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IBM XIV and VMware Synergy with IBM Spectrum Control Base Edition

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International Technical Support Organization

IBM XIV and VMware Synergy with IBM Spectrum Control Base Edition

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Third Edition (December 2015)

This edition applies to IBM Spectrum Control Base Edition V2.2.0 with XIV Storage Software V11.6.0 or later and VMware vSphere V6.0.

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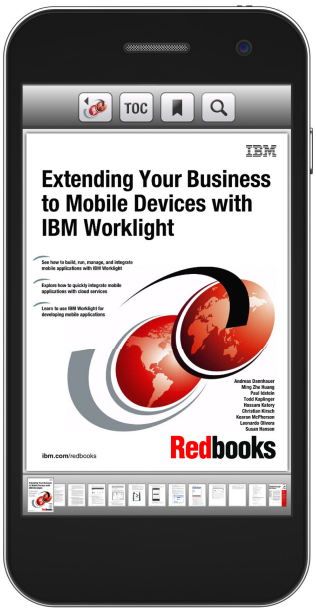

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Preface

This IBM® Redpaper™ publication is a brief overview of synergistic aspects between the IBM XIV® Storage System server and various VMware components that are enabled by IBM Spectrum™ Control Base Edition version 2.2.0. The paper shows how easy and straightforward installing, configuring, and using IBM Spectrum Control™ Base Edition can be to take better advantage of an existing VMware environment, using IBM XIV storage.

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Summary of changes

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

Summary of Changes
for IBM XIV and VMware Synergy with IBM Spectrum Control Base Edition

December 2015, Third Edition

This revision includes the following new and changed information:

- New information:
  - Included VMware Virtual Volumes support
- Changed information:
  - Updates for IBM Spectrum Control Base Edition version 2.2.0
  - Reorganized the paper into separate chapters.

1

Introduction

Virtualization technology is transforming business. Companies are increasingly virtualizing their environments. Organizations often deploy server virtualization to gain economies of scale by consolidating under-used resources on a new platform. Equally crucial to server virtualization is the storage itself. Implementing server virtualization without accounting for storage can cause problems, such as uneven resource sharing and performance and reliability degradation.

The IBM XIV Storage System, with its grid architecture, automated load balancing, and ease of management, provides best-in-class virtual enterprise storage for virtual servers.

Specifically, IBM XIV works in concert with the following VMware products and features:

- VMware vSphere ESX
- VMware vSphere Hypervisor (ESXi)
- VMware vCenter Server using the IBM Storage Management Console for VMware vCenter
- VMware vSphere Web Client (vWC) using IBM Storage Enhancements for vSphere Web Client
- VMware vCenter Server Appliance (vCSA) using the IBM Storage Management Console for VMware vCenter
- VMware vStorage APIs for Data Protection (VADP), using IBM Tivoli® Storage FlashCopy® Manager and Tivoli Storage Manager for Virtual Environments
- VMware vSphere APIs for Storage Awareness (VASA) in concert with VMware Distributed Resource Scheduler (DRS) and Storage I/O Control (SIOC)
- VMware vSphere Storage APIs for Array Integration (VAAI)
- VMware vMotion and Storage vMotion
- VMware vSphere Virtual Volumes (VVols)

IBM Spectrum Control Base Edition software enables a simplified deployment and more efficient integration of XIV and the VMware vCloud suite.

1.1 VMware vCenter Server and vSphere Web Client

The VMware vCenter Server component is the central management and monitoring of VMware vSphere environments. It gives IT administrators dramatically improved control over the virtual environments through a single console.

Starting with vSphere vCenter v5.5, all new features are available only through the vSphere Web Client. These features include vCenter Single Sign-on, vSphere Web Client, vCenter Inventory Service, and vCenter Server database.

1.2 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 ESX hosts, clusters, or data centers as logical drives that can be used for storing VMware datastores (virtual machine data containers).

The IBM Storage Enhancements for vSphere Web Client represent a better alternative to IBM Storage Management Console for VMware vCenter. Compared 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 use IBM storage resources. In addition, storage pool attachment and detachment operations are performed on IBM Spectrum Control Base side, rather than on the vSphere Client side.

The IBM Storage Enhancements for VMware vSphere Web Client are provided as a plug-in on the VMware vSphere Web Client Server, and then communicates with IBM Spectrum Control Base.

1.3 IBM Storage Provider for VMware VASA

VMware vSphere APIs for Storage Awareness (VASA) can provide information about an IBM storage-centric topology, capabilities, attributes, and storage events to vCenter Server, in real time. VMware VASA improves the ability to monitor and automate storage-related operations on VMware platforms. These functional and non-functional characteristics are automatically surfaced by a VASA-compatible storage system, and presented to vCenter to enhance intelligent automation of the storage resource management with the VMware Profile-Driven Storage resource classification and deployment methodology.

IBM Spectrum Control Base and 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).

Version 2.0 of the VASA protocol introduces a new set of APIs specifically for Virtual Volumes that are used to manage storage containers and Virtual Volumes.

1.4 VMware vSphere Virtual Volumes

With the announcement of vSphere 6.0, VMware officially released support for the vSphere Virtual Volumes (VVols) architecture. VVols allow more efficient operations and control of external storage resources, such as the IBM XIV Storage System, running XIV Software version 11.6 or later.

With VVols, the XIV Storage System becomes aware of individual VMDK files, and data operations such as snapshot and replication can be performed directly by XIV, at the VMDK level rather than the entire VMFS datastore.

1.5 VMware vCenter Operations Manager

VMware vCenter Operations Manager is VMware's integrated operations suite, converging performance, capacity, and configuration management. The integration of IBM Spectrum Control Base with VMware vCenter Operations Manager (vCOps) allows monitoring and analysis of XIV health, performance, and capacity. It can dynamically cope with policy-governed workflows to maintain Service Level Agreements (SLA).

1.6 VMware vCenter Orchestrator

You can use the vCenter Orchestrator (vCO) server to create workflows for VMware environments that further automate administrative actions and prevent inconsistent configurations. This approach allows for more self-service functions. vCO integration through IBM Spectrum Control Base provides the ability to create, extend, map, unmap, and delete volumes on the XIV without any VMware or storage administrator actions.

2

VMware Virtual Volumes

This chapter describes the tasks performed by a storage and VMware administrator to configure Virtual Volumes (VVols). It covers the following topics:

- Introduction to VMware vSphere Virtual Volumes
- Defining Virtual Volumes in XIV
- Deleting Virtual Volumes in XIV

2.1 Introduction to VMware vSphere Virtual Volumes

With the announcement of vSphere 6.0, VMware officially released support for the vSphere Virtual Volumes (VVols) architecture. VVols allow more efficient operations and control of external storage resources, such as the IBM XIV Storage System running XIV Software version 11.5.1 or later.

There are many benefits for Storage Administrators and Virtualization Administrators when adopting VVols storage management. Advantages include enhanced efficiencies through automation and thorough integration with VVols. IBM XIV provides an excellent level of storage abstraction to the virtual machine through the following features:

- Easy automation provisioning
- Policy-compliant service levels
- Snapshots
- Cloning
- Off loading
- Instant space reclamation
- Hotspot free performance predictability
- Extreme capacity use

This section provides a short overview of the VVols architecture implementation in XIV. The integration of VVols with XIV is based on the VMware APIs for Storage Awareness (VASA). The IBM support for VASA is part of IBM Spectrum Control Base.

This section discusses the prerequisites and shows a step-by-step illustration of how to practically set up XIV to use vSphere Virtual Volumes.

2.1.1 VMware vSphere Virtual Volumes with IBM XIV

Before the availability of vSphere Virtual Volumes, a virtual machine (VM) in a VMware environment would be presented a disk in the form of a file called a *VMware disk* (VMDK). This file represented a physical disk to the VM and could then be accessed by the operating system installed on the VM in the same way as a physical volume on a regular server. The VMDK file was then placed onto a file system called *VMFS* (VMware file system), hosted by a standard volume (LUN), for example, implemented on external storage system, such as XIV.

Although this design has the advantage of simplicity, it also imposes constraints and limitations on the management of the VM data. Indeed, the Storage Administrator and the VMware Administrator need to agree about the size and placement of volumes in the storage array before the deployment of VMs. This approach presents scalability and granularity issues and cannot respond to business needs dynamically. It also inhibits using advanced storage system functions such as instant snapshots and replication, and complicates backup solutions.

With the availability of the vSphere Virtual Volume technology, each VM disk can now be mapped to an external storage volume (for example, an XIV volume).

Tip: With VVols, the XIV Storage System becomes aware of individual VMDK files. Data operations such as snapshot and replication can be performed directly by XIV at the VMDK level rather than the entire VMFS datastore.

Figure 2-1 shows how VVols changes the landscape of storage in a virtualized environment.

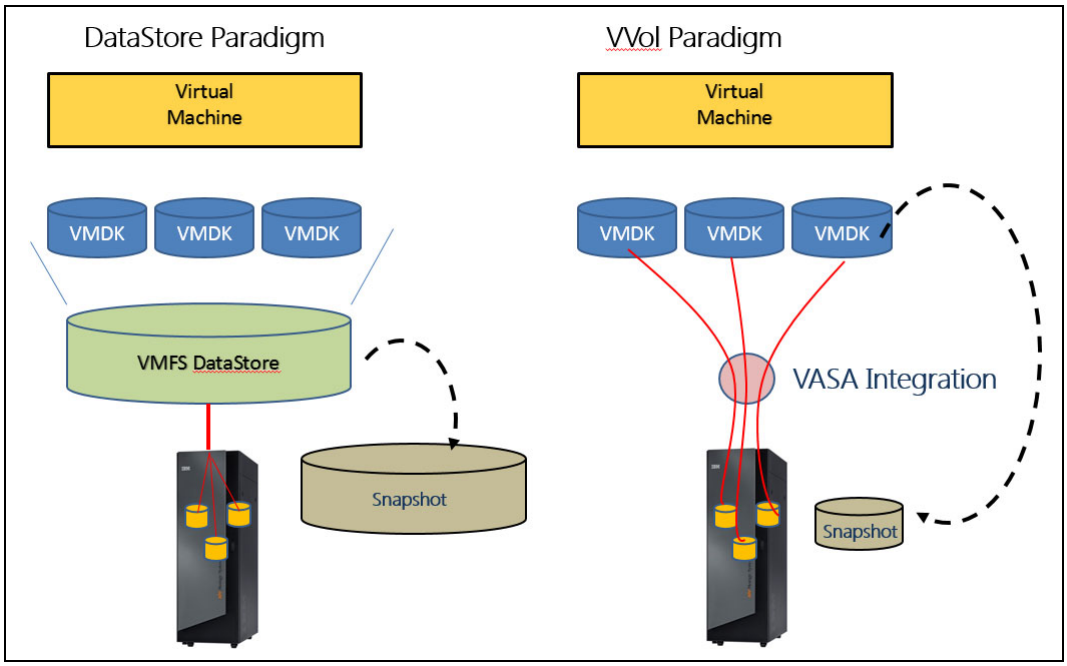

Figure 2-1 VMFS datastore and VVols paradigms

2.1.2 Implementing VMware vSphere Virtual Volumes on IBM XIV

The VVols architecture maintains the concept of VMDK files and remains compatible with data storage implementations already in place. However, under the VVols technology that XIV supports, each VMware VM disk can correspond to an XIV volume and can use the storage functions that apply to an XIV volume, such as encryption, snapshot, and replication.

XIV uses VASA to present virtual volumes to the ESXi host and inform the VMware vCenter of the availability of VVols-aware storage. See Figure 2-2 on page 20.

Storage containers are configured on VASA by the storage administrator and are used to manage VVols and storage resources. Storage containers represent a grouping of virtual volumes attached to a VM. In the XIV implementation, VASA associates a storage container with a single XIV pool and uses it to present the pool resources to vSphere.The storage containers are characterized by storage services and combine storage capacity with a set of attributes, such as encryption or provisioning type. The storage container is used as virtual datastore to match the requirements of a specific VM and constitutes the basis of a Storage Policy Based Management.

VASA uses the concept of an Administrative Logical Unit (ALU), which is the SCSI object, essentially appearing as a LUN that redirects the SCSI stream to its underlying virtual volumes. As such, VVols are not mapped directly to a host like regular volumes. Rather, they are bound to a host through the ALU. The ALU is also known as the Protocol Endpoint LUN. The Protocol Endpoint (PE) represents the access point from VM hosts to the storage system, and allows the storage system to carry on storage-related tasks on behalf of the ESXi hypervisor.

To separate the management of regular storage pools in XIV from those managed through VASA, they are grouped into separate XIV domains. The VASA provider must be assigned to and control a single domain. Because that domain will not be directly managed by the storage administrator, it is marked as an externally managed domain. A new user role, Storage Integration Administrator, is introduced in XIV, and is required to perform specific operations on a managed domain.

The VASA implementation that is provided by IBM is packaged with IBM Spectrum Control Base (Figure 2-2).

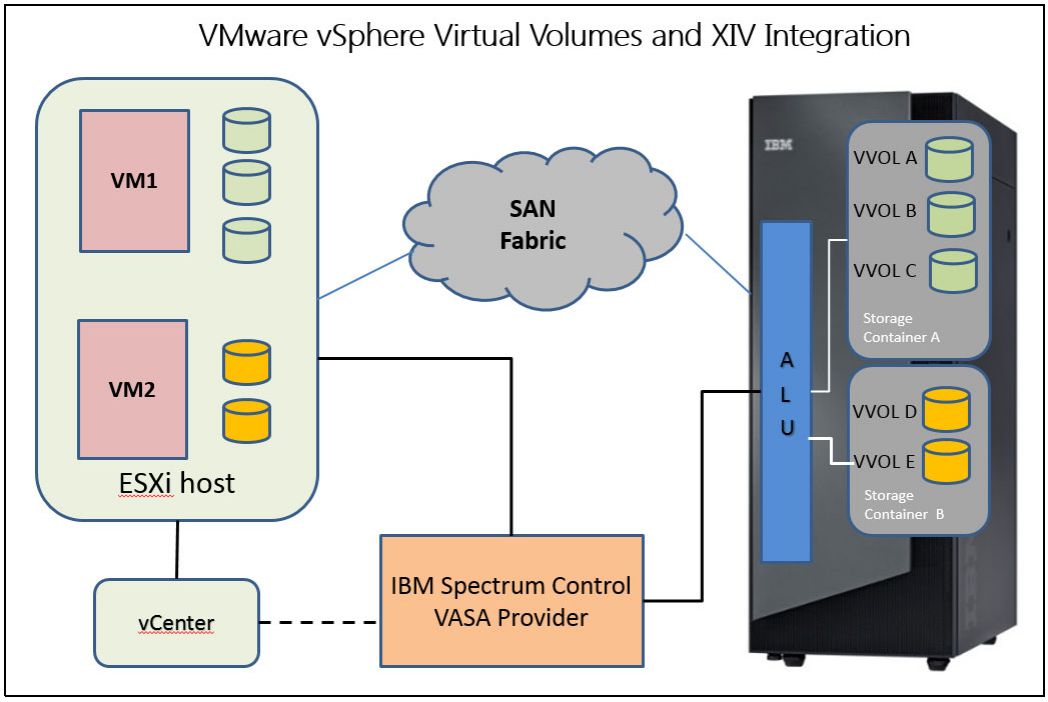

Figure 2-2 VVols and XIV integration

2.1.3 VVols concepts mapping in IBM Spectrum Control Base Edition

Figure 2-3 shows a detailed mapping of VMware vSphere Virtual Volumes concepts in IBM Spectrum Control Base Edition and IBM XIV:

- A VMware vSphere *virtual volume* maps to an IBM XIV *volume* (or *LUN*)
- A VMware *storage container* maps to an IBM Spectrum Control *storage resource*
- VMware *VVols datastore capabilities* map to an IBM Spectrum Control *VVol service*

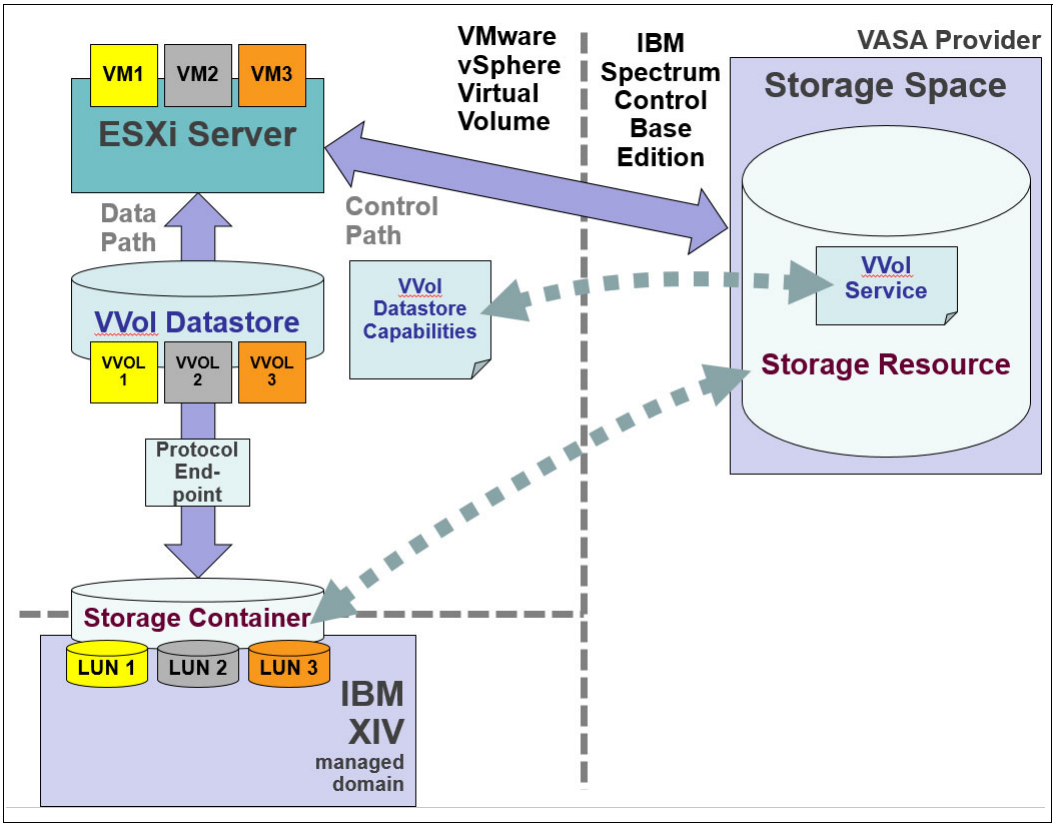

Figure 2-3 VVols concepts mapping with IBM Spectrum Control Base Edition

2.2 Defining Virtual Volumes in XIV

This section provides a quick overview of the requirements and practical tasks to perform for defining and using vSphere Virtual Volumes with XIV.

2.2.1 Prerequisites and configuration

The following software and specific versions are required:

- VMware vCenter 6.0 server installed.
- ESXi 6.0.0 server installed.
- IBM XIV Software v11.5.1 or later installed. Consult with your IBM Technical Advisor for details.
- IBM Spectrum Control Base 2.0.x or later installed. The Linux installation package can be downloaded from IBM Fix Central:

  http://www.ibm.com/support/fixcentral/

  Specify **IBM Spectrum Control** as the product.
- ESXi managed by vCenter.

The following configurations must be completed to connect the VMware infrastructure with an IBM XIV through the VASA interface. To enable VVols for this IBM XIV, complete these steps:

1. Configure the XIV Storage System to create a managed domain for all VVols resources.
2. Configure IBM Spectrum Control to connect to the XIV storage.
3. Configure VASA on both vCenter and IBM Spectrum Control.

2.2.2 IBM XIV configuration

The following configuration steps need to be completed on the XIV Storage System:

1. Create a domain that includes all XIV GUI elements involved in the VVols infrastructure. These tasks can be accomplished either through the XIV GUI or by using the XCLI. This example shows these configuration steps with the XIV GUI:
   a. Create a managed domain to hosts VVols-related XIV elements.
   b. Create a user in this domain with the Storage Integration Administrator role.
   c. Define the VMware ESXi hosts in this domain.
2. Make the created domain an externally managed domain. These required steps must be completed in the IBM XCLI:
   a. Enable metadata service for the IBM XIV.
   b. Configure created domain to be a managed entity.
   c. Create a XIV administrative logical unit for each VMware ESXi host.

