

IBM Spectrum Control Base Edition
Version 2.1.1

User Guide



Note

Before using this document and the product it supports, read the information in "Notices" on page 151.

Edition notice

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Contents

| | |
|--|------------|
| Figures | vii |
| Tables | ix |
| About this guide. | xi |
| Who should use this guide | xi |
| Conventions used in this guide | xi |
| Related information and publications | xi |
| Getting information, help, and service | xii |
| Ordering publications | xii |
| Sending or posting your comments | xii |
| Chapter 1. Introduction | 1 |
| Included cloud interfaces | 1 |
| IBM Storage Provider for VMware VASA. | 1 |
| IBM Storage Enhancements for VMware vSphere Web Client | 2 |
| IBM Storage Plug-in for VMware vCenter Orchestrator | 2 |
| IBM Storage Management Pack for VMware vCenter Operations Manager. | 3 |
| Concept diagram | 3 |
| Virtual volumes | 4 |
| Storage Policy Based Management (SPBM) | 5 |
| Storage space and service management | 6 |
| Management options | 8 |
| Graphical user interface (GUI) | 8 |
| Command line interface (CLI) | 8 |
| Chapter 2. Installation | 11 |
| Compatibility and requirements | 11 |
| Downloading IBM Spectrum Control Base Edition software | 11 |
| Upgrading an existing installation. | 12 |
| Extracting and installing the IBM Spectrum Control Base Edition software package | 16 |
| Uninstalling the Spectrum Control Base Edition software | 18 |
| Chapter 3. IBM Spectrum Control Base Edition operation and management | 19 |
| Required and optional initial tasks. | 19 |
| Configuring LDAP-based directory user access | 20 |
| Managing Spectrum Control from the graphical user interface (GUI) | 26 |
| GUI – Logging in | 26 |
| Spectrum Control GUI. | 28 |
| GUI – Managing high-availability groups | 30 |
| GUI – Managing server certificates | 32 |
| GUI – Managing storage arrays. | 35 |
| GUI – Managing Spectrum Control users | 41 |
| GUI – Managing and monitoring VASA access | 44 |
| GUI – Managing storage spaces and services | 46 |
| GUI – Managing integration with vSphere Web Client | 57 |
| GUI – Managing integration with vCenter Orchestrator. | 62 |
| GUI – Managing integration with vCenter Operations Manager | 65 |
| Managing Spectrum Control from the command-line interface (CLI) | 72 |
| CLI – Switching to 'IBMSC' user mode | 72 |
| CLI – Managing Spectrum Control users | 73 |
| CLI – Managing server certificates. | 74 |
| CLI – Adding or removing storage array credentials. | 76 |
| CLI – Adding or removing storage arrays | 78 |

| | |
|---|------------|
| CLI – Setting the VASA credentials | 80 |
| CLI – Managing integration with vCenter Operations Manager | 81 |
| Chapter 4. Using the IBM Storage Provider for VMware VASA | 85 |
| Registering Spectrum Control as a storage provider in vCenter server | 85 |
| Chapter 5. Using the IBM Storage Enhancements for VMware vSphere Web Client | 89 |
| Required vSphere privileges | 89 |
| Populating vCenter server information to Spectrum Control | 91 |
| Viewing the IBM storage resource information. | 93 |
| Creating and mapping a new storage volume (LUN) | 97 |
| Extending a volume | 104 |
| Renaming a volume | 105 |
| Setting multipath policy enforcement for a volume. | 106 |
| Moving a volume to another storage pool | 107 |
| Unmapping a volume from one or more hosts | 108 |
| Deleting an unused volume | 109 |
| Chapter 6. Using the IBM Storage Plug-in for VMware vCenter Orchestrator | 111 |
| Chapter 7. Using the IBM Storage Management Pack for VMware vCenter Operations Manager | 115 |
| Viewing the XIV Overview dashboard | 117 |
| Using the alert widget | 118 |
| Viewing the XIV Performance dashboard | 119 |
| XIV performance metrics | 121 |
| Viewing the XIV Top 10 dashboard | 125 |
| Monitoring the XIV storage system resources. | 125 |
| Monitoring the XIV resources using thresholds | 126 |
| Chapter 8. Administration | 129 |
| Checking and controlling the Spectrum Control service | 129 |
| Checking and modifying the configuration files | 130 |
| Adjusting system update interval. | 131 |
| Configuring alarm reporting | 131 |
| Configuring metrics scope | 132 |
| Enabling SSL verification | 132 |
| Chapter 9. Troubleshooting | 133 |
| Checking the log files | 133 |
| Checking the format of directory-based storage array credentials | 134 |
| Configuring event forwarding. | 135 |
| Self-assist options for IBM Spectrum Control Base Edition | 136 |
| Chapter 10. Best practices. | 137 |
| Handling datastores | 137 |
| Handling ESXi hosts that use XIV volumes | 137 |
| Distributing volumes evenly on DS8000 systems | 137 |
| Setting the multipath policy for DS8000 and Storwize Family systems | 137 |
| Working with multiple storage arrays | 138 |
| Creating a VVOL-enabled service. | 139 |
| Chapter 11. RESTful API. | 141 |
| RESTful API protocol. | 141 |
| Query request and response | 142 |
| Create request and response | 142 |
| Delete request and response | 143 |
| Update request and response | 143 |
| Action request and response | 144 |

| | |
|--------------------------------|------------|
| Array operations | 144 |
| Module operations | 145 |
| Disk operations. | 146 |
| Interface operations | 147 |
| Port operations. | 148 |
| Emergency shutdown | 149 |
| Notices | 151 |
| Trademarks | 152 |
| Index | 155 |

Figures

| | |
|---|----|
| 1. Integration of IBM storage systems with a VMware environment | 4 |
| 2. VVOL concept | 5 |
| 3. Storage Policy Based Management (SPBM) concept. | 6 |
| 4. Storage elements without VVOL utilization | 7 |
| 5. Storage elements with VVOL utilization | 8 |
| 6. Select product form on Fix Central. | 12 |
| 7. Spectrum Control version number | 15 |
| 8. Spectrum Control login box in a standard web browser. | 27 |
| 9. Spectrum Control Welcome page | 28 |
| 10. Spaces/Services and Storage Systems panes. | 29 |
| 11. High-availability group concept. | 30 |
| 12. Settings option on the Settings menu | 31 |
| 13. Settings dialog box | 32 |
| 14. Connection security warning in the Mozilla FireFox web browser | 33 |
| 15. Generate option on Server Certificate dialog box | 34 |
| 16. Upload files option on Server Certificate dialog box | 35 |
| 17. Storage Systems pane | 36 |
| 18. Current storage array username (for all storage arrays) | 37 |
| 19. Add New Array dialog box | 38 |
| 20. Storage Systems pane | 39 |
| 21. Array error indication | 39 |
| 22. Array Settings dialog box | 40 |
| 23. Array Settings dialog box | 41 |
| 24. Users option in the Setting menu | 42 |
| 25. New User dialog box | 43 |
| 26. List of added users (user names) | 43 |
| 27. Update User page | 44 |
| 28. Registered VASA servers (vCenter servers that employ VASA services). | 45 |
| 29. VASA Credentials dialog box. | 46 |
| 30. Spaces/Services pane | 47 |
| 31. New Space dialog box | 48 |
| 32. List of storage spaces | 48 |
| 33. New Service dialog box | 50 |
| 34. Service Settings dialog box | 54 |
| 35. Array Settings dialog box | 55 |
| 36. Resource Settings dialog box | 56 |
| 37. Add vCenter Server dialog box | 58 |
| 38. Applications pane | 58 |
| 39. vCenter Server Settings dialog box. | 59 |
| 40. vCenter Server Settings dialog box. | 60 |
| 41. vCenter server with attached services. | 61 |
| 42. vCO server on the Applications pane | 62 |
| 43. vCO server with attached services | 63 |
| 44. Download plug-in package button | 64 |
| 45. Current vCO Token | 64 |
| 46. vCenter Orchestrator – IBM Storage Plug-in Configuration. | 65 |
| 47. Monitoring pane | 66 |
| 48. Download PAK File button | 67 |
| 49. Registering the vCOps on the vCenter server | 68 |
| 50. Deploying the management package on the vCOps | 68 |
| 51. Describing the management package on the vCOps | 69 |
| 52. Verifying successful description of the management package on the vCOps | 70 |
| 53. Adding the vCOps server to Spectrum Control. | 71 |
| 54. Storage array attached to the vCOps server | 72 |
| 55. Connection security warning in the Mozilla FireFox web browser | 75 |

| | | |
|------|--|-----|
| 56. | vSphere Client – Storage Providers list | 86 |
| 57. | New Storage Provider dialog box for VASA 2.0 | 86 |
| 58. | vCenter certificate thumbprint dialog box | 87 |
| 59. | Storage Providers list displaying Spectrum Control | 87 |
| 60. | VMware vSphere Web Client – Create Role dialog box | 90 |
| 61. | Populate vCenter Information option in vSphere 6.0 | 91 |
| 62. | Populate vCenter Information option, vSphere 5.5. | 92 |
| 63. | Populate vCenter confirmation message | 92 |
| 64. | IBM Storage category in vSphere Web Client | 93 |
| 65. | IBM Storage information per storage array | 94 |
| 66. | Currently available storage pools per storage array | 94 |
| 67. | IBM Storage information per vCenter server | 95 |
| 68. | IBM Storage information per datacenter | 95 |
| 69. | IBM Storage information per datastore | 95 |
| 70. | IBM Storage information per all ESXi hosts of a vCenter server | 96 |
| 71. | IBM Storage information per all VM templates of a vCenter server | 96 |
| 72. | IBM Storage information per all vApps of a vCenter server | 96 |
| 73. | IBM storage array view – Clicking Create New Volume. | 97 |
| 74. | Top Level Objects view – Clicking Create New Volume | 98 |
| 75. | Right-clicking the storage array | 98 |
| 76. | Clicking the Create New Volume icon. | 99 |
| 77. | Create New Volume wizard (XIV example) | 99 |
| 78. | Setting the volume size with the graphic space marker. | 100 |
| 79. | Creating multiple volumes | 101 |
| 80. | Selecting LUN | 102 |
| 81. | Advanced Host Mapping dialog box. | 103 |
| 82. | Clicking Extend on the pop-up menu | 104 |
| 83. | Rename volume option | 105 |
| 84. | Rename Volume dialog box. | 105 |
| 85. | Set Multipath Policy Enforcement option | 106 |
| 86. | Change Multipath Policy Enforcement dialog box | 107 |
| 87. | Move volume option | 108 |
| 88. | Unmap volume | 109 |
| 89. | Delete volume | 110 |
| 90. | vCenter Orchestrator – Create New Volume workflow – General tab | 112 |
| 91. | vCenter Orchestrator – Create New Volume workflow – Inputs tab | 113 |
| 92. | vCenter Orchestrator – Create New Volume workflow – Parameter References tab | 113 |
| 93. | vCenter Orchestrator – Storage Arrays panel | 114 |
| 94. | vCops GUI – IBM STORAGE option. | 115 |
| 95. | XIV Storage Arrays pane. | 117 |
| 96. | XIV volume health status | 118 |
| 97. | Alert widget | 118 |
| 98. | XIV AND VCENTER RELATIONSHIPS pane | 119 |
| 99. | HEALTH TREE pane | 120 |
| 100. | IBM XIV Performance dashboard, METRIC SELECTOR and METRIC GRAPH panes | 120 |
| 101. | IBM XIV Top 10 dashboard | 125 |
| 102. | vCops GUI – ENVIRONMENT OVERVIEW option. | 126 |
| 103. | vCops ENVIRONMENT OVERVIEW display. | 126 |
| 104. | vCops GUI – ATTRIBUTE PACKAGES option | 127 |
| 105. | vCops Manage Attribute Packages dialog box | 127 |
| 106. | vCops Manage Attribute Packages for IBM XIV array | 128 |
| 107. | Controller GUI – Collect Logs option | 134 |
| 108. | XIV role mapping attributes for directory (LDAP) users | 135 |

Tables

| | | |
|-----|--|-----|
| 1. | Required tasks in sequential order | 19 |
| 2. | Optional tasks | 20 |
| 3. | Arguments for sc_ldap | 22 |
| 4. | ldap.ini configuration parameters. | 24 |
| 5. | Spectrum Control GUI elements. | 29 |
| 6. | Service parameters | 50 |
| 7. | Arguments for sc_users | 73 |
| 8. | User-related arguments for sc_setting | 74 |
| 9. | Arguments for sc_ssl | 75 |
| 10. | Arguments for sc_storage_credentials | 77 |
| 11. | Arguments for sc_storage_array | 79 |
| 12. | Arguments for sc_vasa_admin | 80 |
| 13. | Arguments for sc_vcops_server | 82 |
| 14. | Arguments for sc_vcops_adapter | 83 |
| 15. | Required vSphere privileges | 90 |
| 16. | IBM storage objects and events in vCO | 111 |
| 17. | IBM Storage Icons in vCops | 116 |
| 18. | Capacity metrics | 121 |
| 19. | Health metrics | 121 |
| 20. | Counter metrics. | 121 |
| 21. | Perfromance metrics | 122 |
| 22. | Configuration files | 130 |

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.

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

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- IBM DS8000® on IBM Knowledge Center (ibm.com/support/knowledgecenter/STUVMB)
- IBM DS8800 on IBM Knowledge Center (ibm.com/support/knowledgecenter/STXN8P)
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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 array, 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 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 side, rather than on the vSphere 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.

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 2.1.0, the IBM Storage Plug-in for VMware vCenter Orchestrator supports only XIV storage systems.

The plug-in package can be downloaded from Spectrum Control 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 2.1.0, the IBM Storage Management Pack for VMware vCenter Operations Manager supports only XIV storage systems.

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

After a VMware vCenter Operations Manager server is registered on Spectrum Control that is configured with storage arrays, 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 arrays, 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 arrays, 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 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.

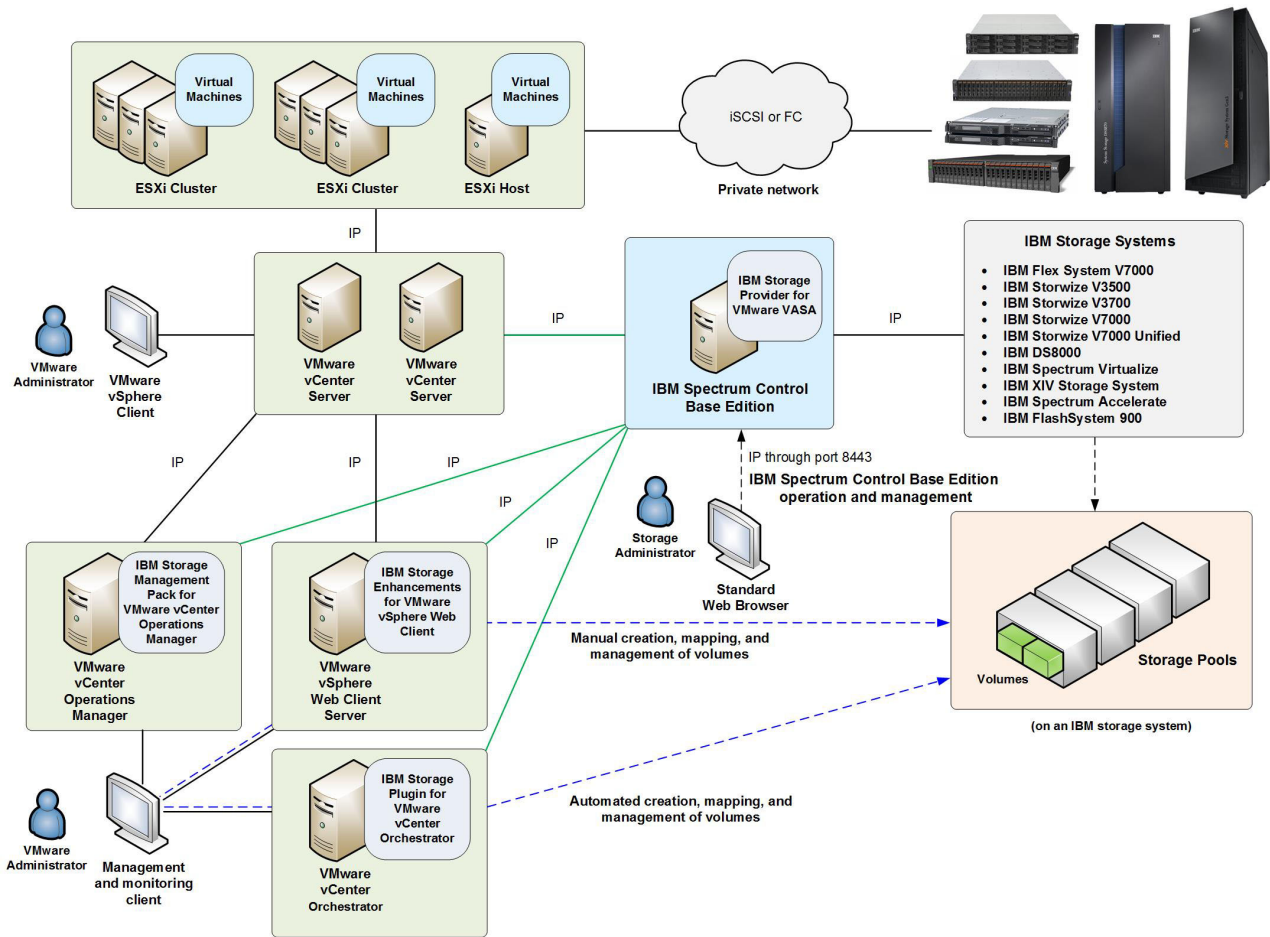


Figure 1. Integration of IBM storage systems with a VMware environment

Spectrum Control allows registered VMware vCenter servers to utilize its VASA functions, which can be monitored on the vSphere 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. New pools cannot be added from the VMware environment.

Virtual volumes

IBM Spectrum Control Base Edition delivers comprehensive storage virtualization support, using VMware Virtual Volume (VVOL) technology.

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 may include thin/thick provisioning, snapshot support, encryption, etc. Moreover, each VVOL can be managed independently. This improves system scalability, ensures granular management, leverages hardware features and performance of storage arrays 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 array. This 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), as illustrated below. Instead of simply presenting a LUN to the hypervisor, letting an ESXi host do data placement and access, a storage system takes on itself a bulk of storage-related functions.

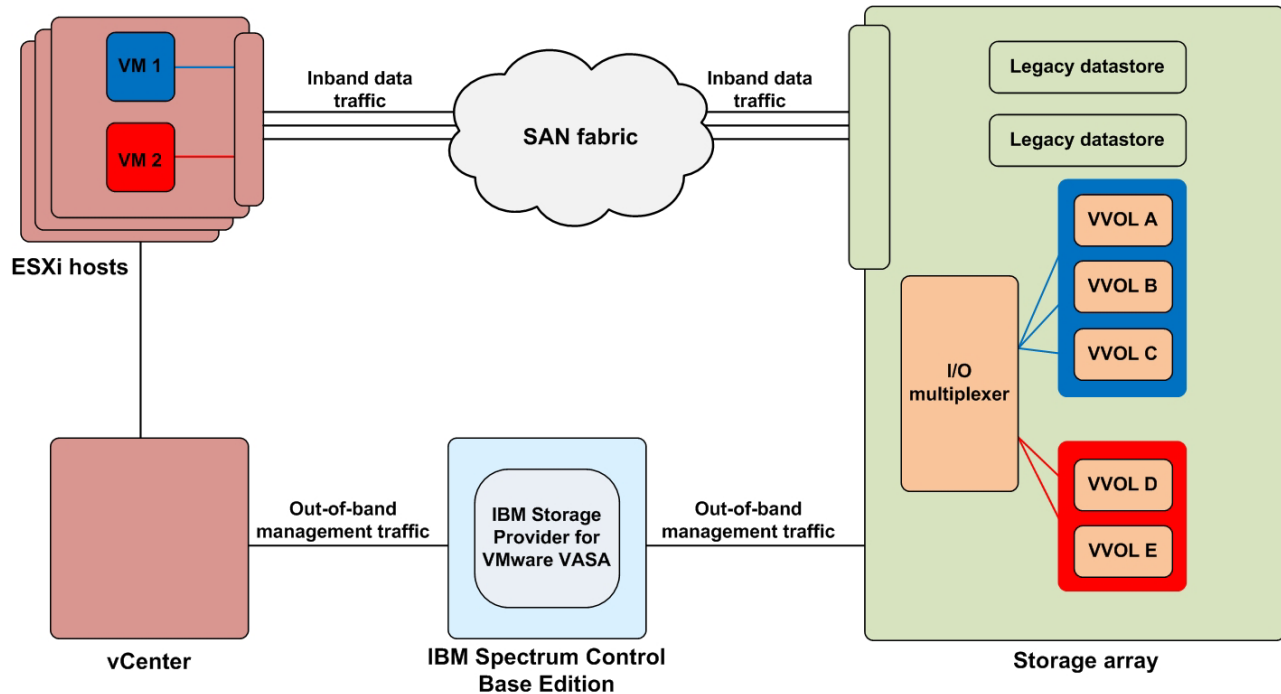


Figure 2. VVOL concept

For instructions about how to configure a VVOL-enabled storage service, see “Creating a VVOL-enabled service” on page 139.

Storage Policy Based Management (SPBM)

IBM Spectrum Control Base Edition uses VMware's 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 array 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.

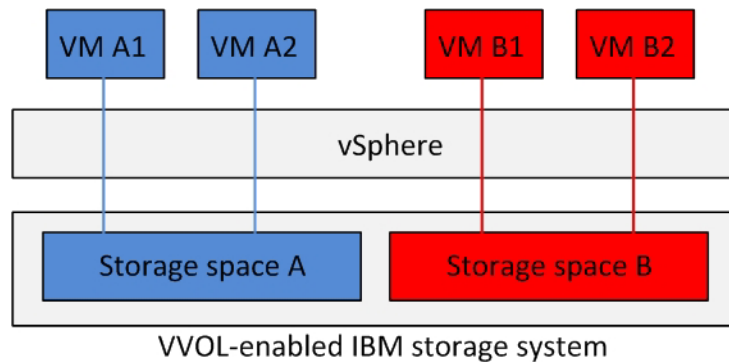


Figure 3. Storage Policy Based Management (SPBM) concept

Storage space and service management

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

The virtual storage entities include:

- Storage service
- Storage space

A service is a combination of assigned storage resources (pools) and user-defined policies. The storage pools, assigned to the service, may reside on any array, as illustrated below. The policies are additional capabilities, such as compression, encryption, etc.

Spaces are groups of services. Usually, a single space is assigned to a specific organization (storage tenant).

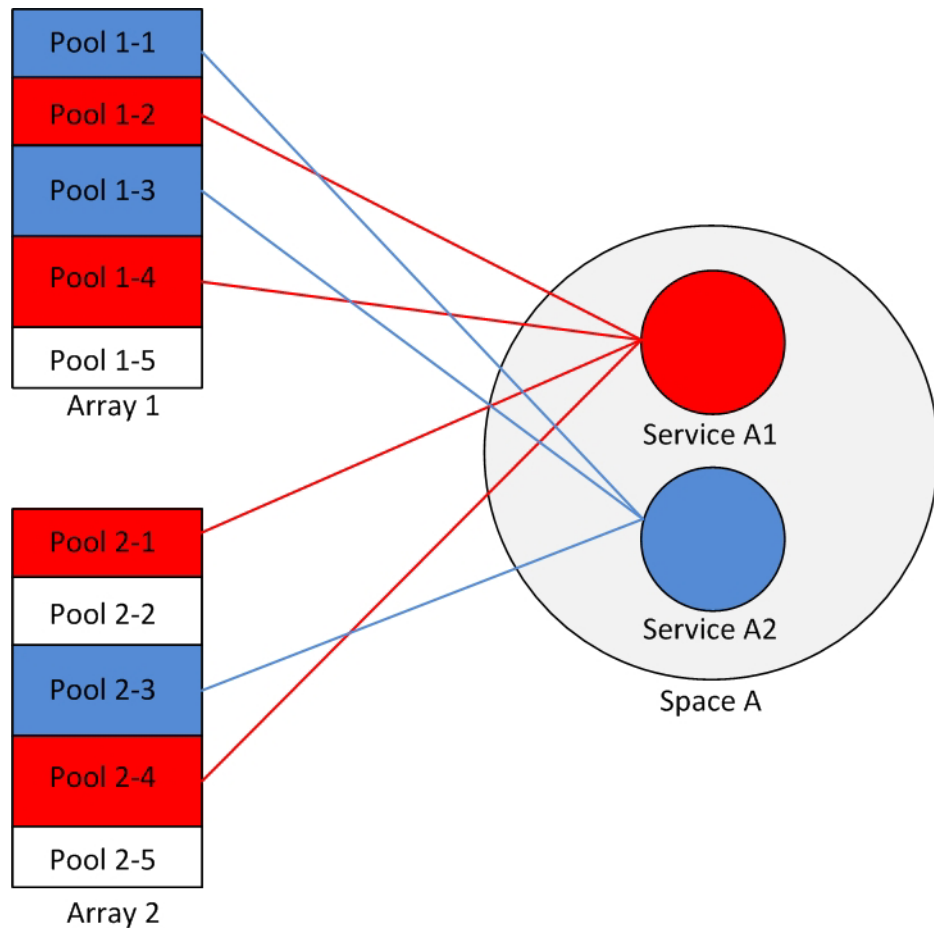


Figure 4. Storage elements without VVOL utilization

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 array (see drawing below). Such array holds a storage resource (group pool) connected to the service. 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.

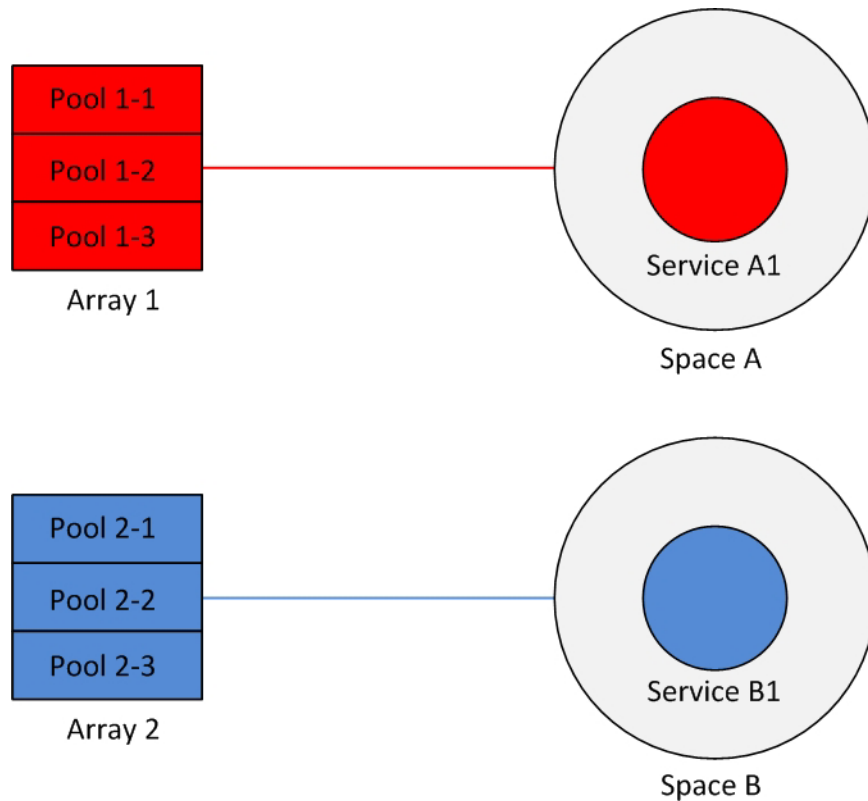


Figure 5. Storage elements with VVOL utilization

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 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 (arrays 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 CLI is used for user and array management, as well as for integration of the cloud interfaces, or applications. The CLI tool is supplied as a part of the Spectrum Control 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 16

For information about uninstallation, see “Uninstalling the Spectrum Control Base Edition software” on page 18.

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 the IBM Knowledge Center (www.ibm.com/support/knowledgecenter) or on the 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 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 package on the website.

Procedure

To download the Spectrum Control software:

1. Go to the IBM Fix Central (www.ibm.com/support/fixcentral).
2. Click the **Select product** tab.
3. Fill out the form, as illustrated below and click **Continue**.

Fix Central

Fix Central provides fixes and updates for your system's software, hardware, and operating system. Not looking for fixes or updates? Please visit [Passport Advantage](#) to download most purchased software products, or [My Entitled Systems Support](#) to download system software.

For additional information, click on the following link.

[Getting started with Fix Central](#)

Select the product below.

When using the keyboard to navigate the page, use the **Alt** and **down arrow** keys to navigate the selection lists.

Product Group*
System Storage

Select from System Storage*
Storage software

Select from Storage software*
Software defined storage

Select from Software defined storage*
IBM Spectrum Control

Figure 6. Select product form on Fix Central

4. On the **Select fixes** page, click the link to the Spectrum Control software and continue with the download.

Upgrading an existing installation

If you are already using a version 1.2.x or 1.5.x of IBM Spectrum Control Base Edition (formerly known as IBM Storage Integration Server), you can upgrade to the newer version without having to uninstall the previous version.

Before you begin

- Back up the current Integration Server database, using the **isis_configuration backup -f /var/tmp/backup -k <key value>** command.
- Verify that the TCP port 8443 is open and network connectivity to the IBM storage systems and VMware resources (vCenter server, vSphere applications, etc) is available. In addition, 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:

1. Log out of the Spectrum Control GUI and close the browser.
2. On the Spectrum Control 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 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 -xzf IBM_Spectrum_Control_Base_Edition-2.1.1-*-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-2.1.1-*.bin` – product BIN file.
 - `ibm_spectrum_control-2.1.1-xxxx-x86_64.bin.asc`– digital signature file for the BIN file verification.
 - `ibm_spectrum_control_java_runtime_extension-2.1.1-*.bin` – Required if DS8000 is used; should be installed last.
 - `ibm_spectrum_control_java_runtime_extension-2.1.0-xx-x86_64.bin.asc` – digital signature file for the BIN file verification.
6. Enter `# gpg --verify ibm_spectrum_control-2.1.1-xxxx-x86_64.bin.asc ibm_spectrum_control-2.1.1-xxxx-x86_64.bin` and `# gpg --verify ibm_spectrum_control_java_runtime_extension-2.1.0-xx-x86_64.bin.asc ibm_spectrum_control_java_runtime_extension-2.1.0-xx-x86_64.bin` to verify the digital signature of the installation files.
 7. Go to the extracted directory and then use the `-U *.rpm` command to run and install all the complementary RPM files.
 8. Enter `chmod +x ibm_spectrum_control-2.1.1-*.bin` to authorize the installation of the product BIN file.
 9. Enter `./ibm_spectrum_control-2.1.1-*.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 service” on page 129).
- 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/vasal/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. If you are using a DS8000 storage array, enter

```
./ibm_spectrum_control_java_runtime_extension-2.1.0-*.bin
```

to install the required Java™ components for DS8000.

13. Review the license agreement which is displayed after you run the installation file.

14. 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

```
Stopping Django service ... [OK]
Stopping Celery services ... [OK]
Starting DS8000 proxy.....[OK]
Starting Celery services ... [OK]
Starting Django service ... [OK]
```

Installation completed successfully.

