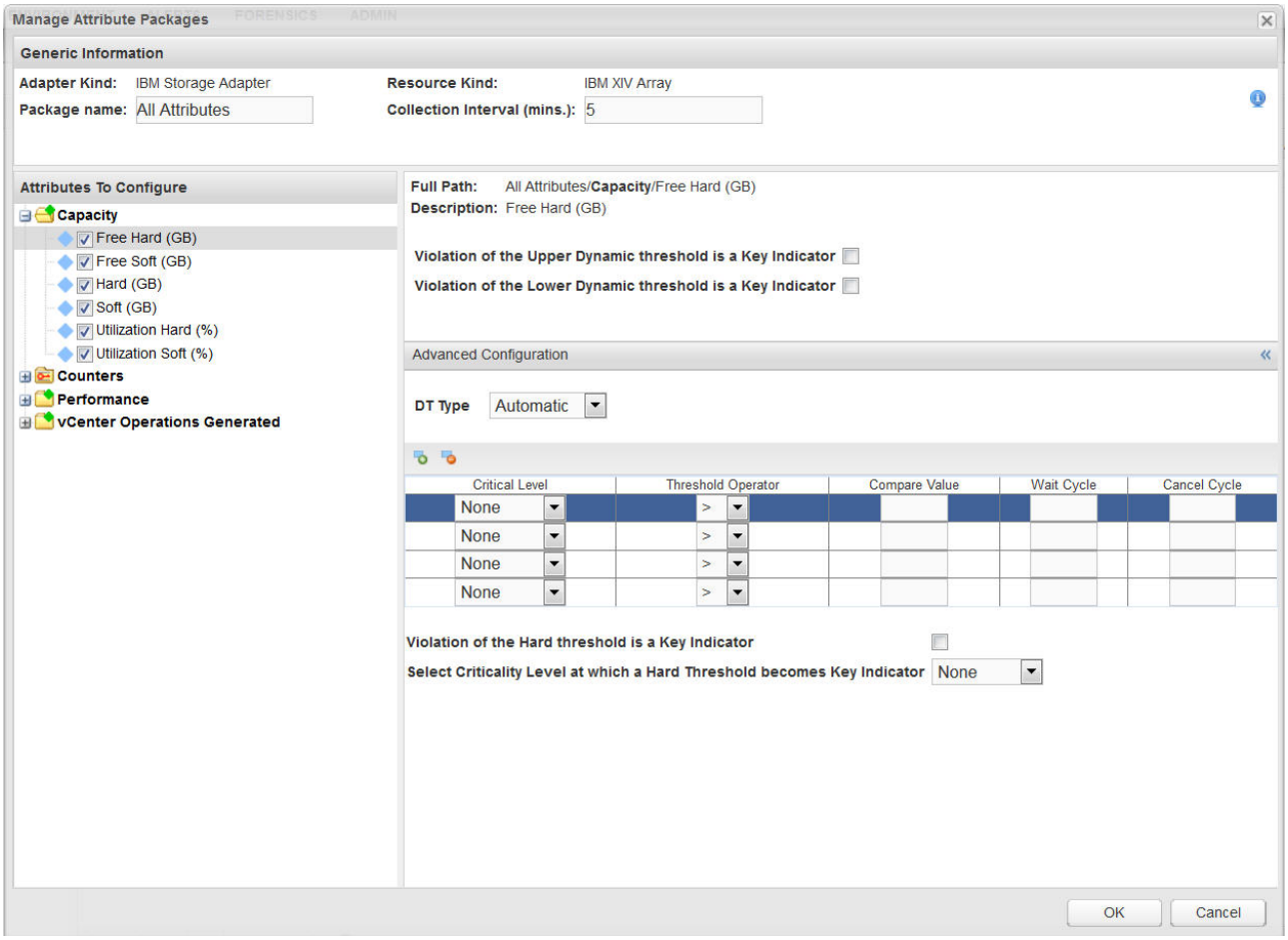


Figure 109. vCOps Manage Attribute Packages for IBM XIV storage system

7. In the **Advanced Configuration** pane, modify the threshold and select the critical level to set threshold to become key indicator.
8. Click **OK** to save the changes. The vCOps Manager starts sending alerts when the thresholds are reached.

Chapter 8. Administration

This chapter details common administrative tasks that can be performed when using the IBM Spectrum Control Base Edition.

See the following sections for more information:

- "Checking and controlling the Spectrum Control Base service"
- "Checking and modifying the configuration files" on page 136

Checking and controlling the Spectrum Control Base service

At any time, you can check whether the IBM Spectrum Control Base Edition service runs properly on the Linux host. You can also stop and then start the service if needed.

Procedure

1. Log on to the Linux command prompt environment as a root user.

Important: Only root users can complete service operations.

2. Enter the following command: **service ibm_spectrum_control status**. The status of the Celery and Django services is displayed.

```
[root@ibmsc]# service ibm_spectrum_control status
Celery services are running...
Django service is running...
```

What to do next

If you want to stop the Spectrum Control Base service, use the **stop** command:

```
[root@ibmsc]# service ibm_spectrum_control stop
Stopping Celery services, this may take several minutes ... [OK]
Stopping Django service ... [OK]
```

To start the service again, use the **start** command:

```
[root@ibmsc]# service ibm_spectrum_control start
Starting Celery services ... [  OK  ]
Starting Django service ... [  OK  ]
```

If you want to stop and then start the Spectrum Control Base service in one command, use the **restart** command:

```
[root@ibmsc]# service ibm_spectrum_control restart
Stopping Celery services, this may take several minutes ... [OK]
Stopping Django service ... [OK]
Starting Celery services ... [OK]
Starting Django service ... [OK]
```

Checking and modifying the configuration files

IBM Spectrum Control Base Edition has several configuration files that store configuration settings that you can change manually if needed.

You can view and modify the contents of each file with any standard text editor, according to the purpose and contents of each file.

After modifying a configuration file, you must restart the Spectrum Control Base service by running the following CLI command on the Linux host:

```
service ibm_spectrum_control restart
```

For more information about this service, see "Checking and controlling the Spectrum Control Base service" on page 135.