Create an IBM XIV domain for all VVols components

The following steps need to be completed to create an IBM XIV domain:

1. From the XIVGUI, log on as the storage administrator.
2. The storage components used as VVols must be in an XIV managed domain, so an XIV domain must be created:
   a. From the XIV GUI main window, select **Actions**, and then **Create Domain** as shown in Figure 2-4.

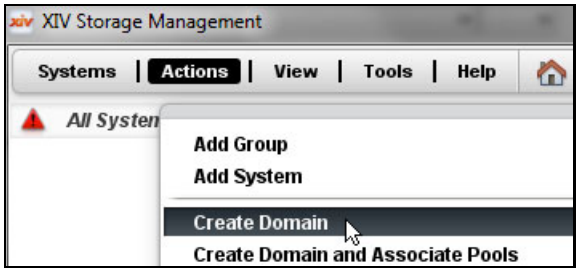

Figure 2-4 Opening the Create Domain wizard

   b. When the **Create Domain** wizard window opens, specify the domain hard size and soft size, making sure that the soft size is four times larger than hard size (if you are going to use thin provisioning), and enter a domain name, as shown in Figure 2-5.

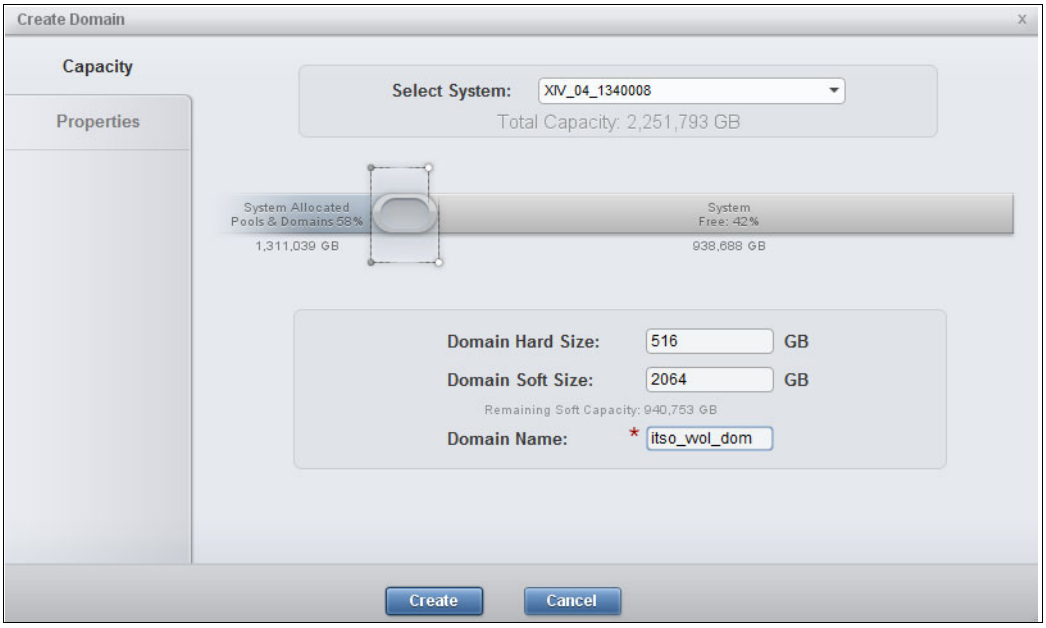

Figure 2-5 Filling capacity tab when creating domain

   c. In the **Properties** tab, specify Pools as at least 3, as shown in Figure 2-6 on page 24. This minimum is required because whenever a VVol is created by IBM Spectrum Control, three pools are created:

Meta pool	Holds VMware virtual machine-related management metadata
Thick pool	For thick provisioning
Thin pool	For thin provisioning

   Specify the other parameters according to your needs, and then click **Create**.

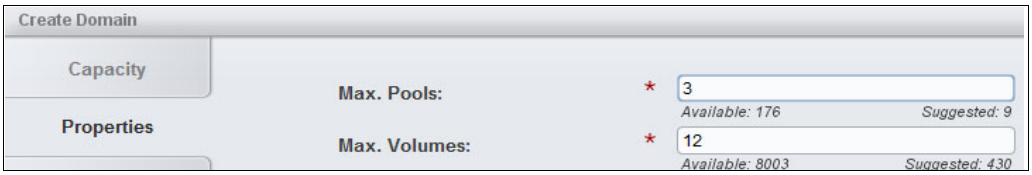

Figure 2-6 Specifying at least three pools in the domain

3. An XIVGUI user with Storage Integration Administrator role must be created and associated with this domain. Complete these steps:

   a. Click the **Padlock** icon, and then select **Users**, as shown in Figure 2-7.

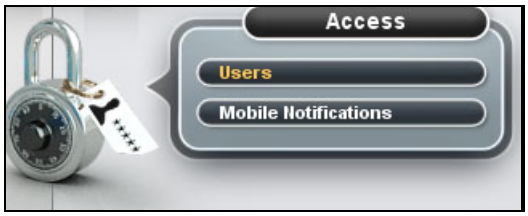

Figure 2-7 Opening the user management page

   b. In the user window that opens, click **Add User** as shown in Figure 2-8.

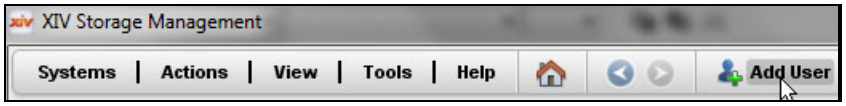

Figure 2-8 Launching the Add User wizard

   c. When the **Add User** wizard window opens, enter the name of the domain previously created and select **Storage Integration Administrator**, as the category, as shown in Figure 2-9, and then click **Add**.

Figure 2-9 Filling user properties

4. The VMware ESXi hosts featuring VVols need to be defined in the newly created domain. Complete the following steps for each of these hosts:

   a. Click the **Hosts** icon, and then select **Host and Clusters**, as shown in Figure 2-10.

Figure 2-10 Launch Host and Clusters page

   b. When the Hosts and Clusters page opens, click **Add Host**, as shown in Figure 2-11.

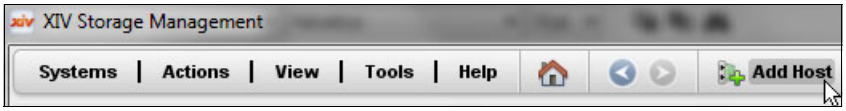

Figure 2-11 Starting the Add Host wizard

   c. When the Add Host wizard window opens. specify the previously created domain name, as shown in Figure 2-12, and click **Add**.

Figure 2-12 Completing fields in the Add Host wizard

5. The newly created hosts now need to be mapped to the corresponding Fibre Channel ports. For this purpose, complete the following steps for each ESXi host:

   a. From the Hosts and Clusters page, right-click the newly created host and select **Add Port**, as shown in Figure 2-13.

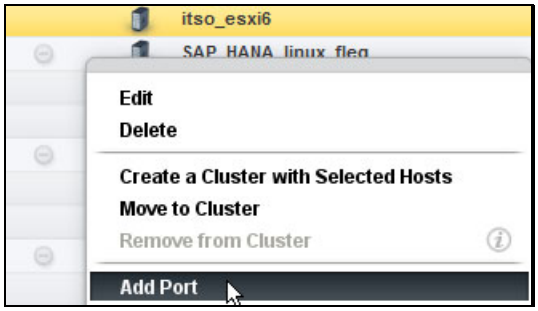

Figure 2-13 Starting the Add Port wizard

   b. Search for the ESXi host port name in the drop-down list and click **Add**, as shown in Figure 2-14. Repeat this step for each ESXi port.

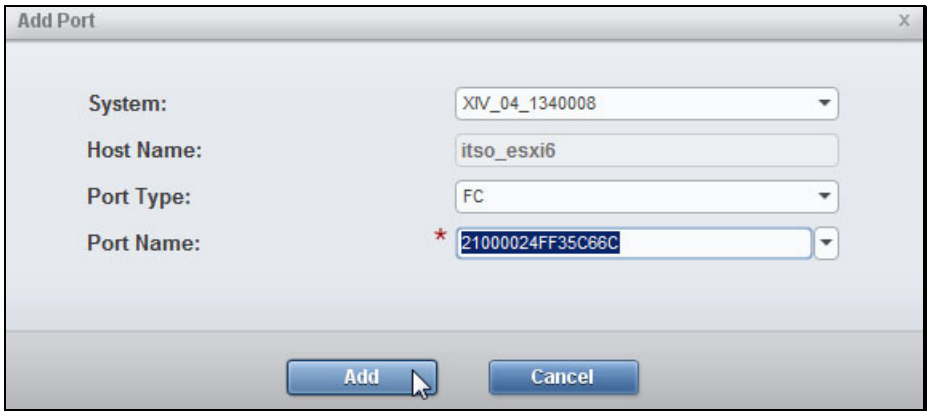

Figure 2-14 Adding a port to a host

> **Tip:** To retrieve the ESXi port names, issue the following command from an SSH session to your host:
>
> ```
> [root@localhost:~] esxcli storage san fc list | grep "Port Name"
>    Port Name: 21:00:00:24:ff:35:c6:6c
>    Port Name: 21:00:00:24:ff:35:c6:6d
> ```
>
> You can also retrieve the ESXi FC ports from the vSphere management.

   c. Your added ports then appear in the **Host and Clusters** window, as shown in Figure 2-15.

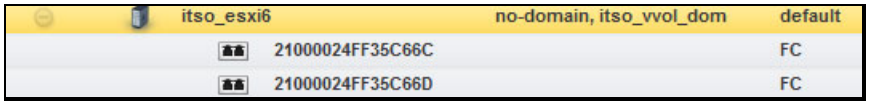

Figure 2-15 Fibre Channel port defined on a host

Make new domain a managed domain

The following steps need to be completed to make a new domain:

1. Log on to your XCLI as user **admin**. Enable metadata service using the command shown in Example 2-1.

   Example 2-1 Enabling metadata service

   ```
   XIV_04_1340008>>metadata_service_enable
   Command executed successfully.
   ```

2. Log on to the XCLI with the user ID (Storage Integration Administrator role) that you created at step c on page 24, and complete the following steps:

   a. Configure the domain that was created at step b on page 23 to be managed, using the command shown in Example 2-2.

      Example 2-2 Configure domain to be managed

      ```
      XIV_04_1340008>>domain_manage domain=itso_vvol_dom managed=yes
      Command executed successfully.
      ```

   b. Create an administrative logical unit for each VMware ESXi host by using the command shown in Example 2-3 with the following parameters:

      alu A name for this administrative logical unit
      host The ESXi host as defined in IBMXIV by step c on page 25
      lun Any unique number between 512 and 755

      Example 2-3 Creating administrative logical unit

      ```
      XIV_04_1340008>>alu_create alu=itso_vvol_alu host=itso_esxi6 lun=600
      Command executed successfully.
      ```

IBM Spectrum Control Base Edition configuration

After the XIV Storage System has been configured, it needs to be known to IBM Spectrum Control. The following are the high-level steps needed to do this:

1. First-time IBM Spectrum Control configuration as illustrated in Chapter 6, “IBM Spectrum Control Base Edition software” on page 73.
   a. Define the IBM Spectrum Control fully qualified domain name and high availability group.
   b. Generate a server certificate.
   c. Set up VASA credentials.
   d. Set up XIV credentials.
2. Add the XIV Storage System.
3. Create a storage space for this XIV in Spectrum Control.
4. Add a VVol-enabled service for this storage space.
5. Define a storage resource with this VVol-enabled service.

Detailed description of the necessary steps

1. Log in to IBM Spectrum Control Web Interface:

   `http://IBM_Spectrum_Control_IP_address:8443`

2. Enter the default login credentials, which are user `admin` and password `admin1!`, as shown in Figure 2-16.

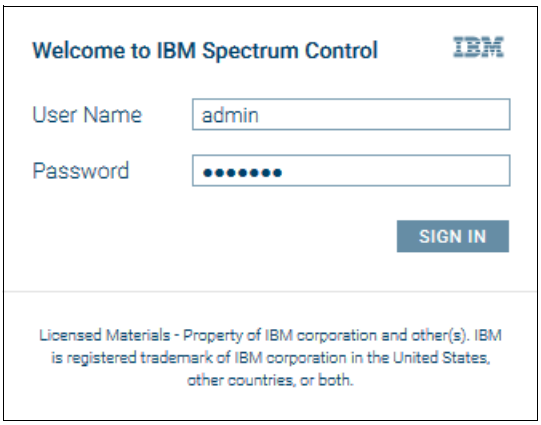

Figure 2-16 Log in to the IBM Spectrum Control user interface

3. If needed, complete the first-time configuration steps described in **6.2, "Spectrum Control Base Edition first-time configuration" on page 76**. Use a Storage Integration Administrator user ID and password as storage credentials.
4. Complete the following steps to add your IBM XIV to Spectrum Control Base:
   a. Click the **+** (plus sign) icon next to the **Storage Systems** pane to add your XIV to the IBM Spectrum Control, as shown in Figure 2-17.

Figure 2-17 Calling the Add New Array form

   b. Complete the **Add New Array** form with your XIV IP address or host name, as shown in Figure 2-18.

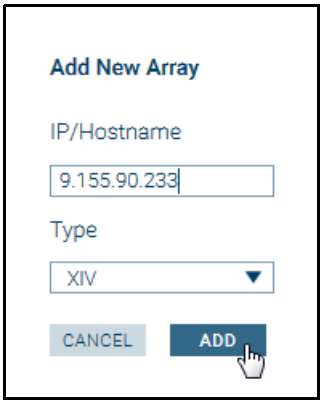

Figure 2-18 Adding your IBM XIV

c. After the XIV address is given, the XIV system is displayed as depicted in Figure 2-19.

Note that the Free size shown in Figure 2-19 corresponds to the size that was defined in step b on page 23.

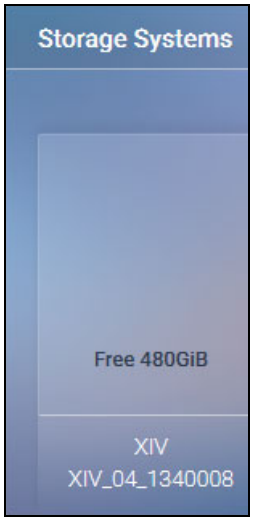

Figure 2-19 Displaying your IBM XIV

d. Optional: You can click the icon and select **Modify**, as shown in Figure 2-20, to display the XIV properties.

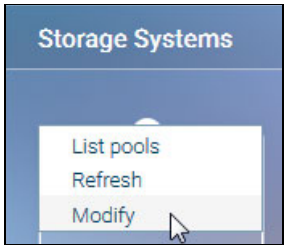

Figure 2-20 Opening XIV properties

The XIV properties window opens, as shown in Figure 2-21. Notice that no service is defined yet. That's the purpose of the steps that follow.

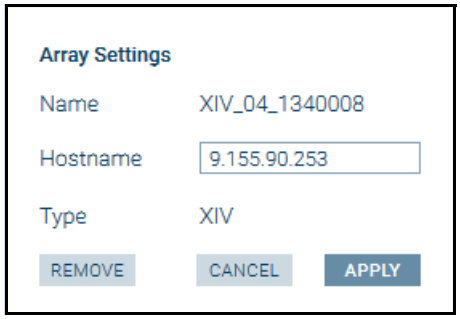

Figure 2-21 Showing XIV properties

Define a storage space and configure a storage service

1. Within IBM Spectrum Control Base server, a virtual storage is defined with a *storage service* and a *storage space*. Therefore, you must first define a storage space. For that purpose, complete the following steps:

   a. Click the **Configuration** icon, and then click **Add New Space** to add a storage space to your IBM Spectrum Control Base server, as shown in Figure 2-22.

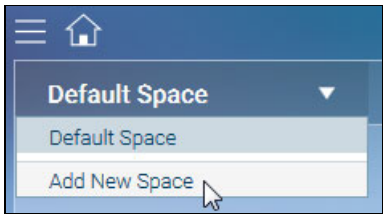

Figure 2-22 Calling the Add New Space form

   b. Provide a name for your new storage space and click **APPLY** as shown in Figure 2-23.

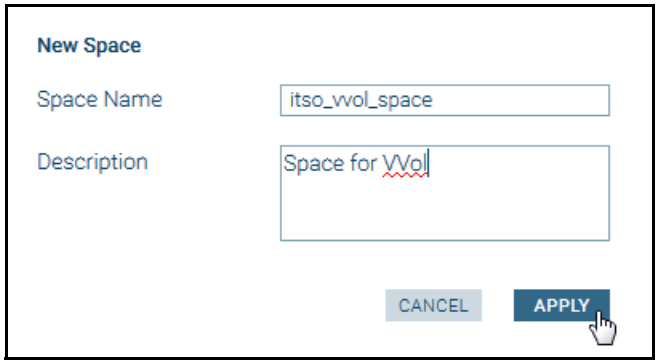

Figure 2-23 Adding a storage space

   IBM Spectrum Control GUI automatically brings you to this newly created storage space.

2. Now that storage space is defined, a storage service must be configured. A storage service is the combination of storage resources and associated user-defined policies, such as encryption and mirroring. Complete the following steps to add a VVol-enabled service to the newly created storage space:

   a. From your newly created storage space, click the **+** icon next to the Services pane, as shown in Figure 2-24.

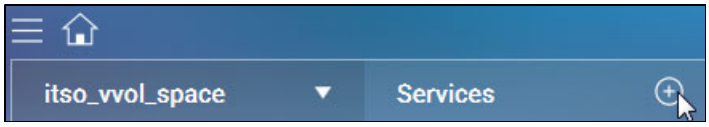

Figure 2-24 Calling the Add New Service form

b. When the New Service form is displayed, complete it as shown in Figure 2-25. Specify features fulfilled by this service according to your needs. Do not forget to select **VVols Service**.

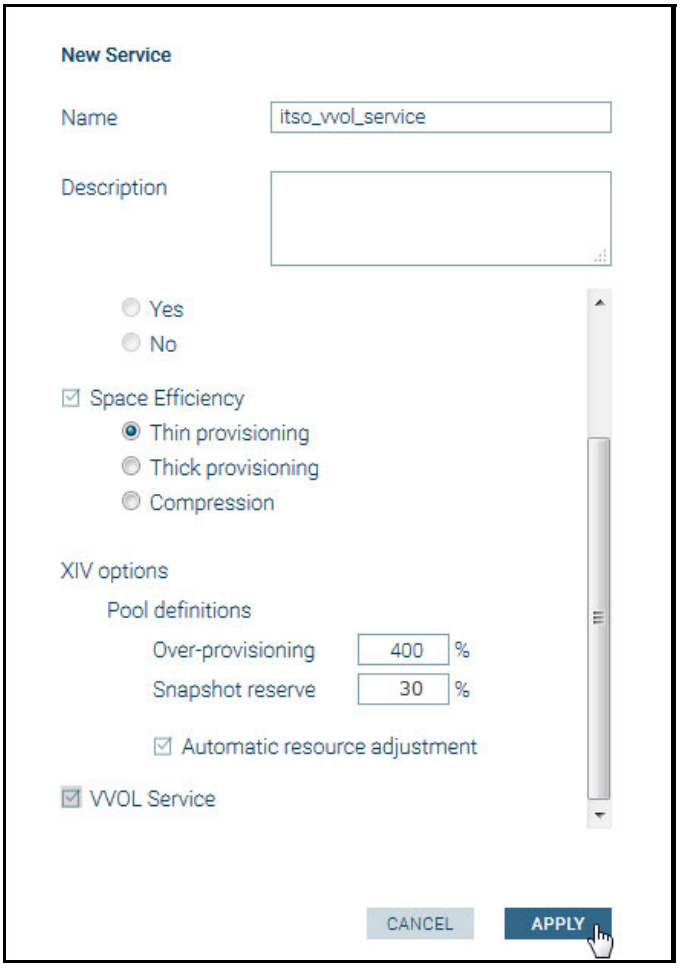

Figure 2-25 Adding a VVol-enabled service in the New Service form

c. The service now appears in your newly created space, as shown in Figure 2-26.

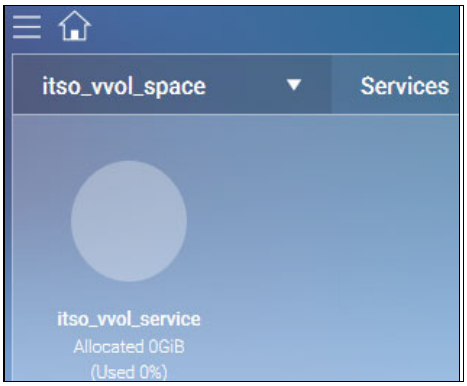

Figure 2-26 New VVols service added

3. Perform the following steps to add a storage resource for this newly created VVol-enabled service:

   a. Click the service that you want to use for the resource to be created, as shown in Figure 2-27 (the circle is darker after you select it).