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

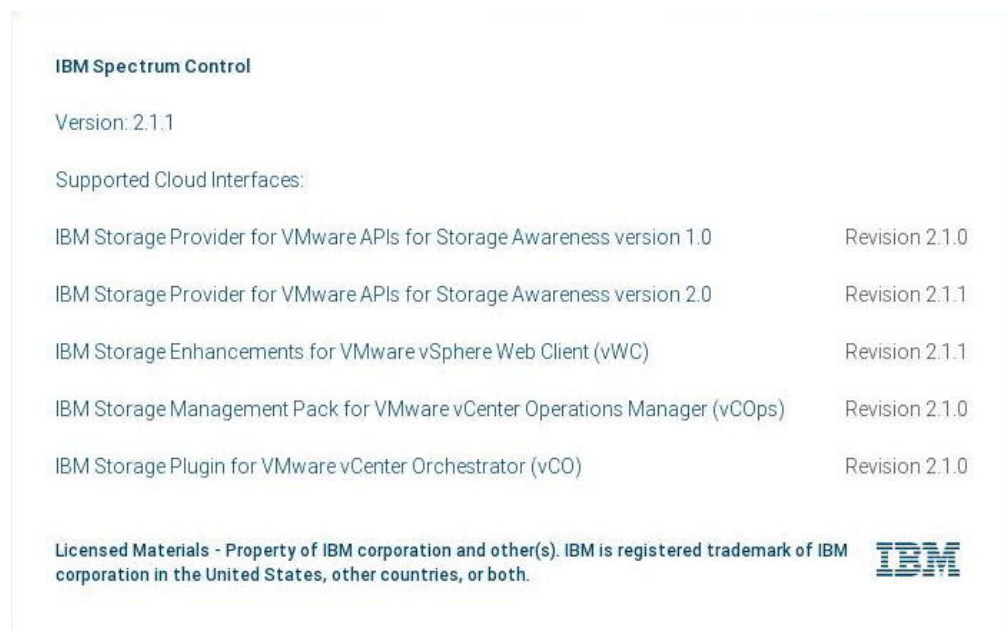


Figure 7. Spectrum Control version number

16. To avoid unauthorized access to Spectrum Control, 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 72. After the upgrade, Spectrum Control:
 - 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 46 for details on how to configure storage spaces and services.
 - With the Spectrum Control 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 62 and “GUI – Managing integration with vCenter Operations Manager” on page 65 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 TCP port 8443 is open and network connectivity to the IBM storage systems and VMware resources (vCenter server, vSphere applications, etc) is available. In addition, make sure that the 'ibmsc' user can access the /opt/ibm and /var/log/sc folders.

Procedure

Follow these steps to install Spectrum Control:

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.
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-2.1.1-*x86_64.tar.gz
```

The following files are extracted:

- `nginx-1.6.2-1.el6ngx.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-2.1.1-*.bin` – product BIN file.
- `ibm_spectrum_control-2.1.1-xxxx-x86_64.bin.asc`– digital signature file for the BIN file verification.
- `ibm_spectrum_control_java_runtime_extension-2.1.0-*.bin` – Required if DS8000 is used; should be installed last.

- `ibm_spectrum_control_java_runtime_extension-2.1.0-xx-x86_64.bin.asc` – digital signature file for the BIN file verification.
5. Enter `# gpg --verify ibm_spectrum_control-2.1.1-xxxx-x86_64.bin.asc ibm_spectrum_control-2.1.1-xxxx-x86_64.bin` and `# gpg --verify ibm_spectrum_control_java_runtime_extension-2.1.0-xx-x86_64.bin.asc ibm_spectrum_control_java_runtime_extension-2.1.0-xx-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 service” on page 129) and a new Linux username – `ibmsc` – is created so that you can use it for the Spectrum Control 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-2.1.1-*.bin` to authorize the installation of the product BIN file.
8. Enter `./ibm_spectrum_control-2.1.1-*.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 'admin!'
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. If you are using a DS8000 storage array, enter `./ibm_spectrum_control_java_runtime_extension-2.1.0-*.bin` to install the required Java components for DS8000.
12. Review the license agreement which is displayed after you run the installation file.
13. 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
```

```
Stopping Django service ... [OK]
Stopping Celery services ... [OK]
Starting DS8000 proxy.....[OK]
Starting Celery services ... [OK]
Starting Django service ... [OK]
```

```
Installation completed successfully.
```

14. To avoid unauthorized access to Spectrum Control, 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 72.

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 software, remove all vCenter servers that were registered for vSphere Web Client, as explained in "GUI – Removing a vCenter server" on page 59. 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 array configurations, storage pool attachments, and vCenter server associations – always back up the Spectrum Control configuration before any uninstallation.
- Uninstalling the software on the Spectrum Control side causes the following features to cease functioning:
 - All CLI and GUI management options on the Spectrum Control side.
 - IBM Storage Enhancements on the vSphere Web Client side.
 - VASA-related operations on the vCenter server side.

Procedure

To uninstall the Spectrum Control software from the Linux host:

1. Log on to the Linux command prompt environment as a root user.
2. Stop the Spectrum Control service, as explained in "Checking and controlling the Spectrum Control service" on page 129.
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 16).

Chapter 3. IBM Spectrum Control Base Edition 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 20
- “Managing Spectrum Control from the command-line interface (CLI)” on page 72
- “Managing Spectrum Control 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 and management tasks.

Note: Unless specified otherwise in the 'Interface' 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 | 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 | • “CLI – Switching to 'IBMSC' user mode” on page 72 |
| 2. | Log in to the GUI and then change the password of the initial admin user. | GUI | • “GUI – Logging in” on page 26 • “GUI – Changing the password of a Spectrum Control user” on page 43 |
| 3. | Define a high-availability group | GUI | • “GUI – Managing high-availability groups” on page 30 |
| 4. | Add SSL certificate for the Spectrum Control server | CLI or GUI | • “CLI – Managing server certificates” on page 74 • “GUI – Managing server certificates” on page 32 |
| 5. | Add the storage array (storage system) access credentials | CLI or GUI | • “CLI – Adding or removing storage array credentials” on page 76 • “GUI – Entering the storage array credentials” on page 36 |
| 6. | Add the storage arrays to be used | CLI or GUI | • “CLI – Adding or removing storage arrays” on page 78 • “GUI – Adding a storage array” on page 38 |
| 7. | Set the VASA access credentials (“VASA Secret”) to allow connection of vCenter servers that require VASA functions. Note: Not applicable to DS8000 systems. | CLI or GUI | • “CLI – Setting the VASA credentials” on page 80 • “GUI – Setting the VASA credentials” on page 45 |

Table 1. Required tasks in sequential order (continued)

| Step | Required task | Interface | Refer to |
|------|--|------------|---|
| 8. | Define storage spaces and services. | GUI | <ul style="list-style-type: none"> • “GUI – Adding a storage space” on page 47 • “GUI – Adding a storage service” on page 49 • “GUI – Defining and attaching storage resources” on page 54 |
| 9. | Add vCenter servers for which you want to utilize the IBM Storage Enhancements for VMware vSphere Web Client. | CLI or GUI | <ul style="list-style-type: none"> • “GUI – Adding a vCenter server” on page 57 |
| 10. | Attach storage services to any specific vCenter server that was added. | CLI or GUI | <ul style="list-style-type: none"> • “GUI – Attaching storage services to a vCenter server” on page 60 |
| 11. | Establish integration with vCenter Orchestrator (vCO). Note: Applicable only to XIV systems. | GUI | <ul style="list-style-type: none"> • “GUI – Managing integration with vCenter Orchestrator” on page 62 |
| 12. | Establish integration with vCenter Operations Manager (vCops). Note: Applicable only to XIV systems. | CLI or GUI | <ul style="list-style-type: none"> • “CLI – Managing integration with vCenter Operations Manager” on page 81 • “GUI – Managing integration with vCenter Operations Manager” on page 65 |

Table 2. Optional tasks

| Optional task | Interface | Refer to |
|--|------------|--|
| Configure LDAP-based directory user access to Spectrum Control | CLI | <ul style="list-style-type: none"> • “Configuring LDAP-based directory user access” |
| Manage the Spectrum Control users | CLI or GUI | <ul style="list-style-type: none"> • “CLI – Managing Spectrum Control users” on page 73 • “GUI – Managing Spectrum Control users” on page 41 |

Configuring LDAP-based directory user access

You can allow external directory users to connect to Spectrum Control 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) is authenticated against the defined directory server.

Use the **sc_ldap** CLI command to configure LDAP-based directory user access to Spectrum Control. 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. 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 array credentials” on page 76 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.
-

Table 3. Arguments for sc_ldap

| Argument | Use after sc_ldap to: |
|--|--|
| <pre> 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> </pre> | <p>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:</p> <ul style="list-style-type: none"> • 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. • Server type (-t; --server_type) – Type of the directory server. One of the following types can be specified: <ul style="list-style-type: none"> – 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. <p>For example:</p> <pre> 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" </pre> <p>When prompted to enter a password, press Enter without entering any password:</p> <pre> 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. </pre> <p>After enabling the directory access, you can test the directory connection by using the test option (see below). Then, restart the Spectrum Control service as explained in “Checking and controlling the Spectrum Control service” on page 129.</p> |

Table 3. Arguments for `sc_ldap` (continued)

| Argument | Use after <code>sc_ldap</code> to: |
|---|---|
| <p><code>configure -e -u <Bind DN username></code> <code>-p <Bind DN password></code></p> | <p>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:</p> <ul style="list-style-type: none"> • Bind DN username (<code>-u</code>; <code>--bind_dn</code>) – Username of the Bind DN user through which access to the directory server is established. Spectrum Control uses this username to log in to the directory server and establish the connection with it. • Bind DN password (<code>-p</code>; <code>--bind_password</code>) – Password of the Bind DN username. <p>For example:</p> <pre>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 mypasswd</pre> <p>When prompted to enter a password, enter the directory server's Bind DN user password:</p> <pre>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.</pre> |
| <p><code>configure -d</code> or <code>configure --disable</code></p> | <p>Disable directory user access.</p> <p>After disabling the directory access, restart the Spectrum Control service as explained in “Checking and controlling the Spectrum Control service” on page 129.</p> |
| <p><code>list</code></p> | <p>Display the current directory server configuration status (on Spectrum Control) and Bind DN username.</p> |
| <p><code>test -u <directory username> -p <password></code></p> | <p>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).</p> <p>For example:</p> <pre>sc_ldap test -u mytestuser -p mytestuserpasswd IBM Spectrum Control LDAP configuration has been verified successfully.</pre> |
| <p><code>-h</code> or <code>--help</code></p> | <p>Display help information that is relevant to <code>sc_ldap</code>.</p> <p>You can also display help for the <code>configure</code>, <code>list</code>, or <code>test</code> argument if it is typed on the command line as well.</p> |

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. Complete the following steps to update Spectrum Control:

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 = <encrypted 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 |
|---------------------------------|---|
| <code>enable_ldap</code> | True or False. When True and enabled, the login attempt is authenticated against the directory server. |
| <code>server_uri</code> | Uniform resource identifier (URI) of the directory server. |

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

| Parameter | Indication |
|--------------------------------|---|
| server_type | Type of the directory server: <ul style="list-style-type: none"> • 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 from the graphical user interface (GUI)

You can log in to Spectrum Control 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 GUI” on page 28
- “GUI – Managing storage arrays” on page 35
- “GUI – Managing Spectrum Control users” on page 41
- “GUI – Managing and monitoring VASA access” on page 44
- “GUI – Managing storage spaces and services” on page 46
- “GUI – Managing integration with vSphere Web Client” on page 57
- “GUI – Managing integration with vCenter Orchestrator” on page 62
- “GUI – Managing integration with vCenter Operations Manager” on page 65

GUI – Logging in

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

The secure IP connection to Spectrum Control 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 32.

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

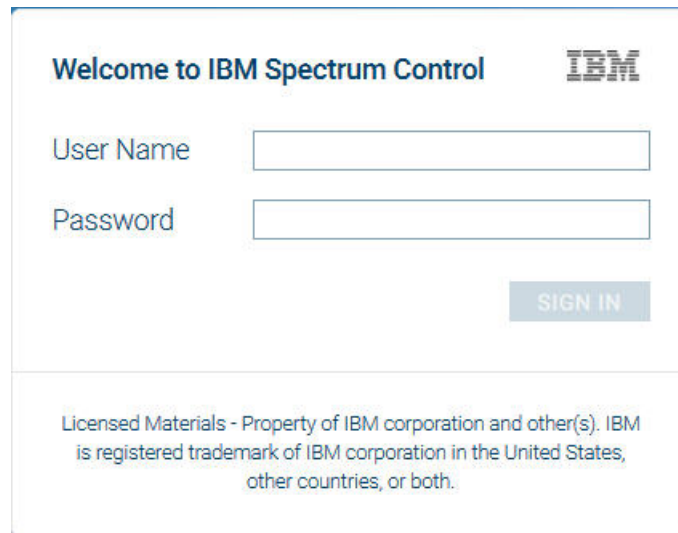


Figure 8. Spectrum Control login box in a standard web browser

Attention:

- After the installation, the initial username is **admin** and the initial password is **admin1!**. To avoid unauthorized access to Spectrum Control, 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 users” on page 41).
- If the Spectrum Control service is stopped on the Linux host (see “Checking and controlling the Spectrum Control service” on page 129), it is not possible to log in or perform any GUI operation.

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

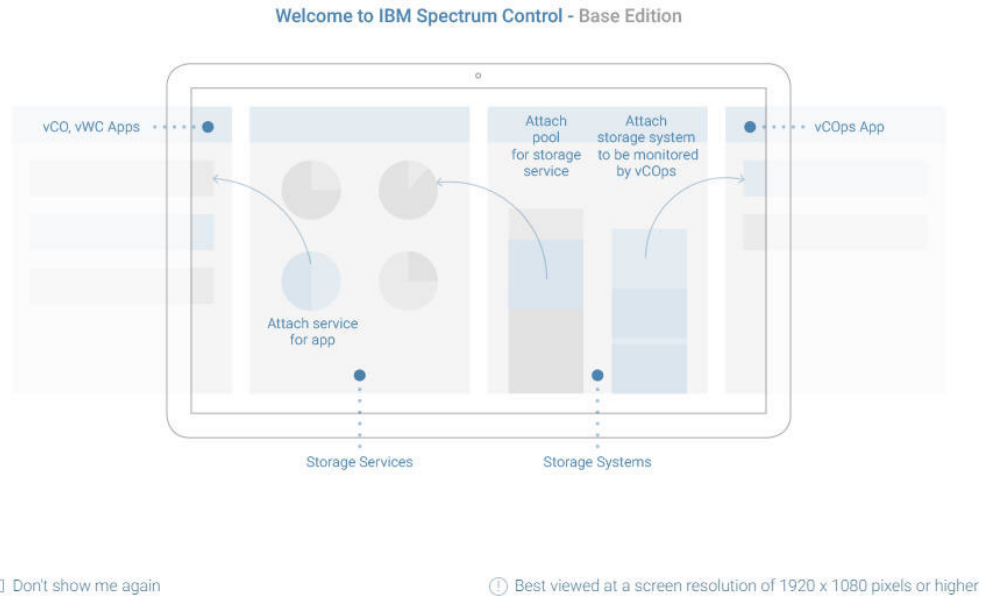


Figure 9. Spectrum Control Welcome page

Spectrum Control 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 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 arrays and storage resources.
- **Monitoring** integration with vCops server.

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

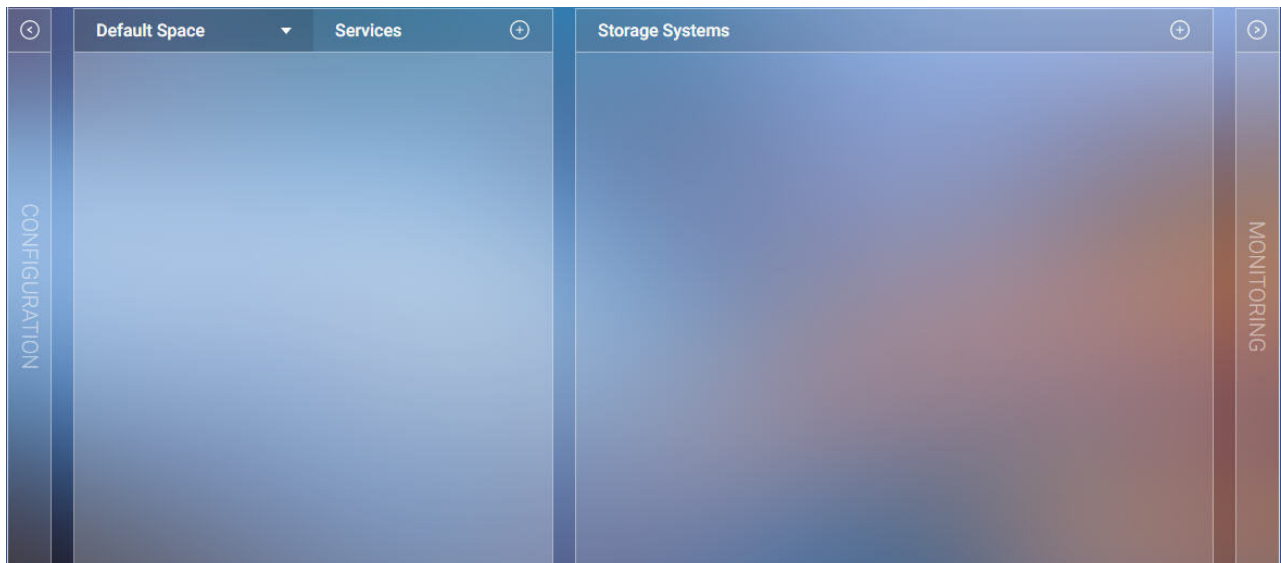


Figure 10. Spaces/Services and Storage Systems panes



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

The table below summarizes functionality of the GUI elements.

Table 5. Spectrum Control GUI elements

| GUI Element | Description |
|-------------|--|
| | This is the Add button. Click this button to add a new object (server, storage service, array, etc). |
| | This is the Edit button, which is displayed when the mouse pointer is moved over an object. Click this button to configure the object (array, pool, server, etc) or remove it. |
| | This is the Home button. Click this button to display the home screen (Spaces/Services and Arrays panes). |
| | This is the Settings button. Use this button to access the Settings menu to: <ul style="list-style-type: none"> • Define storage credentials • Manage certificates • Add and change the Spectrum Control users • Add and edit storage spaces • Collect logs • Display version number of Spectrum Control and included applications • Access product documentation |
| | This is the Remove button. Click this button to remove a storage space from the Space List or delete a user from the User List. These lists are available in the Settings menu. |

Table 5. Spectrum Control GUI elements (continued)

| GUI Element | Description |
|---|---|
|  | This is the Help button. Click this button display the Welcome page, which is also available after login. |
|  | These are the right and left navigation pointers. They indicate if additional panes are available to the right or to the left of the current display. |

GUI – Managing high-availability groups

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

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

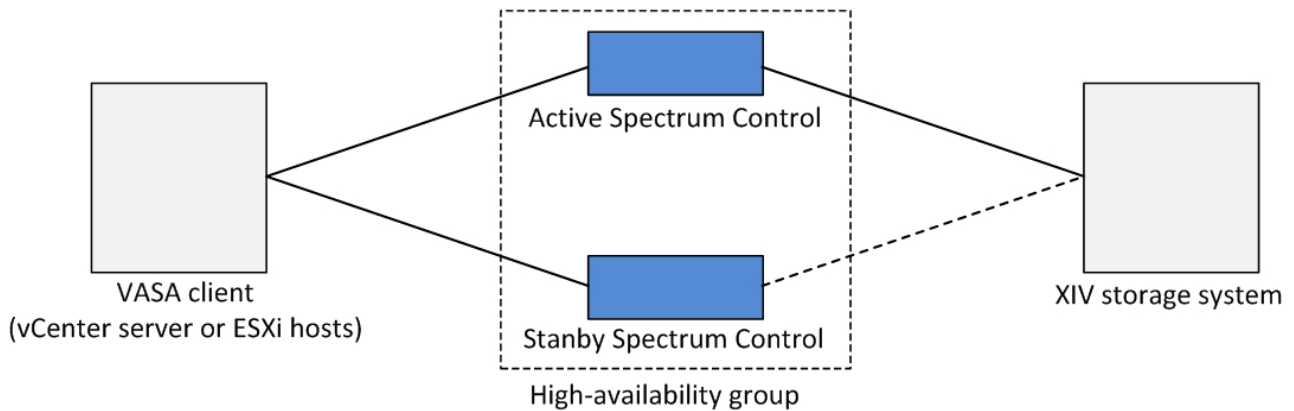


Figure 11. High-availability group concept

To configure HA groups, open the Settings menu. For configuration instructions, see "GUI – Defining a high-availability group" on page 31.

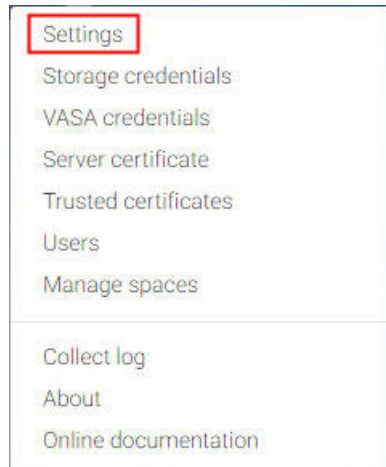


Figure 12. Settings option on the Settings menu

GUI – Defining a high-availability group

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

Before you begin

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

About this task

An HA group is a combination of two or more Spectrum Control instances, operating in the active/passive mode. Active Spectrum Control 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 installation.

Procedure

1. Click **Settings** on the Settings menu. The Settings dialog box is displayed.
2. Enter the FQDN of the first Spectrum Control and the name of the HA group that you want to create, and then click **Apply**. The HA group and its first member are added. The Spectrum Control, which is added to the HA group first, becomes its 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 server certificate, as explained in “GUI – Managing server certificates” on page 32.

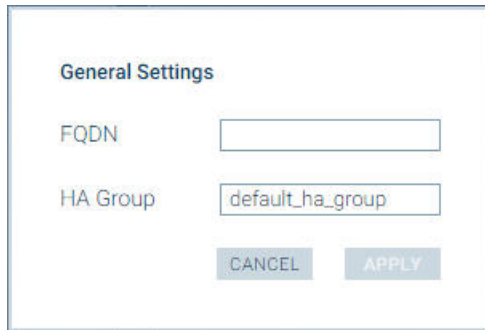


Figure 13. Settings dialog box

3. Add an FQDN of the remaining Spectrum Control servers to define them as standby HA group members.
4. Enter the same HA group name as for the first Spectrum Control instance.
5. Define storage credentials for all Spectrum Control instances, as explained in “GUI – Entering the storage array credentials” on page 36.
6. Add the same storage array for all Spectrum Control instances. Spectrum Control redundancy is available only if all HA group members manage the same storage array. See “GUI – Adding a storage array” on page 38.
7. Configure the server certificates. See “GUI – Managing server certificates.”
8. Register all HA group members as storage providers in the vCenter server. See “Registering Spectrum Control as a storage provider in vCenter server” on page 85.
9. Add storage spaces and services to the active Spectrum Control. There is no need to configure these settings for the backup HA members. See “GUI – Managing storage spaces and services” on page 46.

Note: If you intend to change the default HA group name, any XIV storage array with microcode 11.5, defined on the default HA group member, must be removed from Spectrum Control before the group name change.

A failover to a standby HA group member occurs when the active Spectrum Control service is stopped or reset. See “Checking and controlling the Spectrum Control service” on page 129.

The VVOL-enabled storage services, defined on the active Spectrum Control, are restored on the standby HA group members automatically after the failover is completed.

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, you might encounter a connection security warning before you can access the Spectrum Control login page (see “GUI – Logging in” on page 26).

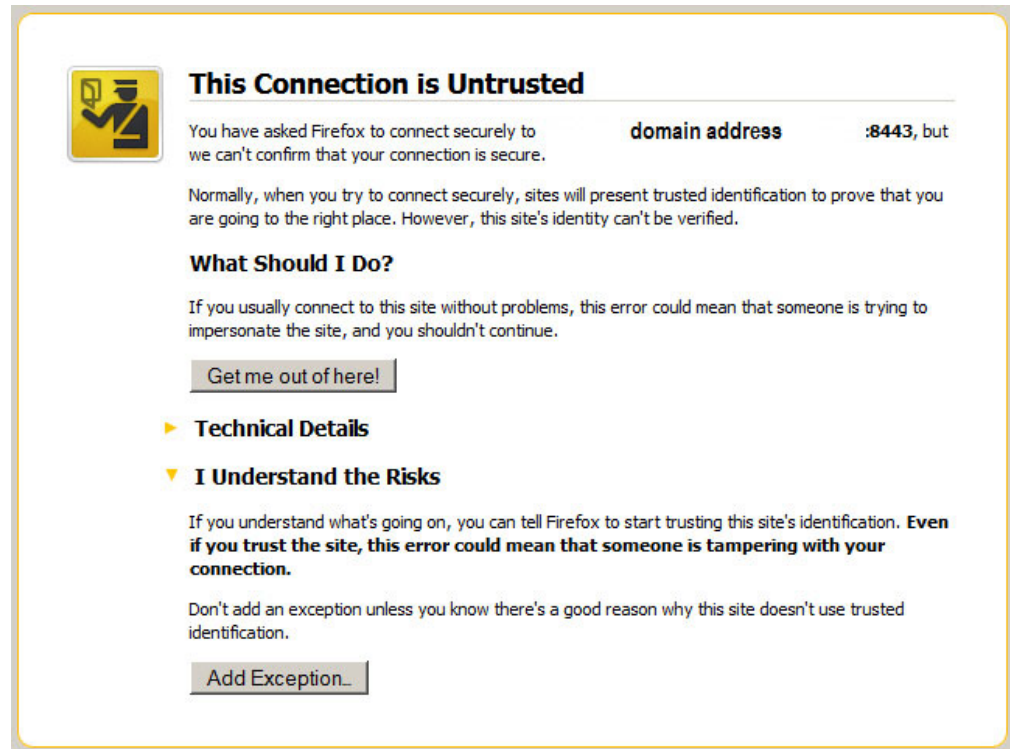


Figure 14. Connection security warning in the Mozilla FireFox web browser

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.

Server Certificate

Certificate: 13772787831092200000

Issued to: N/A

Valid from: 2015-05-20 08:28:56

Valid to: 2025-05-17 08:28:56

Common Name: N/A

Host Name:

Change Certificate

Generate
 Upload files

Hostname

Common Name

IP Address

Validity (Years)

Figure 15. Generate option on Server Certificate dialog box

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

Note: The Spectrum Control 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 31.

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

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

Server Certificate

Certificate: 13772787831092200000

Issued to: N/A

Valid from: 2015-05-20 08:28:56

Valid to: 2025-05-17 08:28:56

Common Name: N/A

Host Name:

Change Certificate

Generate Upload files

Attach Customer Certificate File:

No file chosen

Attach Key File:

No file chosen

Figure 16. 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 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 to complete the procedure.

GUI – Managing storage arrays

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

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

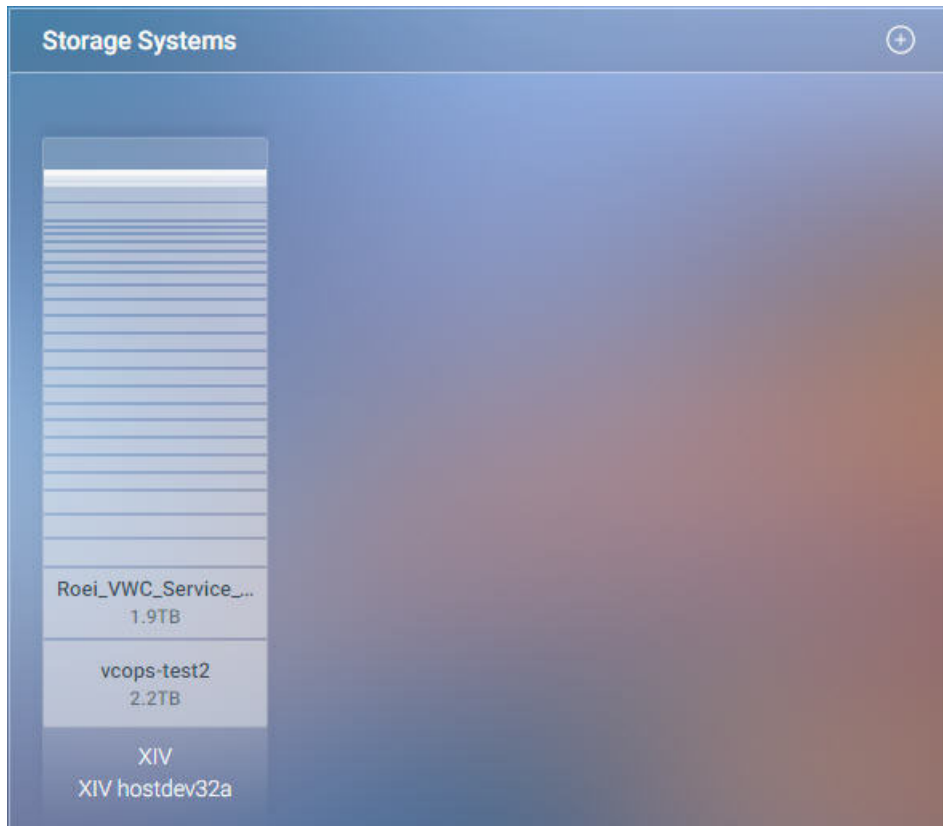


Figure 17. Storage Systems pane

Note: The same operations are available from the CLI as well, as explained “CLI – Adding or removing storage array credentials” on page 76 and in “CLI – Adding or removing storage arrays” on page 78.

- “GUI – Entering the storage array credentials”
- “GUI – Adding a storage array” on page 38
- “GUI – Modifying the IP address or hostname of a storage array” on page 39
- “GUI – Removing a storage array” on page 40

GUI – Entering the storage array credentials

The storage array 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 GUI you can set or change the current storage array access credentials that are used for accessing all the IBM storage arrays.

Important:

- An identical storage admin user account with identical credentials (the same username and password) must already be predefined on all the IBM storage arrays that you intend to use. Spectrum Control can use only a **single array management account** for accessing all the different storage arrays that you use. For more information about how to define a storage admin account on your IBM storage arrays, refer to the relevant storage system management tools documentation.
 - Setting the storage credentials on Spectrum Control allows you to add the IBM storage arrays on the next step.
 - If the array management account is defined on a directory server, see “Checking the format of directory-based storage array credentials” on page 134.
-

Note: The same operations are available from the CLI as well, as explained in “CLI – Adding or removing storage array credentials” on page 76.

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 array username in the **User name** configuration box.

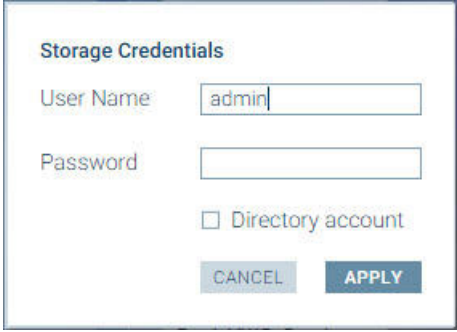


Figure 18. Current storage array username (for all storage arrays)

2. Enter the username and password of the storage admin user that was defined on all your IBM storage arrays.
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 arrays. Spectrum Control will use the credentials that you have set in order to connect to the storage arrays that you add.

Attention: During regular operation, whenever a directory-based storage admin fails to log in (from the Spectrum Control side) to any storage array that is in use, Spectrum Control immediately locks the storage admin user account and all storage arrays become inaccessible on the Spectrum Control 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 array credentials again to unlock the storage admin account on the Spectrum Control side, with either the same credentials or with updated credentials. The equivalent action in the Spectrum Control CLI is to use the force credentials options, as described in “CLI – Adding or removing storage array credentials” on page 76.

GUI – Adding a storage array

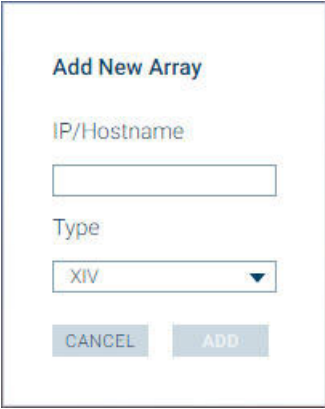
After the storage array credentials are set, you can start adding storage arrays to Spectrum Control.

About this task

The storage arrays that you add can be used by the solution components that are included in the Spectrum Control package (see “Included cloud interfaces” on page 1). You can add each individual storage array 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.



The image shows a dialog box titled "Add New Array". It contains two input fields: "IP/Hostname" and "Type". The "Type" dropdown menu is currently set to "XIV". At the bottom of the dialog, there are two buttons: "CANCEL" and "ADD".