Table 23. Configuration files

File name	Directory location	Purpose or relevant parameters
ibmsyslog.conf	/opt/ibm/ibm_spectrum_control/conf.d/	Defines the logging standard per application, as well as the target of the log messages.
ibmlogs-rotate	/opt/ibm/ibm_spectrum_control/conf.d/	Controls the archive and renewal timing attributes of the log files. For the list of log files, see "Checking the log files" on page 139.
ldap.ini	/opt/ibm/ibm_spectrum_control/conf.d/	See "Configuring LDAP-based directory user access" on page 21.
ldap.conf	/etc/openldap/	See "Configuring LDAP-based directory user access" on page 21.
vasa_config.ini	/opt/ibm/ibm_spectrum_control/conf.d/vasa1/	• **populate_vasa_events_and_alarms** – The time interval in minutes between each operation of filtering relevant events for each connected vCenter server. The default value is 2.
vwc_config.ini	/opt/ibm/ibm_spectrum_control/conf.d/vwc/	• **populate_all_vmware_objects** – The time interval in minutes between each operation of refreshing of all vCenter server information on Spectrum Control Base. The default value is 30. When using a large number of vCenter servers, the value might need to be higher.
hsgsvr_config.ini	/opt/ibm/ibm_spectrum_control/conf.d/hsgsvr/	• **populate_arrays_and_events** – The time interval in minutes between each update of information (changes and events) received from each monitored storage system. The default value is 10. When using a large number of storage systems, the value might need to be higher than 10. See "Working with multiple storage systems" on page 146 for additional information.

Table 23. Configuration files (continued)

File name	Directory location	Purpose or relevant parameters
vcops_config.ini	/opt/ibm/ibm_spectrum_control/conf.d/vcops	See "Adjusting system update interval." See "Configuring alarm reporting." See "Configuring metrics scope" on page 138. See "Enabling SSL verification" on page 138.

Adjusting system update interval

The IBM Storage adapter pushes the XIV system information to the vCenter Operations Manager HTTP Post Adapter, using HTTP post requests.

About this task

By default, the update occurs every five minutes. The system information includes the following:

- Resource definition and all its relevant matrices
- Relationship between the XIV resources
- Relationship between XIV volumes and VMware datastore
- XIV events

Procedure

To change the system update interval:

In the vcops_config.ini file, change the **vcops_push_interval** parameter to a desired value in minutes.

Configuring alarm reporting

XIV events are relayed to the vCenter Operations Manager via the IBM Storage adapter.

About this task

By default, the IBM Storage adapter reports only immediate and critical XIV events to the vCenter Operations Manager. You can select a lowest severity level, instructing the IBM Storage adapter to deliver events that are equal or above the specified value. In addition, you can disable event reporting altogether.

Procedure

To configure alarm reporting:

In the vcops_config.ini file, set the **event_level** parameter to one of the following values:

- none – no events are reported
- info – all events are reported

- warning – warning, immediate and critical events are reported
- immediate – immediate and critical events are reported
- critical – only critical events are reported

Configuring metrics scope

The IBM Storage adapter relays the XIV metrics data to the vCenter Operations Manager.

About this task

You can adjust the scope of metrics data that is pushed by the IBM Storage adapter. By default, the detailed metrics are reported, but you can change the setting to deliver only summary of the performance counters.

Procedure

To change the scope of statistics data:

In the `vcops_config.ini` file, change the **`push_detailed_statistics`** parameter to True (detailed performance metrics) or False (performance metrics summary).

Enabling SSL verification

SSL protocol provides an encrypted communication link between the vCOps server and the IBM Spectrum Control Base Edition.

About this task

To ensure a secure communication channel between the vCOps server and the IBM Spectrum Control Base Edition, you can enable the SSL certification, which is disabled by default. If you enable the SSL verification, make sure to provide a valid certificate via Linux.

Procedure

To enable SSL verification:

In the `vcops_config.ini` file, change the **`verify_ssl_certificate`** parameter to True (enable).

Chapter 9. Troubleshooting

This chapter can help you detect and solve problems that you might encounter when using the IBM Spectrum Control Base Edition.

Note: For up-to-date information about known issues and possible workarounds, refer to the latest release notes.

See the following sections for more information:

- "Checking the log files."
- "Checking the format of directory-based storage system credentials" on page 141.
- "Configuring event forwarding" on page 142.
- "Deleting unused virtual volumes" on page 142
- "Self-assist options for IBM Spectrum Control Base Edition" on page 143.

Checking the log files

The IBM Spectrum Control Base Edition maintains six log files that record different types of events.

You can find the following log files in the `/var/log/sc/` directory:

- `events.log` – Records Spectrum Control Base events according to their type: **Info**, **Error**, or **Warning**. The event logging is compatible with the Rsyslog application, an open source utility for forwarding log messages over IP networks (for more information, see the Rsyslog website). The following example shows different events that might be recorded:

```
IBMSC-0001, INFO, "User {user_name} has logged in."
IBMSC-0002, INFO, "User {user_name} has logged out."
IBMSC-0003, WARNING, "User {user_name} login attempt failed."
IBMSC-0004, INFO, "IBM Spectrum Control local user account {user_name} was created."
IBMSC-0005, INFO, "IBM Spectrum Control local user account {user_name} was deleted."
IBMSC-0006, INFO, "IBM Spectrum Control local user account {user_name} password was reset."
IBMSC-0007, INFO, "Storage credentials were set for user {user_name}."
IBMSC-0008, ERROR, "Storage credentials for user {user_name} were disabled. Reason: {reason}."
IBMSC-0009, INFO, "Storage array identified as {identifier} with IP address {ip_address} has been added."
IBMSC-0010, WARNING, "Storage array {identifier} was removed."
IBMSC-0011, WARNING, "Storage array {identifier} was modified. Its new IP address is {ip_address}."
IBMSC-0014, INFO, "vCenter server with IP address {ip_address} was added by user {user_name}."
IBMSC-0015, WARNING, "vCenter server with IP address {ip_address} was removed."
IBMSC-0016, WARNING, "Credentials for vCenter server with IP address {ip_address} were updated by user {user_name}."
IBMSC-0017, INFO, "Storage pool {pool_name} on storage array {identifier} was attached to vCenter server with IP address
{ip_address}."
IBMSC-0018, WARNING, "Storage pool {pool_name} on storage array {identifier} was detached from vCenter server with IP address
{ip_address}."
IBMSC-0019, ERROR, "Failed to connect to storage array {identifier}. Reason: {reason}."
IBMSC-0020, INFO, "Information retrieval from storage array {identifier} was completed."
IBMSC-0021, ERROR, "Failed to retrieve information from storage array {identifier}. Reason: {reason}."
IBMSC-0022, INFO, "LDAP authentication was enabled."
IBMSC-0023, INFO, "LDAP authentication was disabled."
IBMSC-0024, INFO, "Completed the vSphere Web Client extension task {task_name} with the following parameters: {parameter_list}."
IBMSC-0025, ERROR, "Failed to complete the vSphere Web Client extension task {task_name} with the following parameters
{parameter_list}.
Reason: {reason}."
```