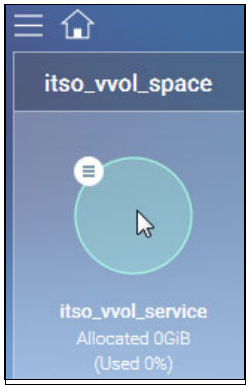

Figure 2-27 Clicking the chosen service for the resource to be created

   b. Click the **Edit** button on the Storage System (IBM XIV Storage System attached), and select **Modify** as shown in Figure 2-28.

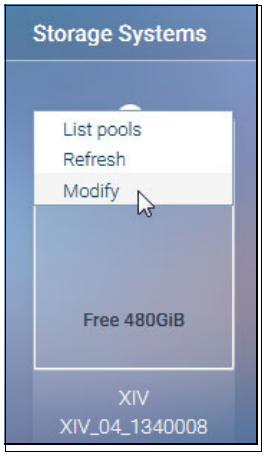

Figure 2-28 Clicking the Array Properties icon

   c. Enter the appropriate details to attach a new storage resource.

> **Note:** Wait a few seconds for the VVols service to be activated on the storage array.

d. As Figure 2-29 shows, the selected service is now displayed. Enter the appropriate size for your resource, and then click **Add**.

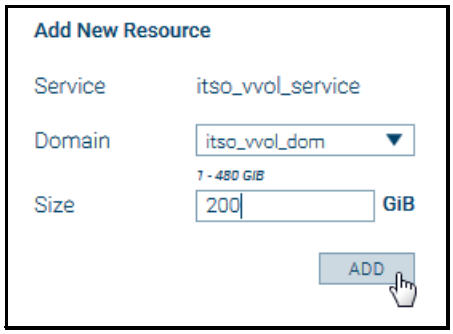

Figure 2-29 Adding a resource

The created storage resource now appears in the Storage System, as shown in Figure 2-30.

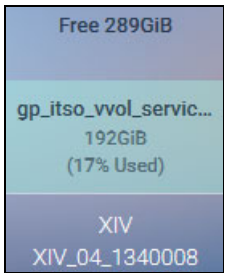

Figure 2-30 Created resource

The associated service also shows that it is now used, as shown in Figure 2-31.

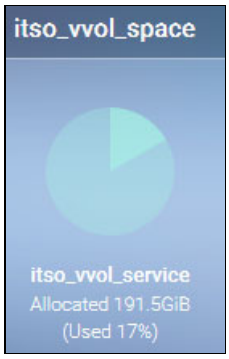

Figure 2-31 Service now shows used

4. In the XIV GUI, as admin user, you can now see the associated pools for this storage resource:

   a. Click the **Pools** icon, and then select **Storage Pools** as shown in Figure 2-32.

Figure 2-32 Opening the Storage Pools window

   b. Three pools have been created for this storage resource, pertaining to the same pool group, as shown in Figure 2-33.

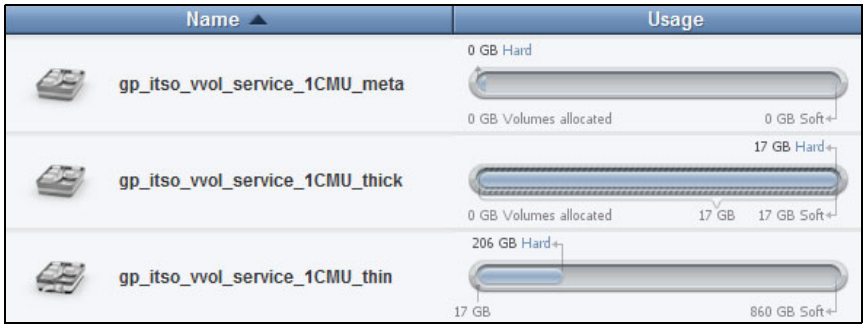

Figure 2-33 Pool groups that are associated to created storage resource

These three pools are within the same pool group:

Meta Pool Holds VMware virtual machine-related management metadata
Thick Pool For thick provisioning
Thin Pool For thin provisioning

Important: Upon creation of VMware virtual volumes, metadata pools could show 100% utilization in the XIV system GUI and marked red. Metadata pools will look 100% used because every time a new space is added it is fully allocated (both hard and soft space) by the XIV system.

The first time you define a new VM using virtual volumes, a 68 GB volume will be allocated from the soft size, and 17 GB will be allocated from the hard size. This space will be used to serve the newly added VM and three more to come. On the addition of the fifth VM, another 68 GB of soft and 17 GB of physical space will be allocated automatically, and so on. Figure 2-34 shows an example for a 100% use of a metadata pool.

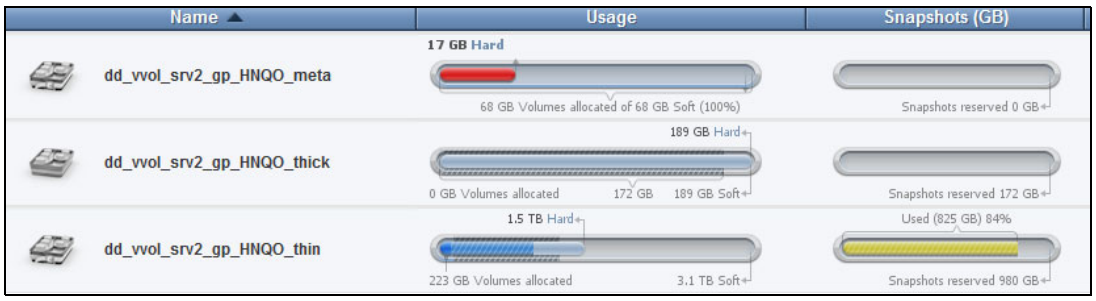

Figure 2-34 Metapool use of 100%, not an error condition

2.2.3 VMware vCenter and IBM Spectrum Control Base configuration

After both XIV and IBM Spectrum Control Base have been configured, IBM Spectrum Control Base can make vCenter aware of the XIV system. To do so, complete the following high-level steps:

1. Register your vCenter in IBM Spectrum Control Base server.
2. Register IBM Spectrum Control Base as VASA storage provider in your VMware vCenter.
3. Attach your IBM Spectrum Control Base configured services to your vCenter.
4. After all of the above steps are complete, the storage resources configured by IBM Spectrum Control Base in step 2 on page 30 are seen by VMware vCenter as *storage containers*. Therefore, you can now configure VVols datastores in vCenter.
5. You can then define VVols datastores with associated VMware storage policies.

These steps are detailed in the next subsection.

Register vCenter in IBM Spectrum Control Base

To register vCenter server in Spectrum Control Base, complete the steps described in 6.2.6, “Add the vCenter server in Spectrum Control Base” on page 82 and 6.2.7, “Control IBM Storage Enhancements for vSphere Web Client plug-in on vCenter” on page 83.

1. Go to the vSphere Web Client Interface, and log in as an administrative user.
2. Click **Home** → **Hosts and Clusters**, click the vCenter server, and then select the **Manage** tab and the **Settings** tab. Doing so displays the IBM Spectrum Control Base Server shown in Figure 2-35.

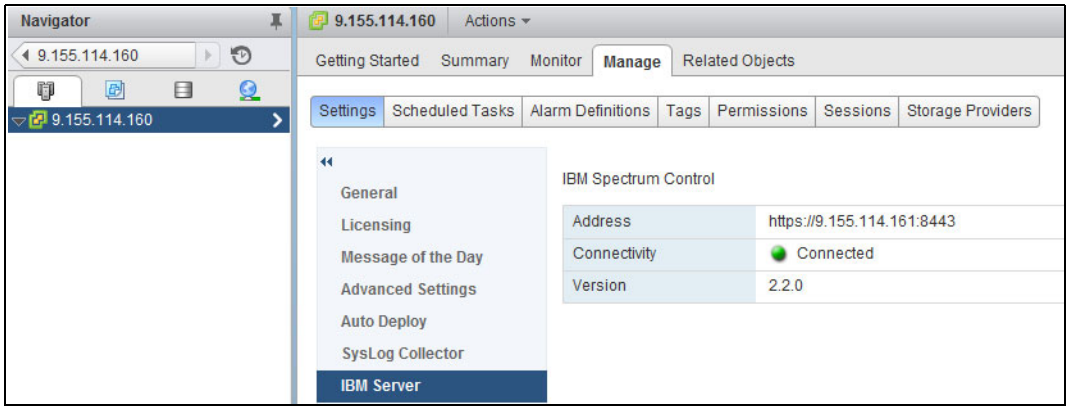

Figure 2-35 IBM Spectrum Control Base Server in vSphere Web Client

Register IBM Spectrum Control Base as VASA storage provider

To register IBM Spectrum Control in VMware vCenter, complete the steps as described in 6.2.8, “Add IBM Spectrum Control Base server as a storage provider on vCenter” on page 84.

The IBM Spectrum Control storage provider is displayed in vCenter as shown in Figure 2-36.

Figure 2-36 Registered IBM Spectrum Control server

You can verify that IBM Spectrum Control indeed accepted vCenter registry by going to the IBM Spectrum Control GUI Settings, and clicking **VASA trusted certificates**, as shown in Figure 2-37.

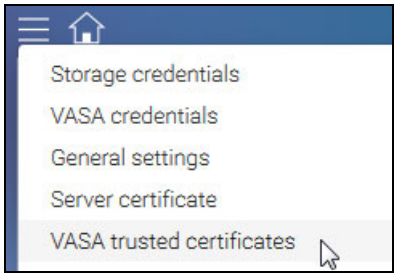

Figure 2-37 Calling VASA trusted certificate window

The window should show the VASA trusted certificate, as shown in Figure 2-38.

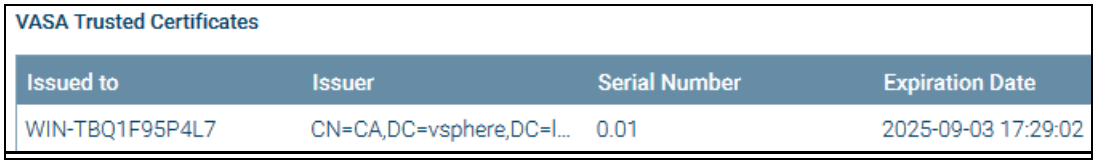

Figure 2-38 VASA trusted certificate

Configure a VMware VVols datastore

The following steps need to be completed to configure a VMware VVols datastore:

1. In the vCenter Web Interface, select **Home** → **Storage**, right-click the datacenter, and then select **Storage** and click **New Datastore**, as shown in Figure 2-39.

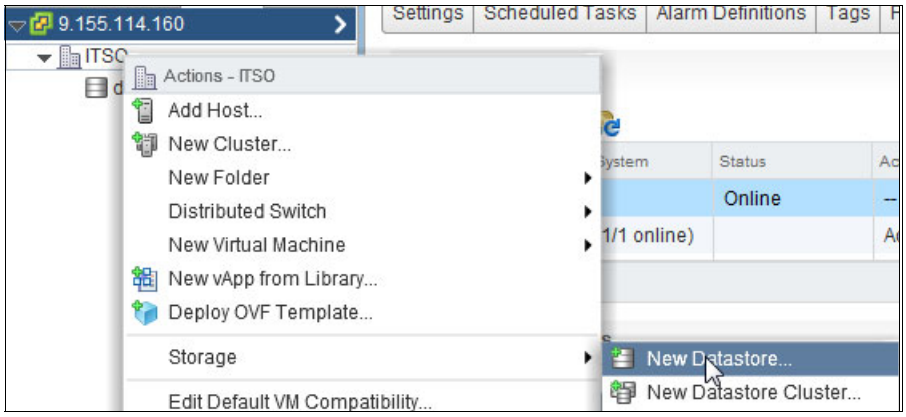

Figure 2-39 Starting the VMware new datastore wizard

2. On the **Location** tab, select your location and click **Next**.

3. On the Type tab, select **VVol** and then click **Next**, as shown in Figure 2-40.

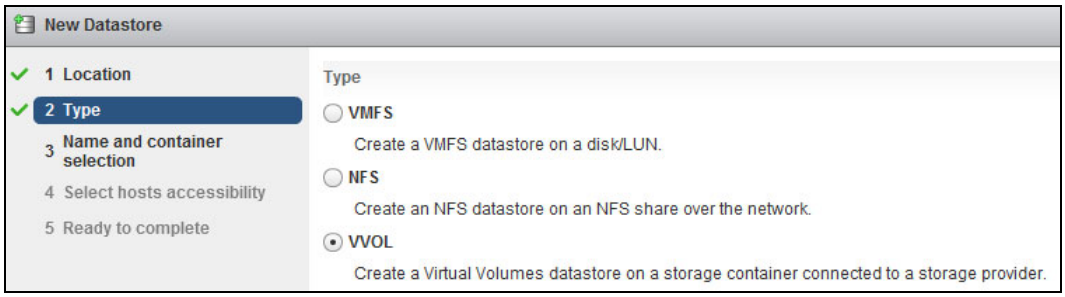

Figure 2-40 Selecting VVol datastore type

4. On the Name and container selection tab, select the storage container of your choice for this VVol datastore, as shown in Figure 2-41, and click **Next**. You can recognize the storage space that you defined in Spectrum Control Base in item b on page 30. This storage space can contain different services with different capabilities.

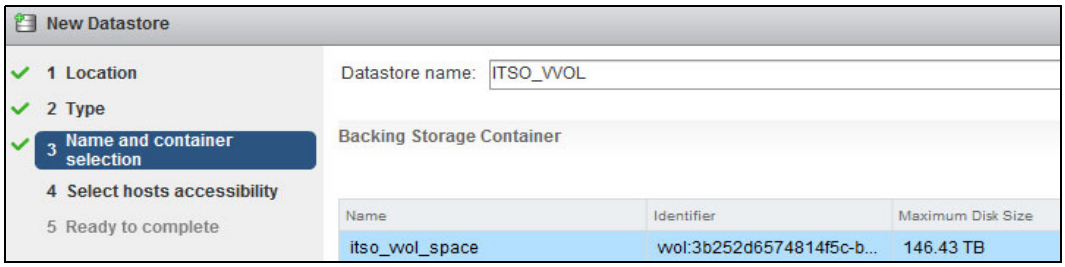

Figure 2-41 Selecting the storage container

5. On the Select hosts accessibility tab, select the host of your choice and click **Next**.
6. The Ready to complete tab is displayed. Click **Finish** to begin creating the datastore.
7. Click the created datastore, select **Manage** and **Settings**, the properties are shown as depicted in Figure 2-42.

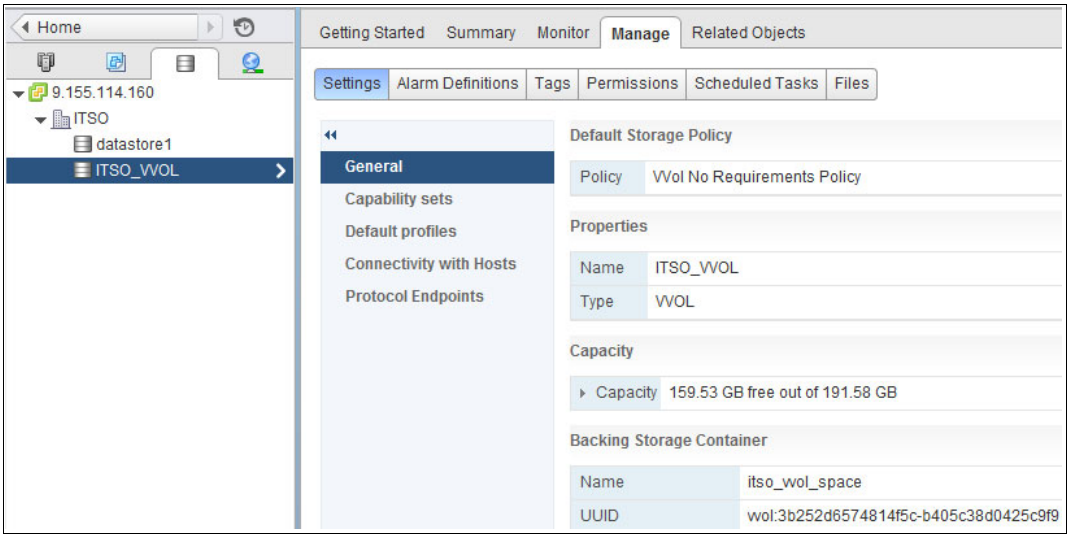

Figure 2-42 Created VVol datastore settings

8. If you click **Capabilities sets**, the services and capabilities configured at the IBM Spectrum Control Base server level in item 2 on page 30 are displayed, as shown in Figure 2-43.

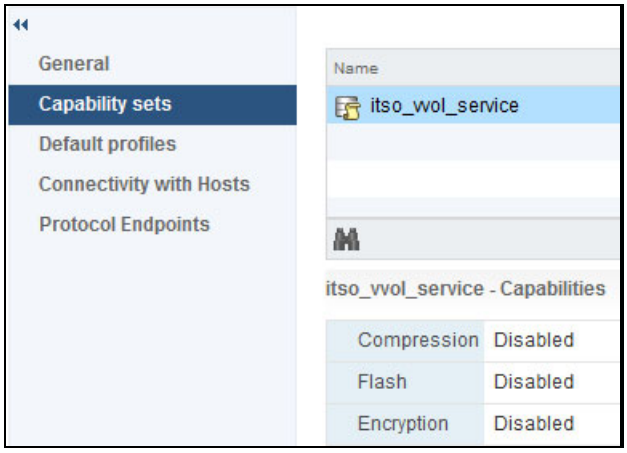

Figure 2-43 Showing VVol datastore capabilities

Defining VMware storage policies

Complete the following steps to define the VMware storage policies:

1. From the vSphere Web Client Home, click **Policies and Profiles** → **VM Storage Policies**.
2. Click the icon **Create a new VM storage policy** as shown in Figure 2-44.

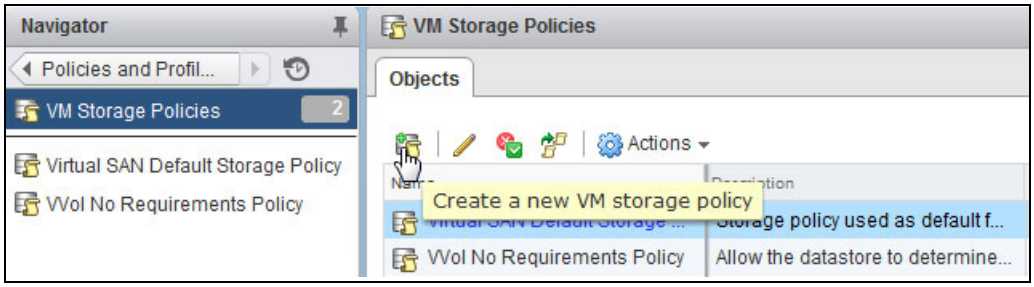

Figure 2-44 Create VM storage policy icon

3. Provide a name for your policy, and click **Next** twice.
4. On the 2a Rule-set 1 tab, complete the wizard as shown in Figure 2-45.

Figure 2-45 Defining one rule

5. Repeat the previous steps for all of the rules that you need.

6. Verify in the storage compatibility that the defined rule set corresponds to the VVols datastore that you expect, as shown in Figure 2-46.