Figure 19. Add New Array dialog box

2. Enter the management IP address or hostname of the array and select the storage array type (XIV, Storwize Family, DS8000, or FlashSystem).
3. Click **Add**. If the credentials are correct (as previously defined; see “GUI – Entering the storage array credentials” on page 36) and the IP connection is established, the storage array is added to the Storage Systems pane.

If the array includes previously defined storage pools, you can view their names and sizes on the array. If no pools exist on the array, you can define them, as explained in “GUI – Defining and attaching storage resources” on page 54.

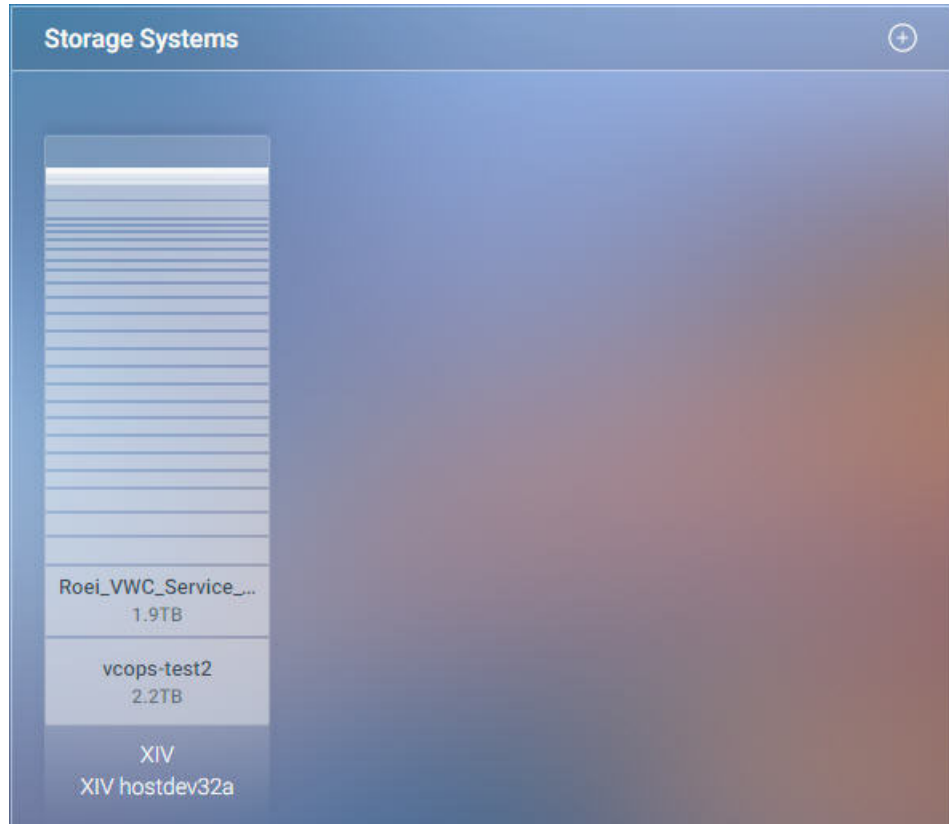


Figure 20. Storage Systems pane

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

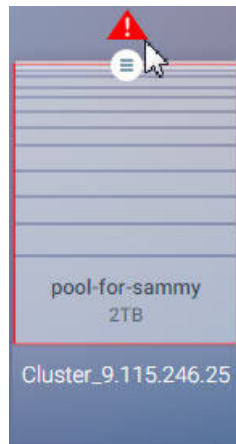


Figure 21. Array error indication

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

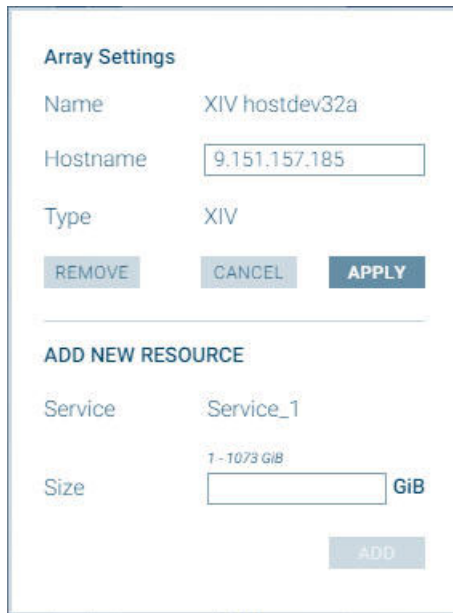
At any time, you can modify the IP address or hostname of an added storage array.

About this task

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

Procedure

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



The screenshot shows a dialog box titled "Array Settings". It has three main sections. The first section contains "Name" (XIV hostdev32a), "Hostname" (9.151.157.185), and "Type" (XIV). Below these are three buttons: "REMOVE", "CANCEL", and "APPLY". The second section is titled "ADD NEW RESOURCE" and contains "Service" (Service_1) and "Size" (1 - 1073 GiB). Below the size field is an "ADD" button.

Figure 22. Array Settings dialog box

Note: If a storage array 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 array, and then click **Apply**.

GUI – Removing a storage array

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

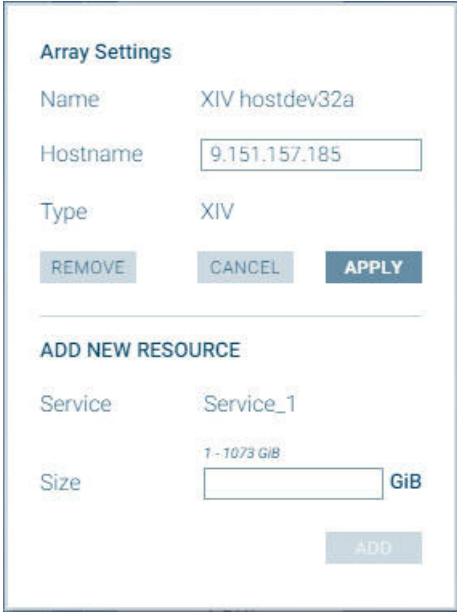
About this task

- A removed storage array, 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 array 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 array 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 array back again to fully restore its management.

Procedure

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



The screenshot shows a dialog box titled "Array Settings". It has three input fields: "Name" with the value "XIV hostdev32a", "Hostname" with the value "9.151.157.185", and "Type" with the value "XIV". Below these fields are three buttons: "REMOVE", "CANCEL", and "APPLY". A horizontal line separates this section from the "ADD NEW RESOURCE" section below. The "ADD NEW RESOURCE" section has a "Service" field with the value "Service_1" and a "Size" field with the value "1 - 1073 GiB" and a "GiB" unit label. There is an "ADD" button at the bottom right of the "ADD NEW RESOURCE" section.

Figure 23. Array Settings dialog box

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

GUI – Managing Spectrum Control users

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

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

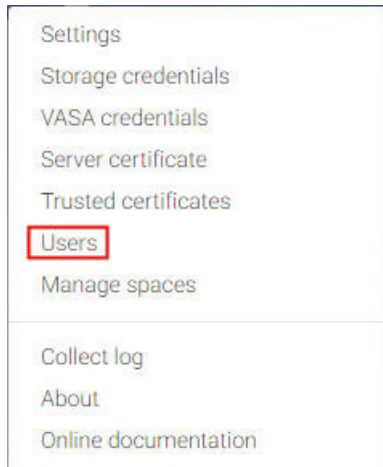


Figure 24. Users option in the Setting menu

Note: The same operations are available from the CLI as well, as explained in “CLI – Managing Spectrum Control users” on page 73.

- “GUI – Adding a new user”
- “GUI – Changing the password of a Spectrum Control user” on page 43
- “GUI – Deleting a user” on page 44

GUI – Adding a new user

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

About this task

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

Note: All Spectrum Control 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.

NEW USER

User Name

Password

Confirm Password

Figure 25. 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.

Users

| User Name |
|-----------|
| admin |

Figure 26. List of added users (user names)

GUI – Changing the password of a Spectrum Control user

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

About this task

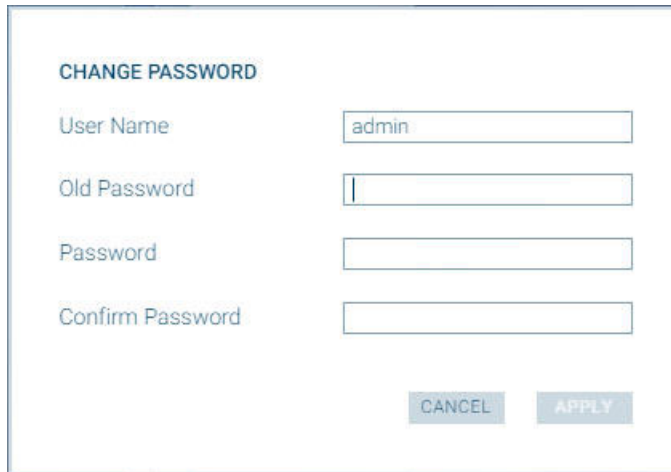
You can modify a user account only by changing its password. Periodic password change is recommended on a regular basis.

Note: Spectrum Control user names cannot be changed. Instead, you can delete a user account (see “GUI – Deleting a user” on page 44) and then create a new one (see “GUI – Adding a new user” on page 42).

Procedure

1. Click **Users** on the Settings menu. The Spectrum Control 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.



The screenshot shows a 'CHANGE PASSWORD' dialog box. It has a title bar with the text 'CHANGE PASSWORD'. Below the title bar are four input fields: 'User Name' (containing the text 'admin'), 'Old Password', 'Password', and 'Confirm Password'. At the bottom of the dialog are two buttons: 'CANCEL' and 'APPLY'.

Figure 27. 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 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 42.

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

Note: Deleting a Spectrum Control 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 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.

Note: This functionality is not applicable to DS8000 systems, which are not supported by the IBM Storage Provider for VMware VASA.

To display a list of all vCenter servers that are currently registered and are utilizing VASA functions, go to the Trusted Certificates dialog box (**Settings > Trusted certificates**). Instructions on adding Spectrum Control as a storage provider to the VMware vCenter Server are detailed in the “Registering Spectrum Control as a storage provider in vCenter server” on page 85 section.

Trusted Certificates

| Issued to | Issuer | Serial Number | Expiration Date |
|-----------|------------------------|---------------|---------------------|
| VMware | /O=VMware/CN=SMS-15... | 1422438942370 | 2025-01-28 09:55:42 |
| | | | |

Figure 28. 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 user accounts, and separately from the storage array credentials.

About this task

VMware vCenter servers can use the VASA credentials to connect to Spectrum Control and utilize VASA functions, as explained in “Registering Spectrum Control as a storage provider in vCenter server” on page 85.

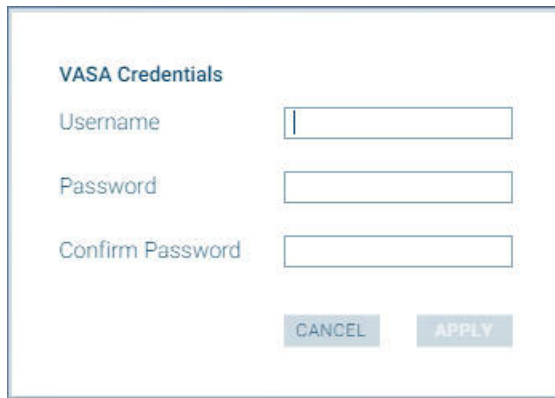
From the Spectrum Control GUI you can set, change, or display these VASA credentials at any time.

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.
 - The same operations are available from the CLI as well, as explained in “CLI – Setting the VASA credentials” on page 80.
-

Procedure

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



The image shows a dialog box titled "VASA Credentials". It contains three text input fields labeled "Username", "Password", and "Confirm Password". At the bottom of the dialog, there are two buttons: "CANCEL" and "APPLY".

Figure 29. 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 user database. See “GUI – Managing Spectrum Control users” on page 41

GUI – Managing storage spaces and services

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

Spectrum Control 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.

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 GUI.

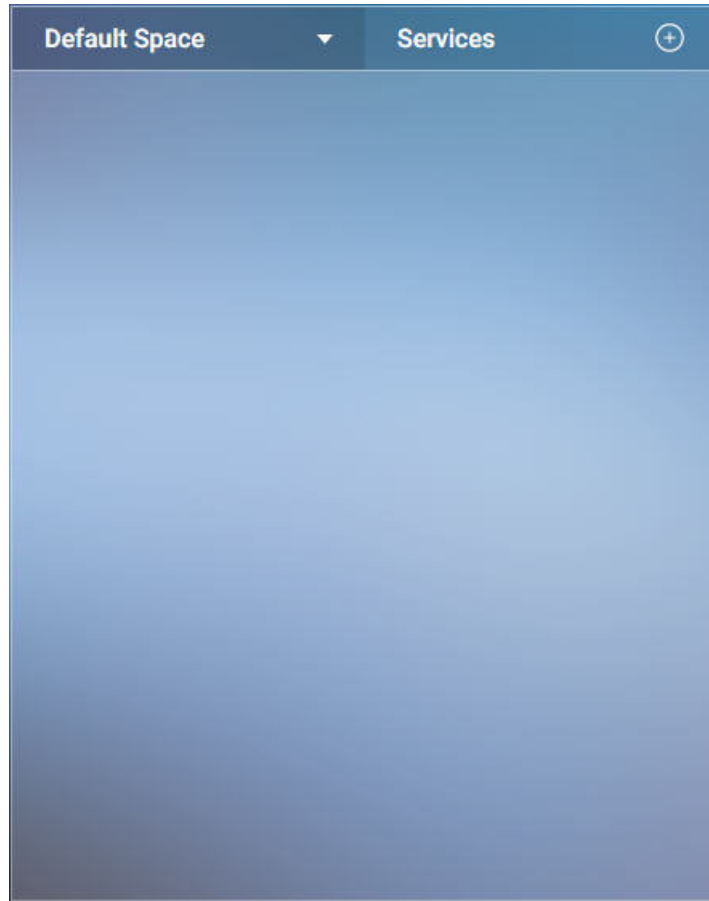


Figure 30. Spaces/Services pane

- “GUI – Adding a storage space”
- “GUI – Removing a storage space” on page 48
- “GUI – Adding a storage service” on page 49
- “GUI – Removing a storage service” on page 53
- “GUI – Defining and attaching storage resources” on page 54
- “GUI – Detaching storage resources from services” on page 56

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

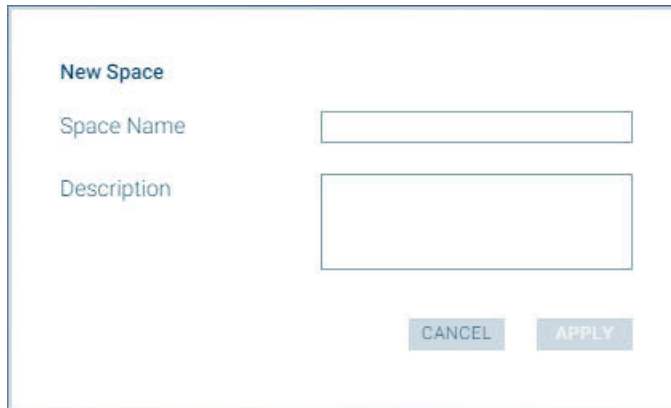
A storage space is a logical grouping of storage services and underlying physical pools. This combination determines the storage that is available when a user requests a storage service provisioning.

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.

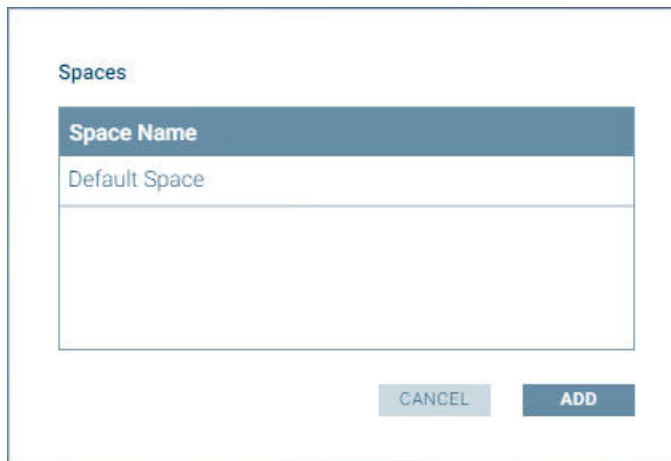
2. Click **Add** . The New Space dialog box is displayed.



The image shows a dialog box titled "New Space". It contains two input fields: "Space Name" and "Description". Below the input fields are two buttons: "CANCEL" and "APPLY".

Figure 31. New Space dialog box

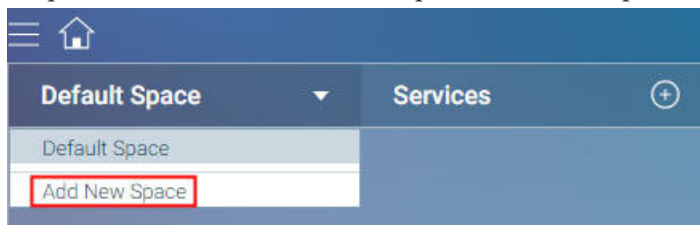
3. Enter the name and description of the storage space that you want to create, and then click **Apply**. The name and description of the created storage space is added to the Spaces list.



The image shows a list of storage spaces. The list is titled "Spaces" and has a header "Space Name". The list contains one entry: "Default Space". Below the list are two buttons: "CANCEL" and "ADD".

Figure 32. 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.

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 53

About this task

A removed storage array, 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 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 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.

New Service

Name

Description

Encryption

Yes

No

Space Efficiency

Thin provisioning

Thick provisioning

Compression

XIV options

 Pool definitions

 Over-provisioning %

 Snapshot reserve %

Automatic resource adjustment

VVOL Service

Figure 33. 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. Currently, you must disable encryption for services, using DS8000 storage resources, if you plan to manage them via vWC. |

Table 6. Service parameters (continued)

| Parameter | Description and values |
|------------------|--|
| Space Efficiency | <p data-bbox="769 254 1453 401">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.</p> <p data-bbox="769 428 1094 455">Configuration considerations</p> <p data-bbox="769 480 1437 592">A service with enabled IBM Real-time Compression will be able to support storage resources which support compression as well. Likewise, any compressed volume in vWC, must be created on a service with data compression enabled.</p> |

Table 6. Service parameters (continued)

| Parameter | Description and values |
|-------------------|---|
| Over-provisioning | <p>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).</p> <p>Configuration considerations</p> <p>The recommended over-provisioning value for a VVOL-enabled service with XIV storage systems is 400%.</p> <p>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.</p> <p>For other cases, you can choose any value:</p> <ul style="list-style-type: none"> • 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. <p>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, do the following:</p> <ul style="list-style-type: none"> • Enable a metadata service. • Create a managed domain. • Define a user with category <i>storageintegrationadmin</i>. • Associate the <i>storageintegrationadmin</i> user with the domain. • Define an ESXi host and associate it with the domain. <p>Important</p> <p>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 for subsequent use by the VMware vWC.</p> <p>The over-provisioning is not relevant for the Storwize Family and DS8000 storage arrays.</p> <p>Configuration examples</p> <ul style="list-style-type: none"> • 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. |

Table 6. Service parameters (continued)

| Parameter | Description and values |
|-------------------------------|--|
| Snapshot reserve | Percentage of storage space on the service reserved for snapshots. |
| 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 VVOL functionality for the service. A 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 array.
 - Only one VVOL-enabled service is allowed per an array and per storage space.
-

4. Click **Apply** to finish the procedure. A new service is added to the current Spaces tab.

What to do next

Define and attach storage pools to the service, as explained in “GUI – Defining and attaching storage resources” on page 54.

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.

Service Settings

Name

Description

Encryption

Yes

No

Space Efficiency

Thin provisioning

Thick provisioning

Compression

XIV options

Pool definitions

 Over-provisioning %

 Snapshot reserve %

Automatic resource adjustment

VVOL Service

Figure 34. Service Settings dialog box

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

GUI – Defining and attaching storage resources

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

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.

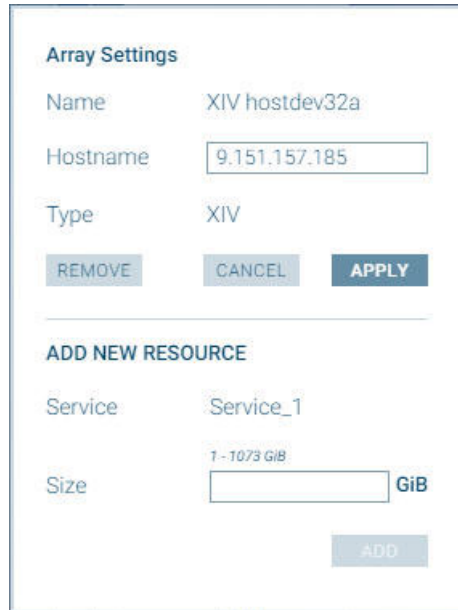
About this task

If no resources (pools) exist on the storage arrays, you can define the resources and attach them to a service to make the physical storage available for the Spectrum Control 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 an array on which you want to define a new resource, and then click the **Edit** button. The Array Settings dialog box is displayed.



The screenshot shows the 'Array Settings' dialog box. It is divided into two main sections. The top section, titled 'Array Settings', contains the following fields and controls: 'Name' with the value 'XIV hostdev32a', 'Hostname' with the value '9.151.157.185', and 'Type' with the value 'XIV'. Below these fields are three buttons: 'REMOVE', 'CANCEL', and 'APPLY'. The bottom section, titled 'ADD NEW RESOURCE', contains the following fields and controls: 'Service' with the value 'Service_1', and 'Size' with a range of '1 - 1073 GiB' and a text input field. Below the size field is an 'ADD' button.

Figure 35. Array Settings dialog box

4. In the **Add New Resource** section of the dialog box, enter a management domain of the pool for the XIV arrays, or a parent pool for the IBM Storwize Family (ver. 7.4 and above), and its size in GB.

Note: Management domains are available for the XIV arrays 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 array and attached to the service. The resource color changes to green to indicate the successful attachment.

The resources defined on the array before the array was attached to Spectrum Control, 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 array 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 IBM Spectrum Virtualize, attach the primary and secondary pools to the same storage service.
-

GUI – Resizing storage resources

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

About this task

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

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.

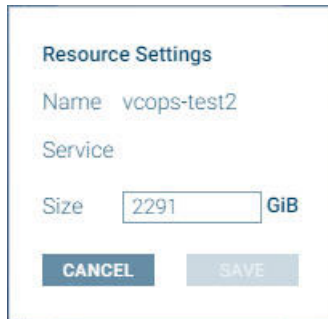


Figure 36. Resource Settings dialog box

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

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 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 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 89).

- “GUI – Adding a vCenter server”
- “GUI – Updating the credentials of a vCenter server” on page 58
- “GUI – Removing a vCenter server” on page 59
- “GUI – Attaching storage services to a vCenter server” on page 60
- “GUI – Detaching storage services from a vCenter server” on page 61

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. 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 89) 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.

The dialog box is titled "Add New vCenter Server for vWC". It contains three input fields: "IP/Hostname", "Username", and "Password". Below the input fields are two buttons: "CANCEL" and "APPLY".

Figure 37. 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 38. Applications pane

GUI – Updating the credentials of a vCenter server

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

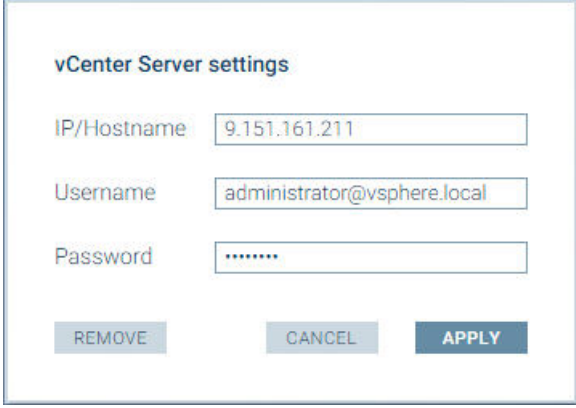
About this task

Whenever the credentials on the vCenter server side change, you can update these credentials on the Spectrum Control 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 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.



The image shows a dialog box titled "vCenter Server settings". It contains three input fields: "IP/Hostname" with the value "9.151.161.211", "Username" with the value "administrator@vsphere.local", and "Password" with a masked value ".....". At the bottom of the dialog box, there are three buttons: "REMOVE", "CANCEL", and "APPLY".

Figure 39. 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

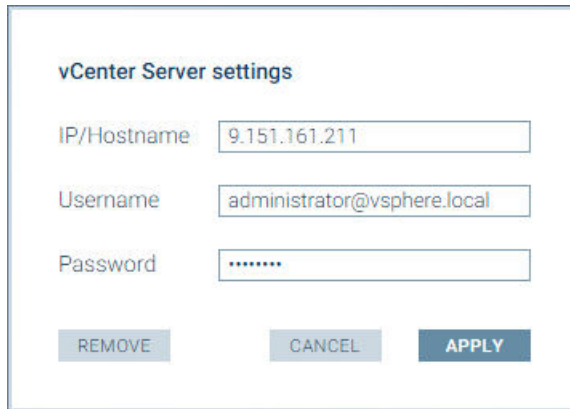
When a vCenter server is no longer needed, you can disconnect it from Spectrum Control by removing it from the Applications pane.

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.



The image shows a dialog box titled "vCenter Server settings". It contains three input fields: "IP/Hostname" with the value "9.151.161.211", "Username" with the value "administrator@vsphere.local", and "Password" with a masked password ".....". At the bottom of the dialog, there are three buttons: "REMOVE", "CANCEL", and "APPLY".

Figure 40. 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 array credentials” on page 36).
- 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 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.

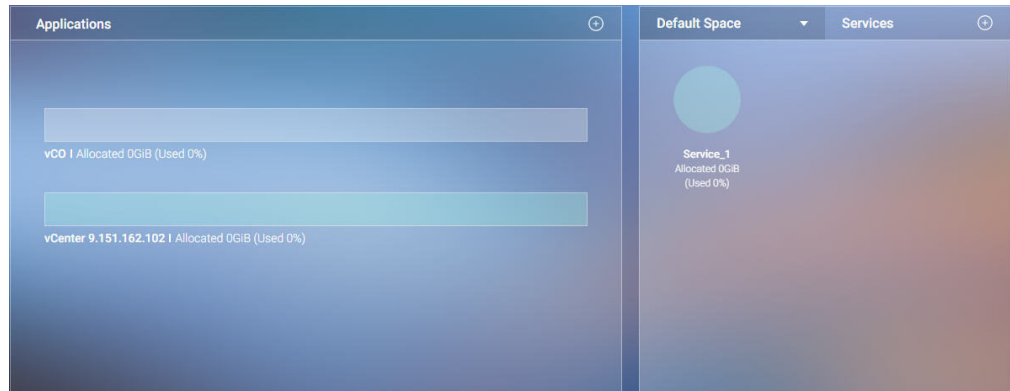


Figure 41. vCenter server with attached services

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 arrays.

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 63
- “GUI – Downloading and installing the plug-in package for vCO” on page 63.
- “GUI – Regenerating the vCO token” on page 65.

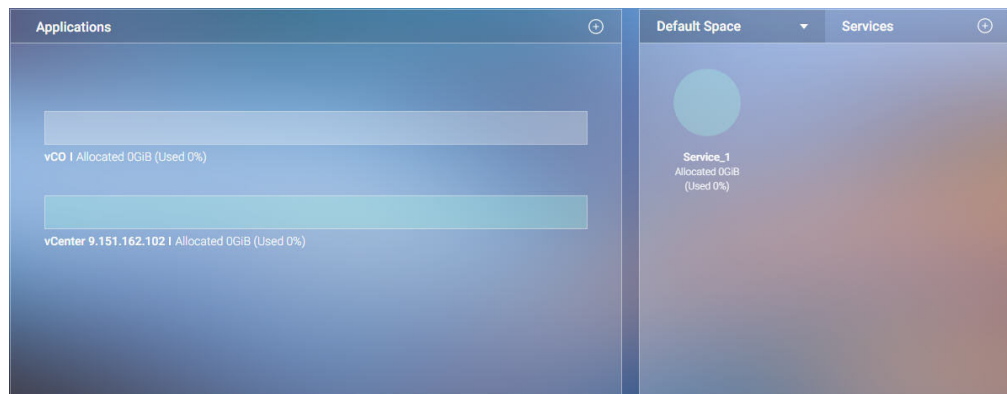


Figure 42. vCO server on the Applications pane

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 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 111).

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.

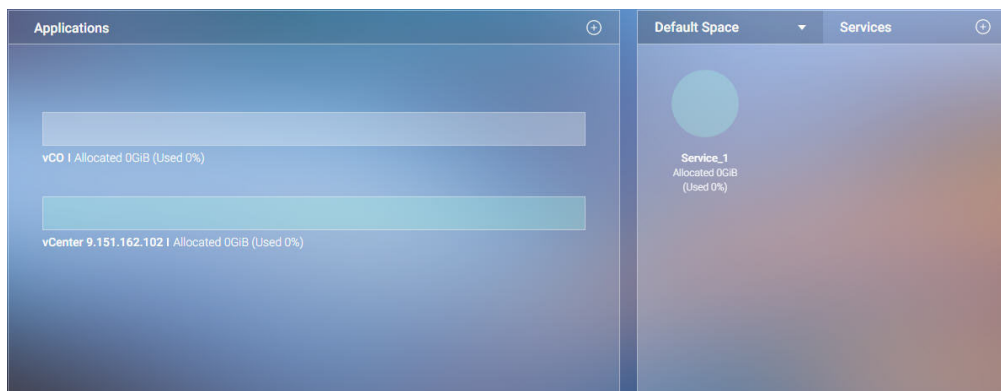


Figure 43. vCO server with attached services

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 and install it on the vCenter Orchestrator server.

Before you begin

To allow the IBM Storage Plug-in to securely identify Spectrum Control and work properly, the SSL certificate that is automatically created on Spectrum Control 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 32.

Important: After the IBM Storage Plug-in is installed on vCenter Orchestrator, the Java security APIs validate that the hostname received from Spectrum Control 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 dialog box, click **Download plug-in package**.

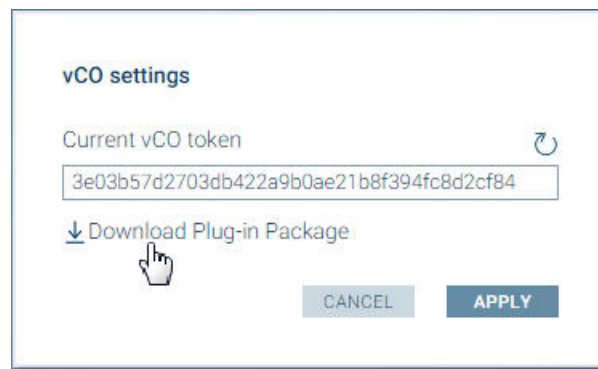


Figure 44. Download plug-in package button

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

```
/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 45. 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 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 IP address or hostname, and also the token key (REST API token) that you obtained earlier.

IBM Storage Plug-in Configuration

Enter Server hostname or IP address:

Enter REST API token:

Figure 46. 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 111.

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 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 63.

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 arrays should be monitored in vCOps.

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

becomes available in vCops (for more information, see Chapter 7, “Using the IBM Storage Management Pack for VMware vCenter Operations Manager,” on page 115).

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

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

- “GUI – Downloading the vCops management package” on page 67.
- “Deploying the management package on vCops” on page 67.
- “Describing the management package on vCops” on page 69.
- “GUI – Connecting the vCops server to Spectrum Control” on page 70.
- “GUI – Attaching and detaching storage arrays on the vCops server” on page 71.

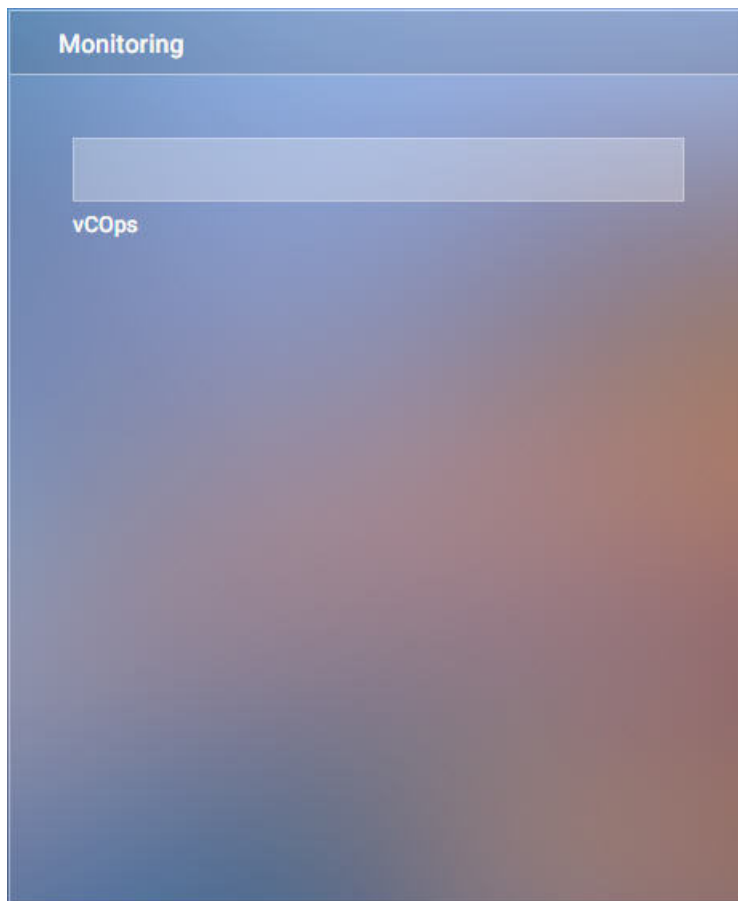


Figure 47. Monitoring pane

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 81.

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 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 48. Download PAK File button

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

```
/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.