- `hsgsvr.log` – Records events regarding monitoring and operations on storage systems and volumes.
- `vasa1.log` – Records events regarding the communication between Spectrum Control Base and the connected vCenter servers that utilize VASA 1.0 functions.

- `vasa2.log` – Records events regarding the communication between Spectrum Control Base and the connected vCenter servers that utilize VASA 2.0 functions. In addition, several events related to the VASA 1.0 activity may be recorded in the `vasa2.log` file as well.
- `vwc.log` – Records events regarding the communication between Spectrum Control Base and the vSphere Web Client Server on which the IBM Storage Enhancements are installed.
- `celery.log` – Records events regarding the Celery services on the Linux host on which Spectrum Control Base is installed.
- `django.log` – Records events regarding the Django service on the Linux host on which Spectrum Control Base is installed.
- `vco.log` – Records events regarding operation of the vSphere Orchestrator, complementing information stored in the `hsgsvr.log` file. The `vco.log` file can be accessed via the **Log** tab of the vCO plug-in interface. If the Inventory folder within the 'IBM Storage' context is empty and the following message is stored in the **`vco.log:`**
  `[SCRepository] com.sun.jersey.api.client.ClientHandlerException: javax.net.ssl.SSLHandshakeException: java.security.cert.CertificateException: No name matching sc8.ps.xiv.ibm.com found`,
  replace the default Spectrum Control Base SSL certificate and key files as described in “GUI – Managing server certificates” on page 33.
- `vcops.log` – Records events regarding the communication between Spectrum Control Base and the connected vCOps servers.
- `traffic.log` – Records XCLI events. This log file is reserved for debug purposes.

You can retrieve and save the current log files in a compressed TAR archive file by using the **Collect Log** option on the Settings menu of the Spectrum Control Base GUI. This option allows you to save different instances of the log files at different times.

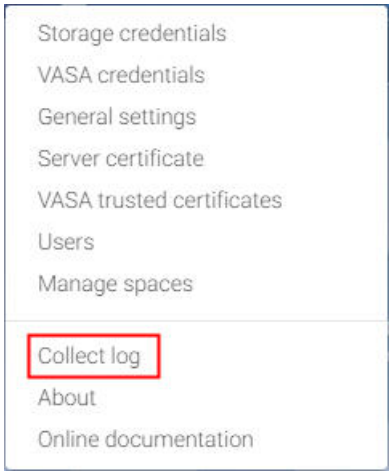


Figure 110. Controller GUI – Collect Logs option

Checking the format of directory-based storage system credentials

If you are using directory-based storage credentials for adding storage systems to the IBM Spectrum Control Base Edition (not for logging in to Spectrum Control Base), you must verify that the directory user name is provided in the correct format.

Different formats are possible for a directory-based user name. For example:

- User name without the domain name, for example: `john21`
- User name with the domain name, for example: `john21@domain_name`

The format that should be used depends on the **directory user name attribute string** that is defined on the storage system. For example:

- **`sAMAccountName`** – User name without the domain name (`john21`).
- **`userPrincipalName`** – User name with the domain name (`john21@domain_name`).

Important: Other user name formats that are not specified above may be used. Consult with your directory server administrator about the required user name format, and make sure that the user name format is properly defined on the storage system.

The following figure shows the user name attribute in the LDAP role mapping definitions for XIV (defined via the XIV management GUI).

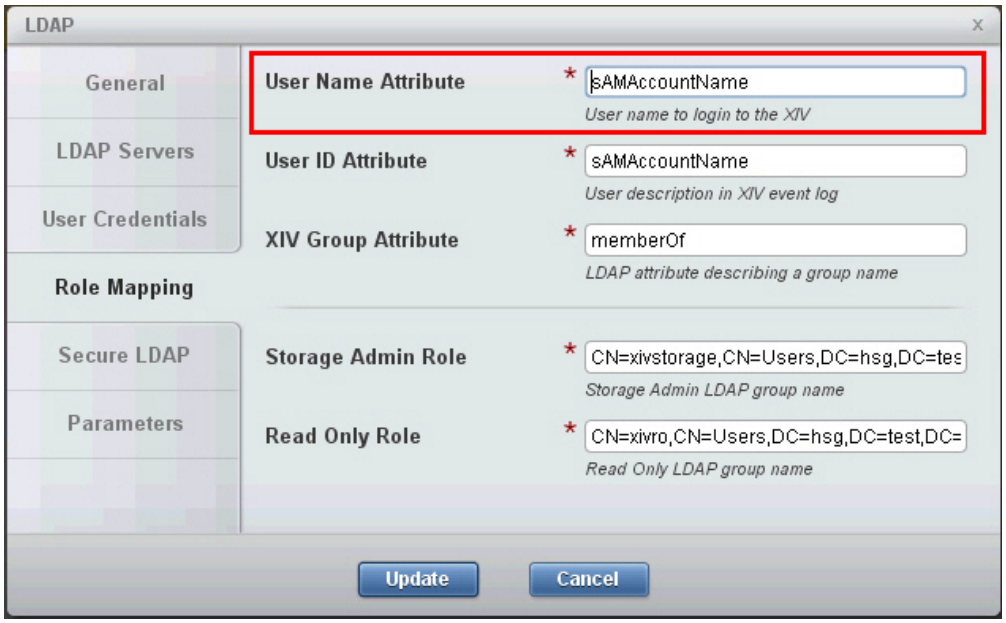


Figure 111. XIV role mapping attributes for directory (LDAP) users

Related tasks:

"GUI – Entering the storage system credentials" on page 40
The storage system credentials are used to connect to the IBM storage system or systems, which your VMware platforms use for storage provisioning.