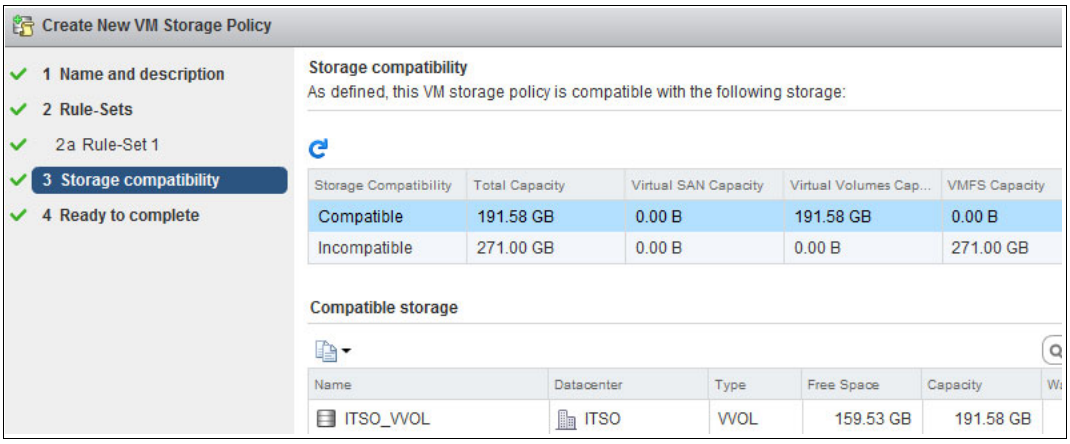

Figure 2-46 Verifying storage compatibility

7. Click **Next** and then **Finish**; Your policy is created, as shown in Figure 2-47.

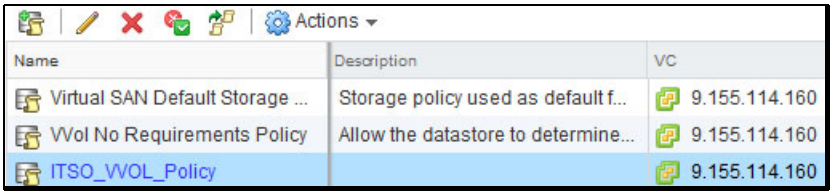

Figure 2-47 Created VM storage policy

8. Whenever you are ready to create a VMware virtual machine, you are now able to select a VM storage policy that will take you to the VVols datastore fulfilling that policy, as shown in Figure 2-48.

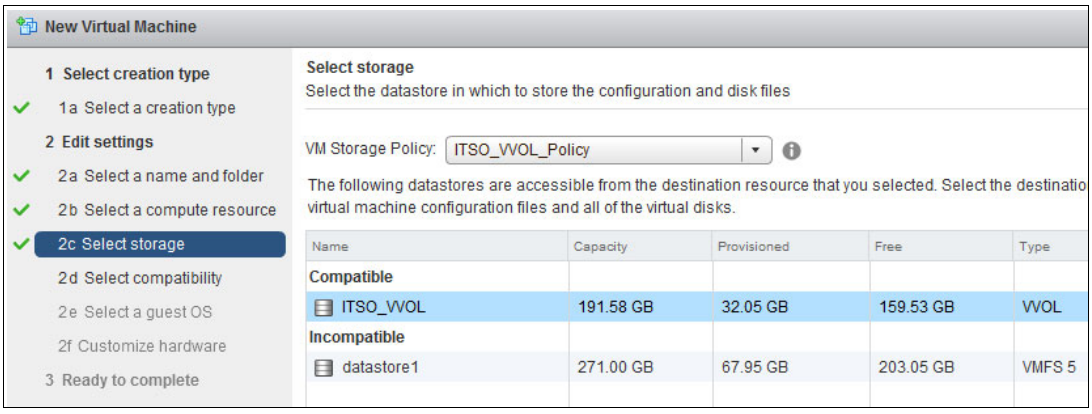

Figure 2-48 Selecting appropriate storage when creating a VMware virtual machine

2.3 Deleting Virtual Volumes in XIV

This section provides a quick overview of the practical tasks to perform for deleting vSphere Virtual Volumes within XIV.

2.3.1 VMware vCenter and IBM Spectrum Control Base VVols removal

1. Migrate or delete all virtual machines located on the VVols datastore and unmount the VVols datastore as shown in Figure 2-49.

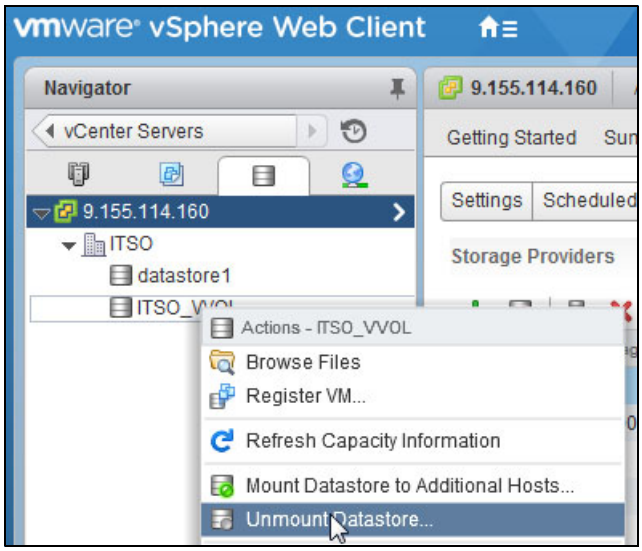

Figure 2-49 Unmount VVols datastore

2. Select the hosts from which the VVols datastore should be unmounted and click **OK** as shown in Figure 2-50.

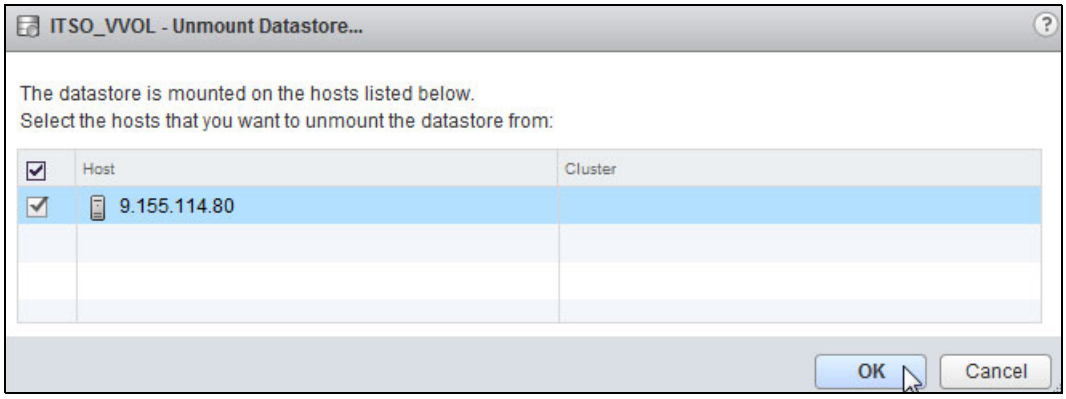

Figure 2-50 Unmount VVols datastore, select hosts

3. Go to Spectrum Control Base, click the VVols service and the Edit button, and select **Resources** as shown in Figure 2-51.

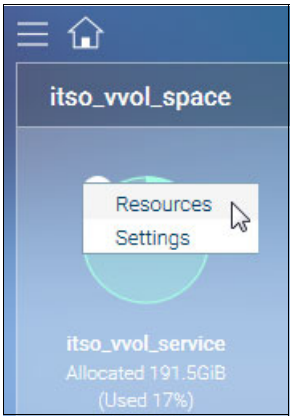

Figure 2-51 Spectrum Control Base select Resources

4. Click the **Remove** button on the resource to delete the storage resource and delete the grouped pools in the VVols domain on XIV, as illustrated in Figure 2-52.

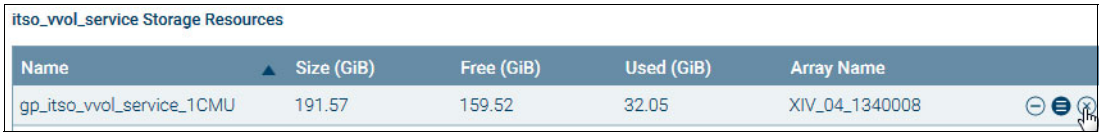

Figure 2-52 Spectrum Control Base Remove Storage Resource

5. Click **OK** to confirm the removal of the storage resource, as depicted in Figure 2-53.

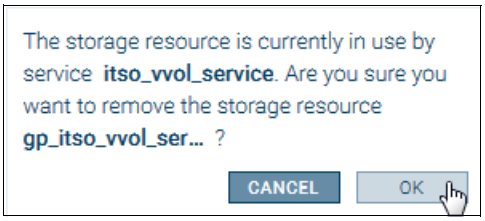

Figure 2-53 Spectrum Control Base Confirmation of Storage Resource removal

6. Click the VVols service and then the **Edit** button, and select **Settings**, as shown in Figure 2-54.

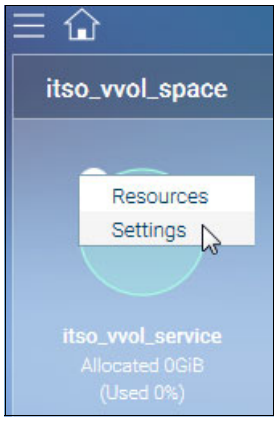

Figure 2-54 Spectrum Control Base select Settings

7. Click **Remove** to remove the service as shown Figure 2-55.

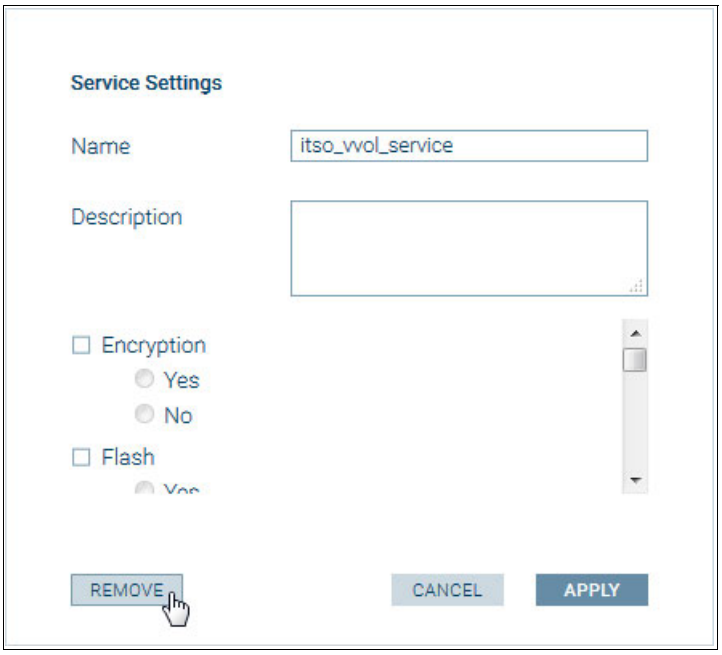

Figure 2-55 Spectrum Control Base Service Removal

8. Click **OK** to confirm the removal of the service as depicted in Figure 2-53 on page 41.

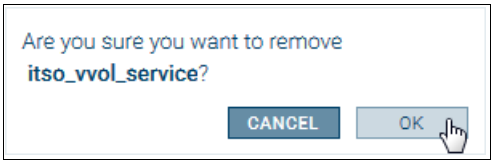

Figure 2-56 Spectrum Control Base Confirmation of Service removal

2.3.2 XIV VVols removal

1. Log on to the XCLI with the user that you created at step c on page 24 (Storage Integration Administrator role), and delete the administrative logical unit for the VMware ESXi host, as shown in Example 2-4.

Example 2-4 Deleting administrative logical unit

```
XIV_04_1340008>>alu_delete alu=itso_vvol_alu

Warning:   Are you sure you want to delete ALU itso_vvol_alu? y/n: y
Command executed successfully.
```

2. From the XIV GUI, log in as a storage administrator. Click the **Padlock** icon, and then select **Domains**, as shown in Figure 2-57.

Figure 2-57 XIV GUI, select Domains

3. Right-click the VVols domain and select **Manage Associations** and **Hosts**, as shown in Figure 2-58.

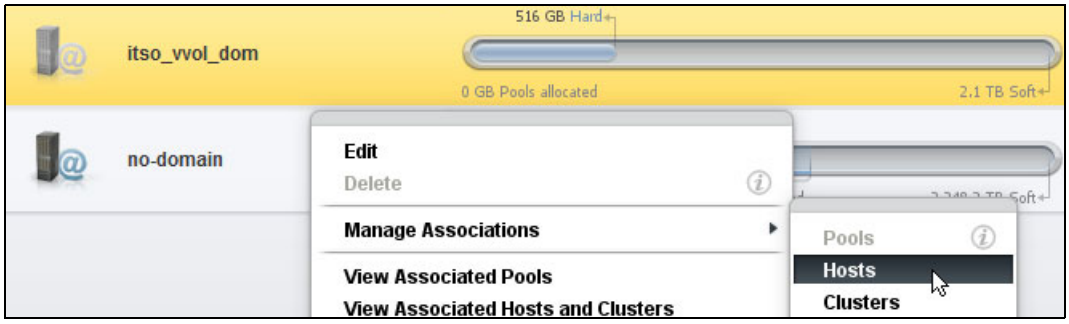

Figure 2-58 XIV GUI Manage Associations

4. Select the host and click the yellow arrow to disassociate the host from the domain, as illustrated in Figure 2-59.

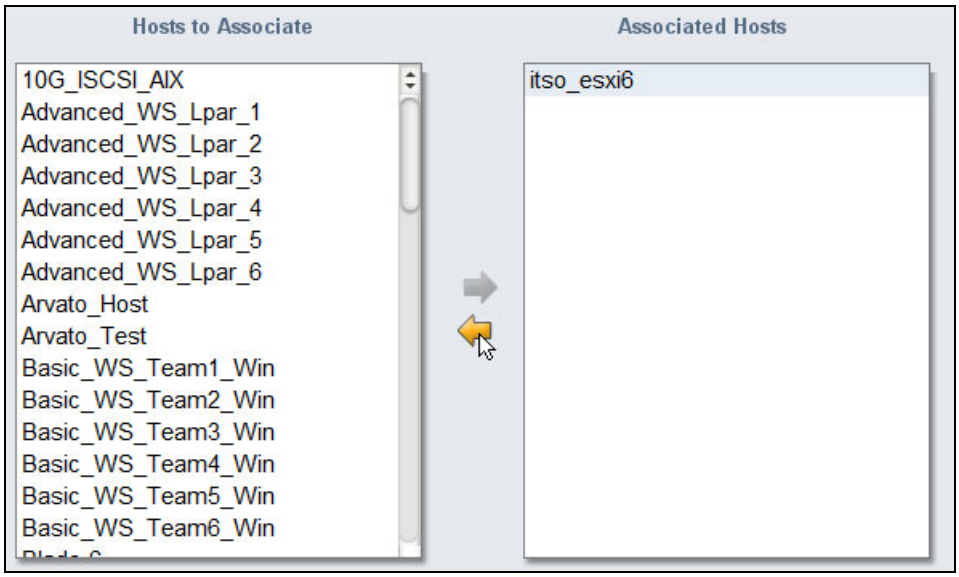

Figure 2-59 XIV GUI, Domain disassociate host

5. Click the **Users** tab, select the Storage Integration Administrator user, and click the yellow arrow to disassociate the user from the domain, as depicted in Figure 2-60.

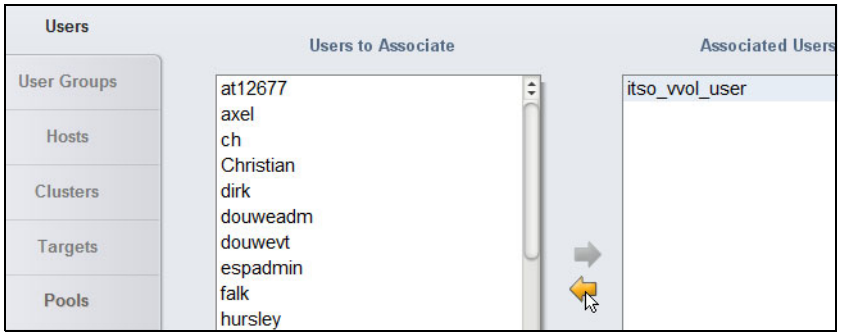

Figure 2-60 XIV GUI, Domain disassociate user

6. Click **Update** to change the domain associations, as shown in Figure 2-61.

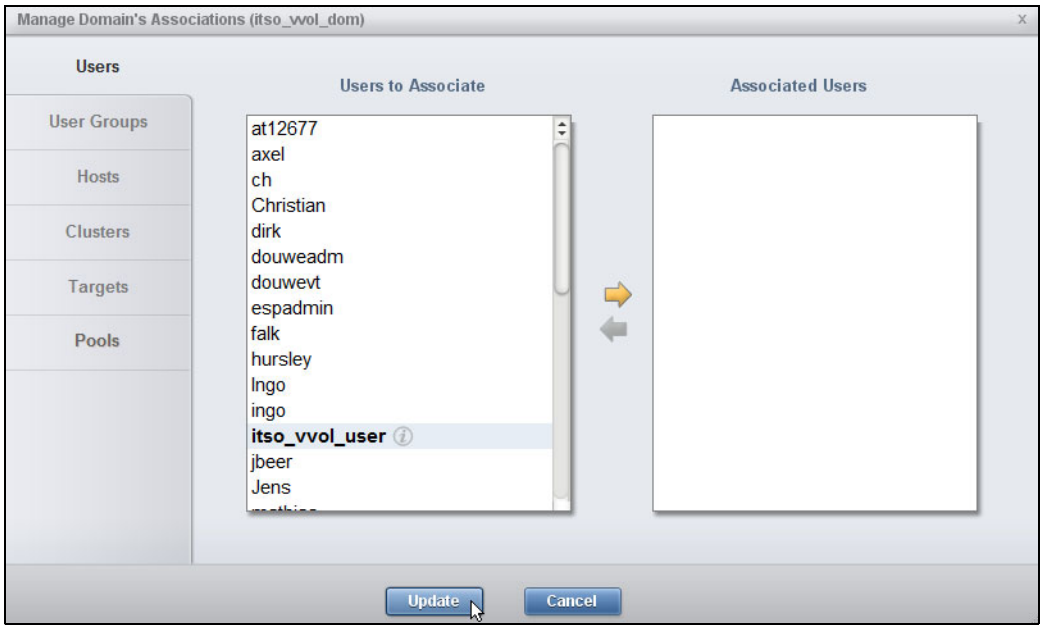

Figure 2-61 XIV GUI update domain associations

7. Click **OK** to confirm the user deletion, as illustrated in Figure 2-62.

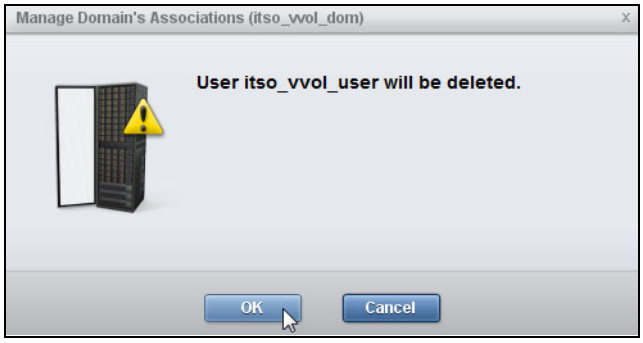

Figure 2-62 XIV GUI confirmation of user deletion

8. Click **OK** to confirm the modification of the externally managed domain, as illustrated in Figure 2-63.

Figure 2-63 XIV GUI confirmation of externally managed domain modification

9. Right-click the VVols domain, and select **Delete**, as shown in Figure 2-64.

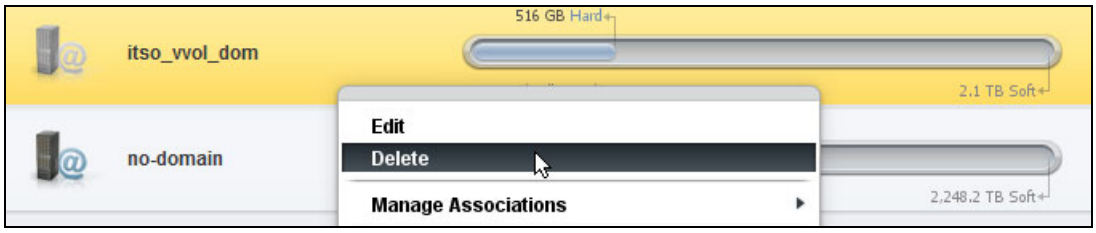

Figure 2-64 XIV GUI, Delete Domain

10. Click **OK** to confirm the modification of the externally managed domain, as illustrated in Figure 2-65.

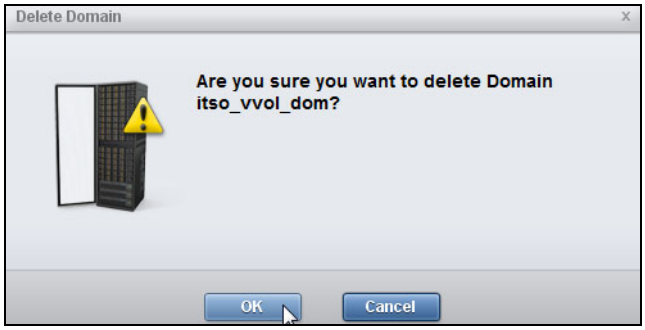

Figure 2-65 XIV GUI confirmation of domain deletion

3

vSphere Web Client

This chapter describes the tasks performed by a storage and VMware administrator to configure and use IBM Storage Enhancements for vSphere Web Client. It covers the following topics:

- vSphere Web Client illustration
- Spectrum Control Base Edition configuration for IBM Storage Enhancements for vSphere Web Client
- Using IBM Storage Enhancements for vSphere Web Client

3.1 vSphere Web Client illustration

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.