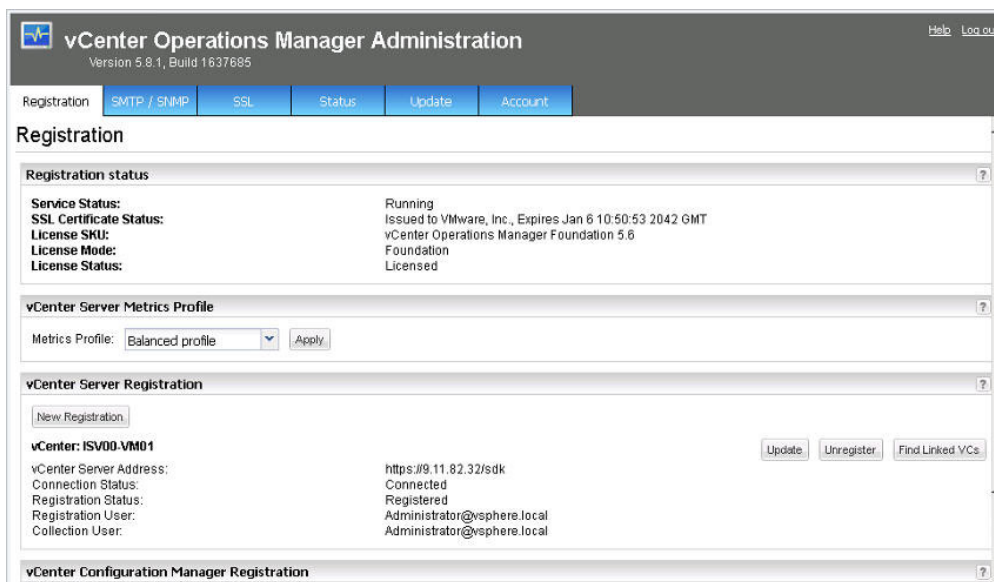


Figure 49. Registering the vCops on the vCenter server

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. After that, click **Update** to deploy the management package on the vCops.
The IBM license agreement is displayed.

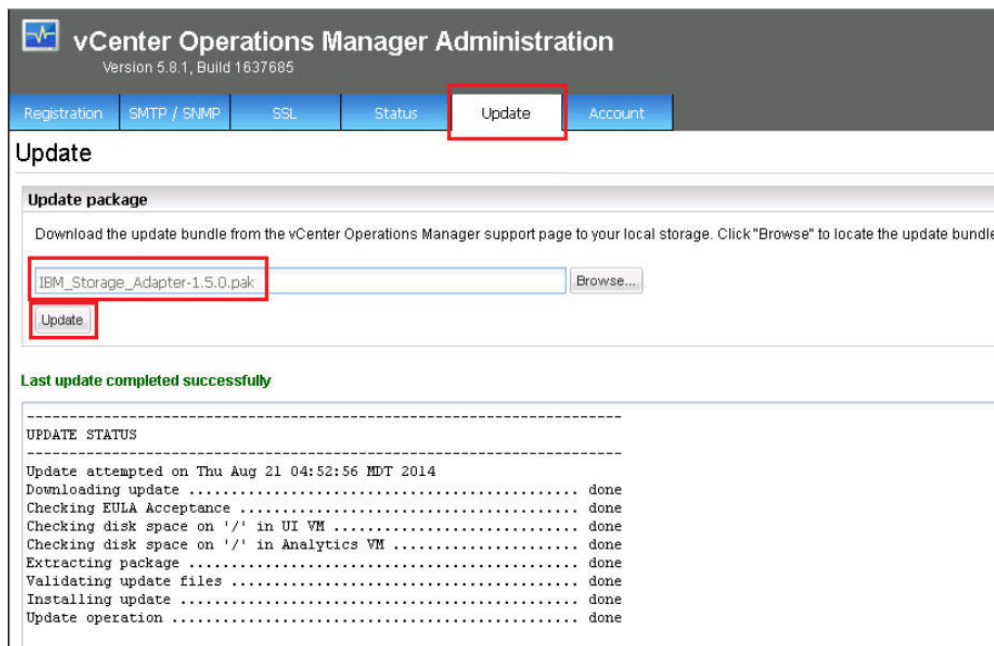


Figure 50. Deploying the management package on the vCops

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.

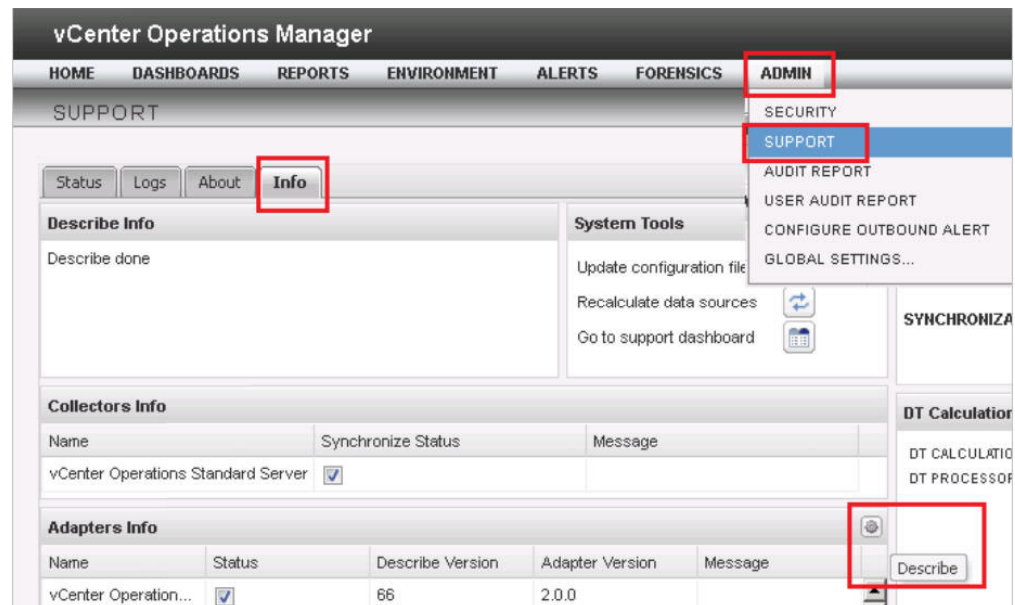


Figure 51. Describing the management package on the vCOps

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.

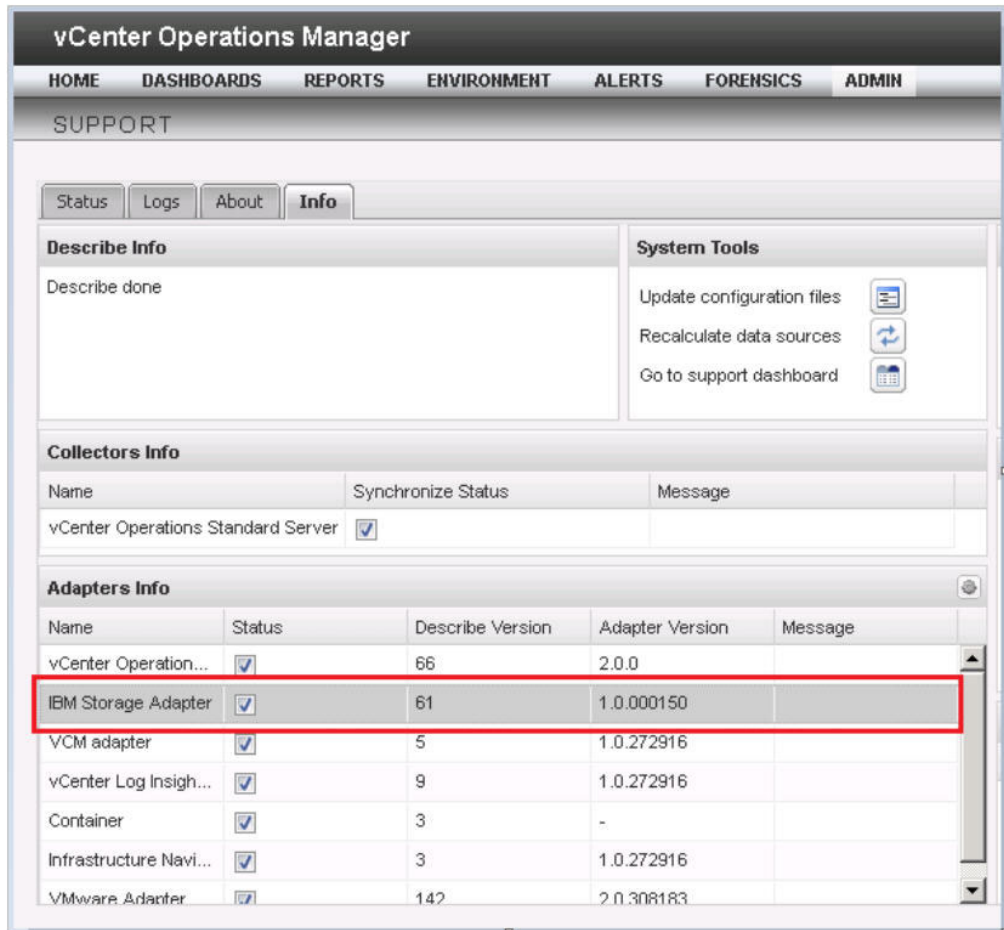


Figure 52. Verifying successful description of the management package on the vCOps

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

What to do next

See “GUI – Connecting the vCOps server to Spectrum Control.”

GUI – Connecting the vCOps server to Spectrum Control

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

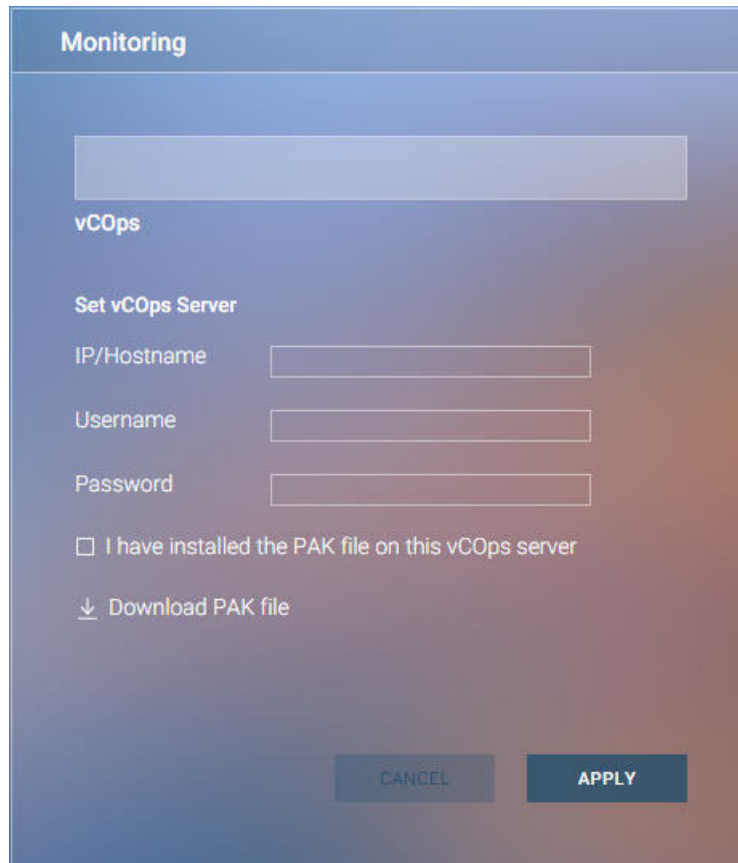
About this task

The vCenter Operations Manager server must be connected to Spectrum Control, 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



The screenshot shows a 'Monitoring' dialog box with a blue header. Below the header is a grayed-out area. Underneath, the text 'vCOPS' is displayed. A section titled 'Set vCOPS Server' contains three input fields: 'IP/Hostname', 'Username', and 'Password'. Below these fields is a checkbox labeled 'I have installed the PAK file on this vCOPS server' and a link with a download icon labeled 'Download PAK file'. At the bottom right, there are two buttons: 'CANCEL' and 'APPLY'.

Figure 53. Adding the vCOPS server to Spectrum Control

green.

What to do next

See “GUI – Attaching and detaching storage arrays on the vCOPS server.”

GUI – Attaching and detaching storage arrays on the vCOPS server

The IBM storage arrays connected to Spectrum Control must be added to the vCOPS Manager as well.

About this task

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

Procedure

To manage the storage arrays on the vCOPS server:

1. On the Monitoring pane, click the vCOPS server to which you want to attach storage arrays.

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

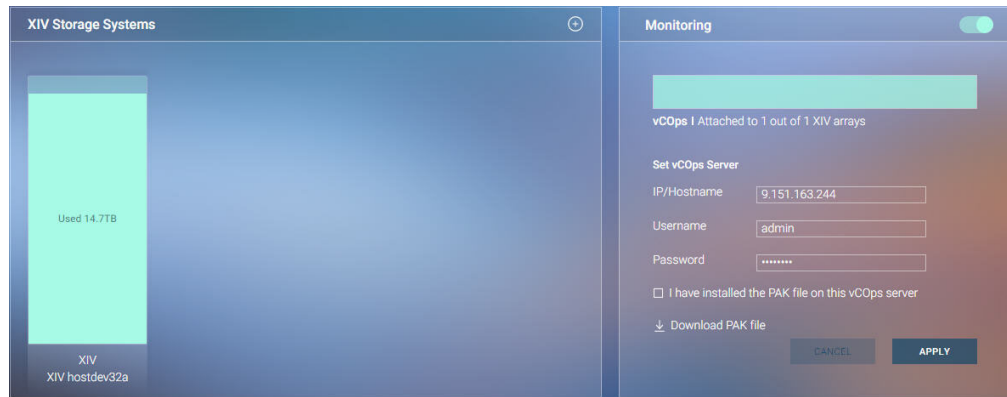


Figure 54. Storage array attached to the vCOPS server

You can detach a storage array from the vCOPS server by clicking the attached array. When detached, the array 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 arrays are attached to the server out of total number of arrays defined on Spectrum Control. The color of the vCOPS server changes from dark to bright green in accordance with the number of attached arrays.

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

You can access and control Spectrum Control 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 users” on page 73
- “CLI – Adding or removing storage array credentials” on page 76
- “CLI – Adding or removing storage arrays” on page 78
- “CLI – Setting the VASA credentials” on page 80
- “CLI – Managing integration with vCenter Operations Manager” on page 81

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 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 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 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 users” on page 41.
- 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 20.

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. 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: <pre>sc_users add -n johnvc -p *****</pre> |

Table 7. Arguments for `sc_users` (continued)

| Argument | Use after <code>sc_users</code> to: |
|---|--|
| <p><code>change_password -n <username> -p <new password></code></p> <p>or</p> <p><code>change_password --user_name <username> --user_password <password></code></p> | <p>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.</p> <p>For example:</p> <pre>sc_users change_password -n johnvc -p *****</pre> |
| <p><code>delete -n <username></code></p> <p>or</p> <p><code>delete --user_name <username></code></p> | <p>Delete a user account from the server.</p> <p>For example:</p> <pre>sc_users delete -n johnvc</pre> |
| <p><code>list</code></p> | <p>Display the names of currently defined user accounts.</p> <p>For example:</p> <pre>sc_users list User list: john_vc zivka1_vc lihit_vc</pre> |
| <p><code>-h</code></p> <p>or <code>--help</code></p> | <p>Display help information that is relevant to <code>sc_users</code>.</p> <p>You can also display help for the <code>add_user</code>, <code>change_password</code>, or <code>delete_user</code> argument if it is typed on the command line as well.</p> |

Table 8. User-related arguments for `sc_setting`

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

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, you might encounter a connection security warning before you can access the Spectrum Control login page (see “GUI – Logging in” on page 26).

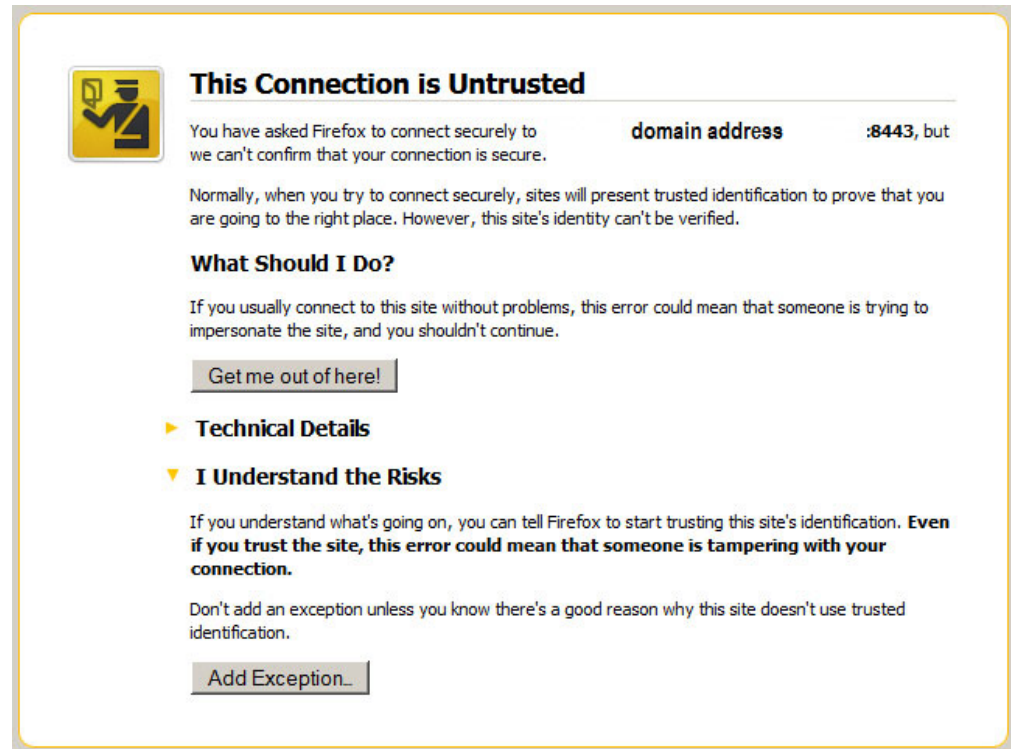


Figure 55. Connection security warning in the Mozilla FireFox web browser

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 32.

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 server and certificate validity period (in days). For example: <pre>sc_ssl generate -c mycommonname -n "sc_serverhostname" -i 1.0.0.200 -e 5000</pre> |

Table 9. Arguments for `sc_ssl` (continued)

| Argument | Use after <code>sc_ssl</code> to: |
|---|--|
| <code>trust -c <certificate_path></code> | <p>Select an SSL certificate to be trusted, by providing a path to its location.</p> <p>For example:</p> <pre>sc_ssl trust -c CA_certificate.crt</pre> |
| <code>import -c <certificate_path> -k <key_path></code> | <p>Import a SSL certificate and a key file, by providing paths to their locations.</p> <p>For example:</p> <pre>sc_ssl import -c self_signed_certificate.crt -k private_key.key</pre> |
| <code>-h</code> | <p>Display help information that is relevant to <code>sc_ssl</code>.</p> <p>You can also display help for the <code>generate</code>, <code>trust</code>, or <code>import</code> argument if it is typed on the command line as well.</p> |

CLI – Adding or removing storage array 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 arrays that you intend to use. Spectrum Control can use only a **single array management account** for accessing all the different storage arrays that you use. For more information about how to define a storage admin account on your IBM storage arrays, refer to the relevant storage system management tools documentation.
 - Setting the storage credentials on Spectrum Control allows you to add the IBM storage arrays on the next step.
 - If the array management account is defined on a directory server, see “Checking the format of directory-based storage array credentials” on page 134.
-

Use the `sc_storage_credentials` CLI command to set (add), remove, or display the current storage array access credentials that Spectrum Control uses in order to access all the IBM storage arrays. 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 array credentials” on page 36.
-

Table 10. Arguments for `sc_storage_credentials`

| Argument | Use after <code>sc_storage_credentials</code> to: |
|--|--|
| <p><code>set -u <array username></code> <code>-p <array password></code> <code>-f</code> <code>-a <user type></code> or <code>set --user <array username></code> <code>--password <array password></code> <code>--force</code> <code>--user_account <user type></code></p> | <p>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.</p> <p>For example, if the storage admin user is locally defined on the storage system, enter:</p> <pre>sc_storage_credentials set -u john21 -p ***** -a local</pre> <p>And if the storage admin user is defined on a directory server, enter:</p> <pre>sc_storage_credentials set -u john21 -p ***** -a directory</pre> <p>Attention: During regular operation, whenever a directory-based storage admin fails to log in (from the Spectrum Control side) to any storage array that is in use, Spectrum Control immediately locks the storage admin user account and all storage arrays become inaccessible on the Spectrum Control side. This is to prevent repeated login attempt failures after which the directory server blocks that user account. In such a case, use the <code>-f</code> or <code>--force</code> argument on the command line to unlock the storage admin account on the Spectrum Control side, with either the same credentials or with updated credentials. For example:</p> <pre>sc_storage_credentials set -u john21 -p ***** -f -a directory</pre> <p>The equivalent action in the Spectrum Control GUI is to update the account credentials, as described in “GUI – Entering the storage array credentials” on page 36.</p> <p>If the storage credentials are defined on a directory server, see “Checking the format of directory-based storage array credentials” on page 134.</p> |
| <p><code>remove</code></p> | <p>Delete the existing storage array user account definition from the server.</p> <p>For example:</p> <pre>sc_storage_credentials remove</pre> <p>Attention: If you already added storage systems to the server, deleting the user account disconnects all these storage systems.</p> |

Table 10. Arguments for `sc_storage_credentials` (continued)

| Argument | Use after <code>sc_storage_credentials</code> to: |
|---|--|
| <code>list</code> | <p>Display the username of the existing storage array user account definition.</p> <p>The following example shows the command output when the storage admin user account is defined locally on the storage system:</p> <pre> 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 </pre> <p>The following example shows the command output when the storage admin user account is defined on a directory server:</p> <pre> 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 </pre> |
| <code>-h</code> or <code>--help</code> | <p>Display help information that is relevant to <code>sc_storage_credentials</code>.</p> <p>You can also display help for the <code>set</code> argument if it is typed on the command line as well.</p> |

CLI – Adding or removing storage arrays

All IBM storage systems that provide storage resources to your VMware platforms must be defined as storage arrays 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 storage arrays). Use the required argument after the command, as specified in the following table.

Important:

- IBM storage arrays can be added only after the storage credentials are set, as explained in “CLI – Adding or removing storage array credentials” on page 76.
- If you want to remove existing storage arrays:
 - A removed storage array, 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 array 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 array 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 array 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 arrays” on page 35.

Table 11. Arguments for `sc_storage_array`

| Argument | Use after <code>sc_storage_array</code> to: |
|--|---|
| <p><code>add -i <management IP address> -t <array type></code></p> <p>or</p> <p><code>add --mgmt_ip <management IP address> --type <array type></code></p> | <p>Add a storage array (IBM storage system) specified by an IP address or DNS, and the type of the array.</p> <p>For the <code>-t</code> (array type) argument, specify <code>xiv</code> for XIV, <code>svc</code> for IBM Spectrum Virtualize, Storwize, and Flex System, or <code>ds8k</code> for DS8000.</p> <p>For example:</p> <pre>sc_storage_array add -i 10.100.155.200 -t xiv</pre> <p>Optional: you can define an alias name for the added XIV system, by adding <code>-a <alias name></code> or <code>--alias <alias name></code> to the command.</p> <p>For example:</p> <pre>sc_storage_array add -i 10.100.155.200 -t xiv -a mystorage1</pre> <p>Note: If you choose not to define an alias, the alias name that is already defined (if one was defined) on the IBM storage system side is automatically assigned as the alias name.</p> |
| <p><code>remove -a <system alias name></code></p> <p>or</p> <p><code>remove --alias <system alias name></code></p> | <p>Remove a storage array specified by its alias name (alias that was given by you or was automatically assigned).</p> <p>For example:</p> <pre>sc_storage_array remove -a mystorage1</pre> |
| <code>list</code> | <p>List the names and details of all the IBM storage arrays that are currently added (and were not removed). The displayed information includes:</p> <ul style="list-style-type: none"> • Array alias • Array identifier • Management IP address • Elapsed time since last update • Connected • Notes® <p>See the example after this table.</p> |
| <code>refresh</code> | Refresh information about all managed IBM storage arrays. |
| <p><code>-h</code></p> <p>or <code>--help</code></p> | <p>Display help information that is relevant to <code>sc_storage_array</code>.</p> <p>You can also display help for the <code>add</code> or <code>remove</code> argument if it is typed on the command line as well.</p> |

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

```
sc_storage_array list
```

| Array Alias | Array Identifier | Management IP Addresses | Elapsed time 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 and utilize VASA functions, as explained in “Registering Spectrum Control as a storage provider in vCenter server” on page 85. 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 45.

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: <pre>sc_vasa_admin set_secret -n johnvasa -p *****</pre> The secret key for the VASA Provider has been set successfully. |
| list_secret | Display the username of the currently defined VASA credentials. For example: <pre>sc_vasa_admin list_secret</pre> 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 arrays should be monitored in vCops.

After a vCops server connection is defined and storage arrays are associated with the vCops server, detailed monitoring information for these storage arrays becomes available in vCops (for more information, see Chapter 7, “Using the IBM Storage Management Pack for VMware vCenter Operations Manager,” on page 115).

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 arrays to any created HTTP POST adapter. A storage array 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 arrays can be attached to HTTP POST adapters only after the storage arrays have been added to Spectrum Control, as explained in “CLI – Adding or removing storage arrays” on page 78.
 - 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 67.
 - If you want to detach storage arrays:
 - A detached storage array can no longer be monitored through vCenter Operations Manager.
 - After the detachment, you can reattach the storage array 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 65.
-

Table 13. Arguments for `sc_vcops_server`

| Argument | Use after <code>sc_vcops_server</code> to: |
|---|--|
| <p><code>add -n <hostname> -u <username> -p <password></code></p> <p>or</p> <p><code>add --hostname <hostname> --username <username> --password <password></code></p> | <p>Add a vCOPS server connection by specifying the following parameters on the command line:</p> <ul style="list-style-type: none"> • 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. <p>For example:</p> <pre>sc_vcops_server add -n vcops1.domain -u john1 -p *****</pre> <p>Note: The local HTTP POST adapter is added automatically after the vCOPS server is added.</p> |
| <p><code>remove -n <hostname></code></p> <p>or</p> <p><code>remove --hostname <hostname></code></p> | <p>Remove a vCOPS server connection by specifying its IP address or hostname on the command line.</p> <p>For example:</p> <pre>sc_vcops_server remove -n vcops1.domain</pre> <p>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).</p> |
| <p><code>disable -n <hostname></code></p> <p>or</p> <p><code>disable --hostname <hostname></code></p> | <p>Disable reporting to a vCOPS server (without removing its connection) by specifying its IP address or hostname on the command line.</p> <p>For example:</p> <pre>sc_vcops_server disable -n vcops1.domain</pre> <p>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).</p> |
| <p><code>enable -n <hostname></code></p> <p>or</p> <p><code>enable --hostname <hostname></code></p> | <p>Resume reporting to a vCOPS server by specifying its IP address or hostname on the command line.</p> <p>For example:</p> <pre>sc_vcops_server enable -n vcops1.domain</pre> |

Table 13. Arguments for `sc_vcops_server` (continued)

| Argument | Use after <code>sc_vcops_server</code> to: |
|---|--|
| <code>list</code> | <p>List all the currently connected (added) vCOPs servers and their operation status (enabled or disabled).</p> <p>For example:</p> <pre>sc_vcops_server list vCOPs Hostname Status ----- vcops1.domain Enabled vcops2.domain Disabled</pre> |
| <code>-h</code> or <code>--help</code> | <p>Display help information that is relevant to <code>sc_vcops_server</code> .</p> <p>You can also display help for the add, remove, enable, or disable argument if it is typed on the command line as well.</p> |

Table 14. Arguments for `sc_vcops_adapter`

| Argument | Use after <code>sc_vcops_adapter</code> to: |
|---|---|
| <code>array_attach -a <alias> -n <hostname></code> or <code>array_attach --alias <alias> --hostname <hostname></code> | <p>Attach a storage array to a vCOPs HTTP POST adapter (of a vCOPs server) by specifying the following parameters on the command line:</p> <ul style="list-style-type: none"> Alias name of the storage array that you want to attach. IP address or hostname of the storage array that you want to attach. <p>For example:</p> <pre>sc_vcops_adapter array_attach -a myXIV -n 9.150.200.100</pre> <p>Note: The storage array must already be added to Spectrum Control, as explained in “CLI – Adding or removing storage arrays” on page 78.</p> |
| <code>array_detach -a <alias> -n <hostname></code> or <code>array_detach --alias <alias> --hostname <hostname></code> | <p>Detach a storage array from a vCOPs HTTP POST adapter (of a vCOPs server) by specifying the following parameters on the command line:</p> <ul style="list-style-type: none"> Alias name of the storage array that you want to detach. IP address or hostname of the storage array that you want to detach. <p>For example:</p> <pre>sc_vcops_adapter array_detach -a myXIV -n 9.150.200.100</pre> |
| <code>add -s <server> -n <hostname></code> or <code>add --server <server> --hostname <hostname></code> | <p>Add an HTTP POST adapter for a vCOPs server by specifying the following parameters on the command line:</p> <ul style="list-style-type: none"> 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. <p>For example:</p> <pre>sc_vcops_adapter add -s vcops1.domain -n adapter2.domain</pre> |

Table 14. Arguments for `sc_vcops_adapter` (continued)

| Argument | Use after <code>sc_vcops_adapter</code> to: |
|---|---|
| <p><code>remove -n <hostname></code></p> <p>or</p> <p><code>remove --hostname <hostname></code></p> | <p>Remove an HTTP POST adapter by specifying its IP address or hostname on the command line.</p> <p>For example:</p> <pre data-bbox="654 369 1412 426">sc_vcops_adapter remove -n adapter2.domain</pre> |
| <p><code>report_thresholds -n <hostname></code></p> <p>or</p> <p><code>report_thresholds --hostname <hostname></code></p> | <p>Report the thresholds to a vCops server by specifying its IP address or hostname on the command line.</p> <p>For example:</p> <pre data-bbox="654 579 1412 636">sc_vcops_adapter report_thresholds -n vcops1.domain</pre> |
| <p><code>report_thresholds -a</code></p> <p>or</p> <p><code>report_thresholds -all</code></p> | <p>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.</p> <pre data-bbox="654 768 1412 825">sc_vcops_adapter report_thresholds -a</pre> |
| <p><code>list</code></p> | <p>List all the currently defined HTTP POST adapters and display their associated vCops server, alias name of attached storage arrays, last report time (report to the vCops server), and indication regarding whether the adapter is remote or locally defined.</p> <p>For example:</p> <pre data-bbox="654 1041 1412 1203"> 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 </pre> |
| <p><code>-h</code></p> <p>or <code>--help</code></p> | <p>Display help information that is relevant to <code>sc_vcops_adapter</code>.</p> <p>You can also display help for the <code>array_attach</code>, <code>array_detach</code>, <code>add</code>, <code>remove</code>, or <code>report_thresholds</code> argument if it is typed on the command line as well.</p> |

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.