Configuring event forwarding

Storage system level events generated by a storage system can be forwarded by the IBM Spectrum Control Base Edition to the VMware vRealize Log Insight for monitoring and analysis.

Procedure

To configure event forwarding:

1. Go to the `/opt/ibm/ibm_spectrum_control/conf.d/` directory.
2. Open the `ibmsyslog.conf` file for editing.
3. Look for the following code block:

```
if $programname == 'array_events' then ?SCLogFileName;SCLogFormat
& ~
```

4. Add the IP address of the VMware vRealize Log Insight server and UDP port in the following format: `& @@<log_insight_address>:<port>`.

Example

To forward the storage system events to the VMware vRealize Log Insight server with IP address 9.151.163.122 via UDP port 514 in addition to writing them to the `/var/log/sc/array_events.log` file, enter the following:

```
if $programname == 'array_events' then ?ISISLogFileName;ISISLogFormat
& @@9.151.163.122:514
& ~
```

To relay the storage system events to the VMware vRealize Log Insight server with IP address 9.151.163.122 via UDP port 514 without writing them to the local log file, enter the following:

```
if $programname == 'array_events' then @@9.151.163.122:514
& ~
```

Deleting unused virtual volumes

When a VM is deleted in the vSphere environment, its underlying storage resources (pools) and virtual volumes might remain on the storage system even after the deletion. These elements are not visible on the Spectrum Control Base GUI, and must be deleted via XCLI.

About this task

This procedure details how to use XCLI to delete residual XIV storage resources and orphaned virtual volumes after their VMs were deleted.

Procedure

To delete the leftover virtual volumes:

1. Launch the XIV XCLI tool and log in as a storage administrator (*storageintegrationadmin*).
2. List all existing virtual volumes, by using the **`vol_list`** command.

```
XIV hostdev31c>>vol_list managed=yes domain=test
Name   Size (GB) Master Name Consistency Group  Pool       Creator   Compressed  Compression Ratio (%)  Used Capacity (GB)  Compression Saving (GB) Managed
test_1 17                                       gp_1_meta  tester_1  no          0                                                                  yes
test_1 18                                       gp_2_meta  tester_1  no          0                                                                  yes
```

3. Delete the virtual volume, by using the **`vol_delete`** command.

```
XIV hostdev31c>>vol_delete vol=test_1
Warning:   This is a managed object. Performing manual operations on it may cause severe problems to the managing software. Are you sure you want to perform
the operation on this managed object? y/n: y
```

4. List all group pools in the domain, by using the **gp_list** command.

```
XIV hostdev31c>>gp_list domain=test
Name                    Meta Pool Name              Thin Pool Name              Thick Pool Name
gp_1                    gp_1_meta                   gp_1_thin                   gp_1_thick
gp_2                    gp_2_meta                   gp_2_thin                   gp_2_thick
```

5. List all pools in the group pool, by using the **pool_list** command.

```
pool_list gp=gp_1 managed=yes
Name        Size (GB) Soft Vols (GB) Snap Size (GB) Soft Empty (GB) Hard Size (GB) Hard Vols (GB) Locked Hard Snaps (GB) Hard Empty (GB) Domain Create Compressed Volumes Managed
gp_1_thin   653       0              34             619             309             0              no     0               309             test   no                       yes
gp_1_meta   0         0              0              0               0               0              no     0               0               test   no                       yes
gp_1_thick  34        0              34             0               34              0              no     0               34              test   no                       yes
```

6. Delete the group pool, by using the **gp_delete** command.

```
XIV hostdev31c>>gp_delete gp=gp_1
```

7. Delete the all pools that belonged to the deleted group pool, by using the **pool_delete** command.

```
XIV hostdev31c>>pool_delete pool=gp_1_thin
```

Self-assist options for IBM Spectrum Control Base Edition

IBM Support provides several online self-service tools for Spectrum Control Base Edition users.

You can try using the following tools to find information and resolve issues without having to contact IBM Support:

- Spectrum Control-related questions on IBM developerWorks (developer.ibm.com/answers/topics/spectrum%20control/#) – Allows you to ask questions online and get answers from IBM experts or other users. The issue of interest can also be searched for in older discussions.
- IBM Redbooks® (redbooks.ibm.com) – Technical documents where IBM experts share their expertise and best practices for using IBM Spectrum Control.

The above resources are constantly being indexed by web search engines such as Google (google.com).

Chapter 10. Best practices

Refer to the general guidance and best practices that are described in the following sections.

- "Handling datastores"
- "Handling ESXi hosts that use XIV volumes"
- "Distributing volumes evenly on DS8000 systems"
- "Setting the multipath policy for DS8000 and Storwize Family systems"
- "Working with multiple storage systems" on page 146
- "Upgrading or installing Spectrum Control Base with vSphere failover" on page 147
- "Creating a VVol-enabled service" on page 147
  - "Creating a VVol-enabled service on XIV storage systems" on page 148
  - "Creating a VVol-enabled service on storage systems that run IBM Spectrum Virtualize" on page 149

Handling datastores

For best performance of VMware datastores:

- Create each datastore on a separate storage volume.
- If you use snapshots/mirroring for volumes, place all Datastore Extents volumes (the building block LUNs of a datastore) in a consistency group (defined by using the storage system GUI or CLI).

Handling ESXi hosts that use XIV volumes

For the best performance of ESXi hosts that use XIV volumes, define all ESXi hosts within a cluster as cluster hosts on the XIV storage system as well.

Following this practice prevents situations in which a storage volume is mapped to different ESXi hosts in a cluster using different LUN numbers, thus making this LUN unusable.

Distributing volumes evenly on DS8000 systems

DS8000 storage systems have two rank groups, 0 and 1, each managed by a single server. In addition, each DS8000 extent pool is based on one rank group.

Accordingly, it is recommended to spread volumes evenly across the DS8000 systems. Spreading the volumes equally on the extent pools of rank groups 0 and 1 balances the workload across the DS8000 system.

Setting the multipath policy for DS8000 and Storwize Family systems

When using the IBM Storage Enhancements for VMware vSphere Web Client, the recommended multipath policy for DS8000 and Storwize Family (including SAN Volume Controller) storage systems is **Round Robin**.