When used with the XIV Storage System, VMware administrators can self-provision volumes (logical unit numbers, or LUNs) in selected storage pools that were predefined by the storage administrators. The volumes are mapped to ESX hosts, clusters, or data centers as logical drives that can be used for storing VMware datastores (virtual machine data containers).

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

The following steps are necessary for using Storage Enhancements for vSphere Web Client:

- If not done yet, perform the first-time Spectrum Control Base configuration as illustrated in **6.2, "Spectrum Control Base Edition first-time configuration" on page 76**:
  - Define the Spectrum Control fully qualified domain name and high availability group as shown in 6.2.1, "Define the fully qualified domain name and high availability group" on page 77.
  - Generate a server certificate as shown in 6.2.2, "Generate a server certificate" on page 78.
  - Set up VASA credentials as shown in 6.2.3, "Set up VASA credentials" on page 79.
  - Set up XIV credentials as shown in 6.2.4, "Set up storage credentials" on page 80.

Important: If you need to use IBM Storage Enhancements for vSphere Web Client in parallel with VVols, you must create an additional non-externally managed domain on XIV and use the same Storage Integration Administrator user as for VVols.

  - Add the XIV Storage System as shown in 6.2.5, "Add the XIV Storage System as a storage array" on page 81.
  - Add the vCenter server as shown in 6.2.6, "Add the vCenter server in Spectrum Control Base" on page 82.
  - Control the plug-in on vSphere Web Client as illustrated in 6.2.7, "Control IBM Storage Enhancements for vSphere Web Client plug-in on vCenter" on page 83.
  - Add Spectrum Control Base as storage provider in vSphere Web Client as illustrated in 6.2.8, "Add IBM Spectrum Control Base server as a storage provider on vCenter" on page 84.
- Perform the Spectrum Control Base Configuration for IBM Storage Enhancements for vSphere Web Client.
- Start using IBM Storage Enhancements for vSphere Web Client.

3.2 Spectrum Control Base Edition configuration for IBM Storage Enhancements for vSphere Web Client

Complete the steps in the subsections that follow.

3.2.1 Define a storage space

Within the Spectrum Control Base Edition server, a virtual storage is defined with a *storage service* and a *storage space*. Therefore, you must first complete the following steps to define a storage space:

1. Click the **Settings** button, and then click **Add new Space** to add a storage space to Spectrum Control, as shown in Figure 3-1.

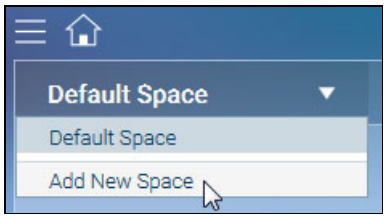

Figure 3-1 Calling the Add New Space form

2. Provide a name for your new storage space and click **APPLY** as shown in Figure 3-2.

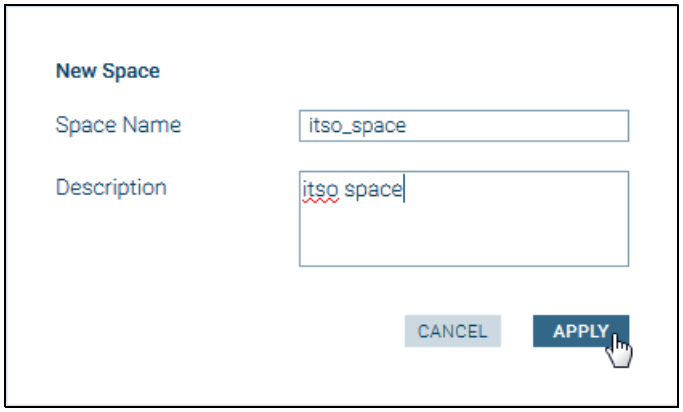

Figure 3-2 Adding a storage space

The Spectrum Control GUI automatically brings you to this newly created storage space.

3.2.2 Configure a storage service

Now that storage space is defined, a storage service must be configured. A storage service is the combination of storage resources and associated user-defined policies, such as encryption and thin provisioning. Complete the following steps to add a service to the newly created storage space:

1. From the newly created storage space, click the **+** icon next to the Services pane, as shown in Figure 3-3.

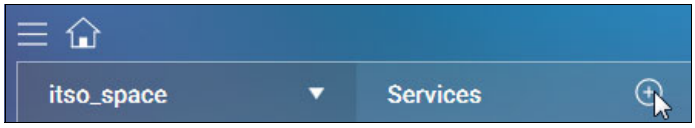

Figure 3-3 Calling the Add New Service form

2. When the New Service form opens, complete it as shown in Figure 3-4. Specify features fulfilled by this service according to your needs.

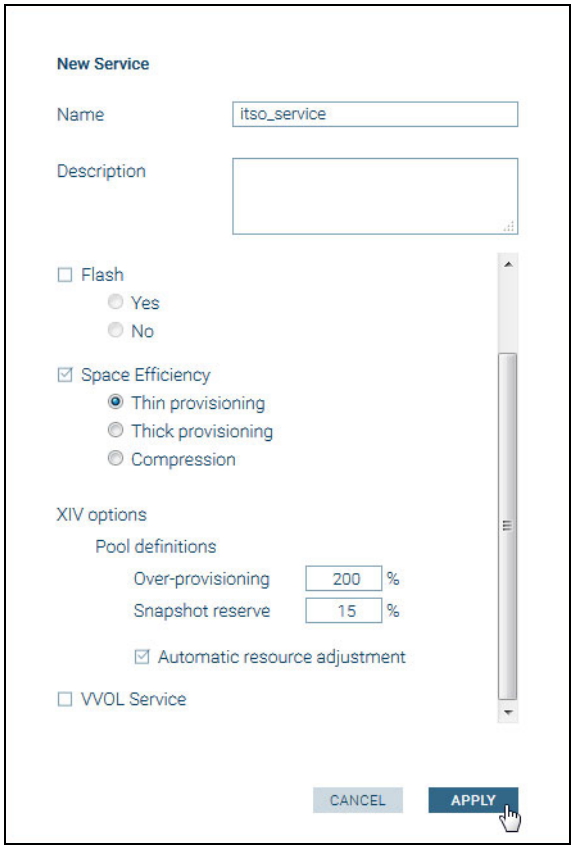

Figure 3-4 Adding a service

The service now appears in the newly created space, as shown in Figure 3-5.

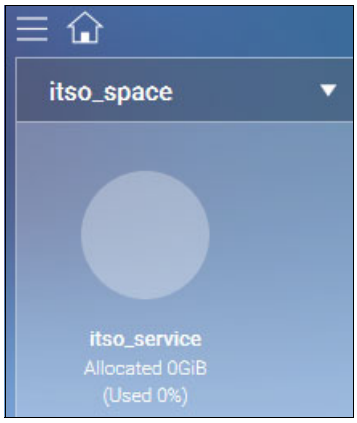

Figure 3-5 New service added

3.2.3 Add a storage resource

Complete the following steps to add a storage resource for this service:

1. Click the service, and, in the Storage Systems pane, click the **Edit** button at the top of the storage system (IBM XIV Storage System attached), and then select **Modify** as shown in Figure 3-6.

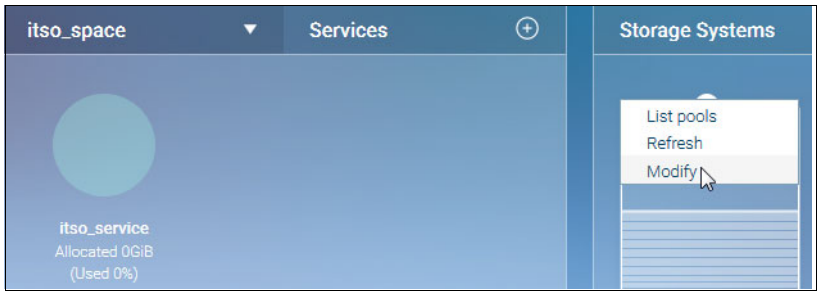

Figure 3-6 Modify storage resources

2. Enter the appropriate details to generate a new storage resource, as shown in Figure 3-7. Click **ADD** to create a storage pool on the XIV and attached to the service.

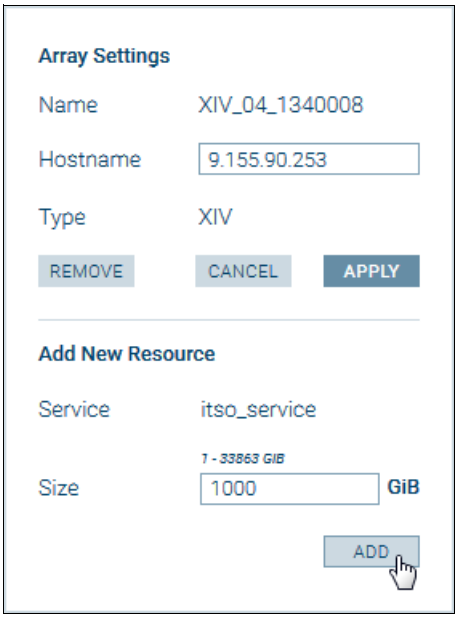

Figure 3-7 Add new storage resource

3. Click the left arrow navigation pointer, as shown in Figure 3-8.

Figure 3-8 Opening Spectrum Control Base Configuration pane

4. Select the vCenter and the added service to attach the service to vCenter as illustrated in Figure 3-9.

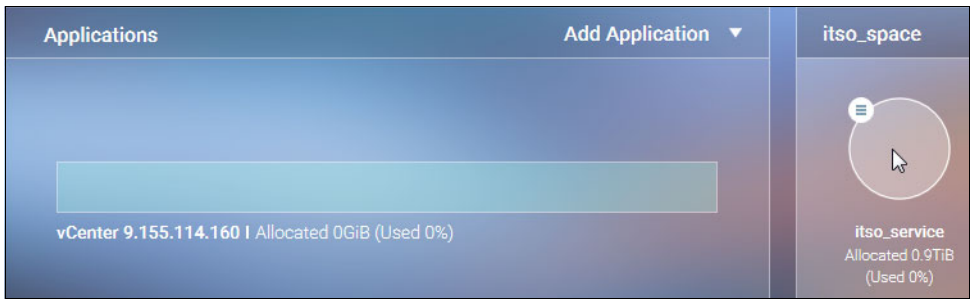

Figure 3-9 Service attachment to vCenter

5. Click **OK** to confirm the service attachment, as shown in Figure 3-10.

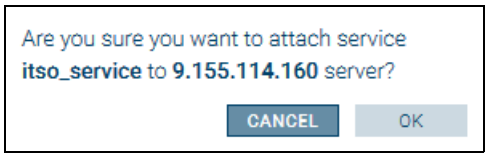

Figure 3-10 Service attachment confirmation

3.3 Using IBM Storage Enhancements for vSphere Web Client

This section explains how to use the IBM Storage Enhancements for vSphere Web Client.

3.3.1 Review available storage enhancements

1. Open vSphere Web Client and select **Home** → **Storage**, select your datacenter, click **Action**, and then select **All IBM Storage Enhancements for VMware vSphere Web Client Actions** → **Create New Volume**, as depicted in Figure 3-11, to create a new volume.

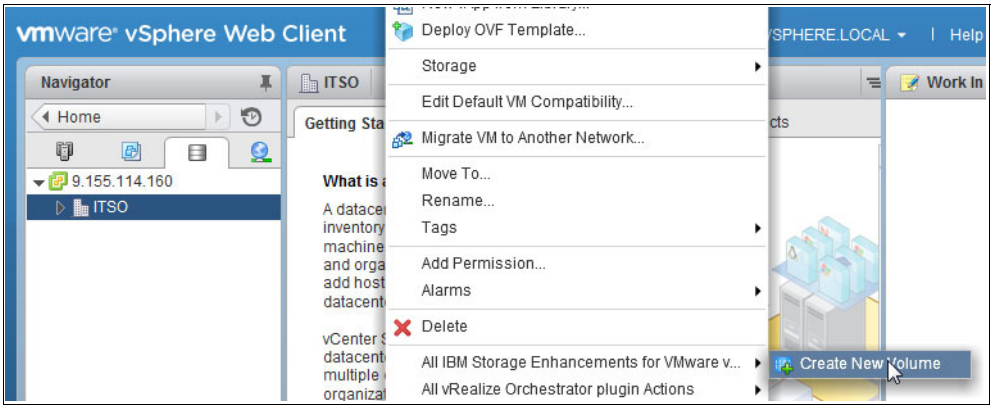

Figure 3-11 The IBM Storage Enhancements for VMware vSphere Web Client plug-in

2. When the Create New Volume window opens, the Storage System/Pool drop-down menu lists the storage pools that were configured. Select your host, size, and amount of the volumes, the pool, a name, and click **OK**,as shown in Figure 3-12.

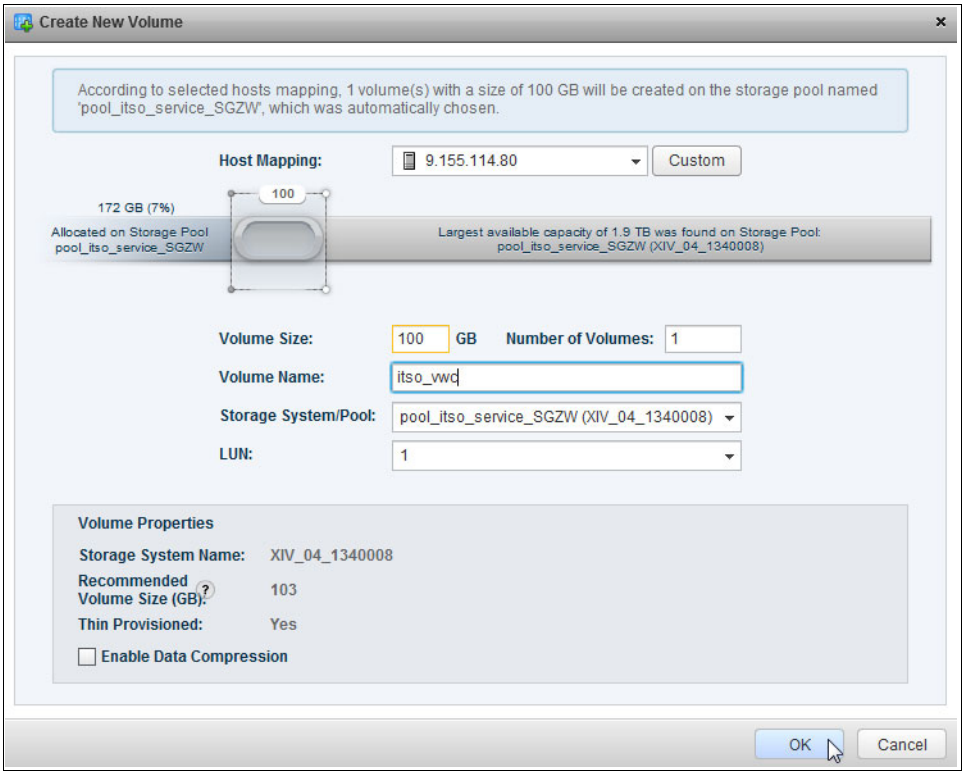

Figure 3-12 Creating a new XIV volume with the Web Client plug-in

Figure 3-13 shows the new XIV volume that is created and mapped to the ESXi host in vSphere Web Client.

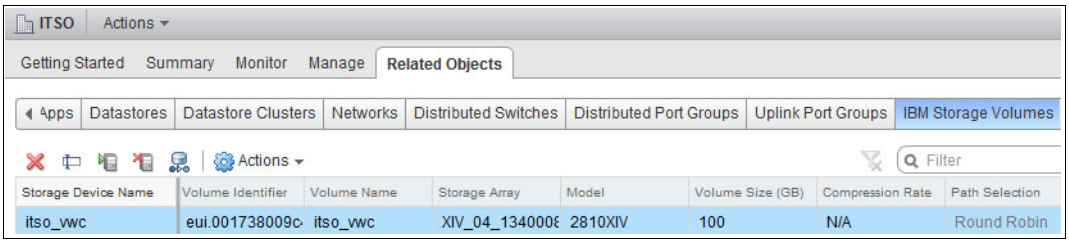

Figure 3-13 An XIV volume that is created and mapped from the vSphere Web Client

Important: This volume was created and mapped directly from the vSphere Web Client, without the need to access the XIV Storage System GUI or CLI directly.

3.3.2 Additional storage control and monitoring options

The IBM Storage Enhancements for VMware vSphere Web Client plug-in provides additional rich storage control and monitoring capabilities, beyond simple volume creation and mapping. These capabilities are accessible through the IBM Storage Volumes section in the vSphere Web Client.

Select **Home** → **vCenter Inventory List** → **vCenter Servers**, double-click the vCenter server, select **IBM Storage Volumes** and the volume, and then click the **Summary** tab to see the summary. Figure 3-14 shows an example.

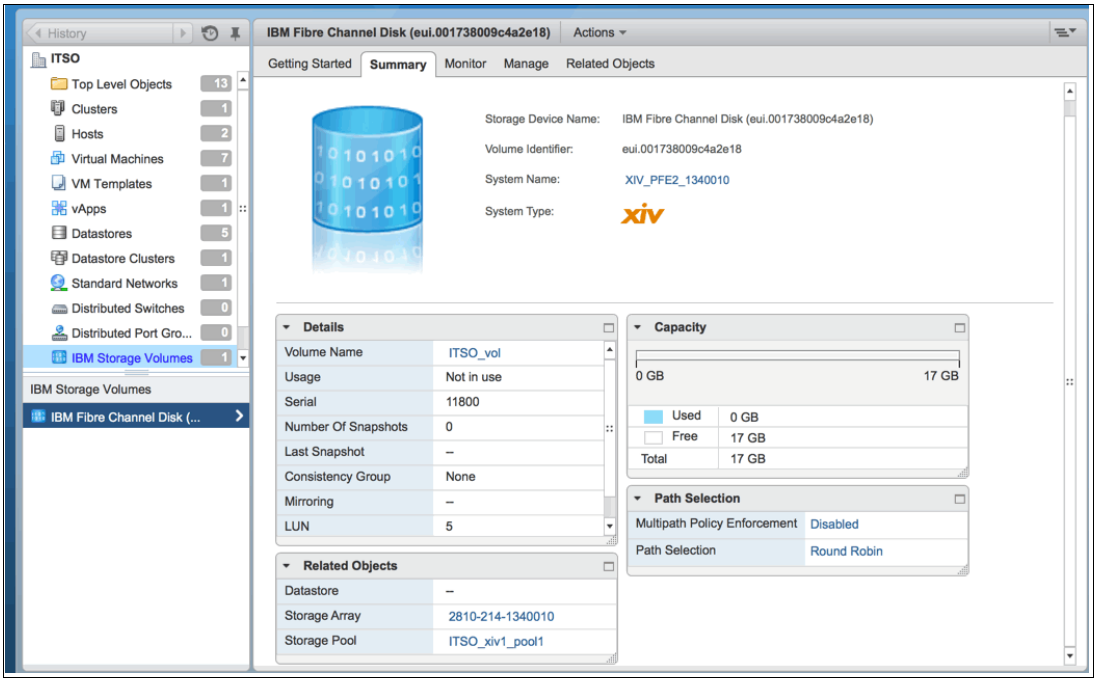

Figure 3-14 The Summary page for an IBM Storage Volume in the vSphere Web Client

Figure 3-15 illustrates the extra actions that the plug-in provides for XIV volumes.