Note: IBM DS8000 systems are not supported by the IBM Storage Provider for VMware VASA.

After the IBM storage systems have been added to the controller, 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 in the relevant vCenter server or servers.

Registering Spectrum Control 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 array is configured for both, vCenter uses IBM Tivoli Storage Productivity Center provider **as the only source of information** for that array's storage views on vSphere 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 arrays from a specific storage provider, allowing you to remove the array association with the IBM TPC provider.

- The **date and time** that are defined on both the vCenter server and on Spectrum Control 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 on a single vCenter server by using vSphere Client.

Procedure

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

1. In vSphere Client, click **vCenter > vCenter Servers**, and click on vCenter server, which has been already connected to Spectrum Control.

2. On the **Manage** tab, click **Storage Providers**.
3. Click the plus sign to add a new storage provider.

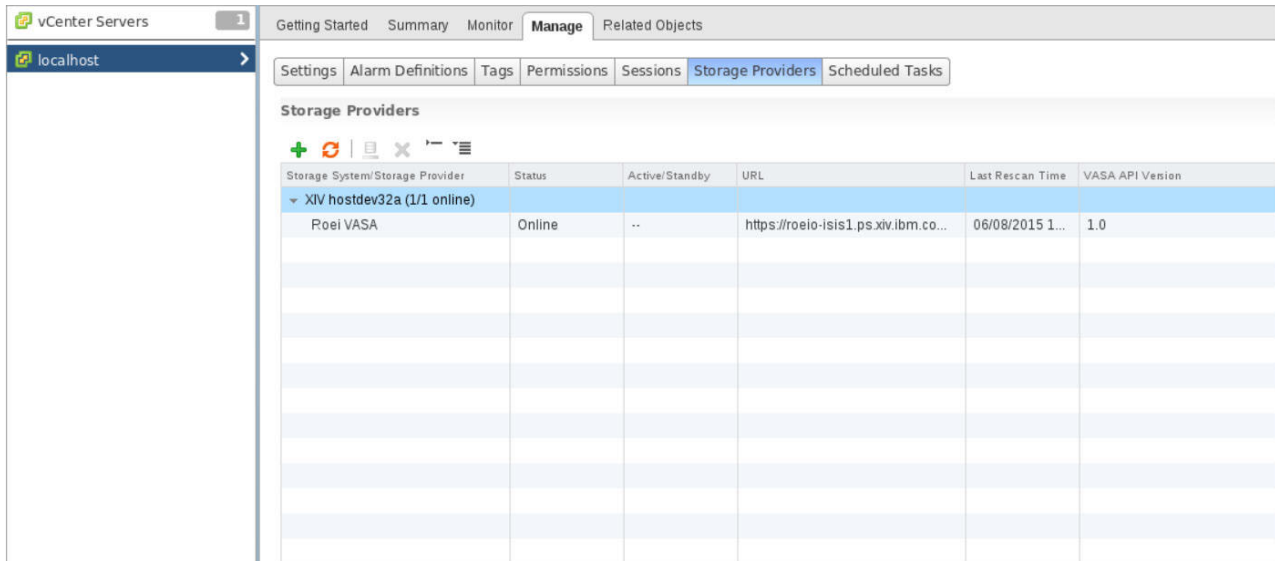


Figure 56. vSphere Client – Storage Providers list

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 (the VASA Secret is predefined as explained in “GUI – Adding a new user” on page 42). The URL should be entered in the *ip:port* format, specifying the relevant IP address and port number of Spectrum Control:
 - https://[Spectrum Control IP address]:8443/services/vasa1 for VASA 1.0
 - https://[Spectrum Control IP address]:8443/services/vasa for VASA 2.0

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

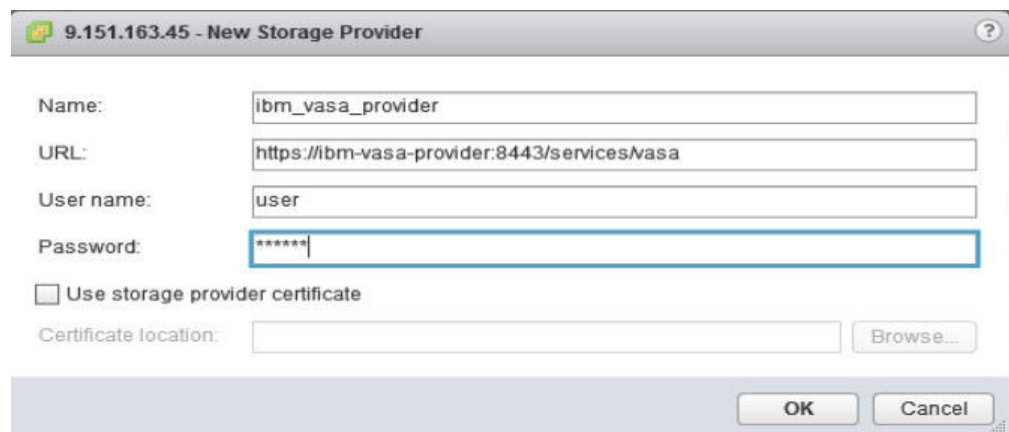


Figure 57. New Storage Provider dialog box for VASA 2.0

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



Figure 58. vCenter certificate thumbprint dialog box

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

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

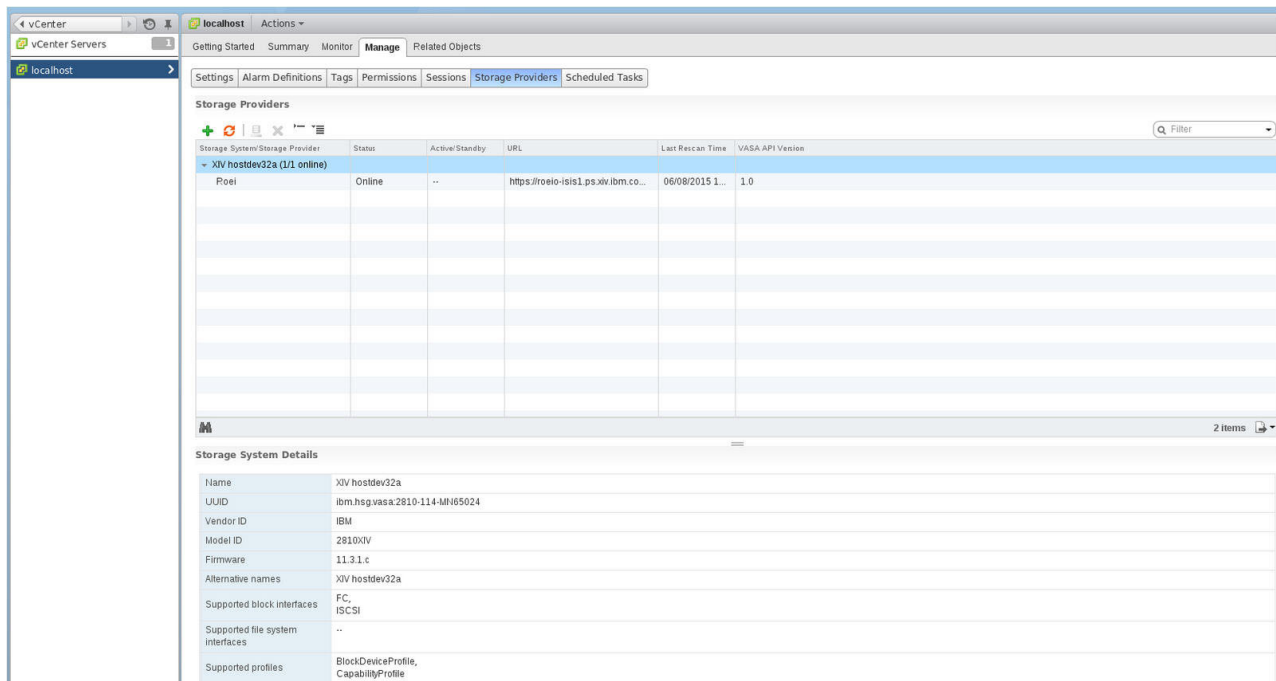


Figure 59. Storage Providers list displaying Spectrum Control

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 57).
 - 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” on page 91
- “Viewing the IBM storage resource information” on page 93
- “Creating and mapping a new storage volume (LUN)” on page 97
- “Extending a volume” on page 104
- “Renaming a volume” on page 105
- “Setting multipath policy enforcement for a volume” on page 106
- “Moving a volume to another storage pool” on page 107
- “Unmapping a volume from one or more hosts” on page 108
- “Deleting an unused volume” on page 109

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 15. 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 57) | <ul style="list-style-type: none"> • 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 89) | |

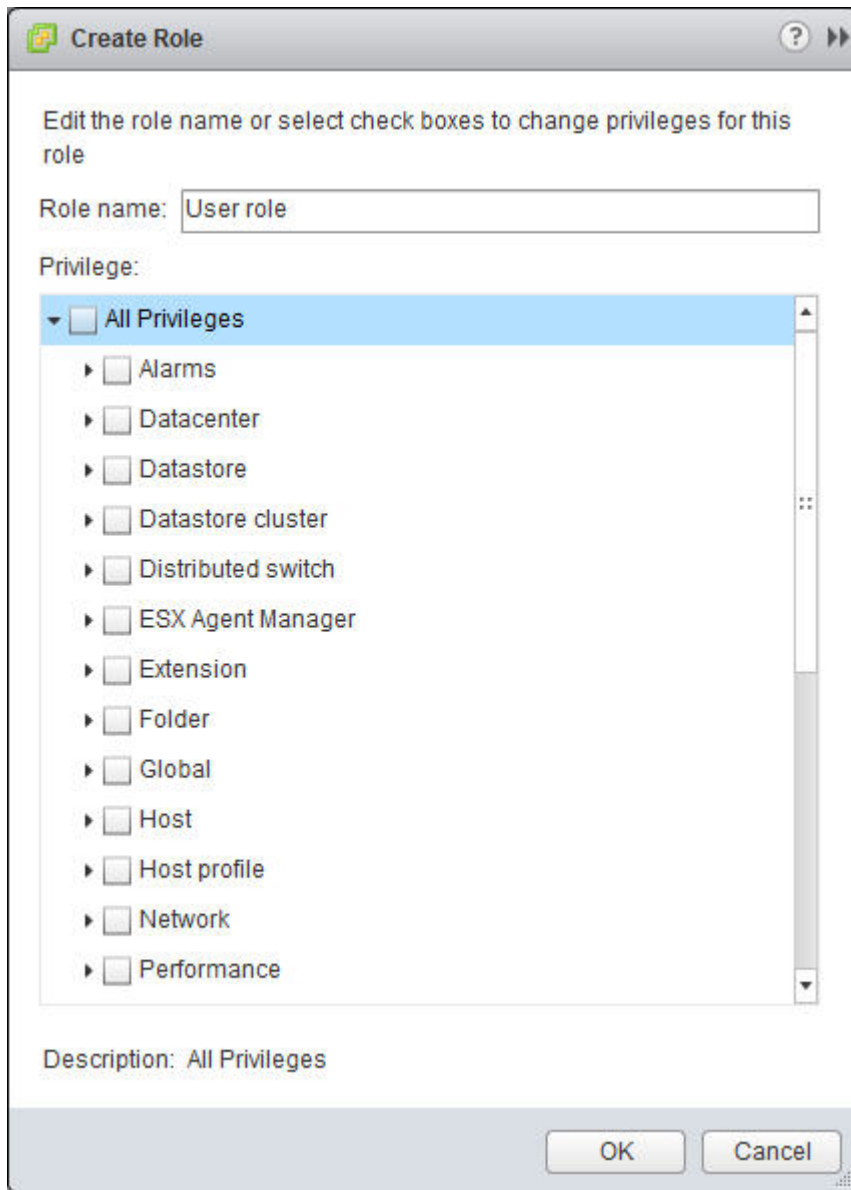


Figure 60. VMware vSphere Web Client – Create Role dialog box

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

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 every 30 minutes (as defined in `vmc_config.ini`, see “Checking and modifying the configuration files” on page 130). 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, as explained in “GUI – Adding a vCenter server” on page 57.

Procedure

1. In vSphere Web Client, focus on the relevant vCenter server.
2. Refresh Spectrum Control, 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**.

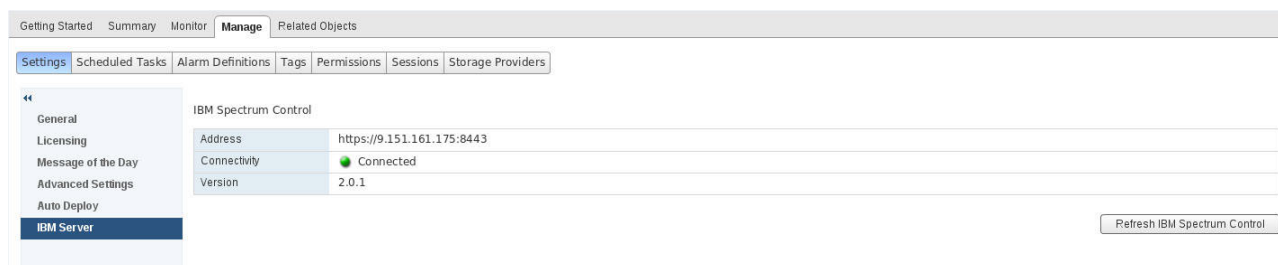


Figure 61. Populate vCenter Information option in vSphere 6.0

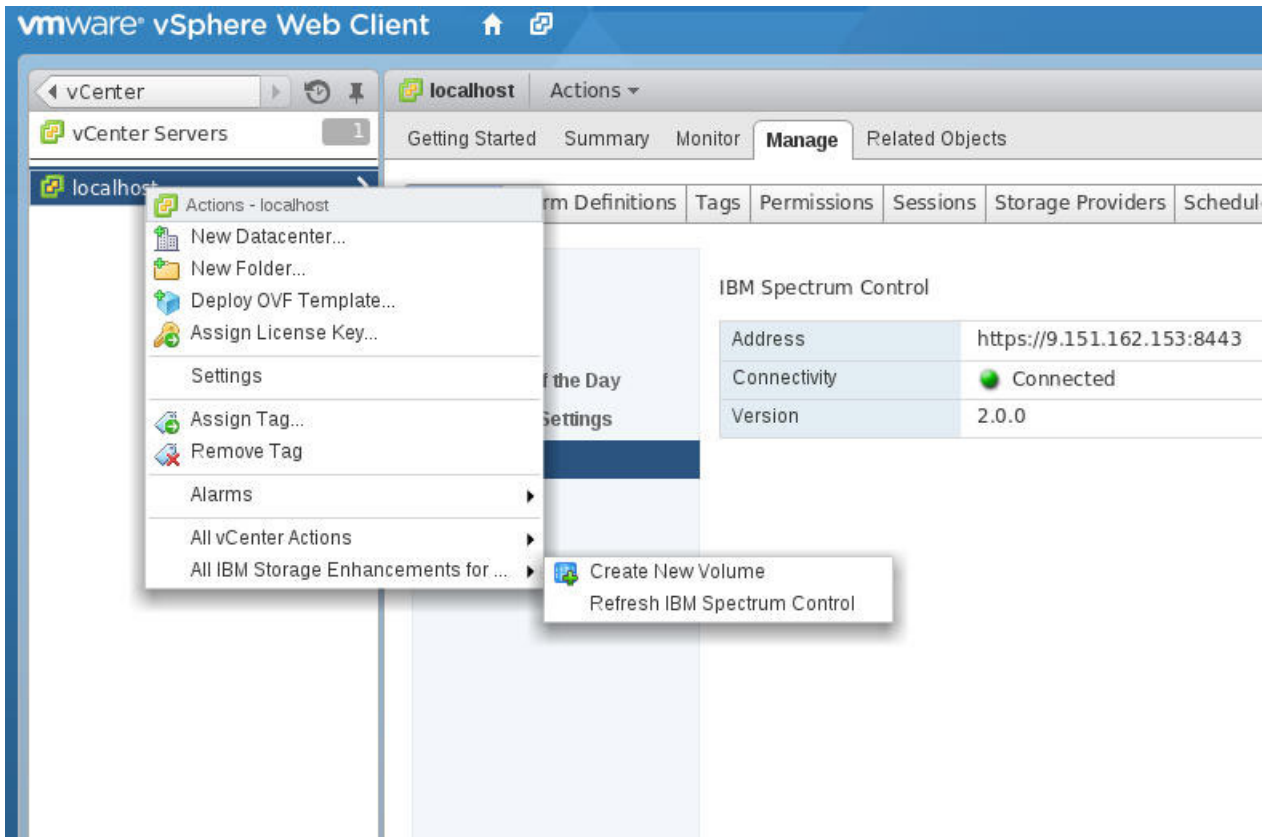


Figure 62. Populate vCenter Information option, vSphere 5.5

3. A confirmation message appears.

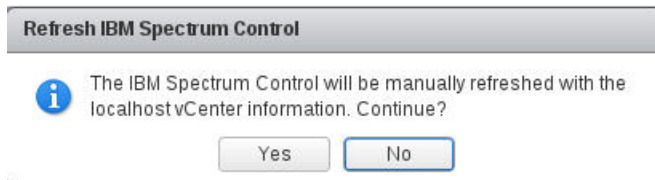


Figure 63. Populate vCenter confirmation message

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

Viewing the IBM storage resource information

After the IBM Storage Enhancements for VMware vSphere 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.

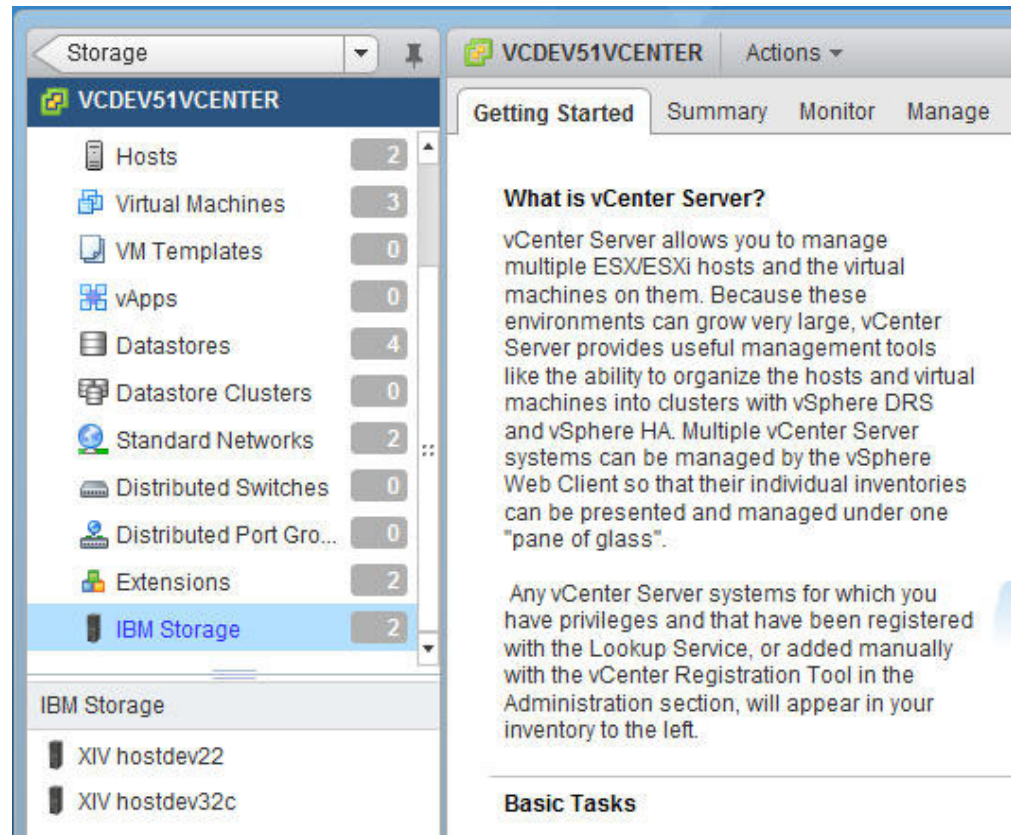


Figure 64. IBM Storage category in vSphere Web Client

For each vCenter server, the IBM Storage category shows how many IBM storage arrays are available for that vCenter server. The number and type of available IBM storage arrays is determined on the IBM Spectrum Control Base side, as explained in “GUI – Managing storage arrays” on page 35 and “GUI – Managing integration with vSphere Web Client” on page 57.

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

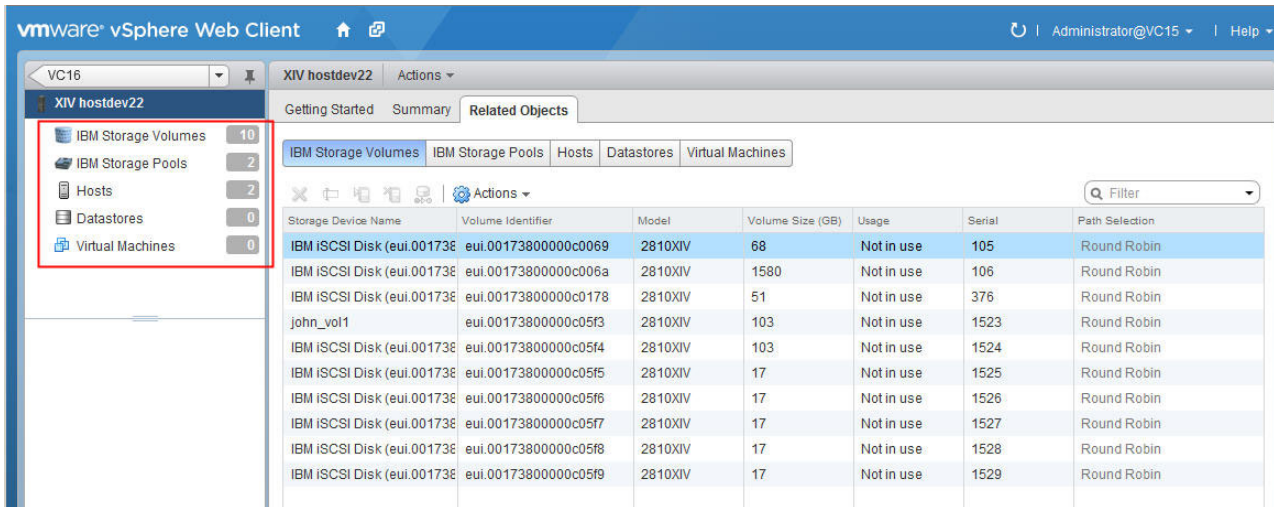


Figure 65. IBM Storage information per storage array

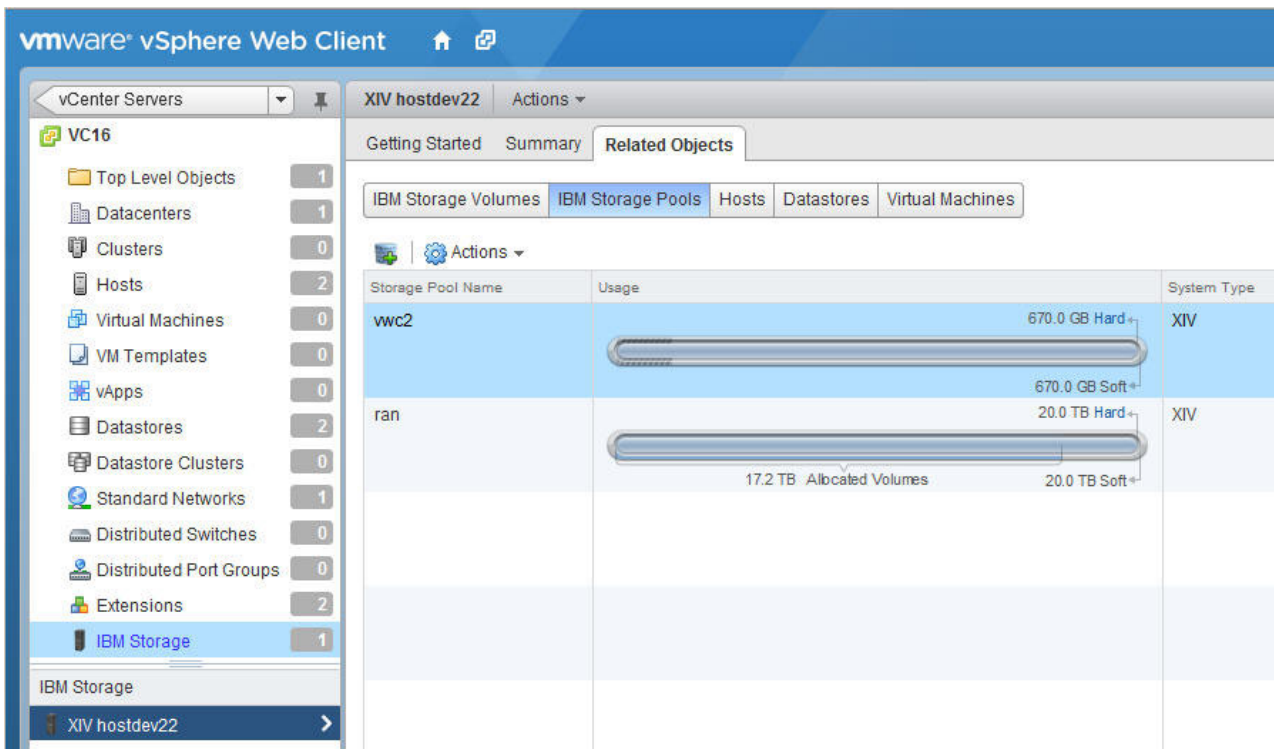


Figure 66. Currently available storage pools per storage array

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.