If you are using VMware ESXi servers of version 5.5 or later, the **Round Robin** multipath policy is enforced by default. However, if you are using earlier ESX or

ESXi versions, the **Fixed** policy is chosen by default, and it is recommended to change the multipath policy on those servers to **Round Robin**.

For information about how to change the default multipath policy enforcement for earlier ESX or ESXi versions, refer to article 1017760 on the VMware Knowledge Base website (kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1017760).

Working with multiple storage systems

The IBM Spectrum Control Base Edition, running on RHEL 6.3–6.6 64-bit operating systems, utilizes CPU and memory resources in accordance with the amount of objects monitored by the vCOps server.

Before you begin

For best results, deploy Spectrum Control Base on a dedicated server. The minimum hardware requirements are detailed in the latest release notes, available on the IBM Knowledge Center or on the IBM Fix Central (www.ibm.com/support/fixcentral).

About this task

The object population is handled by Celery workers. Any increase in the amount of the monitored objects requires additional workers and hardware resources to complete this task. By default, five Celery workers are active. The recommended hardware and software requirements for different amounts of monitored objects are as follows:

- Up to 1000 objects per storage system:
  - Up to 20 storage systems – 64-bit dual-core CPU, 4 GB of RAM, 5 Celery workers
  - Up to 40 storage systems – 64-bit quad-core CPU, 6 GB of RAM, 7 Celery workers
  - Up to 100storage systems – 64-bit six-core CPU, 6 GB of RAM, 13 Celery workers
- Up to 5000 objects per storage system:
  - Up to 20 storage systems – 64-bit quad-core CPU, 4 GB of RAM, 5 Celery workers
  - Up to 40 storage systems – 64-bit six-core CPU, 6 GB of RAM, 10 Celery workers, 15 min. population interval
  - Up to 100 storage systems – 64-bit six-core CPU, 6 GB of RAM, 15 Celery workers, 25 min. population interval

The procedure for adding Celery workers and adjusting population interval is detailed below.

Procedure

To configure a number of Celery workers and adjust a population interval:

1. Go to the `/opt/ibm/ibm_spectrum_control/conf.d/celery` directory.
2. Edit the `ldl_array` file and change the number of Celery workers in the **hsgsvr_array** parameter to a desired value.
3. Save the changes.

4. Go to the `/opt/ibm/ibm_spectrum_control/conf.d/hsgsvr` directory.
5. Edit the `hsgsvr_config.ini` file and change the population interval in the **`populate_arrays_and_events`** parameter to a desired value in minutes.
6. Save the changes.
7. Restart the Spectrum Control Base service (`service ibm_spectrum_control restart`).

Upgrading or installing Spectrum Control Base with vSphere failover

Spectrum Control Base can be upgraded or installed together with vSphere failover procedure.

Before you begin

- Verify that at least two Spectrum Control Base instances are registered as storage providers on a vCenter server.
- Both Spectrum Control Base instances must be online, one of them must be active and the other one – standby.

About this task

To minimize system downtime, you can upgrade the existing Spectrum Control Base or install its new release along with completing failover between active and standby instances in vSphere environment.

Procedure

1. Copy the upgrade or installation package files to a temporary folder on a virtual machine that is hosting Spectrum Control Base.
2. Upgrade or install the standby Spectrum Control Base instance. See "Upgrading an existing installation" on page 12 or "Extracting and installing the IBM Spectrum Control Base Edition software package" on page 15.
3. Verify the standby instance connectivity to a storage system, by using the **`sc_storage_array list`** command. A proper connectivity to a storage system is indicated by *Yes* in the *Connected* field, as illustrated in the following example.

```
Array Alias    Array Identifier    Management IP Addresses    Elapsed time since last update    Connected    Notes
-------------  ------------------  -------------------------  --------------------------------  -----------  -------
SVC232         0000020062A1D16C    9.115.246.232               7 minutes                         Yes
```

4. Complete the active Spectrum Control Base failover to the standby instance, by restarting the guest operation system of the virtual machine that is hosting the active Spectrum Control Base. The failover process can take up to 8 minutes to complete. As a result, the standby instance becomes active, running the newly upgraded or installed Spectrum Control Base.
5. Repeat the upgrade/install and failover processes for the remaining Spectrum Control Base instances.

Creating a VVol-enabled service

The IBM Spectrum Control Base Edition introduces a comprehensive storage virtualization support, using VMware virtual volume (VVol) technology.

Before you begin

Note: The virtual volume functionality is supported by the IBM XIV (11.5.1 or later) and storage systems that run IBM Spectrum Virtualize (7.6 or later).

- Verify that all required ESXi hosts are connected and defined at the storage system side.
- Verify that the Spectrum Control Base time is synchronized with the time, used by the vCenter server

About this task

This section details how to create a VVol-enabled storage service on XIV or storage systems that run IBM Spectrum Virtualize. The service or a group of services can be used to define storage spaces, serving as virtual datastores for VM deployment. See the following sections, depending on a storage system in use:

- "Creating a VVol-enabled service on XIV storage systems"
- "Creating a VVol-enabled service on storage systems that run IBM Spectrum Virtualize" on page 149

Creating a VVol-enabled service on XIV storage systems

The IBM Spectrum Control Base Edition introduces a comprehensive storage virtualization support, using VMware Virtual Volume (VVol) technology.

About this task

This section details how to create a VVol-enabled storage service on XIV storage systems.

To create a VVol-enabled storage service:

- Enable VVol utilization at the XIV side.
- Create the service, using Spectrum Control Base.

Procedure

1. Launch the XIV management GUI and log in as a storage administrator.
2. Create a domain with required soft and hard capacity. Make sure that the soft capacity is four times larger than the hard capacity.
3. For XIV and Spectrum Accelerate storage systems, define a user with category *storageintegrationadmin*.
4. Associate the *storageintegrationadmin* user with the domain.
5. Associate all ESXi hosts with the domain.

Important: The managed domain that you created cannot be used for traditional volumes without virtualization. You must create a separate regular domain for them. This domain must have the same user and the ESXi hosts that you intend to manage. However, you need to create a separate storage resource and a new service on the regular domain via Spectrum Control Base for subsequent use by the VMware vWC.