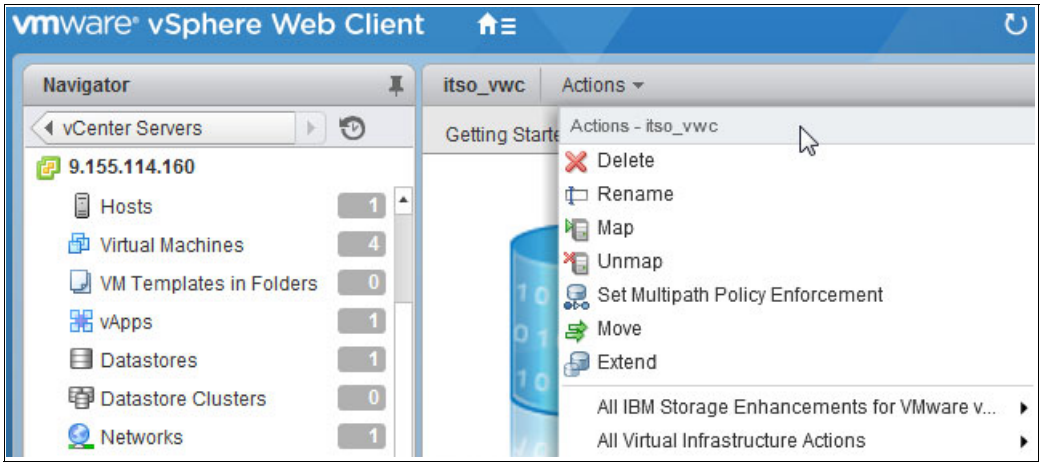

Figure 3-15 The available actions for an IBM Storage Volume in the vSphere Web Client

The IBM Storage Enhancements for VMware vSphere Web Client plug-in also provides a volume management page, where you can do the following tasks for an XIV volume:

- Adjust volume settings, such as volume name, multipath policy enforcement, and volume size.
- View and adjust storage pool settings and move volumes between pools.
- View and modify volume host mappings.

Figure 3-16 shows IBM Storage Pools section of the Manage page for an IBM Storage Volume in the vSphere Web Client.

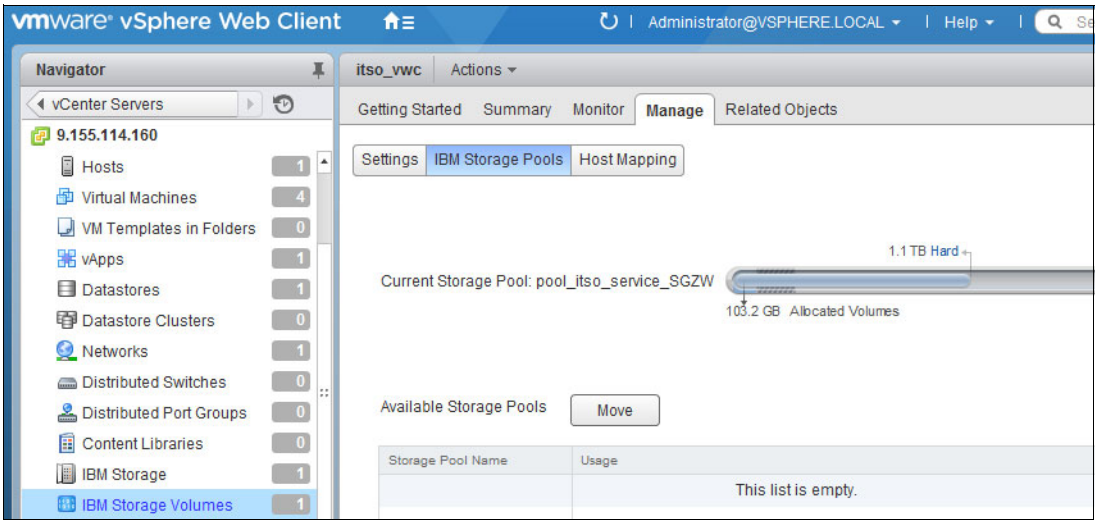

Figure 3-16 IBM Storage Pools on the Manage page in the vSphere Web Client

Figure 3-17 shows the Host Mapping section of the Manage page for an IBM Storage Volume in the vSphere Web Client.

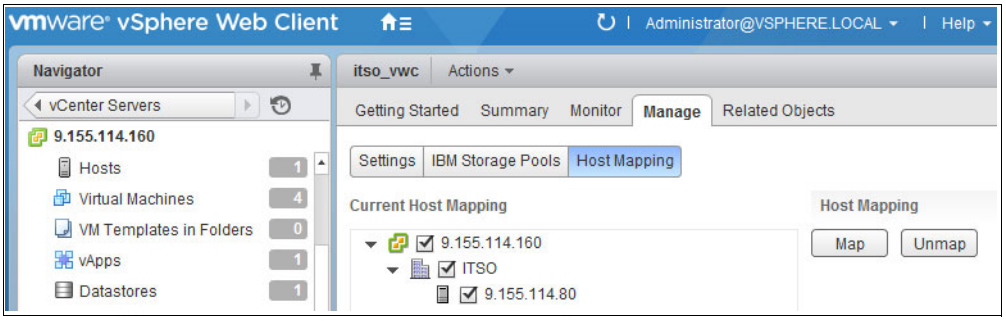

Figure 3-17 The Host Mapping section of the Manage page in the vSphere Web Client

4

VMware vCenter Operations Manager

This chapter describes the tasks performed by a storage and VMware administrator to configure IBM Spectrum Control Base Edition for vCenter Operations Manager (VCOps). It covers the following topics:

- Configuration of Spectrum Control Base server for VCOps
- Installation of the Storage Management Package on vCOps
- IBM XIV dashboards in vCOps

4.1 Configuration of Spectrum Control Base server for VCOps

The integration of IBM Spectrum Control Base Edition with VMware vCenter Operations Manager (vCOps) allows monitoring and analysis of XIV health, performance, and capacity. It can dynamically cope with policy-governed workflows to maintain SLAs.

1. To configure IBM Spectrum Control Base to work with vCOps, log on to Spectrum Control Base and click the right-arrow navigation pointer, as shown in Figure 4-1 to open the Monitoring pane.

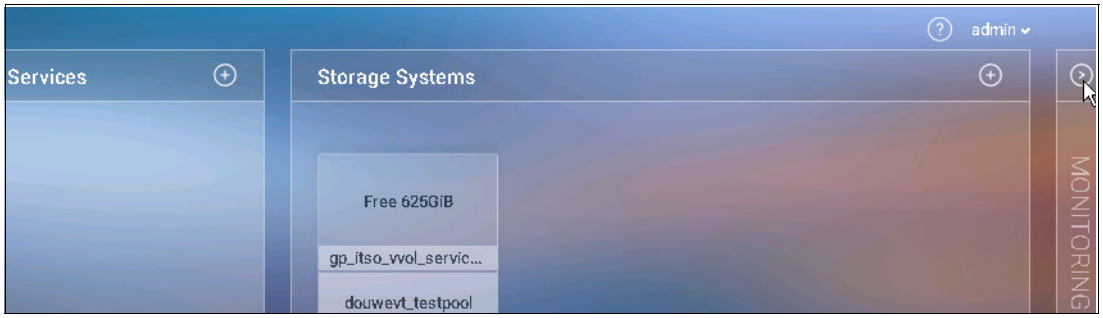

Figure 4-1 Open Monitoring pane

2. Click the **Edit** button as illustrated in Figure 4-2.

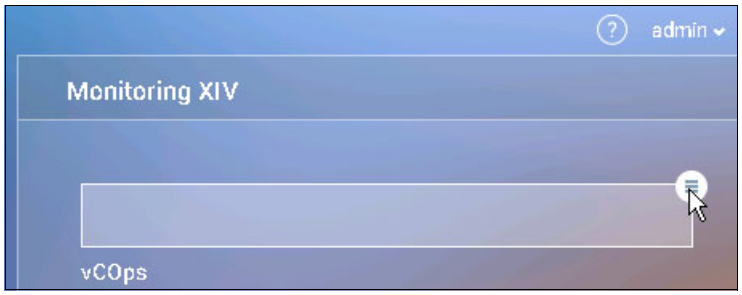

Figure 4-2 Edit vCOps in Spectrum Control Base

3. Click **Download PAK file**, as depicted in Figure 4-3, to download the PAK that contains XIV related dashboard for vCOps. Your browser prompts you to save the PAK file locally on your workstation.

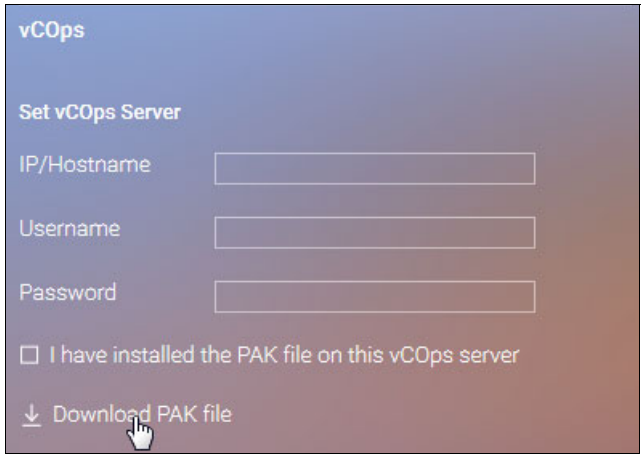

Figure 4-3 Downloading the IBM Spectrum Control Base PAK file for vCOps

4.2 Installation of the Storage Management Package on vCOps

1. Open the **Update** page as shown in Figure 4-4 of the vCOps administration GUI of your vCOps server:

   `https://vCOps_UI_IP_address/admin`

   Select the PAK file, and update vCOps. Then, accept the License Agreement to proceed.

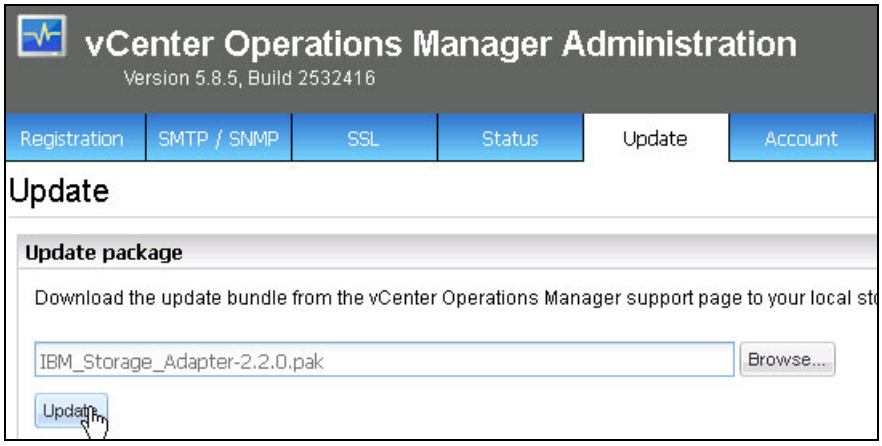

Figure 4-4 Update vCOps with the IBM Spectrum Control Base PAK file

2. Complete IP address and vCOps GUI credentials in Spectrum Control Base, select **I have installed the PAK file on this vCOps server**, and click **APPLY**, as illustrated in Figure 4-5.

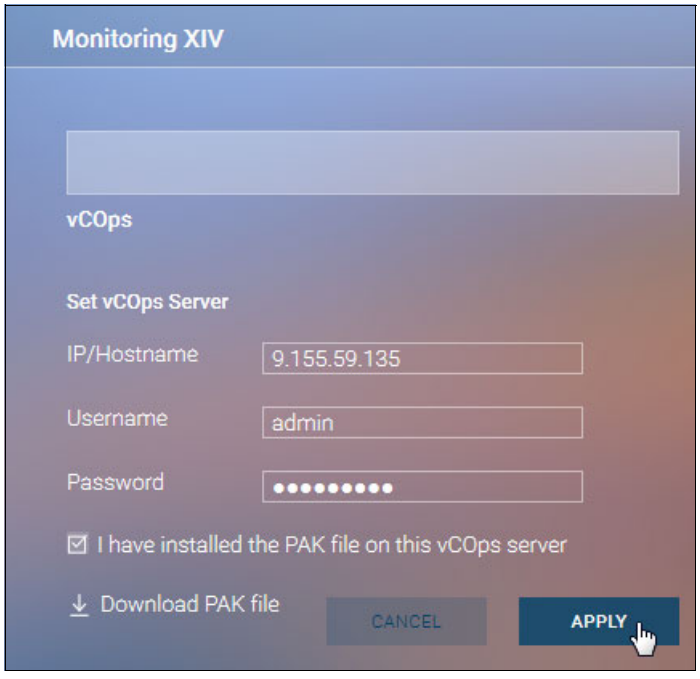

Figure 4-5 vCOps UI server definition in Spectrum Control Base

3. Click vCOps and click XIV to attach the XIV to the vCOps server, as shown in Figure 4-6.

Figure 4-6 Call XIV attach to vCOps server

4. Click **OK** to confirm the XIV attachment to the vCOps server, as depicted in Figure 4-7.

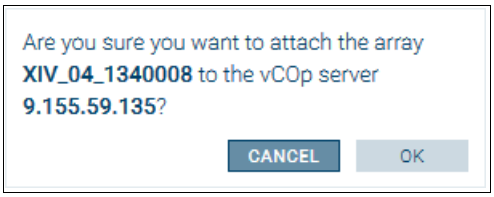

Figure 4-7 Confirmation of XIV attachment to vCOps server

4.3 IBM XIV dashboards in vCOps

After the PAK file is successfully installed on the vCOps server, the dashboards related to the IBM XIV system are visible in the vCOps custom GUI:

`https://vCOps_UI_IP_address/vcops-custom`

Figure 4-8 shows examples of the XIV dashboards.

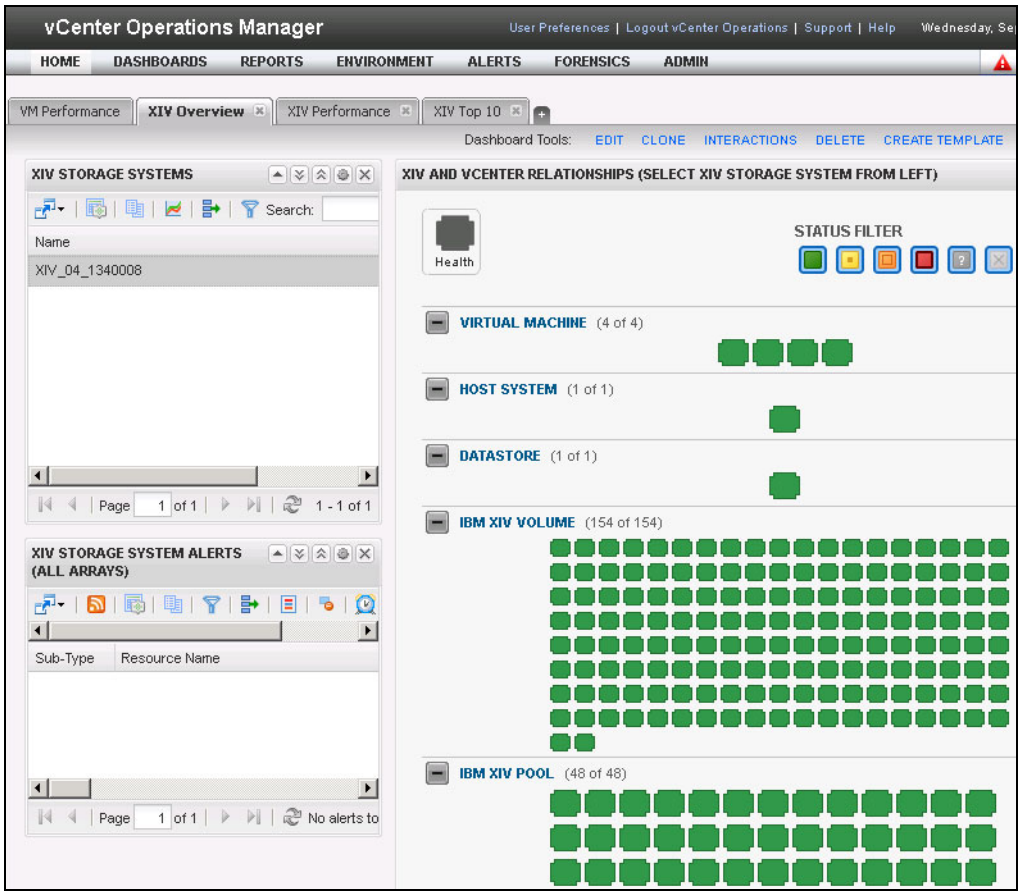

Figure 4-8 The XIV dashboard installed in vCOps GUI through IBM Spectrum Control Base PAK file

Three main dashboards are available for XIV storage arrays in vCOps:

- IBM XIV Top 10 includes the following charts, each with 10 entries:
  - Top 10 XIV volumes by IOPS (in the last hour)
  - Top 10 XIV volumes by IOPS (in the 24 hours)
  - Top 10 XIV volumes by throughput (in the last hour)
  - Top 10 XIV volumes by throughput (in the 24 hours)
  - Top 10 XIV hosts by IOPS (in the last hour)
  - Top 10 XIV hosts by IOPS (in the 24 hours)
  - Top 10 XIV hosts by throughput (in the last hour)
  - Top 10 XIV hosts by throughput (in the 24 hours)
- IBM XIV Overview provides clickable icons that represent relationships among all virtual elements and storage elements that are in use.
- IBM XIV Performance provides performance information about the graphical elements that you can click.

5

Spectrum Control configuration for vCenter Orchestrator

This chapter describes the tasks performed by a storage and VMware administrator to configure IBM Spectrum Control Base for vCenter Orchestrator (vCO). It covers the following topics:

- Configuration of Spectrum Control Base Server for vCO
- Running XIV workflows in vCO

5.1 Configuration of Spectrum Control Base Server for vCO

You can use the vCenter Orchestrator (vCO) server to create workflows for VMware environments that further automate administrative actions and prevent inconsistent configurations, which allows for more self-service functions. vCO integration through IBM Spectrum Control Base provides the ability to create, extend, map, unmap, and delete volumes on the XIV without any VMware or storage administrator actions.

At the time of writing this Redbooks publication, only vCO 5.1.x and 5.5.x are supported. However, these vCO versions are not supported by VMware for vSphere 6, so the plug-in for vCO can only be used in vSphere 5.1.x and vSphere 5.5.x environments.

The following assumptions are made in this illustration:

- You have an installed, configured, and started vCO server/application.
- You have an installed instance of IBM Spectrum Control Base Edition.

> **Important:** Replace the self-signed certificate and key that comes with the default IBM Spectrum Control Base Edition by either generating a new certificate and key file on the Spectrum Control Base itself or by using an externally generated certificate and key file.

1. Click the left-arrow navigation pointer, as shown in Figure 5-1.

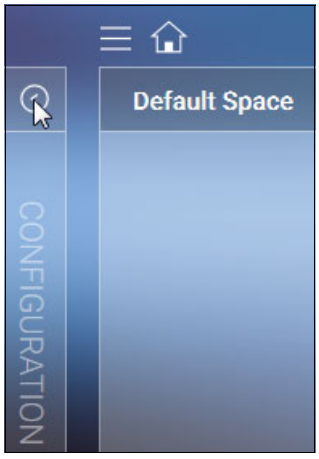

Figure 5-1 Opening Spectrum Control Base Configuration pane

2. Click **Add Application** and select **Add vCO**, as shown in Figure 5-2.

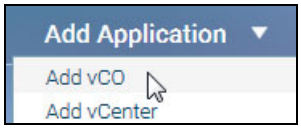

Figure 5-2 Add vCO

3. Click **OK** to confirm creation of the vCO application, as shown in Figure 5-3.

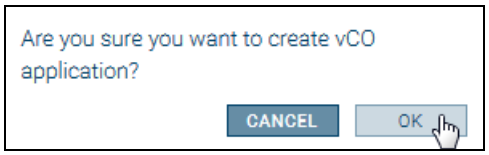

Figure 5-3 Confirmation of vCO application creation

4. Select **vCO** and click th **Edit** button, as depicted in Figure 5-4.

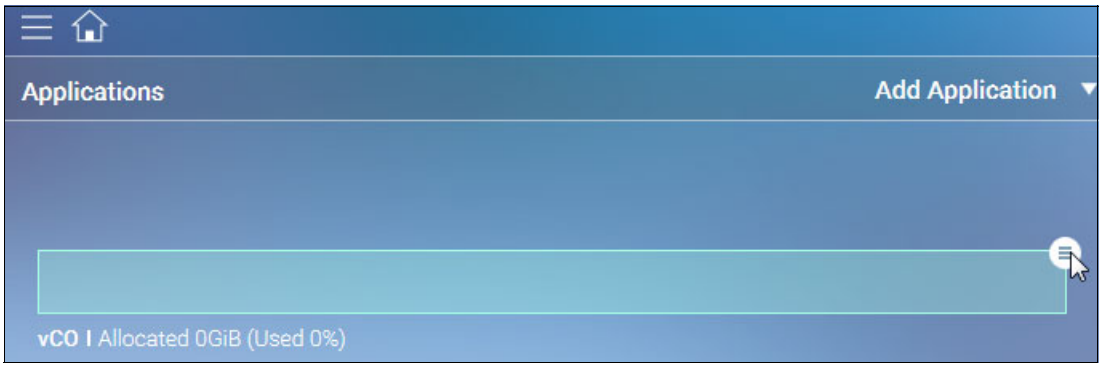

Figure 5-4 Edit vCO properties

5. Download the plug-in package for vCO from the vCO tab in IBM Spectrum Control Base, as shown in Figure 5-5.

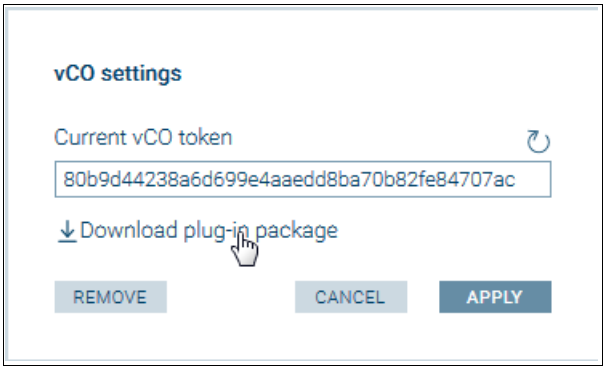

Figure 5-5 Download the plug-in package from IBM Spectrum Control Base

6. Go to the vCO configuration web interface:

```
https://vCenter-IP-address:8283
```

Select the **Install Application** tab from the General section. Select the plug-in file and click **Install**, as shown in Figure 5-6, afterward accept the license agreement.