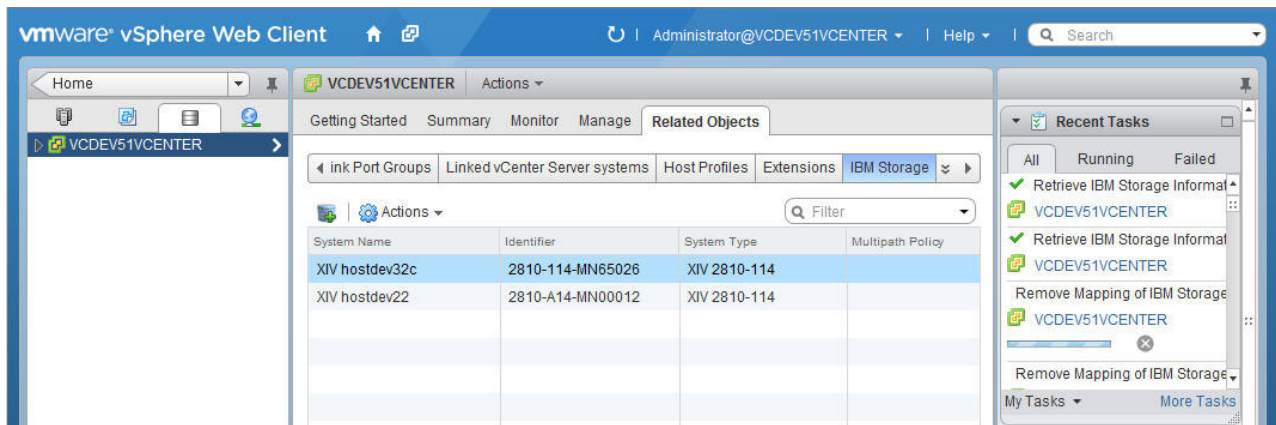


Figure 67. IBM Storage information per vCenter server

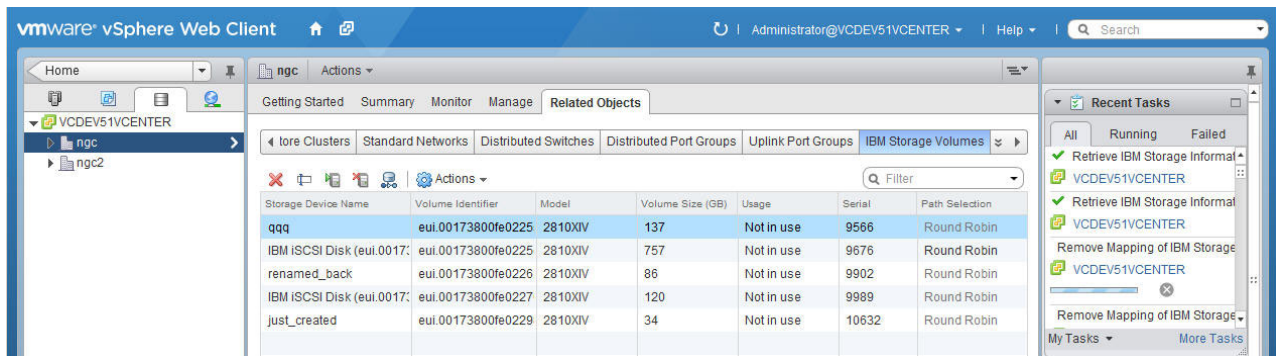


Figure 68. IBM Storage information per datacenter

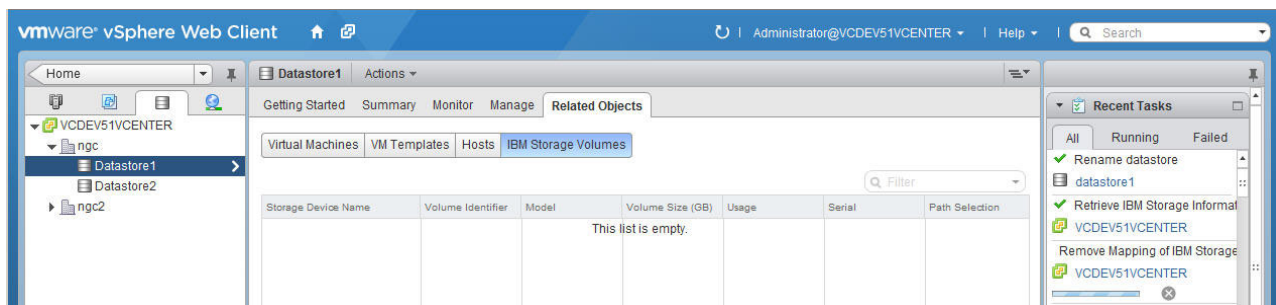


Figure 69. IBM Storage information per datastore

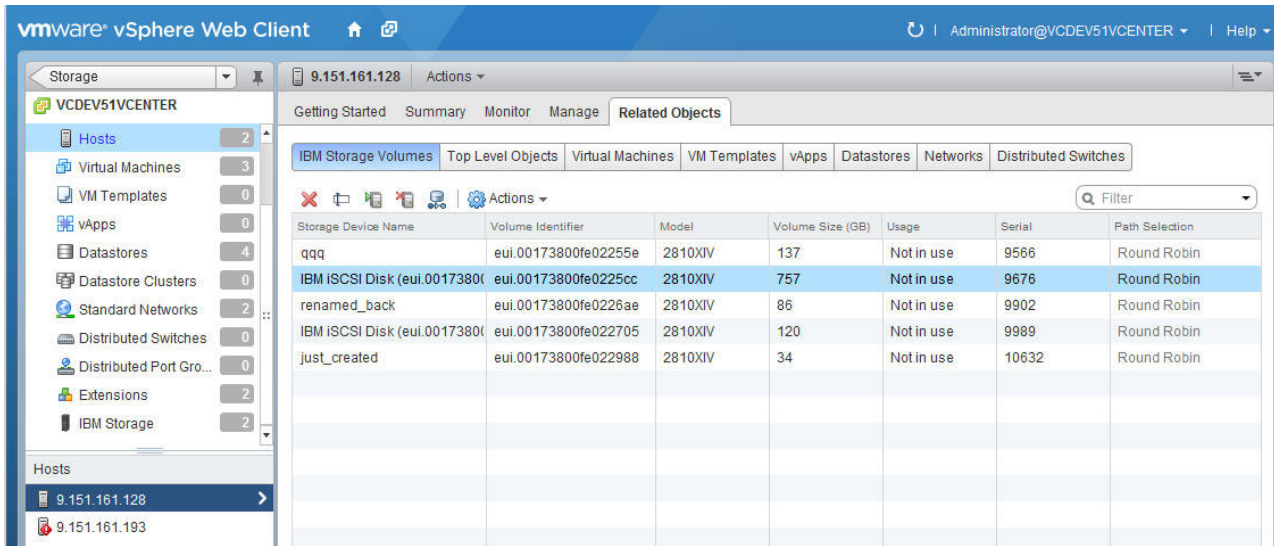


Figure 70. IBM Storage information per all ESXi hosts of a vCenter server

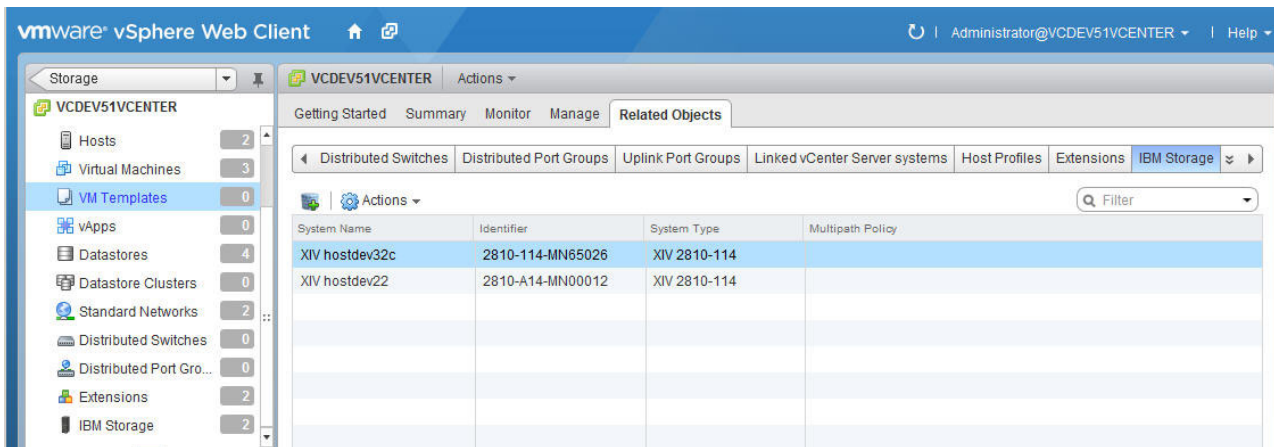


Figure 71. IBM Storage information per all VM templates of a vCenter server

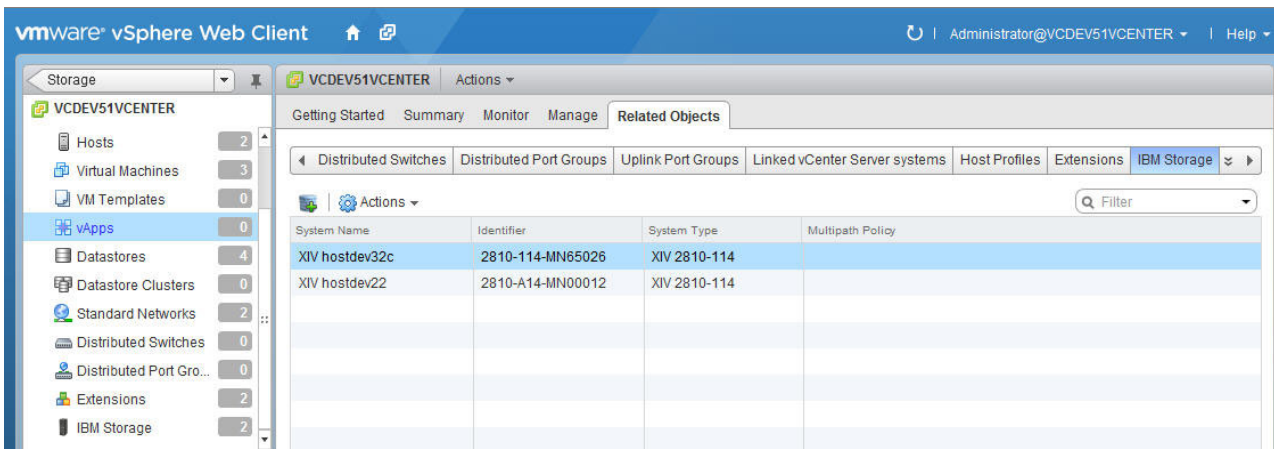


Figure 72. IBM Storage information per all vApps of a vCenter server

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 side. For more information, see “GUI – Managing integration with vSphere Web Client” on page 57
 - 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 array on which you want to create the new volume. The IBM storage array and the relevant storage pools should already be associated with the vCenter server (see “Viewing the IBM storage resource information” on page 93).
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**.

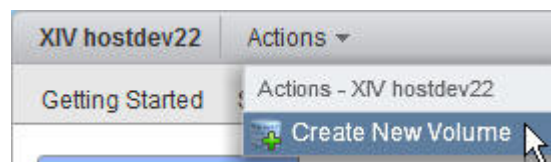


Figure 73. IBM storage array view – Clicking Create New Volume

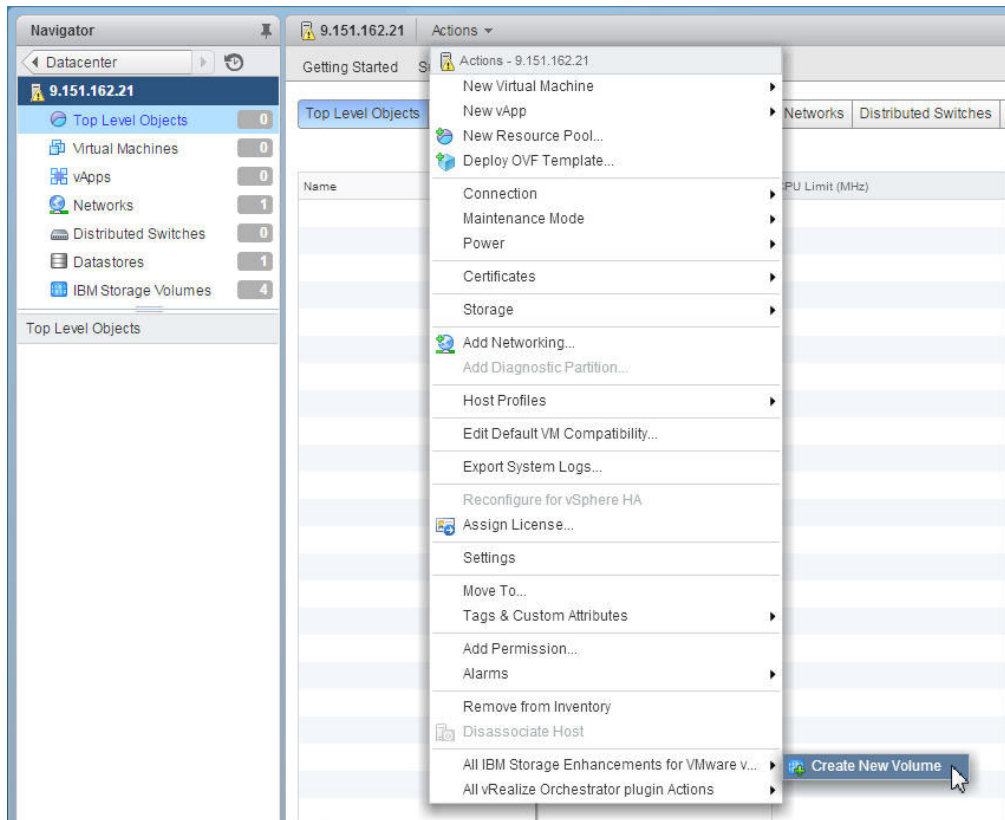


Figure 74. Top Level Objects view – Clicking Create New Volume

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

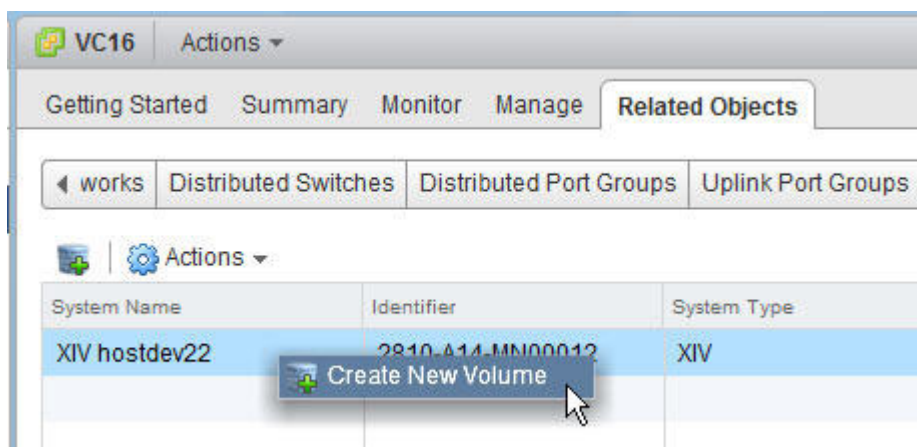


Figure 75. Right-clicking the storage array

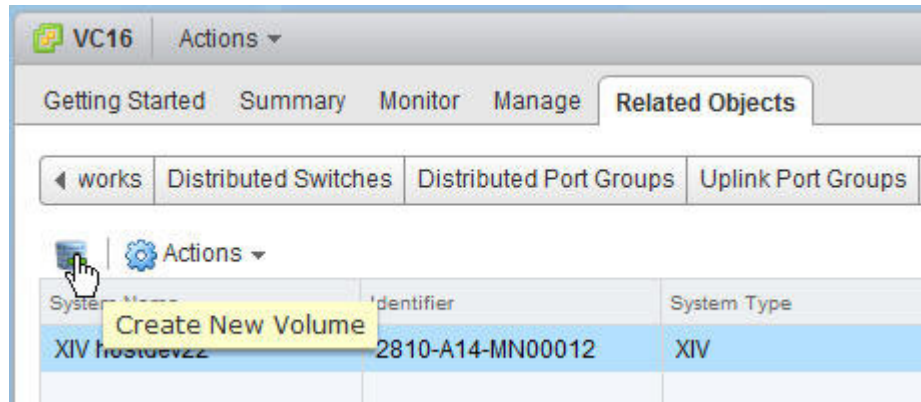


Figure 76. Clicking the Create New Volume icon

The Create New Volume dialog box is displayed.

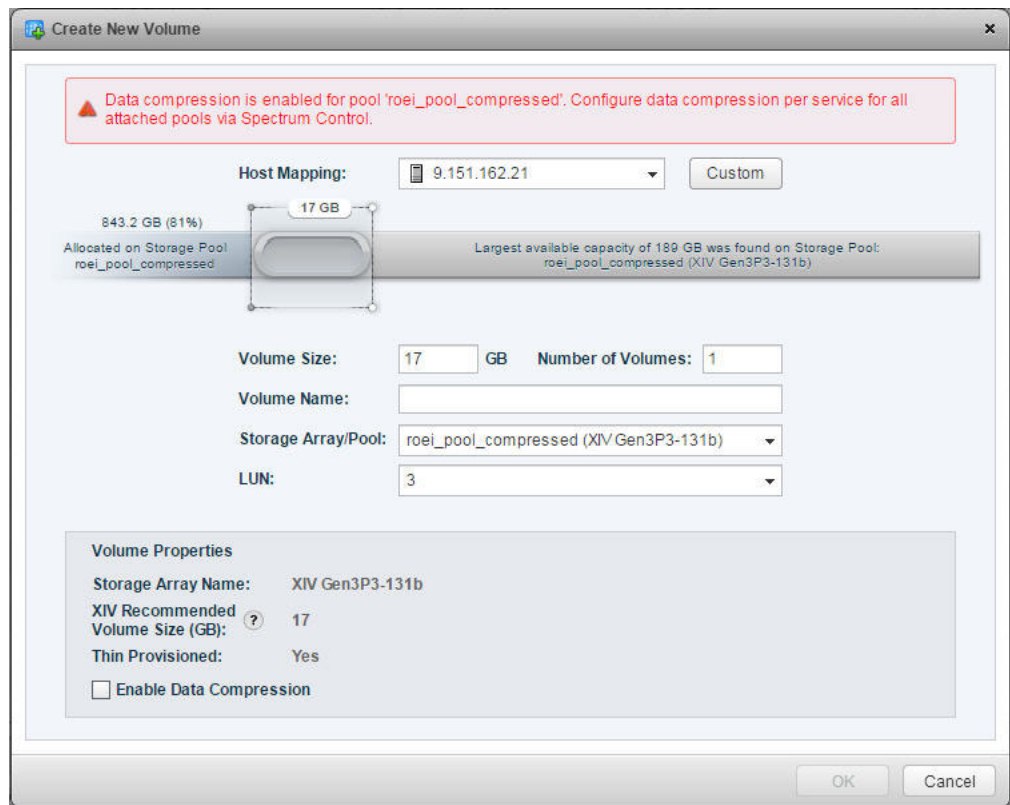


Figure 77. Create New Volume wizard (XIV example)

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.

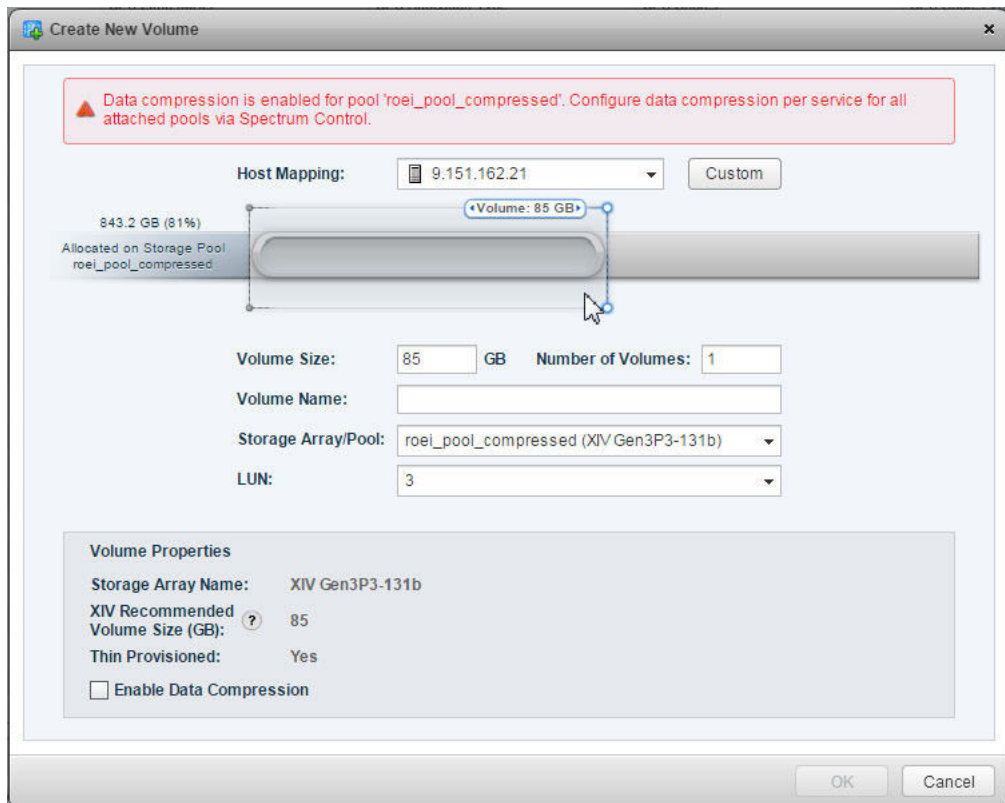


Figure 78. Setting the volume size with the graphic space marker

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 array 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 101): 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).

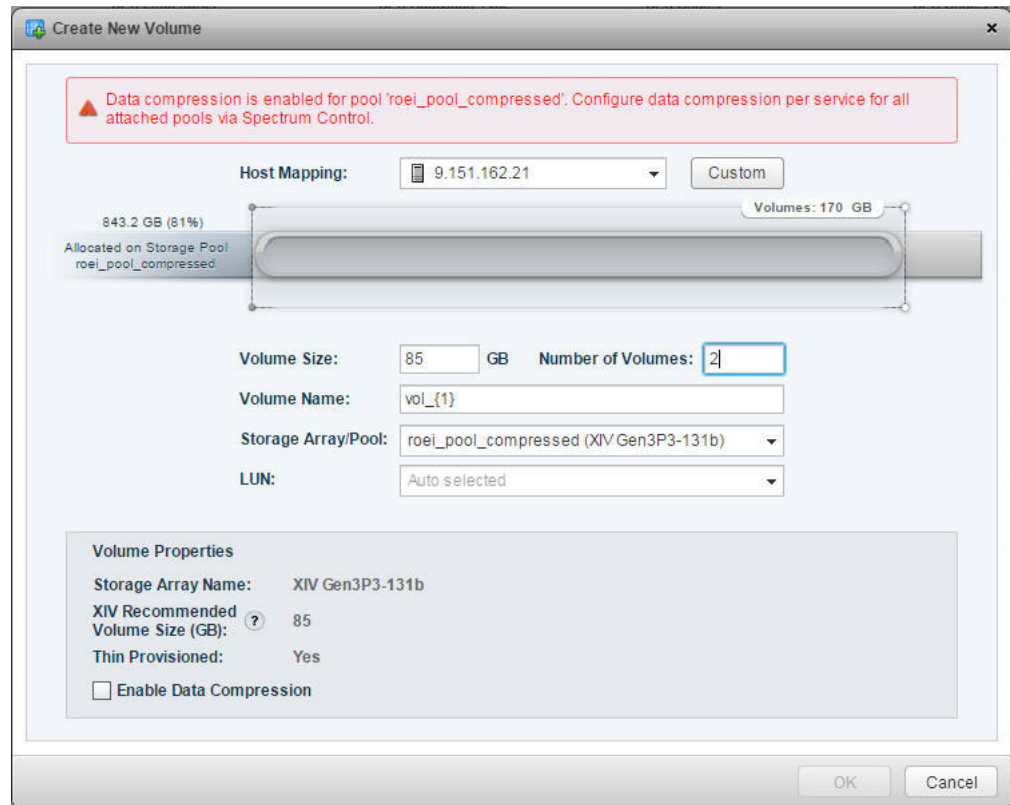


Figure 79. Creating multiple volumes

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 49. 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.

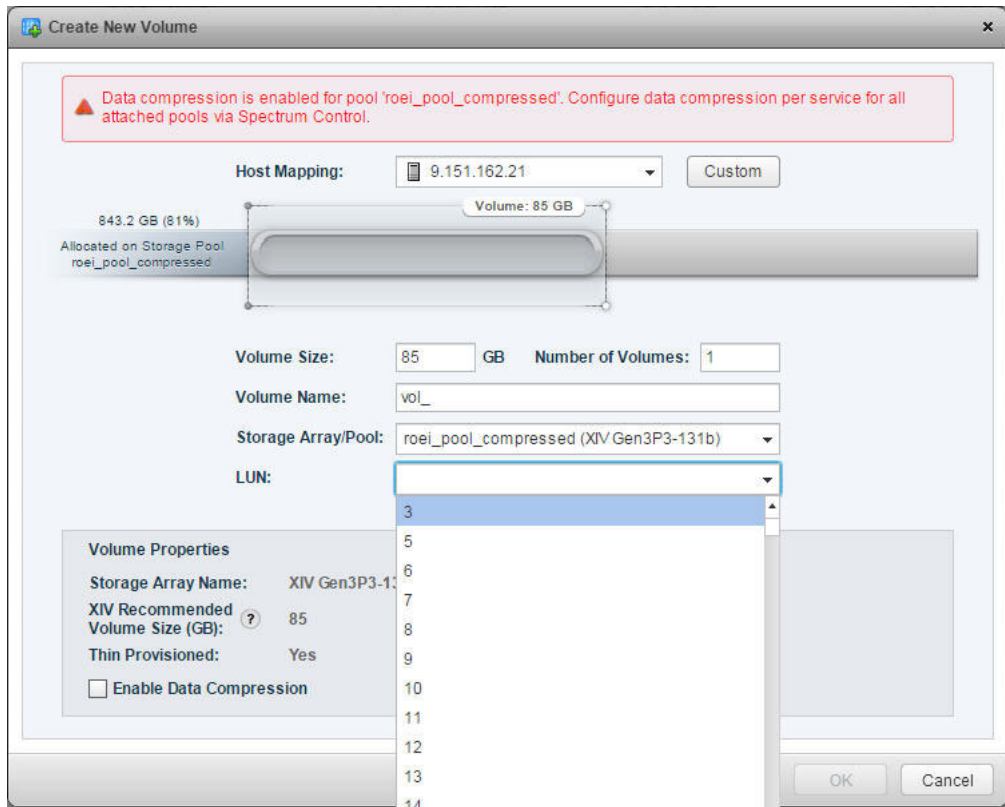


Figure 80. Selecting LUN

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 Flex System, 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.

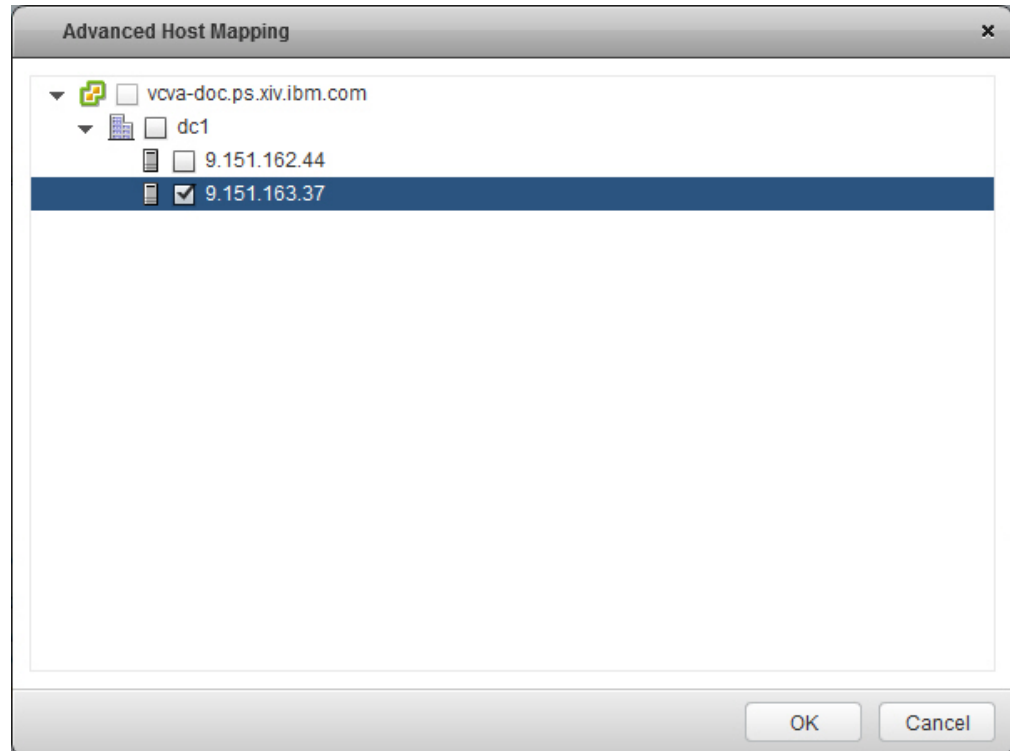


Figure 81. Advanced Host Mapping dialog box

Note: Any ESXi host that is connected to the storage array can be selected. Hosts that are not connected to the storage array 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**.

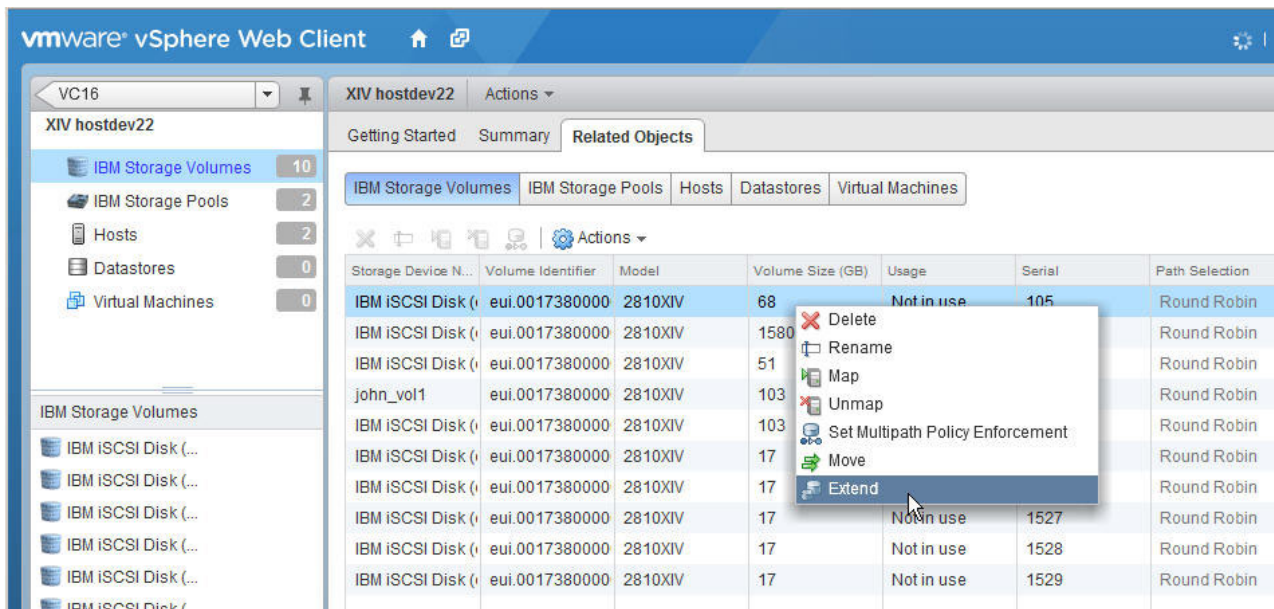


Figure 82. Clicking Extend on the pop-up menu

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.

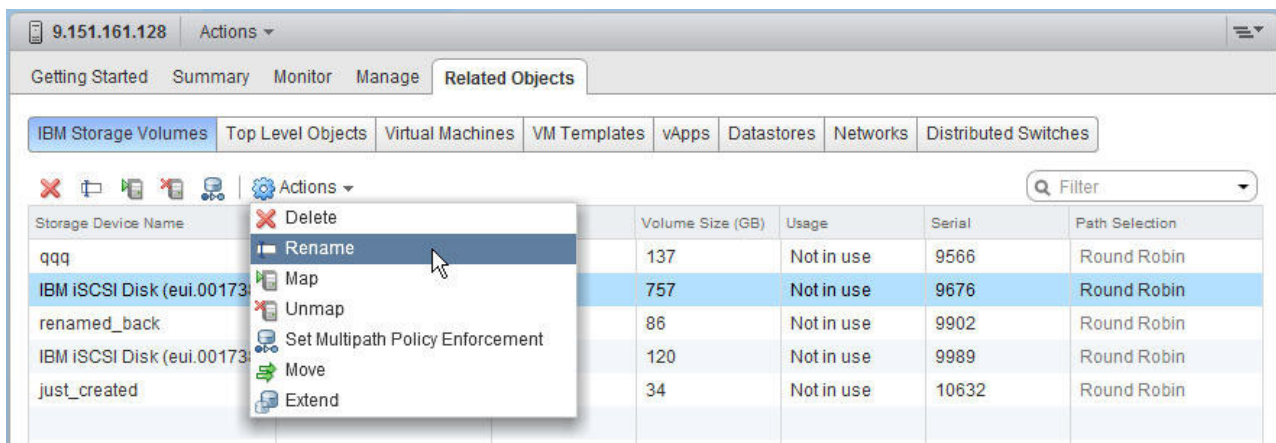


Figure 83. Rename volume option

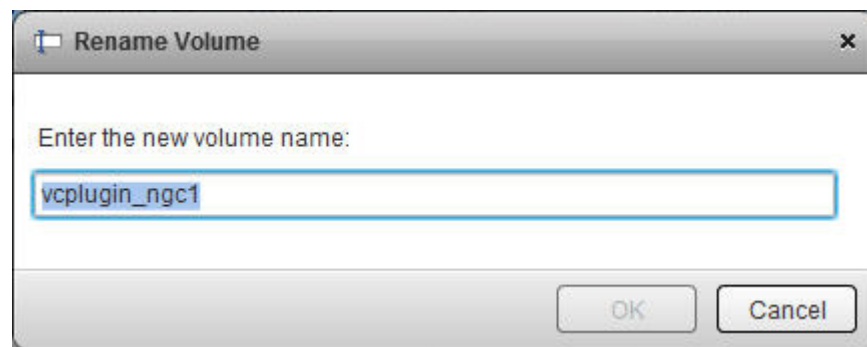


Figure 84. Rename Volume dialog box

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 137.

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.

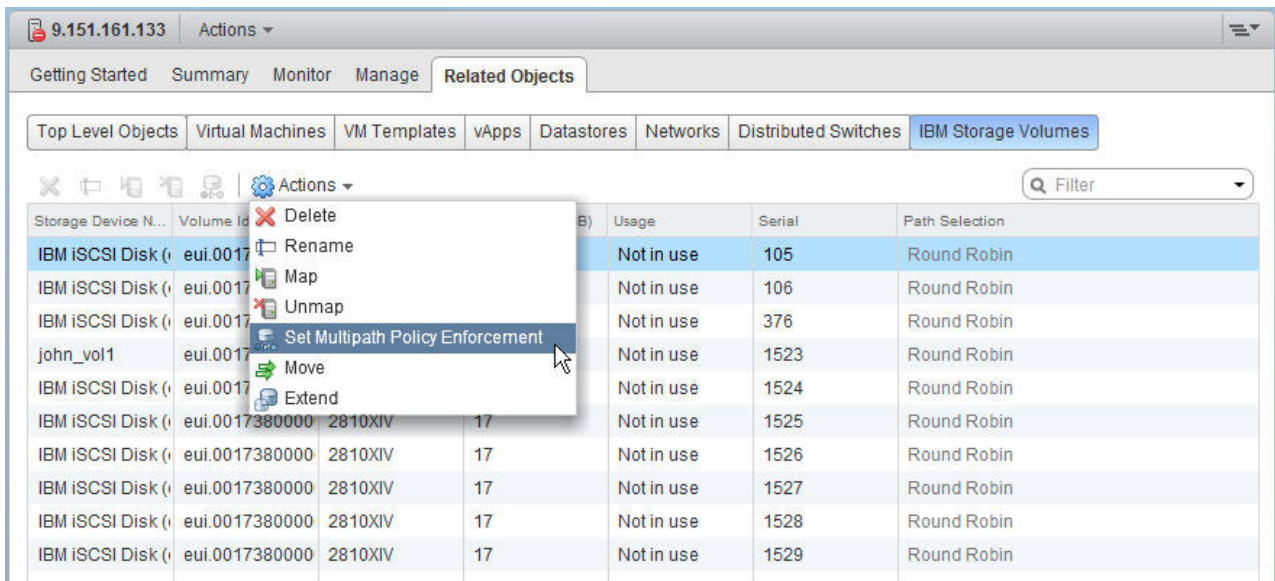


Figure 85. Set Multipath Policy Enforcement option

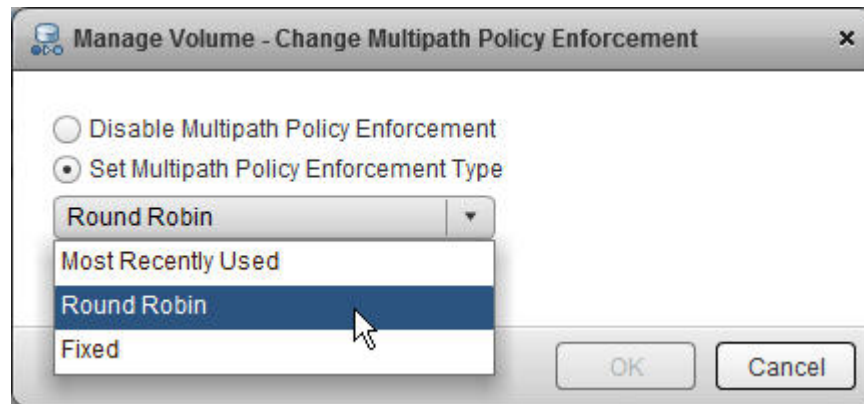


Figure 86. Change Multipath Policy Enforcement dialog box

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.