---

6. Launch the XIV XCLI tool.
7. Enable the metadata service for the XIV, using the `metadata_service_enable` command.
8. Close the he XIV XCLI tool and return to the XIV management GUI.
9. Change the storage administrator user to *storageintegrationadmin* user and re-launch the XIV XCLI tool

10. Create a new Administrative Logical Unit (ALU) per each ESXi host. Use the following XCLI format: `alu_create alu=<alu-name> host=<host-name> lun=logical-unit-number`. Make sure that the LUN is in the 512–755 range.
11. Launch Spectrum Control Base.
12. Configure a fully qualified domain name for the Spectrum Control Base server and define a high-availability group. See "GUI – Defining a high-availability group" on page 32.
13. Generate a self-signed Spectrum Control Base server certificate. See "GUI – Managing server certificates" on page 33.
14. Set up VASA credentials. See "GUI – Setting the VASA credentials" on page 46.
15. Enable the *storageintegrationadmin* to access the XIV storage resources. See "GUI – Entering the storage system credentials" on page 40.
16. Add the XIV storage system to the Spectrum Control Base. See "GUI – Adding a storage system" on page 42.
17. Add a new storage space. See "GUI – Adding a storage space" on page 48.
18. Add a VVol-enabled service to the storage space. See "GUI – Adding a storage service" on page 50.
19. Define a storage resource and attach it to the VVol-enabled service. See "GUI – Defining and attaching storage resources" on page 55.
20. Register Spectrum Control Base as a storage provider on VMware vCenter server. See "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91.
21. Launch the vWC and create a VVol-enabled datastore. Select the storage space that you defined as an underlying storage resource for the datastore.

Creating a VVol-enabled service on storage systems that run IBM Spectrum Virtualize

The IBM Spectrum Control Base Edition introduces a comprehensive storage virtualization support, using VMware Virtual Volume (VVol) technology.

About this task

This section details how to create a VVol-enabled storage service on storage systems that run IBM Spectrum Virtualize (7.6 or later).

To create a VVol-enabled storage service:

- Enable VVol utilization at the side of a storage system that runs IBM Spectrum Virtualize.
- Create the service, using Spectrum Control Base.

Procedure

1. Activate the storage system CLI utility and log in as *SecurityAdmin*, and then create a user group with role *VASAProvider* (**mkusergrp -name <vasa_group_name> -role VASAProvider**).
2. Create a *VASAProvider* user in the user group (**mkuser -name <user_name> -usergrp <vasa_group_name>**).
3. Create a metadata volume (**mkmetadatavdisk -mdiskgrp <pool_name>**).
4. For each ESXi host, define the host on the storage system as *adminlun* type (**svctask mkhost -name <host_name> -fcwwpn <fibre_channel_wwpn> -iscsiname <iscsi_wwn> -type adminlun**).

5. Launch Spectrum Control Base.
6. Define a high-availability group. See "GUI – Defining a high-availability group" on page 32.
7. Generate a self-signed Spectrum Control Base server certificate. See "GUI – Managing server certificates" on page 33.
8. Set up VASA credentials. See "GUI – Setting the VASA credentials" on page 46.
9. Enable the *VASAProvider* user to access the storage resources. See "GUI – Entering the storage system credentials" on page 40.
10. Add the storage system to the Spectrum Control Base. See "GUI – Adding a storage system" on page 42.
11. Add a new storage space. See "GUI – Adding a storage space" on page 48.
12. Add a VVol-enabled service to the storage space. See "GUI – Adding a storage service" on page 50.
13. Define a storage resource and attach it to the VVol-enabled service. See "GUI – Defining and attaching storage resources" on page 55.
14. Register Spectrum Control Base as a storage provider on VMware vCenter server. See "Registering Spectrum Control Base as a storage provider in vCenter server" on page 91.
15. Launch the vWC and create a VVol-enabled datastore. Select the storage space that you defined as an underlying storage resource for the datastore.

Chapter 11. RESTful API

RESTful API for IBM Spectrum Control Base Edition provides an application programming interface (API) for managing IBM storage resources, using the Spectrum Control Base capabilities.

Note: This Spectrum Control Base version supports API management only for IBM Spectrum Accelerate storage systems.

RESTful API for Spectrum Control Base relies on a transport protocol to process the following requests.

- Query – Returns object entities managed by Spectrum Control Base.
- Create – Creates a new entity.
- Delete – Deletes an existing entity.
- Update – Performs a partial update of an existing entity.
- Action – Performs a complimentary action (for example, phases out a disk on a specific XIV system).

RESTful API protocol

The API uses HTTP as the transport protocol and relies on HTTP for some features (for example, security).

The protocol relies on HTTP methods to support CRUD operations (Create/Read/Update/Delete).

- POST – Create and action operations.
- GET – Query (read) operations.
- DELETE – Delete operations.
- PATCH – Partial update operations.

The API URL is built from scope specifiers and resource identifiers.

- **api** – Specifies the main API scope.
- **v1** – Specifies the protocol version.
- **resource type** – Specifies type of the system resource.
- **id** – Identifies the resource.

For example, `GET /api/v1/disks/7`.

RESTful API for Spectrum Control Base returns the following codes for request status:

- **200** – The request has succeeded.
- **401** – The request requires user authentication.
- **405** – The request method is not allowed for the specified resource.
- **500** – The request cannot be implemented due to an unexpected condition.

Note: Additional codes may be used according to the requirements of the REST standards.

Query request and response

RESTful API for IBM Spectrum Control Base Edition uses query requests to return the state of a single resource or a list of resources.

You can run a query by issuing the **GET** command (on a URI). The following list shows the query format types:

- A single resource – Single resource properties are returned.
- A collection of resources – A list of resources and their properties is returned.

For example, `GET /api/v1/interfaces/22` lists the properties of the interface with identification number 22, as illustrated below.

```
{
    "name": "aaab",
    "array": "pu16",
    "module": "1:Module:1",
    "type": "iSCSI",
    "address": "3.3.3.5",
    "netmask": "255.255.255.0",
    "gateway": "3.3.3.254",
    "address6": "",
    "gateway6": "",
    "mtu": "1500",
    "ports": "1",
    "id": 22
}
```

Note: Query requests can contain additional URI arguments, such as filtering parameters. When used, it returns only resources that match your filtering criteria. For example, `GET /api/v1/interfaces?array=pu21` captures interfaces that exist on array *pu21*.