Figure 5-6 Install the IBM Spectrum Control Base plug-in

After the plug-in installs successfully, the new plug-in Information window opens, as shown as in Figure 5-7.

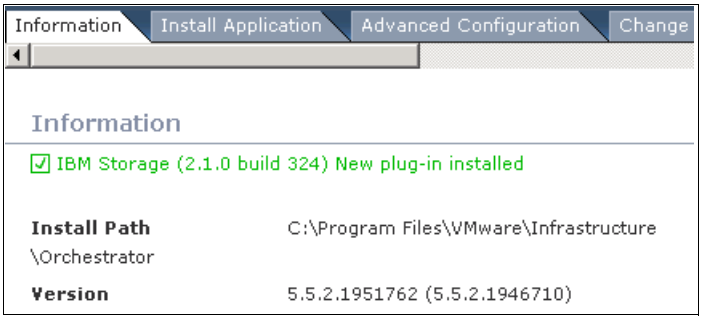

Figure 5-7 Successfully installed plug-in

Additional steps are necessary to use the IBM storage plug-in with vCO.

7. Select **Network** and the **SSL Trust Manager** tab, complete the IP address and port of Spectrum Control Base server, and click **Import**, as shown in Figure 5-8.

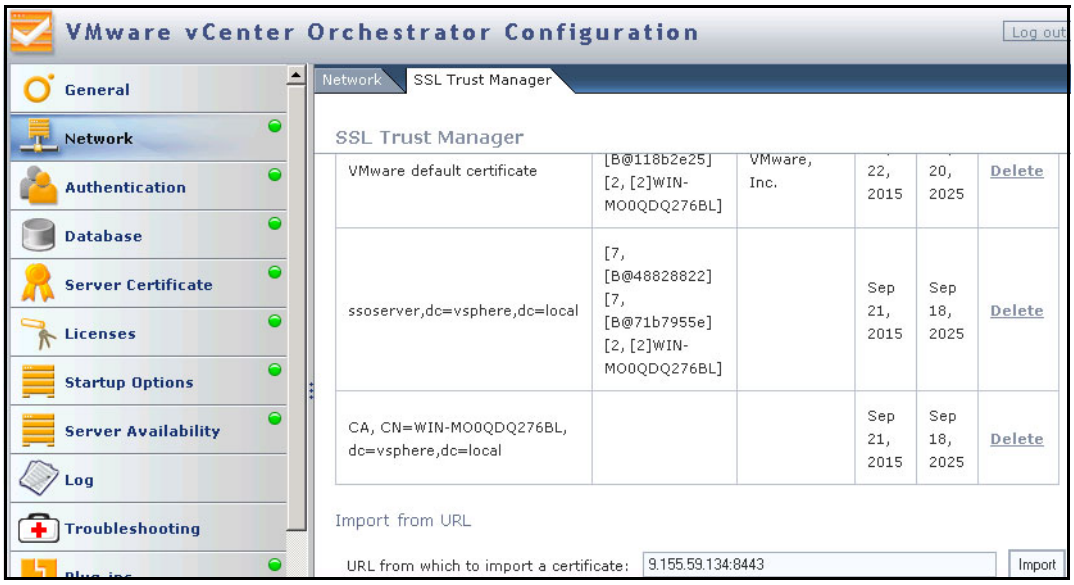

Figure 5-8 Call Import Spectrum Control Base Certificate

8. Click **Import** to import the certificate into vCO, as depicted in Figure 5-9.

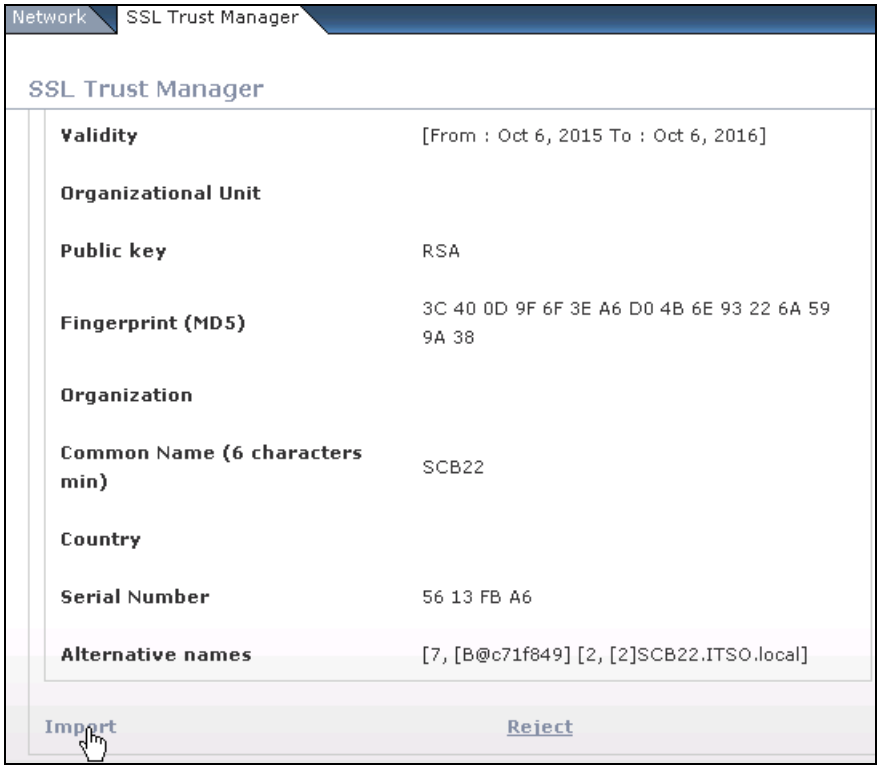

Figure 5-9 Import Spectrum Control Base Certificate

9. Select the **SSH** tab and click **New Connection**, as shown in Figure 5-10.

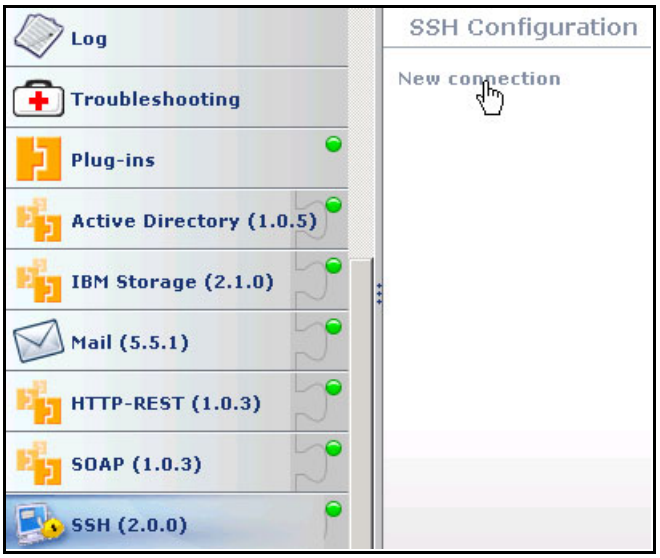

Figure 5-10 Call New SSH connection to Spectrum Control Base

10. Complete the IP address of the Spectrum Control Base server and click **Apply changes**, as shown in Figure 5-11.

Figure 5-11 vCO SSH configuration

11. Now, you must link vCO to IBM Spectrum Control Base system. To do so, find the newly created IBM Storage plug-in section to finish the configuration, as shown in Figure 5-12.

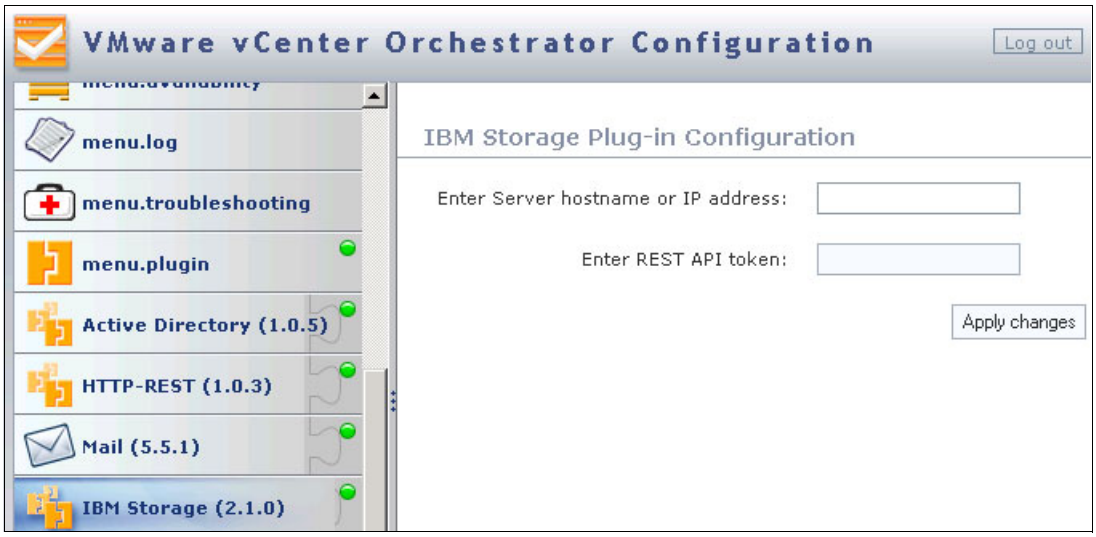

Figure 5-12 IBM Storage plug-in configuration window

12. Obtain a token from the IBM Spectrum Control Base web interface to give to the IBM storage vCO plug-in by clicking the gear icon, as shown in Figure 5-13.

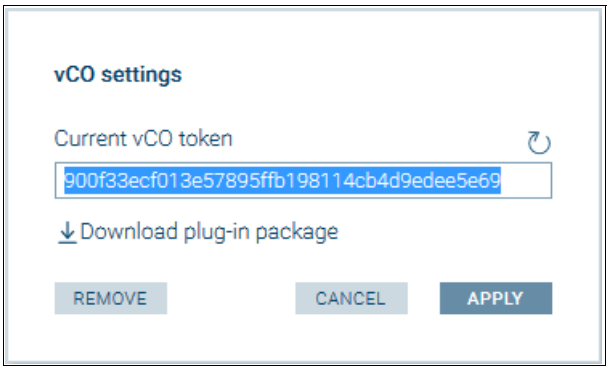

Figure 5-13 vCO token generation

13. After the token is generated, enter it into the IBM Storage Plug-in Configuration window (Figure 5-14) in the vCO web interface, along with the IP address of IBM Spectrum Control Base from which the token was generated. Then, click **Apply changes**.

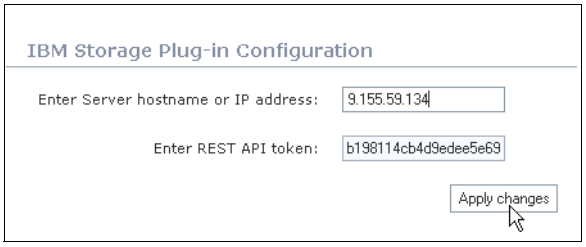

Figure 5-14 Configuring the plug-in for vCO to talk to IBM Spectrum Control Base

14. From IBM Spectrum Control Base web interface, you can now attach a service from the target XIV to be managed also by vCO or managed by vCO only. Click vCO and click the service, as shown in Figure 5-15. For more details about the creation of services, see 3.1, “vSphere Web Client illustration” on page 48.

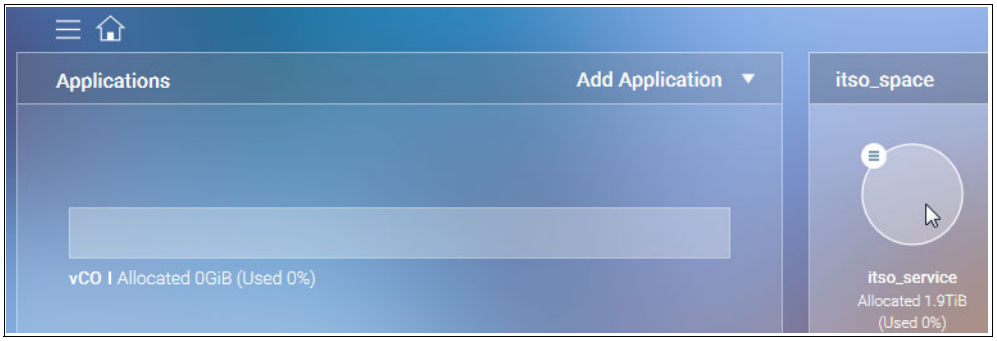

Figure 5-15 Attach service to vCO

15. Click **OK** to confirm the attachment,as displayed in Figure 5-16.

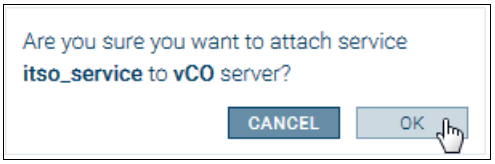

Figure 5-16 Confirmation of service attachment

16. After the installation and configuration has finished, verify the settings from the VMware vCO client, as shown in Figure 5-17.

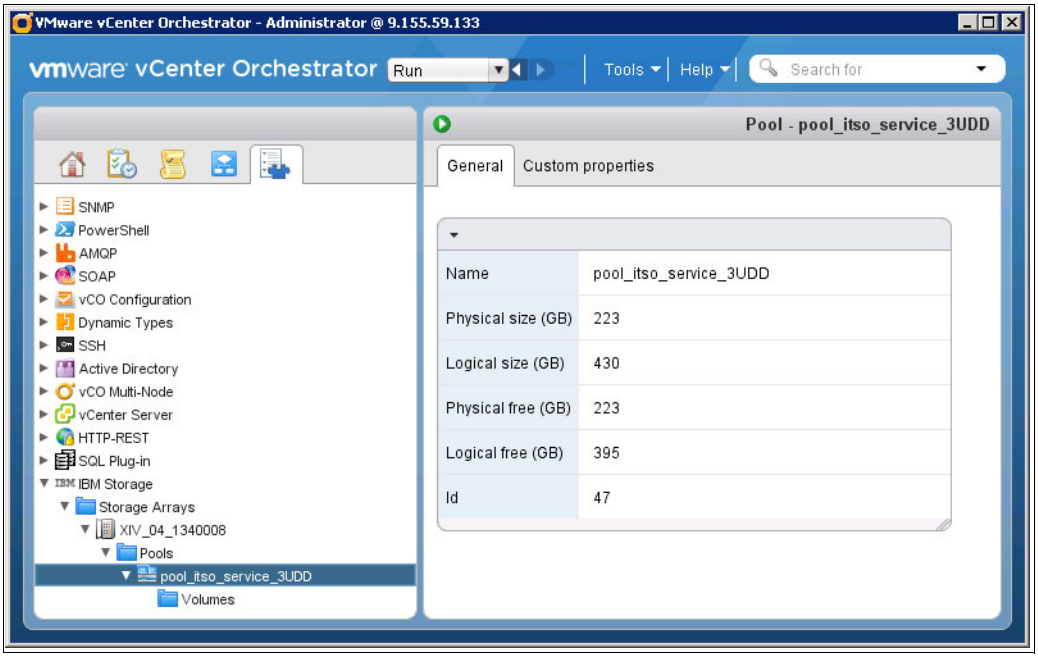

Figure 5-17 vCO client

As Figure 5-18 shows, the library is now populated with IBM specific workflows that you can use to create, delete, extend, map, and unmap XIV volumes in VMware.

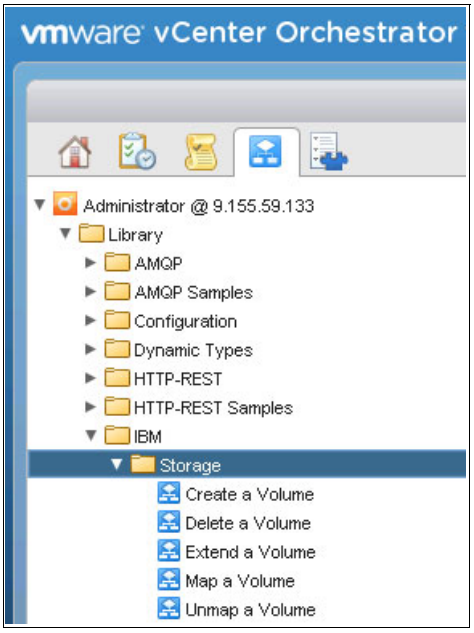

Figure 5-18 IBM Spectrum Control Base vCO workflows added to the library for use

5.2 Running workflows in vCO

There are five default workflows that come with IBM Spectrum Control Base vCO integration:

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

Any of these workflows can be used to run the named operations. A more complex workflow can be created by using these workflows together, for example, “Create a volume” with “Map a volume” and “Add datastore on iSCSI/FC/local SCSI” to allow creating, mapping, and preparing a volume for a VMware ESX cluster.

Figure 5-19 and Figure 5-20 illustrate a basic workflow example.

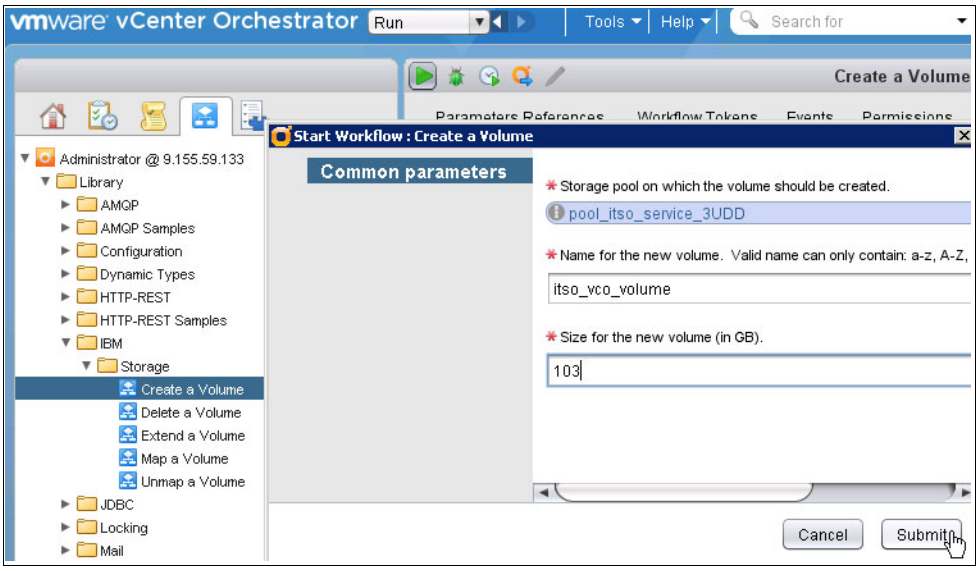

Figure 5-19 Running “Create a volume workflow”

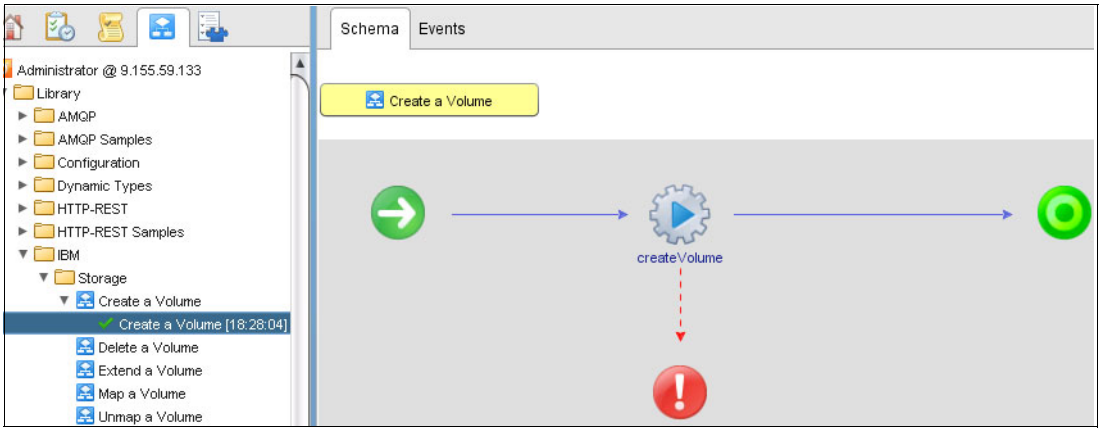

Figure 5-20 Completed workflow for “Create a volume”

6

IBM Spectrum Control Base Edition software

This chapter introduces the IBM Spectrum Control Base Edition software and is divided into the following sections:

- IBM Spectrum Control Base Edition overview
- Spectrum Control Base Edition first-time configuration

6.1 IBM Spectrum Control Base Edition overview

IBM Spectrum Control Base Edition is a centralized server system that consolidates a range of IBM storage provisioning, automation, and monitoring solutions through a unified server platform. IBM Spectrum Control Base Edition is an improved and enhanced version of the IBM Storage Integration Server solution. It provides a single-server backend location and enables centralized management of IBM storage resources for different virtualization and cloud platforms.