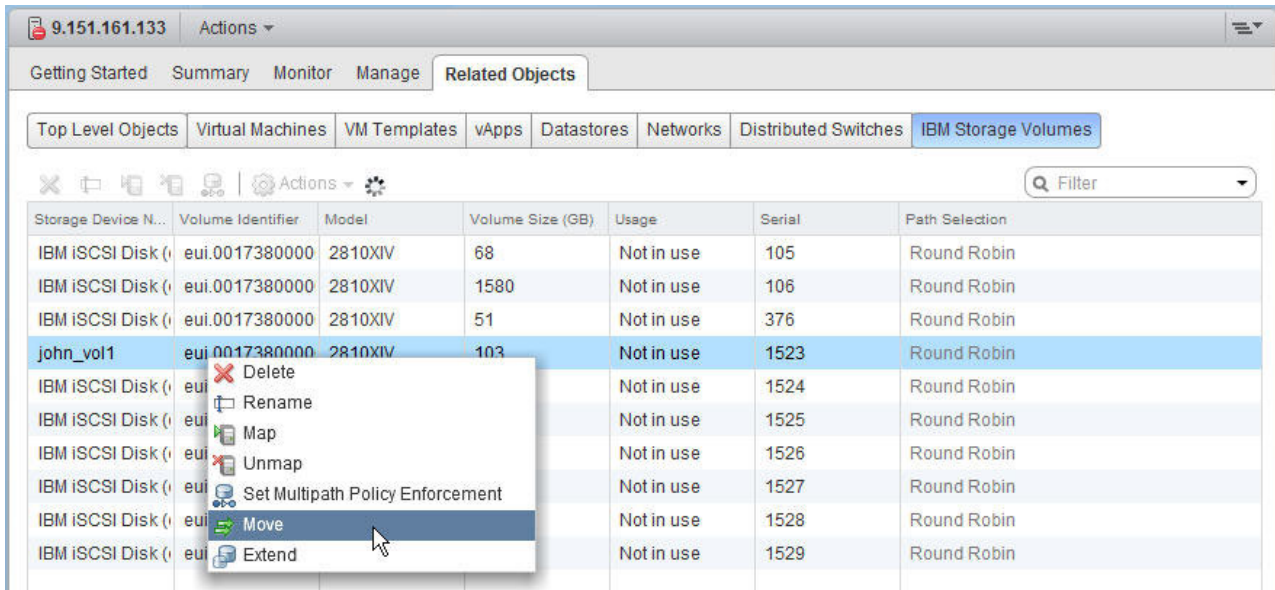


Figure 87. Move volume option

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.

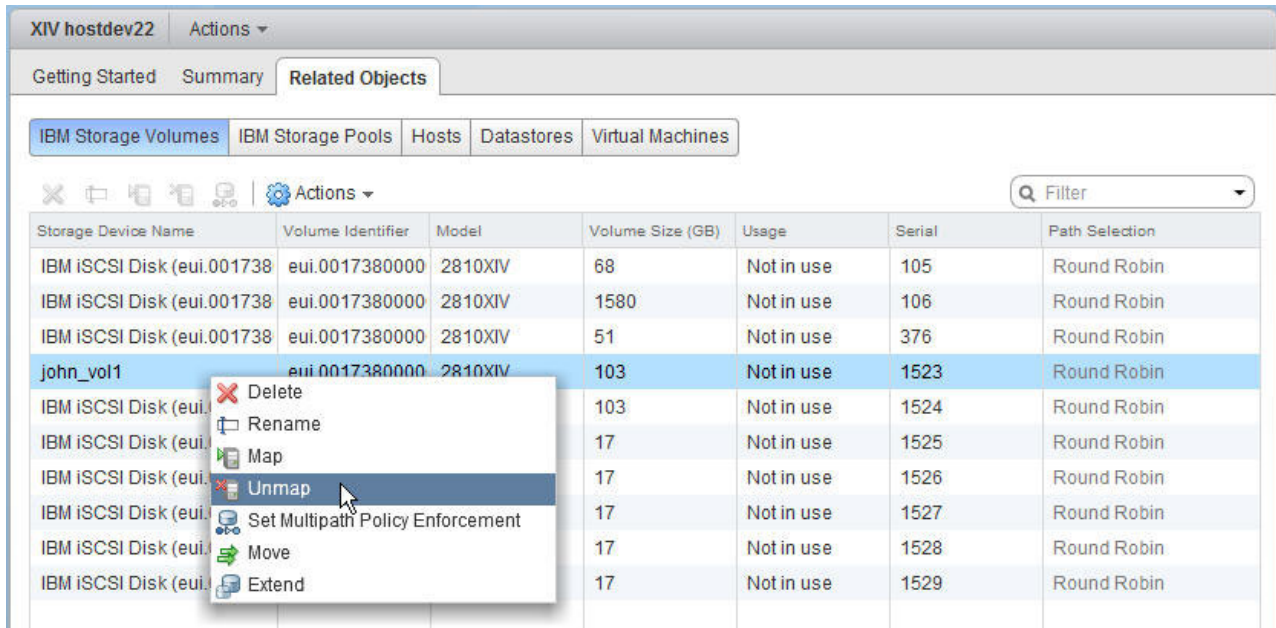


Figure 88. Unmap volume

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.

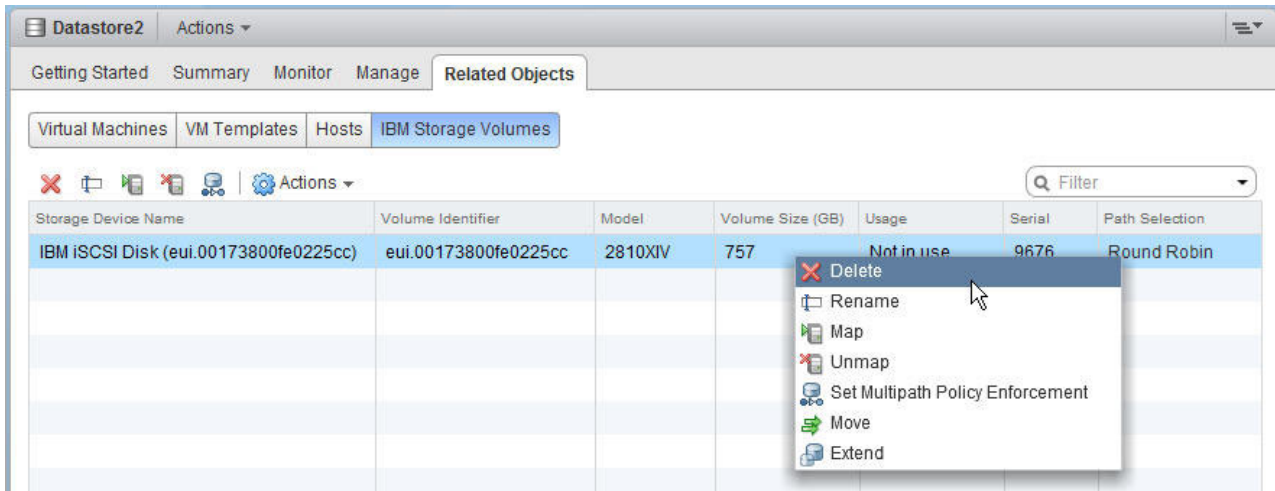


Figure 89. Delete volume

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 arrays.

After the IBM Storage Plug-in is deployed (see “GUI – Downloading and installing the plug-in package for vCO” on page 63), the IBM storage objects become available in the vCO, as detailed in the table below.

Table 16. 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 arrays 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 array 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.

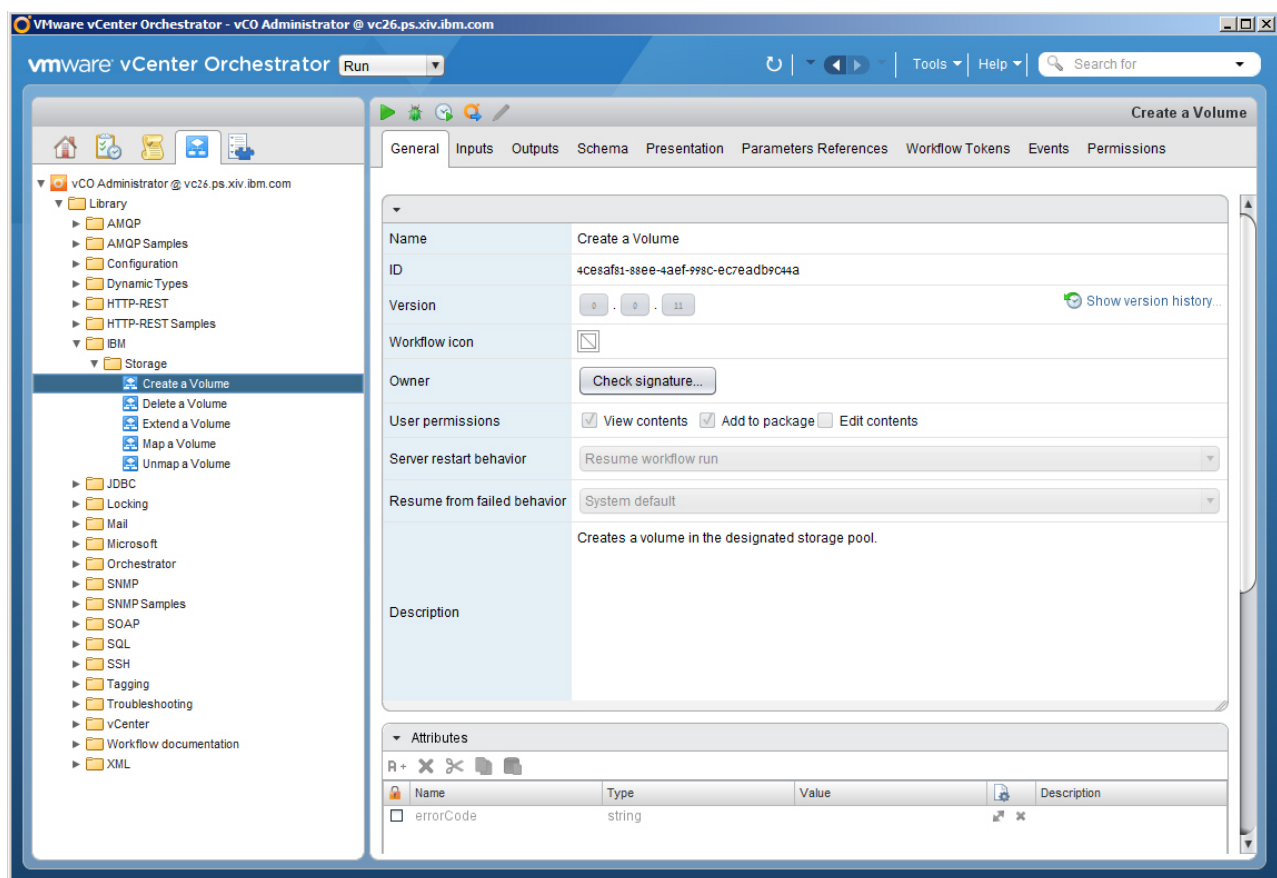


Figure 90. vCenter Orchestrator – Create New Volume workflow – General tab

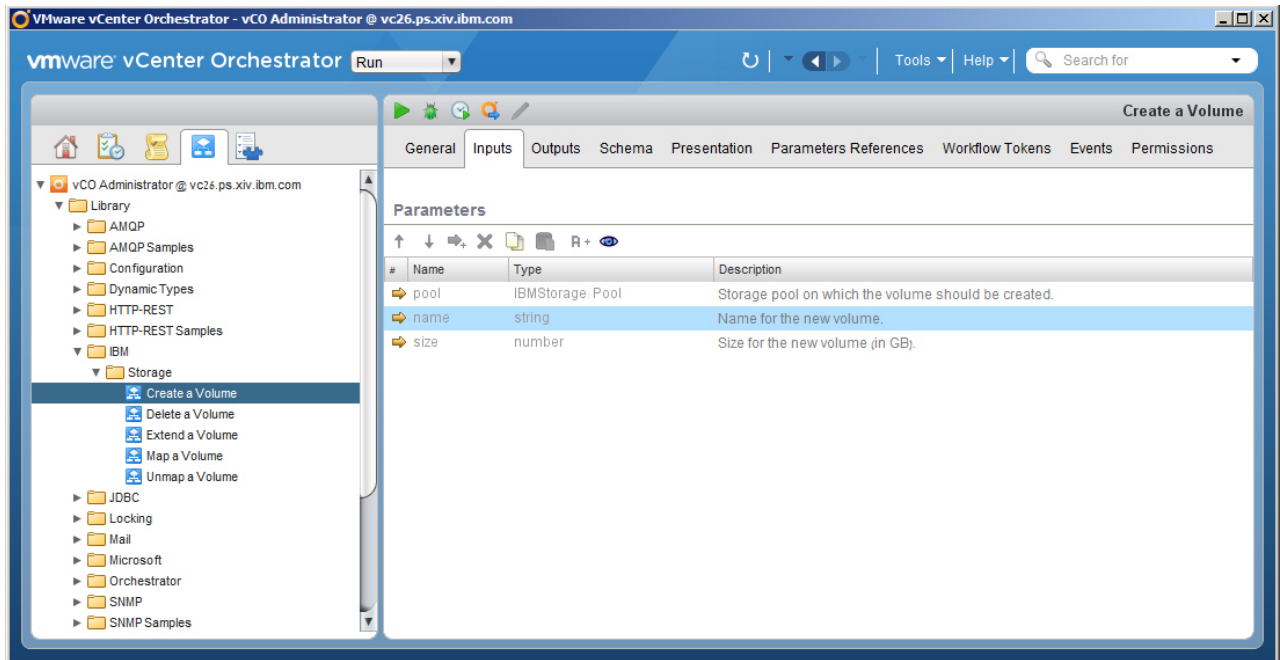


Figure 91. vCenter Orchestrator – Create New Volume workflow – Inputs tab

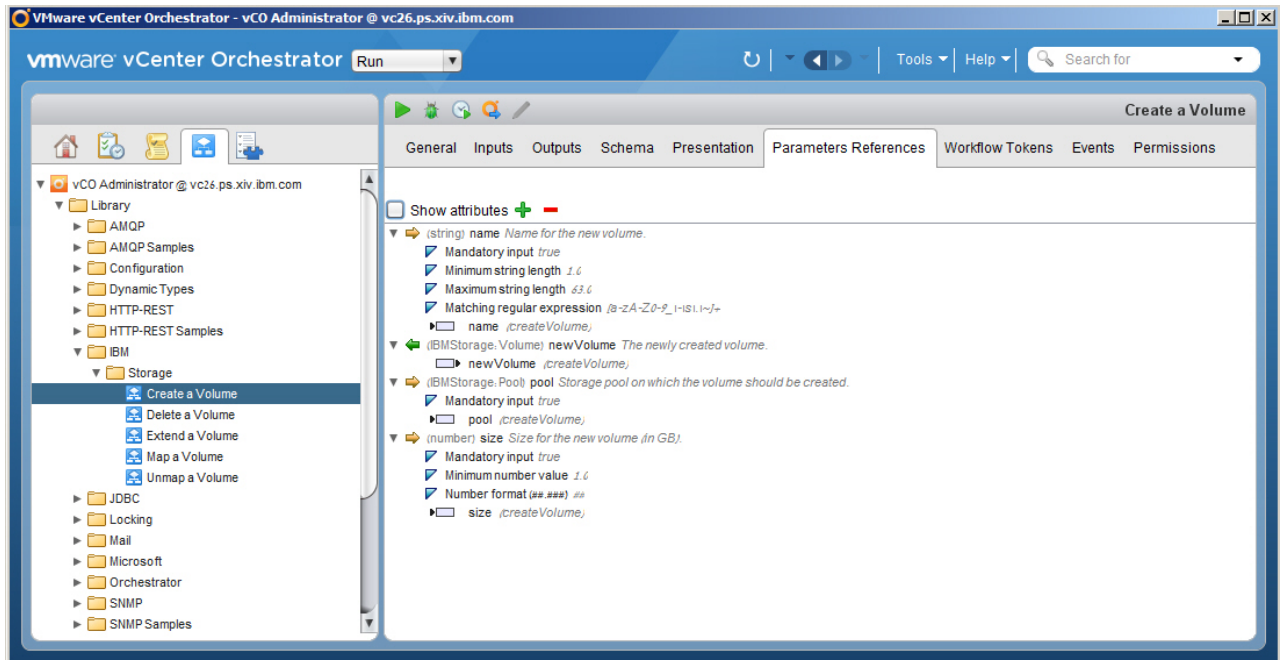


Figure 92. vCenter Orchestrator – Create New Volume workflow – Parameter References tab

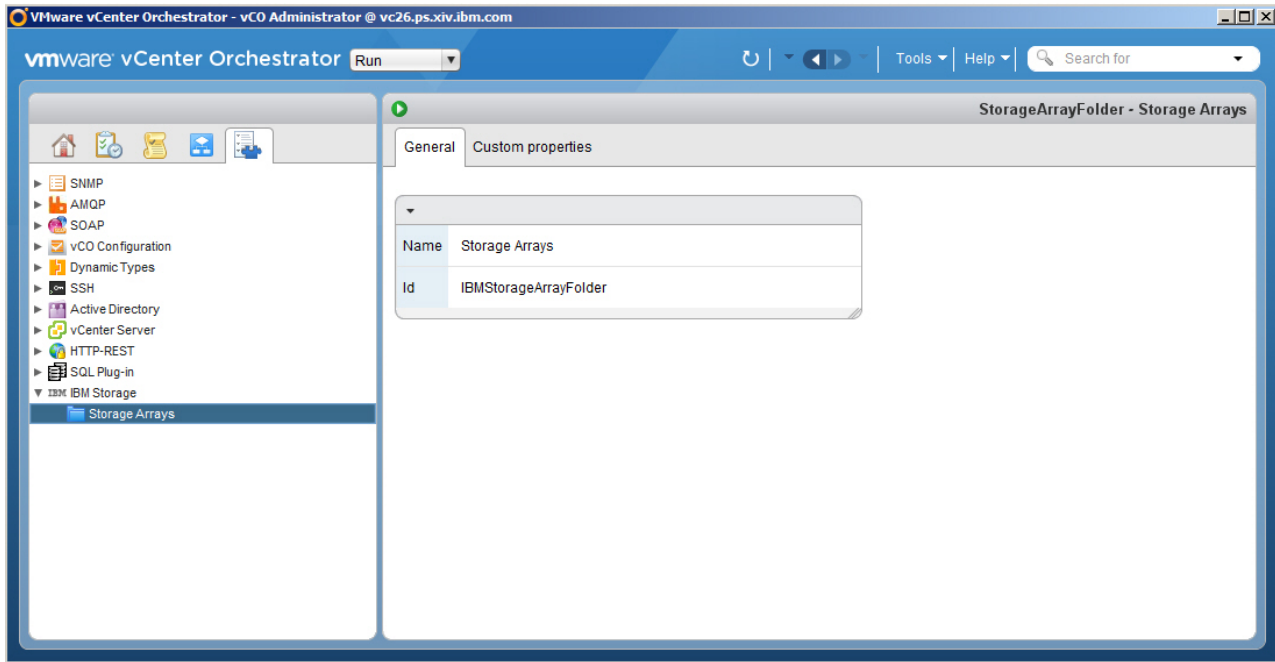


Figure 93. vCenter Orchestrator – Storage Arrays panel

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 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 arrays, 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 arrays.

Three main dashboards are available for XIV storage arrays:

- “Viewing the XIV Overview dashboard” on page 117
- “Viewing the XIV Performance dashboard” on page 119
- “Viewing the XIV Top 10 dashboard” on page 125

In addition, you can:

- Monitor storage system resources. See “Monitoring the XIV storage system resources” on page 125.
- Configure monitoring thresholds. See “Monitoring the XIV resources using thresholds” on page 126.

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.

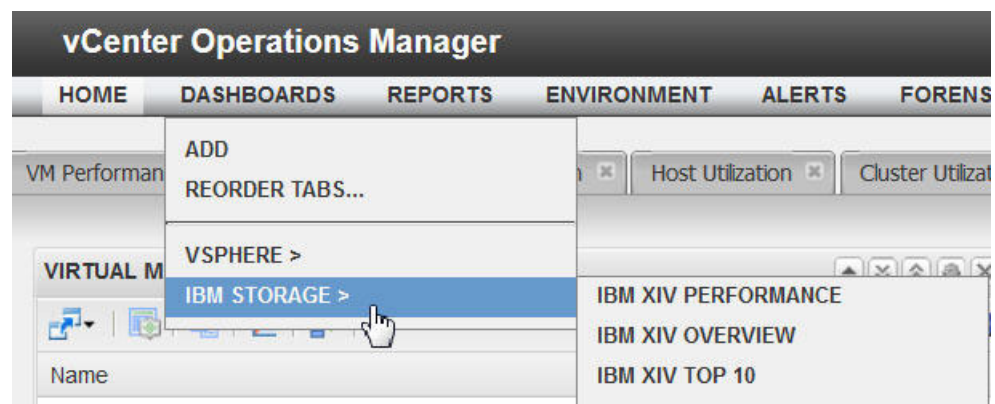














Figure 94. vCOps GUI – IBM STORAGE option

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

Table 17. 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

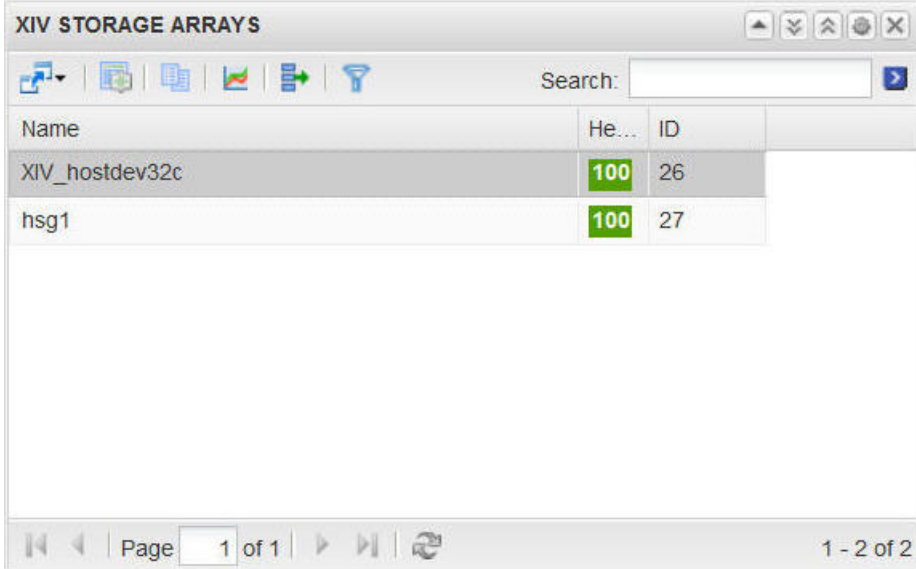
IBM XIV Overview dashboard presents relationships between all virtual elements and storage elements that are in use.

Procedure

To display IBM XIV resource overview:

1. In the IBM XIV Overview dashboard, click a storage array in the **XIV STORAGE ARRAYS** pane. The list of all the resources related to the selected storage array are displayed in the in the right pane of the Overview dashboard. The resources include virtual machines, host systems, datastores, volumes, pools, 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 118.



| Name | He... | ID |
|----------------|-------|----|
| XIV_hostdev32c | 100 | 26 |
| hsg1 | 100 | 27 |

Figure 95. 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.

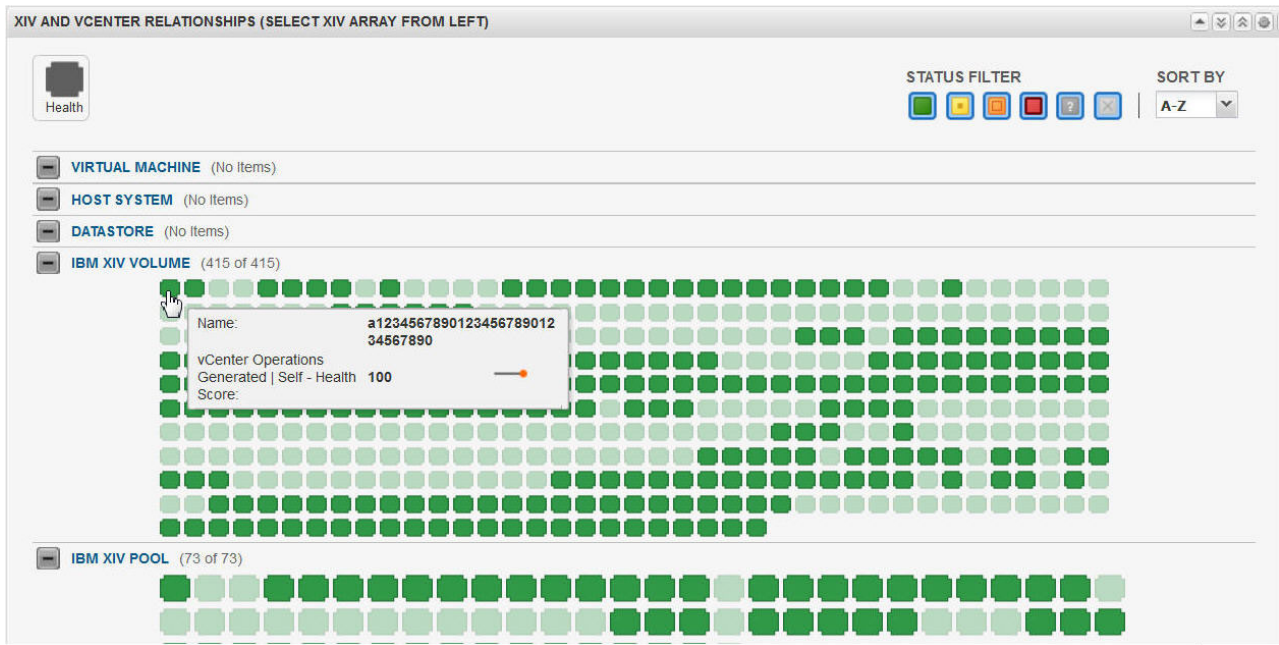


Figure 96. XIV volume health status

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.

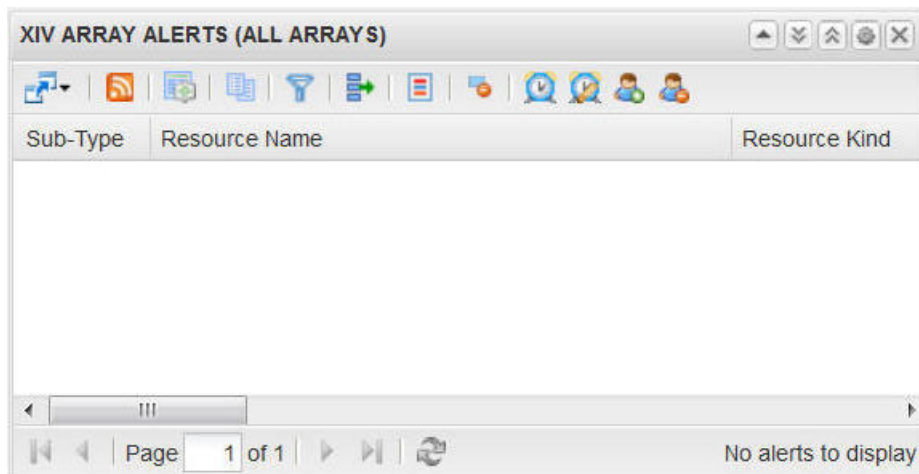


Figure 97. Alert widget

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.

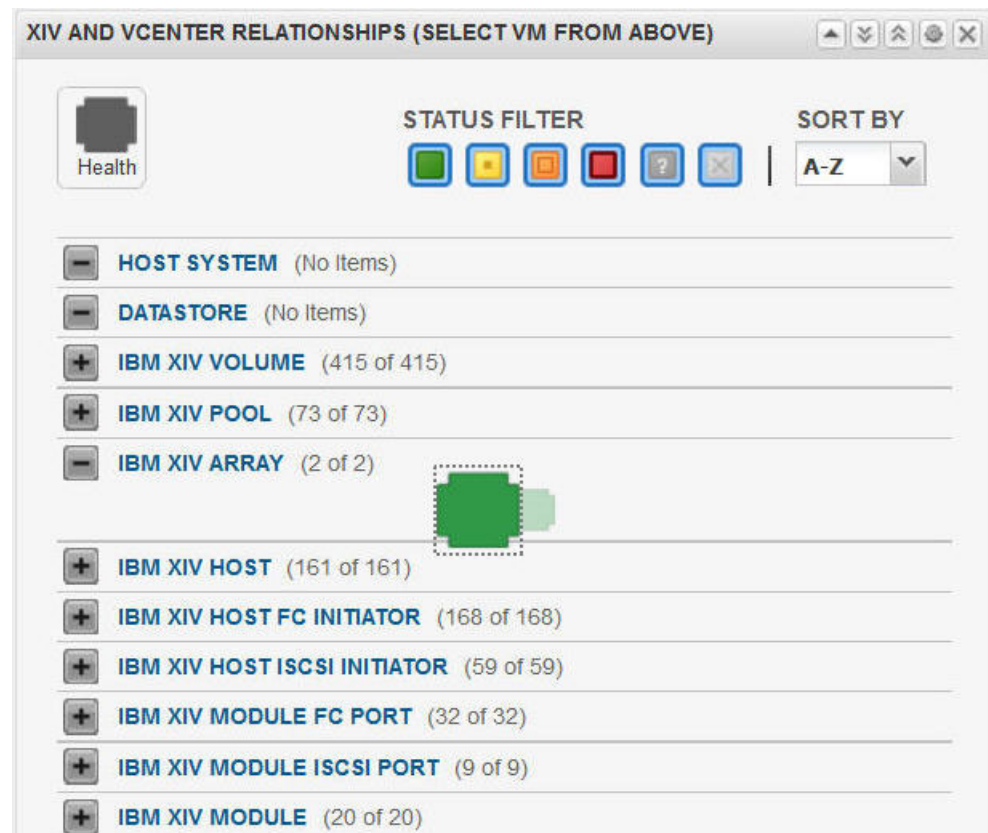


Figure 98. XIV AND VCENTER RELATIONSHIPS pane

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

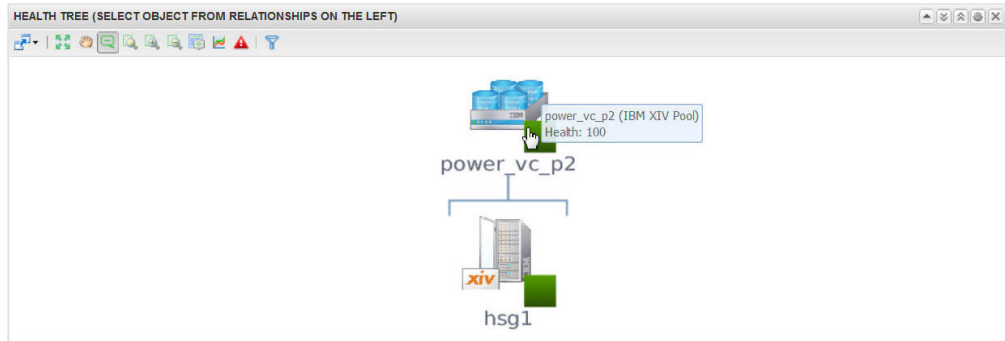


Figure 99. HEALTH TREE pane

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 121.
4. Select a metrics of an element to display its metric graph in the **METRIC GRAPH** pane.