The **GET** command can be used to monitor a running task. For example, `GET /api/v1/tasks/04fc6120-60ae-4182-baa9-687d6ae96ffe` returns the current task status:

```
{
    "reason": null,
    "task_id": "04fc6120-60ae-4182-baa9-687d6ae96ffe",
    "start_time": "2015-03-03T06:57:48.573",
    "task_state": "Running",
    "array_id": "2810-999-PR16118",
    "name": "disk phase-in"
}
```

A task ID is generated, when the task is initiated by the action request. See "Action request and response" on page 154.

Create request and response

RESTful API for IBM Spectrum Control Base Edition uses create requests for object creation.

You can create an object by issuing the **POST** command followed by request object. The request must contain a set of parameters required for object creation.

For example, `POST /api/v1/interfaces` entered with the parameters detailed below, creates an interface on the specified storage system module.

```
name aaab
address 3.3.3.3
netmask 255.255.255.0
gateway 3.3.3.254
array pu16
module 1:Module:1
ports 1
```

The response to the POST request is as follows:

- `OK`, followed by the new object, if the task is completed successfully.
- An error message, detailing a reason for the failed request, as illustrated below.

```
{
    "detail": "One of the physical ports specified is already assigned to an IP Interface"
}
```

Delete request and response

RESTful API for IBM Spectrum Control Base Edition uses delete requests for object deletion.

You can delete an object by issuing the **`DELETE`** command on a full URL. The request must contains a single object, which is a target of the delete request.

For example, `DELETE /api/v1/interfaces/22` deletes the interface 22.

The response to the delete request is `OK` if the task is completed successfully, or an error message with a status code, detailing a reason for the failed request, as illustrated below.

```
{
    "detail": "Not found"
}
```

Update request and response

RESTful API for IBM Spectrum Control Base Edition uses update requests for partial object update.

You can update an object by issuing the **`HTTP PATCH`** command on a full URL. The request must contains a single object, which is the target of the update request.

For example, `PATCH /api/v1/interfaces/26` entered with the parameters detailed below, changes the name and IP address of the interface 26.

```
name aaac
address 3.3.3.5
```

The response to the update request is as follows:

- `OK`, followed by the updated object, if the task is completed successfully
- An error message with a status code, detailing a reason for the failed request, as illustrated below.

```
{
    "detail": "IP address specified for the default gateway is not in the subnet of
   the IP Interface"
}
```

Action request and response

RESTful API for IBM Spectrum Control Base Edition uses action requests to perform complimentary actions on the requested objects, which are out of scope of other request types.

You can initiate an action by issuing the **POST** command (on a URI). For example, `POST /api/v1/disks/82/phasein` starts a phase-in procedure for disk 82.

The response to the request is OK, followed by the task ID, as illustrated below. The task ID can be used in a query request to monitor the task progress, see "Query request and response" on page 152.

```
OK
{
    "task id": "04fc6120-60ae-4182-baa9-687d6ae96ffe"
}
```

If the request fails, an error message is displayed, carrying a status code with a reason for the failed request.

Storage system operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET** and **POST** commands for storage system (array) operations.

You can run a storage system query by issuing the **GET** command to retrieve a list of storage systems and their properties, or display the properties of a single storage system.

For example, `GET /api/v1/arrays/2810-999-dc21011` lists the properties of the storage with identification number 2810-999-dc21011, as illustrated below.

```
OK 200
{
  "id": 2810-999-dc21011,
  "alias": "pu21",
  "mgmt_addresses": [
        "9.151.153.87",
        "9.151.153.86",
        "9.151.153.39"
   "last_updated": "2015-04-15T17:55:02.431",
   "error_message": "",
   "connected": true,
   "name": "XIV pur21m10m11m15",
   "firmware_version": "11.5.0",
   "scsi_model_identifier": "2810XIV",
   "array_type": "2810XIV",
   "storage_model": "XIV",
   "physical_capacity": 12011310153728,
   "serial": "21011",
   "capacity_max_pool_size": 12011,
   "capacity_soft_mib": 11454878,
   "capacity_hard_mib": 11454878,
   "capacity_free_soft_mib": 32822,
   "capacity_free_hard_mib": 6859798,
   "capacity_spare_disks": 3,
   "capacity_spare_modules": 1,
   "capacity_target_spare_disks": 3,
   "capacity_target_spare_modules": 1,
   "capacity_limit_percentage": 100
}
```

The upgrade procedure is implemented by issuing the **POST** command with this syntax: `POST /api/v1/arrays/<array-id>/upgrade`. The input parameters include the following mandatory entries: *username*, *password* and *pkg_name*.

Note: Before running the upgrade, verify that:

- The correct installation file is stored in the `/opt/ibm/ibm_spectrum_control/downloads/` directory. The package must be compatible with the valid upgrade path from the current microcode.
- The credentials to be supplied have sufficient access level to complete the upgrade procedure.

For example, to upgrade the storage system 2810-999-dc21011 microcode to version 11.5.0.c, enter `POST /api/v1/arrays/2810-999-dc21011/upgrade` with the required parameters.

```
POST /api/v1/interfaces
{
 "username": "opsadmin",
  "password": "opspasswd",
 "pkg_name": "xiv_ver_11.5.0.c.tgz"
}
```

If the response to the upgrade request is OK, followed by the task ID, as illustrated below. The task ID can be used in a query request to monitor the upgrade progress, see "Query request and response" on page 152.

```
OK
{
    "task id": "04fc6120-60ae-4182-baa9-687d6ae96ffe"
}
```

In addition, you can use the **GET** to retrieve the current state of the upgrade procedure.

For example, to get the current upgrade status for storage system 2810-999-dc21011, enter `GET /api/v1/arrays/2810-999-dc21011/upgrade`. The output is illustrated below.

```
OK 200
{
 "array": "2810-999-dc21011",
 "state": "Upgrade Not Underway",
  "consequence": "New version has not been downloaded yet",
  "package_target_version": ""
}
```

Module operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET** and **POST** commands for module operations.

You can run a module query by issuing the **GET** command to get a list of modules that belong to a storage system and their properties, or display the properties of a single module.