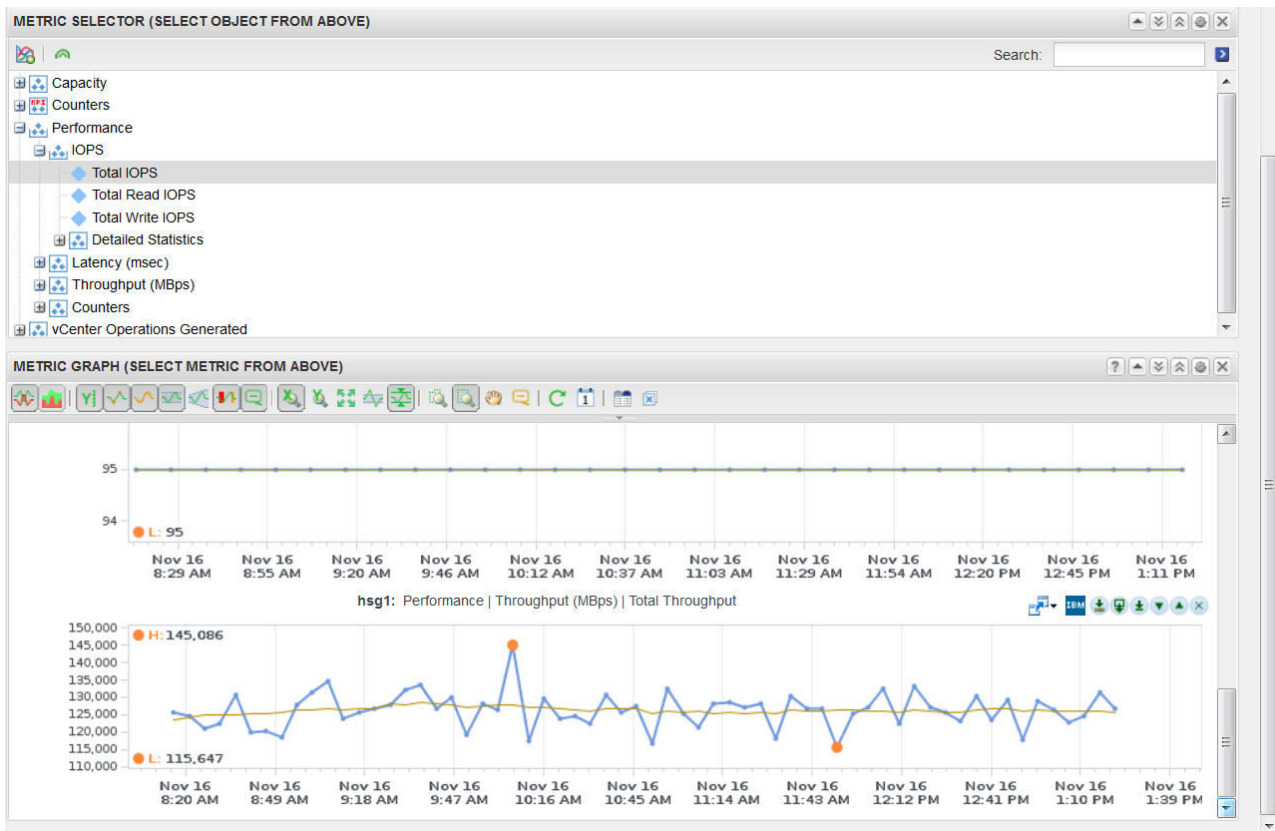


Figure 100. IBM XIV Performance dashboard, METRIC SELECTOR and METRIC GRAPH panes

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 18. 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 array | Array |
| Free Soft (GB) | Free soft size of the array | |
| 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 19. 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 | Health status of the disk. The REPLACE value indicates disk failure. | Disk |
| Online | Connection status of the resource | Module FC Port, Module iSCSI Port |

Table 20. Counter metrics

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

Table 21. Performance 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 21. Performance 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 21. Performance 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.

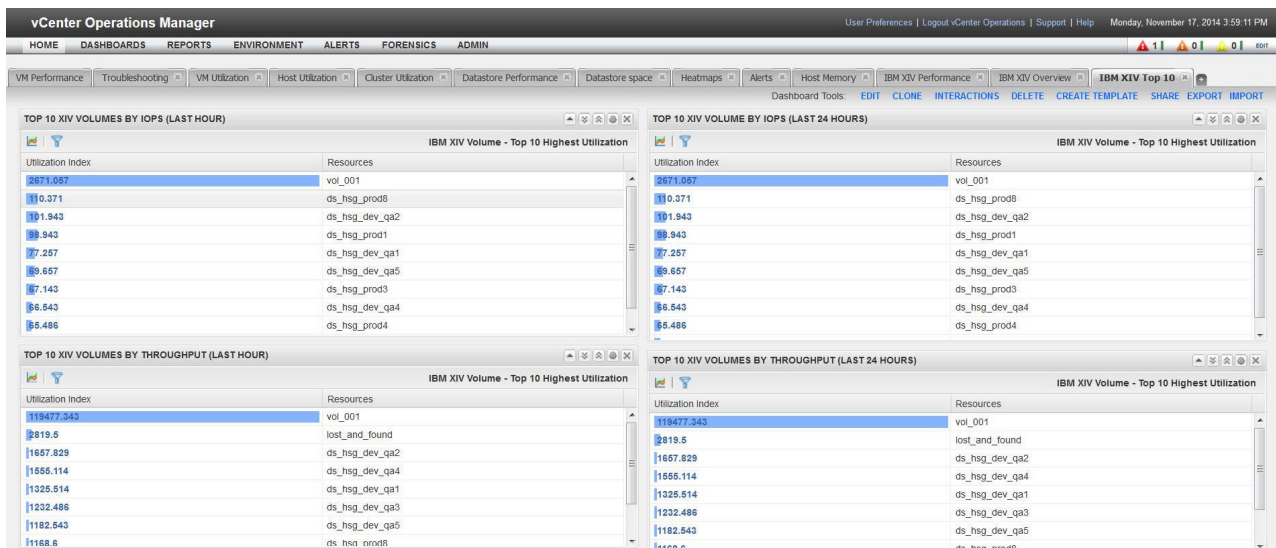


Figure 101. IBM XIV Top 10 dashboard

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.

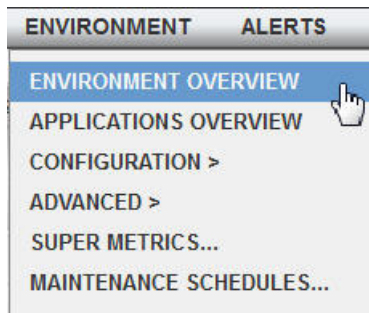


Figure 102. vCops GUI – ENVIRONMENT OVERVIEW option

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

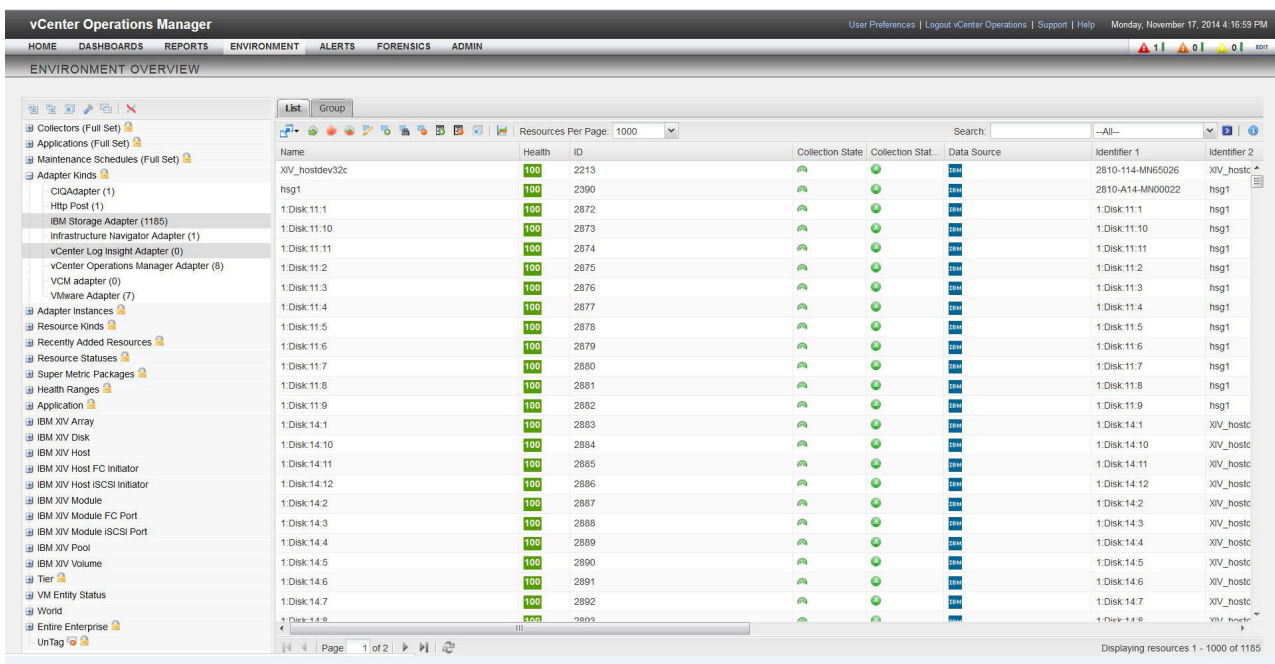


Figure 103. vCops ENVIRONMENT OVERVIEW display

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.

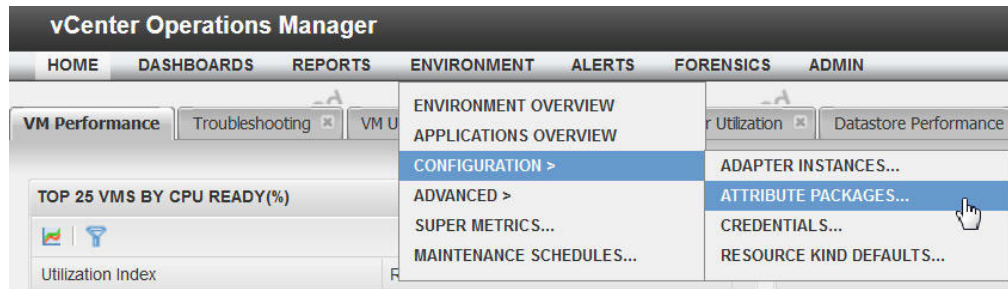


Figure 104. vCops GUI – ATTRIBUTE PACKAGES option

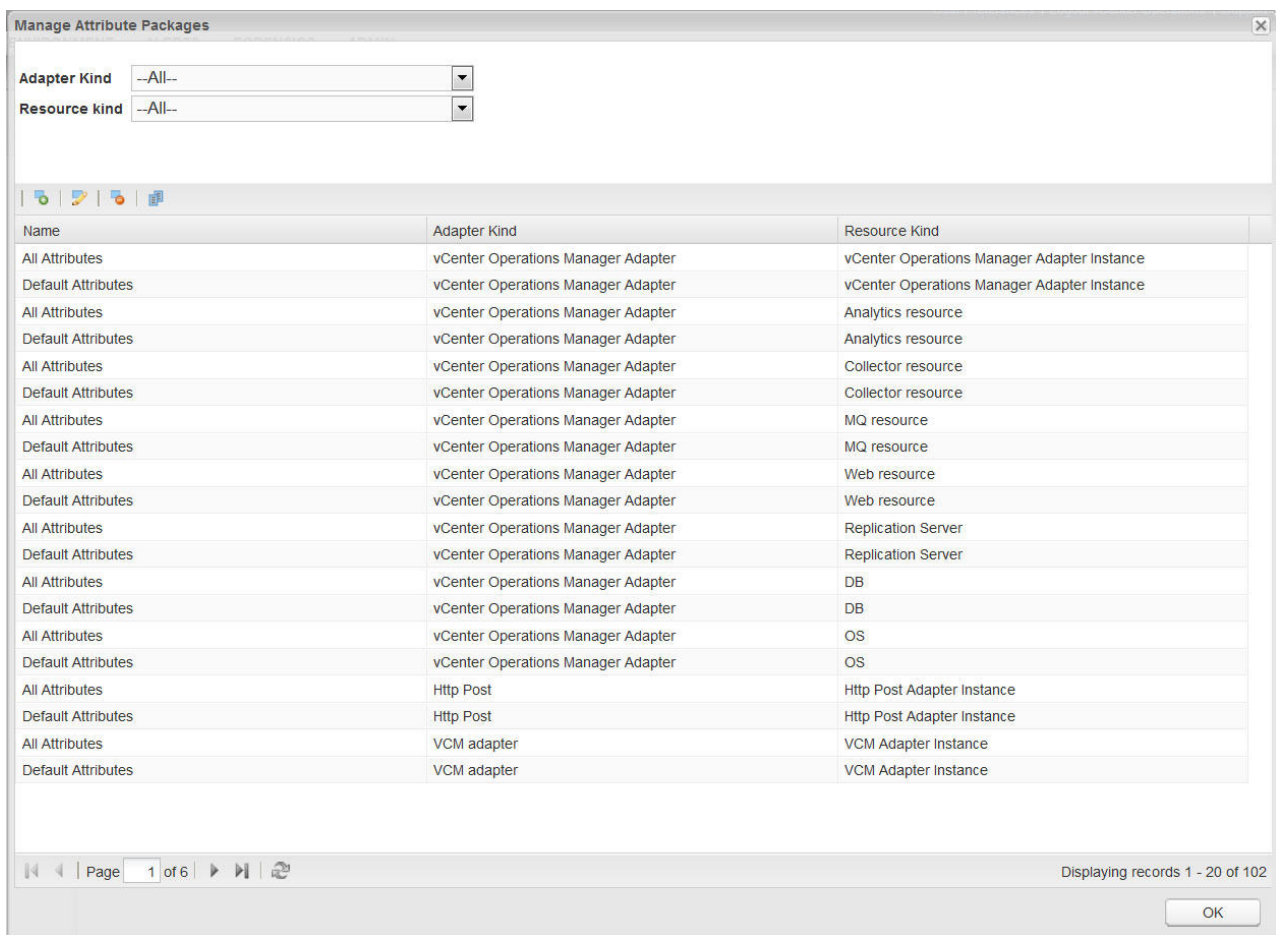


Figure 105. vCops Manage Attribute Packages dialog box

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.

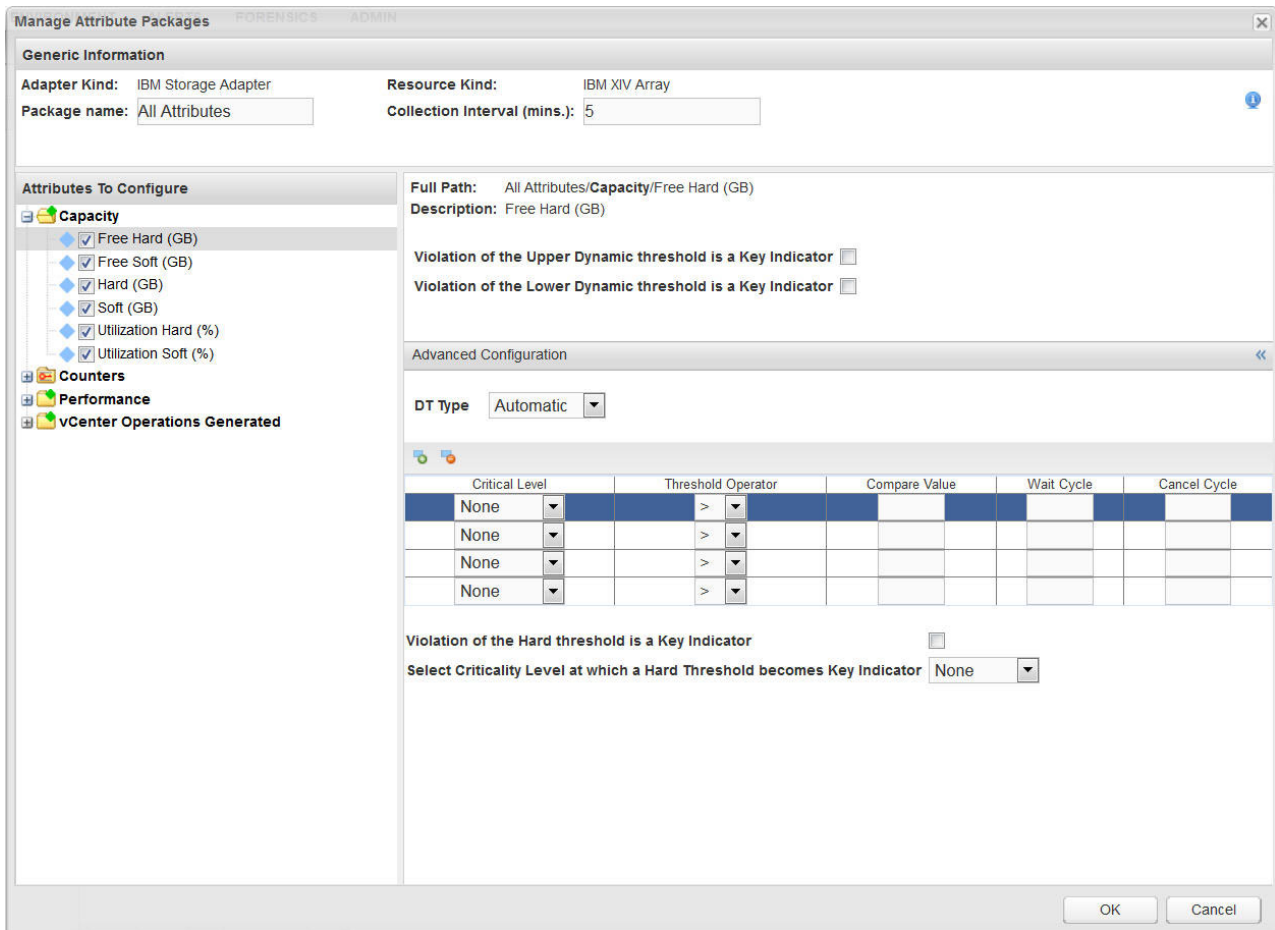


Figure 106. vCops Manage Attribute Packages for IBM XIV array

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 service”
- “Checking and modifying the configuration files” on page 130

Checking and controlling the Spectrum Control 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 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 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 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 service” on page 129.

Table 22. 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 133. |
| ldap.ini | opt/ibm/ibm_spectrum_control/conf.d/ | See “Configuring LDAP-based directory user access” on page 20. |
| ldap.conf | /etc/openldap/ | See “Configuring LDAP-based directory user access” on page 20. |
| vasa_config.ini | opt/ibm/ibm_spectrum_control/conf.d/vasa1/ | <ul style="list-style-type: none">• 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/ | <ul style="list-style-type: none">• populate_all_vmware_objects – The time interval in minutes between each operation of refreshing of all vCenter server information on Spectrum Control. 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/ | <ul style="list-style-type: none">• 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 arrays, the value might need to be higher than 10. See “Working with multiple storage arrays” on page 138 for additional information. |

Table 22. 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 132. See “Enabling SSL verification” on page 132. |
| essni_proxy.properties | /opt/ibm/ibm_spectrum_control/conf.d/ds8k_proxy | ESS network interface (ESSNI) proxy configuration file. |

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.”
- S
- “Checking the format of directory-based storage array credentials” on page 134.
- “Configuring event forwarding” on page 135.
- “Self-assist options for IBM Spectrum Control Base Edition” on page 136.

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 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:

```
SC-0001, INFO, "User {user_name} has logged in."
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 arrays and volumes.
- `vasa1.log` – Records events regarding the communication between Spectrum Control and the connected vCenter servers that utilize VASA functions.

- `wvc.log` – Records events regarding the communication between Spectrum Control 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 is installed.
- `sc_django.log` – Records events regarding the Django service on the Linux host on which Spectrum Control is installed.
- `ds8k_proxy.log` – Records ESS network interface (ESSNI) proxy operations for DS8000.
- `ds8k_jsvc_error.log` – Records startup failures of the ESSNI proxy for DS8000.
- `ds8k_jsvc.log` – Records Apache Jsvc operations for DS8000.
- `vco.log` – Records events regarding operation of the vSphere Orchestrator, complementing information stored in the `hsgsvr.log` file. The `vco.log` file is 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 SSL certificate`
and key files as described in “GUI – Managing server certificates” on page 32.

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 GUI. This option allows you to save different instances of the log files at different times.

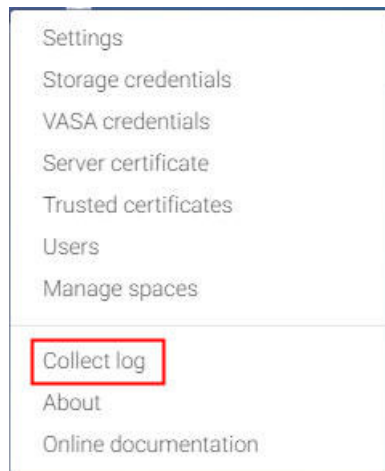


Figure 107. Controller GUI – Collect Logs option

Checking the format of directory-based storage array credentials

If you are using directory-based storage credentials for adding storage arrays to the IBM Spectrum Control Base Edition (not for logging in to Spectrum Control), 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).

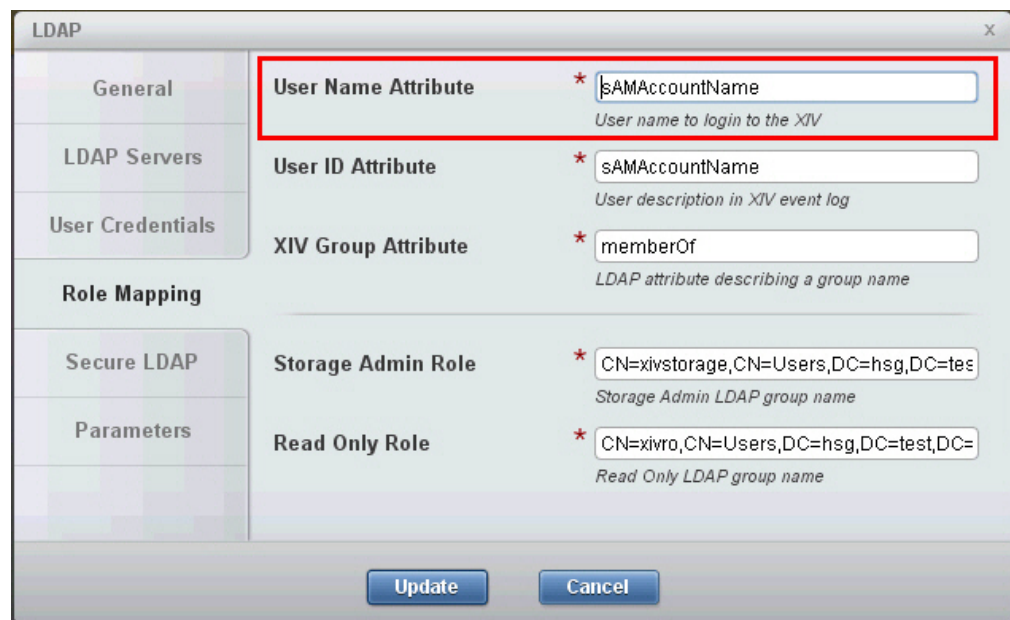


Figure 108. XIV role mapping attributes for directory (LDAP) users

Related tasks:

“GUI – Entering the storage array credentials” on page 36

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

Configuring event forwarding

Array-level events generated by XIV 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 XIV 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 XIV 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
& ~
```

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 arrays” on page 138
- “Creating a VVOL-enabled service” on page 139

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 arrays

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 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 array:
 - Up to 20 arrays – 64-bit dual-core CPU, 4 GB of RAM, 5 Celery workers
 - Up to 40 arrays – 64-bit quad-core CPU, 6 GB of RAM, 7 Celery workers
 - Up to 100 arrays – 64-bit six-core CPU, 6 GB of RAM, 13 Celery workers
- Up to 5000 objects per array:
 - Up to 20 arrays – 64-bit quad-core CPU, 4 GB of RAM, 5 Celery workers
 - Up to 40 arrays – 64-bit six-core CPU, 6 GB of RAM, 10 Celery workers, 15 min. population interval
 - Up to 100 arrays – 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 service (`service ibm_spectrum_control restart`).

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

- Verify that all required ESXi hosts are connected and defined at the XIV side.
- Verify that the Spectrum Control 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. The service or a group of services can be used to define storage spaces, serving as virtual datastores for VM deployment.

To create a VVOL-enabled storage service:

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

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. 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 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 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.
12. Configure a fully qualified domain name for the Spectrum Control server and define a high-availability group. See “GUI – Defining a high-availability group” on page 31.
13. Generate a self-signed Spectrum Control server certificate. See “GUI – Managing server certificates” on page 32.

14. Set up VASA credentials. See “GUI – Setting the VASA credentials” on page 45.
15. Enable the *storageintegrationadmin* to access the XIV storage resources. See “GUI – Entering the storage array credentials” on page 36.
16. Add the XIV array to the Spectrum Control. See “GUI – Adding a storage array” on page 38.
17. Add a new storage space. See “GUI – Adding a storage space” on page 47.
18. Add a VVOL-enabled service to the storage space. See “GUI – Adding a storage service” on page 49.
19. Define a storage resource and attach it to the VVOL-enabled service. See “GUI – Defining and attaching storage resources” on page 54.
20. Register Spectrum Control as a storage provider on VMware vCenter server. See “Registering Spectrum Control as a storage provider in vCenter server” on page 85.
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.

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 capabilities.

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

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

- Query – Returns object entities managed by Spectrum Control.
- 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 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 144.

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 contain 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 contain 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 142.

```
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.

Array operations

RESTful API for IBM Spectrum Control Base Edition uses the **GET** and **POST** commands for array operations.

You can run an array query by issuing the **GET** command to retrieve a list of arrays and their properties, or display the properties of a single array.

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 array 2810-999-dc21011 microcode to version 11.5.0.c, enter `GET /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 142.

```
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 array 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 array 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 142.

```

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 array 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 142.

```
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 array 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 array 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 array shutdown.

You can shut down an array in emergency mode by issuing the **POST** command, followed by the arrays argument, the array ID and the shutdown argument.

For example, POST /api/v1/arrays/1/shutdown shuts down the array with identification number 1, issuing the OK response.

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Index

A

- access to array 76
- add
 - storage array 78
 - storage provider 85
 - user 73
- adding vCops server 70
- admin commands 73
- admin username 26
- administration 129
- alarm reporting 131
- alert widget 118
- array credentials 76, 134
- attach arrays 81
- automation 2

B

- best practices 138, 139
 - datastores 137
 - distributing DS8000 volumes 137
 - ESXi hosts 137

C

- certificate
 - generating 32, 74
 - replacing 32, 74
- change password 73
- check service 129
- CLI commands 72
- collect logs 133
- command-line interface
 - add or remove storage array
 - credentials 76
 - add or remove storage arrays 78
 - adding users 73
 - configure directory server access 20
 - manage vCenter Operations Manager 81
 - managing Spectrum Control 72
 - set VASA credentials 80
 - switch to IBMSC user mode 72
 - tasks 19
- compatibility 11
- concept diagram 3
- configuration files
 - modify 130
- creating or mapping LUN 97

D

- datastores
 - best practices 137
- debug mode 130
- deploying management package 67
- describing management package 69
- detach arrays 81

- detect problems 133
- directory user 134
- directory users 20
- download plug-in 63
- download site 11
- DS8000 volumes
 - best practices 137

E

- ESX server versions 137
- event forwarding 135
- extract files 16

F

- Fix Central 11

G

- GUI 28
 - add storage array 38
 - adding new users 42
 - adding storage array 38
 - adding storage service 49
 - adding storage space 47
 - adding vCenter server 57
 - attach storage resource 54
 - attach storage services to vCenter server 60
 - change user password 43
 - define storage resource 54
 - defining high-availability groups 31
 - deleting users 44
 - detach storage resources from services 56
 - detach storage services from vCenter server 61
 - detach storage services from vCO server 63
 - enter storage array credentials 36
 - logging in 26
 - manage Spectrum Control 26
 - manage storage arrays 35
 - manage storage spaces and services 46
 - manage the users 41
 - manage VASA access 45
 - manage vCenter Operations Manager 65
 - manage vCenter Orchestrator 62
 - manage vSphere Web Client 57
 - modify IP address or hostname 40
 - remove storage array 40
 - remove storage service 53
 - remove vCenter server 59
 - removing storage space 49
 - resize storage resource 56
 - setting VASA credentials 45
 - storage credentials 36

- GUI (*continued*)

- tasks 19
- update vCenter server credentials 58

H

- HA group 30
- High-availability group 30
- hsgsvr_config.ini 130

I

- ibmsc username 16
- ibmsyslog.conf 130
- installation
 - Spectrum Control Base Edition 16
 - upgrade 12
- interval 130

L

- large-scale deployment 138
- LDAP 20, 134
- ldap.conf 20
- ldap.ini 20, 130
- list
 - storage array 78
 - users 73
- list arrays 81
- log files 133
- LUN
 - create 97

M

- management 19
- management package 67
- management URL 26
- managing arrays on vCops 71
- managing pools on vCO 62
- metrics 121
- metrics scope 132
- monitoring 125, 126
- multipath policy 106, 137

O

- Operations Manager 3
- optional tasks 19
- Orchestrator 2
- Overview dashboard 115, 117, 118

P

- PAK 67, 69
- Performance dashboard 115, 119, 121
- performance data 3
- plug-in package 63, 65

- populate vCenter
 - update Spectrum Control 91
- port 8443 26

R

- register
 - Spectrum Control 85
- release notes 11
- remove
 - storage array 78
 - storage credentials 76
 - user 73
- remove VASA certificate 45
- required tasks 19
- requirements 11
- resolve issues 129, 133
- Round Robin 106, 137
- rpm package 16

S

- server users 73
- service 6
- service status 129
- space 6
- SPBM 6
- SSL 130
- SSL verification 132
- start service 129
- stop service 129
- storage array commands 78
- storage credentials 134
 - display 76
 - remove 76
 - set 76
- storage enhancements
 - vSphere Web Client 89
- storage monitoring 3
- Storage Policy Based Management 6
- storage resource information
 - viewing 93
- storage volume
 - create 97
- supported storage systems 11
- system update interval 131

T

- tar.gz file 16
- tasks 19
- thresholds 126
- time interval 130
- Top 10 dashboard 115, 125
- troubleshoot 133

U

- uninstall
 - Spectrum Control Base Edition
 - software 18
- upgrade 12
- user
 - privileges 89
 - roles 89

- user authentication 20
- username 134

V

- VASA access 45
- VASA credentials 45, 80
- VASA Provider server 85
- vasa_config.ini 130
- vCAC 2
- vCenter Operations Manager 3, 67, 69, 70, 71, 115, 117, 118, 119, 121, 125, 126, 131, 132
- vCenter Orchestrator 2, 62, 65, 111
- vCenter Server 85
- vCloud automation 2
- vCO 2, 62, 65, 111
- vCO plug-in 63, 65
- vCOPs 3, 67, 69, 70, 71, 115, 117, 118, 119, 121, 125, 126, 131, 132, 138
- vcops_config.ini 130
- vendor providers 85
- virtual volumes 5
- VMware VASA
 - using storage provider 85
- volume
 - deleting unused 109
 - extending 104
 - move to another storage pool 107
 - multipath policy enforcement 106
 - rename 105
 - unmapping from host 108
- vSphere Client 85
- vSphere privileges 89
- vSphere Web Client
 - storage enhancements 2
- vSphere Web Client enhancements 89
- VVOL 5, 139
- VVOL service 139
- vWC 57
- vwc_config.ini 130

W

- what to do first 19
- workflows 2



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