For example, `GET /api/v1/modules/1` lists the properties of the module with identification number 1, as illustrated below.

```
OK 200
{
 "id": 1,
```

```
 "component_id": "1:Module:7",
 "status": "OK",
 "type" : "g3.0_interface",
 "requires_service": "REPLACE",
 "service_reason" : "HARDWARE_ERROR",
 "disk_bay_count" : 12,
 "fc_port_count" : 4,
 "ethernet_port_count" : 4,
 "memory_gb" : 15
}
```

You can initiate phase-in or phase-out action on a module by issuing the **POST** command with the following syntax:

- `POST /api/v1/modules/<module-id>/phasein`
- `POST /api/v1/modules/<module-id>/phaseout`

For example, `POST /api/v1/modules/3/phasein` starts a phase-in procedure for the module with identification number 3. The response to the request is OK, followed by the task ID, as illustrated below. The task ID can be used in a query request to monitor the task progress, see "Query request and response" on page 152.

```
OK
{
 "task id": "04fc6120-60ae-4182-baa9-687d6ae96ffe"
}
```

Disk operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET** and **POST** commands for disk operations.

You can run a disk query by issuing the **GET** command to get a list of disks that belong to a storage system and their properties, or display the properties of a single disk.

For example, `GET /api/v1/disks/1` lists the properties of the disk with identification number 1, as illustrated below.

```
OK 200
{
 "id": "1",
 "array": "pur15m1",
 "name": "1:Disk:1:2",
 "status": "OK",
 "capacity": "2TB",
 "vendor" : "IBM",
 "model" : "ST32000444SS",
 "size" : "1878633",
 "serial" : "9WM1YM3M",
 "requires_service" : "REPLACE",
 "service_reason" : "HARDWARE_ERROR",
 "temperature" : 19,
 "encryption" : "Not supported"
 "controller" : "SAS"
}
```

You can initiate phase-in or phase-out action on a disk by issuing the **POST** command with the following syntax:

- `POST /api/v1/disks/<disk-id>/phasein`
- `POST /api/v1/disks/<disk-id>/phaseout`

For example, `POST /api/v1/disks/82/phasein` starts a phase-in procedure for the disk with identification number 82. The response to the request is OK, followed by the task ID, as illustrated below. The task ID can be used in a query request to monitor the task progress, see "Query request and response" on page 152.

```
OK
{
  "task id": "04fc6120-60ae-4182-baa9-687d6ae96ffe"
}
```

Interface operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET**, **PATCH**, **POST** and **DELETE** commands for interface operations.

You can run an interface query by issuing the **GET** command to get a list of IP interfaces that belong to a storage system and their properties, or display the properties of a single interface. The command output can be filtered by module ID or interface type (management, iSCSI, etc.).

For example, `GET /api/v1/interfaces/11` lists the properties of the interface with identification number 11, as illustrated below.

```
OK 200
{
 "name": "management",
 "array": "pu16",
 "module": "1:Module:1",
 "type": "Management",
 "address": "9.151.156.3",
 "netmask": "255.255.248.0",
 "gateway": "9.151.159.254",
 "address6": "",
 "gateway6": "",
 "mtu": "1500",
 "ports": "",
 "id": 11
}
```

You can initiate a partial update action on an interface by issuing the **PATCH** command with the following syntax: `PATCH /api/v1/interfaces/<interface-id>`. The input parameters include the following entries: *name*, *mtu*, *netmask*, *address*, *gateway*.

For example, the following request updates the required parameters for interface 25.

```
PATCH /api/v1/interfaces/25
{
 "name": "interface_name",
 "address": "9.151.151.3"
}
```

The response to the request is as follows:

```
OK 200
{
 "name": "interface_name",
 "array": "pu16",
 "module": "1:Module:1",
 "type": "iSCSI",
 "address": "9.151.151.3",
 "netmask": "255.255.255.248",
 "gateway": "9.151.151.222",
```

```
 "address6": "",
 "gateway6": "",
 "mtu": "1500",
 "ports": "1",
 "id": 25
}
```

You can create a new iSCSI interface entry by issuing the **POST** command with the following syntax: `POST /api/v1/interfaces`. The input parameters include the following entries:

- Mandatory – *name*, *address*, *array*, *netmask*, *module*, *ports*.
- Optional – *mtu*, *gateway*.

For example, the following request creates a new interface with the required parameters.

```
POST /api/v1/interfaces
{
 "name": "iSCSI_1_1",
 "array": "pu16",
 "module": "1:Module:1",
 "address": "9.151.151.151",
 "netmask": "255.255.255.248",
 "gateway": "9.151.151.222",
 "mtu": "1500",
 "ports": "1"
}
```

The response to the request is as follows:

```
OK 200
{
 "name": "iSCSI_1_1",
 "array": "pu16",
 "module": "1:Module:1",
 "type": "iSCSI",
 "address": "9.151.151.151",
 "netmask": "255.255.255.248",
 "gateway": "9.151.151.222",
 "address6": "",
 "gateway6": "",
 "mtu": "1500",
 "ports": "1",
 "id": 25
}
```

You can delete an iSCSI interface by issuing the **DELETE** command with the following syntax: `DELETE /api/v1/interfaces/<interface-id>`.

For example, `DELETE /api/v1/interfaces/1` deletes the interface with identification number 1.

Port operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET** command for port operations.

You can run an interface query by issuing the **GET** command to get a list of IP ports that belong to a storage system and their properties, or display the properties of a single port. The command output can be filtered by module ID or interface type (management, iSCSI, etc.).

For example, `GET /api/v1/ports/1` lists the properties of the port with identification number 1, as illustrated below.

```
OK 200
{
 "index": 1,
 "array": "pur15m1",
 "role": "iSCSI",
 "ip_interface": "iSCSI_1_1",
 "module" : "1:Module:1"
}
```

Emergency shutdown

RESTful API for IBM Spectrum Control Base Edition uses the **POST** command for initiating an emergency storage system shutdown.

You can shut down a storage system in emergency mode by issuing the **POST** command, followed by the `arrays` argument, the storage system ID and the `shutdown` argument.

For example, `POST /api/v1/arrays/1/shutdown` shuts down the storage system with identification number 1, issuing the OK response.

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