Spectrum Control Base Edition facilitates the integration of IBM Storage System resources by using options with supported independent software vendor (ISV) platforms and frameworks. It provides a foundation for integration with IBM systems and ISV solutions.

Figure 6-1 shows a conceptual diagram of the consolidation that Spectrum Control Base Edition enables. Keep in mind that it is a conceptual diagram, with VMware vSphere as the only currently supported target environment.

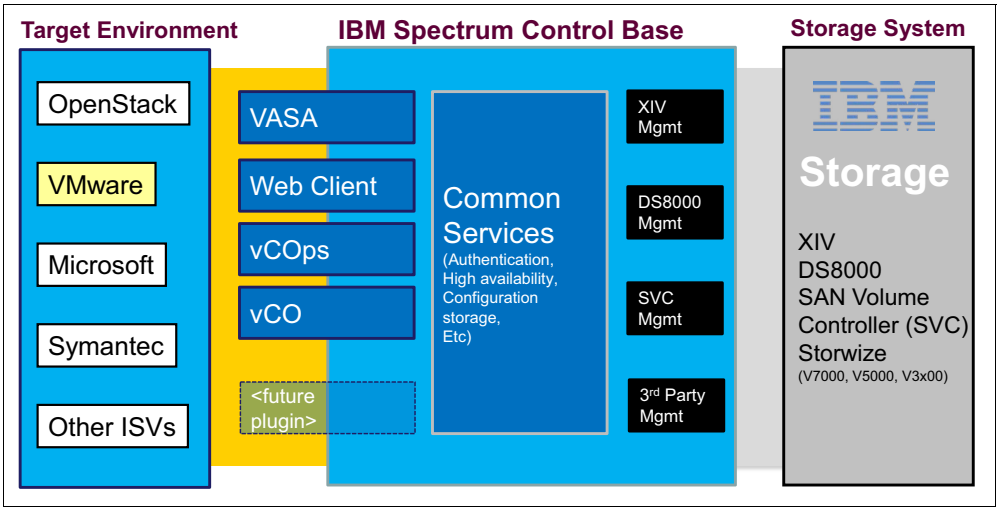

Figure 6-1 IBM Spectrum Control Base Edition concept

6.1.1 IBM Spectrum Control Base Edition management

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

The storage administrator uses Spectrum Control Base Edition resources to control preferred IBM storage systems for use in the VMware environment. The administrator also controls the specific vCenter servers that can use the IBM storage resources.

Within the VMware vSphere Web Client, administrators can create, map, and have complete control of storage volumes on the available storage systems and storage pools, defined by the IBM XIV storage administrator.

In parallel, Spectrum Control Base allows registered VMware vCenter servers to connect and use its vSphere APIs for Storage Awareness (VASA), VMware vCenter Operations Manager (vCOps), and VMware vCenter Orchestrator (vCO) API functions.

6.1.2 IBM Spectrum Control Base Edition advantages

The diagram in Figure 6-2 shows how Spectrum Control Base acts as a middle layer between the VMware environment and the XIV Storage System, thereby consolidating and reducing the VMware components generated requests against the storage system.

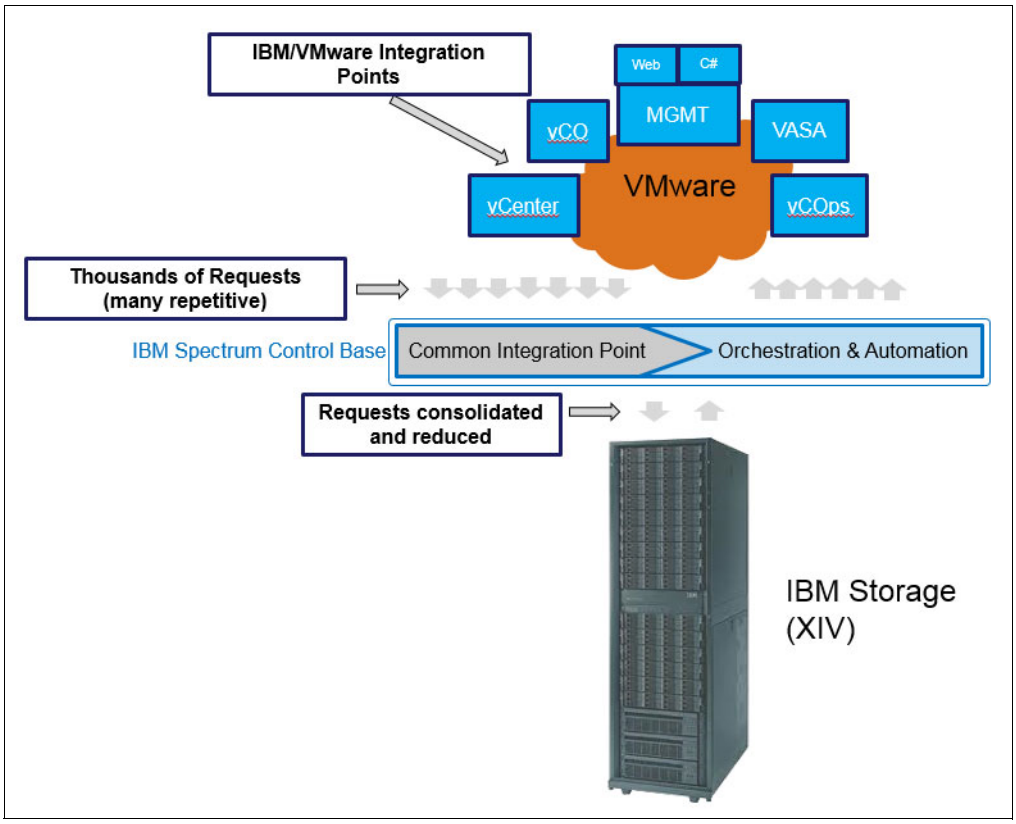

Figure 6-2 XIV and VMware Integration with IBM Spectrum Control Base Edition

As previously noted, there are many integration points in VMware, including vCenter, vCO, management capabilities in both traditional vSphere Client and vSphere Web Client, VASA, vCOps. Those various VMware entities generate thousands of requests against the storage system, for gathering the information that they need. Moreover, these various entities are requesting the same information again and again from the storage system.

This approach, with many redundant requests against the storage system, does not scale well in very large environments, with multiple virtual centers. In large environments (several thousands of ESX hosts), those many requests cannot be handled in a timely fashion. For example, when using the IBM Storage Enhancements for vSphere Web Client in such large environments, the time spent to refresh that agent (plug-in) can be 30 minutes easily, or even up to one hour for very large sites. Using the traditional approach of having an agent (in this case, the vCenter plug-in) poll the storage system for each vCenter or ESX host is what causes the long refresh time.

With Spectrum Control Base, you get a control layer that will fetch the information from XIV, and cache that information. All the repetitive requests, from the VMware components can now be served from that middle tier. All of the orchestration and integration is happening through that cached server, and it can provide the requested information to the layer above without hammering the XIV. This capability is particularly important for vCOps, which is sending many thousands of commands for information to XIV, monitoring the health of the system and volumes and how they relate to VMware, and also gathering performance data.

Spectrum Control Base runs as a host application under Linux, with minimum requirements and a straightforward installation and configuration process. The configuration process is illustrated later. VMware vCenter Appliances (vCSA) 5.5 or later support VASA, so you do not need to use a Windows based vCenter server.

Where to find more information:

- See the “Compatibility and requirements” topic in the IBM Spectrum Control Base Edition section of the IBM Knowledge Center:

  http://ibm.co/1RKFgI3

- For information about extracting and installing the IBM Spectrum Control Base Edition software package, see “Installation” in the IBM Spectrum Control Base Edition section of the IBM Knowledge Center:

  http://ibm.co/1QDiXD6

6.2 Spectrum Control Base Edition first-time configuration

The following steps are necessary for a first-time configuration:

1. Define the Spectrum Control Base Edition fully qualified domain name and high availability group.
2. Generate a server certificate.
3. Set up VASA credentials.
4. Set up storage credentials.
5. Add the XIV Storage System as a storage array.
6. Add vCenter server to IBM Spectrum Control Base Edition.
7. Control IBM Storage Enhancements for vSphere Web Client plug-in on vCenter.
8. Add IBM Spectrum Control Base server as a storage provider on vCenter.

First, log in to the IBM Spectrum Control web interface:

`https://IBM_Spectrum_Control_IP_address:8443`

Then, enter the default login credentials of user *admin* and password `admin1!` and click **SIGN IN**, as shown in Figure 6-3.

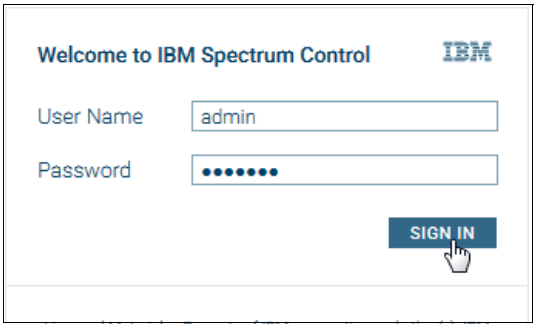

Figure 6-3 Log in to the IBM Spectrum Control user interface

The Spectrum Control Base Edition GUI consists of these four panes:

Applications	Integration with vCenter and vCO servers.
Spaces/Services	Handling storage spaces and services
Storage Systems	Management of storage systems and storage resources
Monitoring	Integration with vCOps server

After successful login, the Spaces/Services and Storage Systems panes are displayed. In the upper-left and upper-right are the Navigation arrows **< >** to navigate to the **Applications** or **Monitoring** panes.

Tip: For security reasons, change the password after first login. Follow the procedures explained in the “GUI – Changing the password of a Spectrum Control Base use” topic in IBM Knowledge Center:

`http://tiny.cc/uhwy5x`

The sections that follow guide you through the necessary steps.

6.2.1 Define the fully qualified domain name and high availability group

Complete the following steps to define Spectrum Control Base Edition fully qualified domain name and high availability group:

1. In the upper-left corner, you’ll find the Settings and the Home icons shown in Figure 6-4.

Figure 6-4 Settings and Home icons

2. To configure the Spectrum Control fully qualified domain name, click the **Settings** button, and then select **General settings** as shown in Figure 6-5.

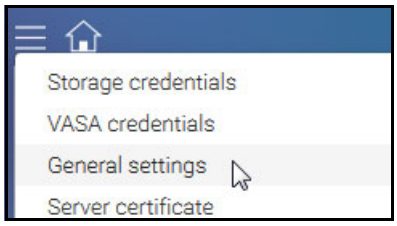

Figure 6-5 Opening the General settings form

3. Complete the General settings form shown in Figure 6-6 with the following parameters:

   FDQN Fully domain qualified name of the Spectrum Control server

   HA GROUP High availability group containing this Spectrum Control server

   The first defined Spectrum Control Base server within a HA group is the active server. The second one is the standby.

   For more information about the high availability feature, see the *IBM Spectrum Control Base User Guide*, which is provided when you download IBM Spectrum Control Base Edition from IBM Fix Central:

   `http://www.ibm.com/support/fixcentral/`

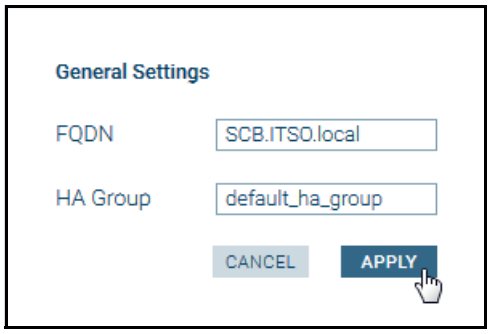

Figure 6-6 Filling general settings form

6.2.2 Generate a server certificate

1. To verify whether a certificate needs to be generated for this Spectrum Control server, click the **Settings Icon**, and then click **Server certificate**, as shown in Figure 6-7.

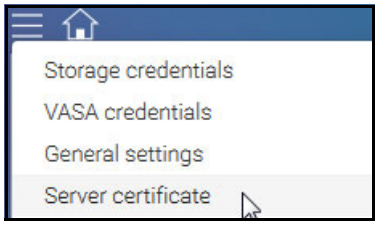

Figure 6-7 Opening the “Server certificate” form

2. A certificate similar to the one shown in Figure 6-8 normally already exists and is valid from the date of your configuration.

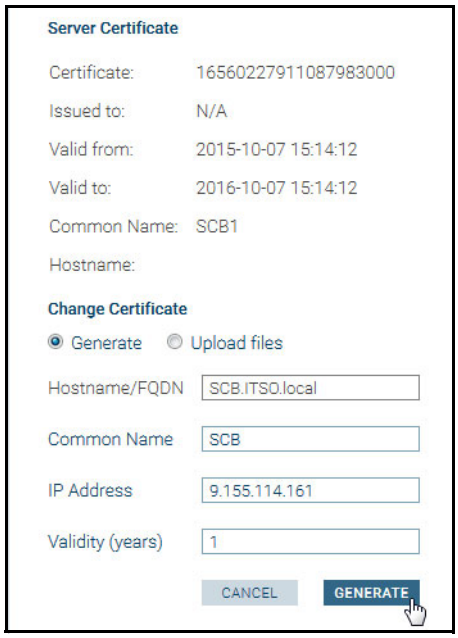

Figure 6-8 Generating a server certificate

3. Regardless, it is required to regenerate the certificate so that the FDQN previously generated is integrated in the certificate. Complete the fields on the form and click **GENERATE**.
4. After the certificate is generated, click **OK** to reload the web page again, as shown in Figure 6-9. Confirm the security exceptions in your browser afterward.

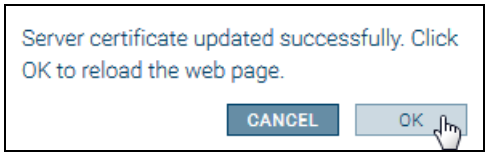

Figure 6-9 Reload the web page

6.2.3 Set up VASA credentials

Complete the following steps to configure VASA credentials in Spectrum Control Base Edition:

1. Click the **Settings icon**, and then select **VASA credentials** to set up the VASA credentials in Spectrum Control, as shown in Figure 6-10.

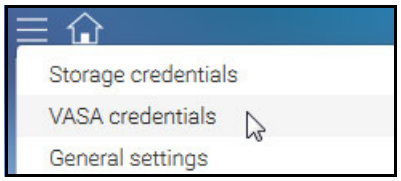

Figure 6-10 Opening the VASA credentials form

2. When the VASA credentials form opens, complete the credentials fields, and click **APPLY**, as illustrated in Figure 6-11. The credentials are used to register Spectrum Control Base as a storage provider at vCenter.

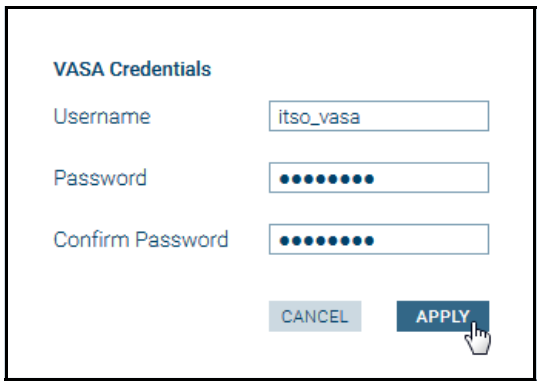

Figure 6-11 Creating VASA credentials

6.2.4 Set up storage credentials

Complete the following steps to configure your XIV credentials in Spectrum Control Base Edition:

1. Click the **Settings** icon, and then select **Storage Credentials**, as shown in Figure 6-12.

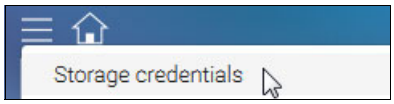

Figure 6-12 Opening the storage credentials form

2. Set the storage credentials, which must be common to all of the storage devices that will be connected to your Spectrum Control Base server and have been already created on XIV. Then, click **APPLY**, as shown in Figure 6-13.

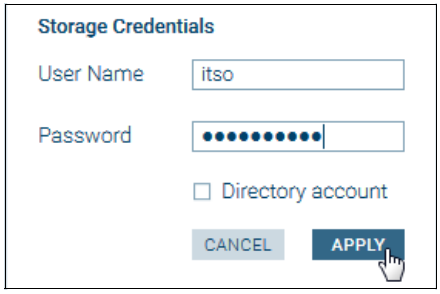

Figure 6-13 Providing IBM XIV Storage credentials on Spectrum Control Base server

Important information

- The storage credentials must be common to all the storage devices that will be connected to your Spectrum Control Base server.
- By using only IBM Storage Enhancements for vSphere Web Client, it is sufficient to run with a Storage Administrator user role and without domains.
- But as a preferred practice, use the Storage Integration Administrator user role, which is assigned to one or more domains. Doing so prevents unintentional interference with other users using the same XIV.
- If VVols are required, you must use Storage Integration Administrator user role and domains.

6.2.5 Add the XIV Storage System as a storage array

Complete the following steps to add your IBM XIV to Spectrum Control:

1. Click the **+** (plus sign) icon next to the **Storage Systems** pane to add your XIV to Spectrum Control, as shown in Figure 6-14.

Figure 6-14 Opening the Add New Array form

2. Complete the **Add New Array** form, specifying your XIV IP address or host name, as shown in Figure 6-15. Then, click **ADD.**

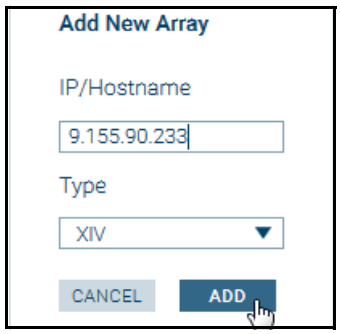

Figure 6-15 Adding your IBM XIV as a storage array

3. The XIV system is displayed in the Storage System pane depicted in Figure 6-16.

Figure 6-16 XIV successfully added to the Spectrum Control Base server as a storage array

6.2.6 Add the vCenter server in Spectrum Control Base

Complete the following steps to add the vCenter Server to Spectrum Control:

1. Click the left-pointing navigation arrow, as shown in Figure 6-17.

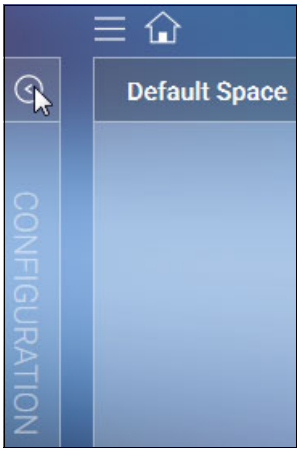

Figure 6-17 Opening Spectrum Control Base Configuration pane

2. Click **Add Application** and select **Add vCenter** as shown in Figure 6-18.

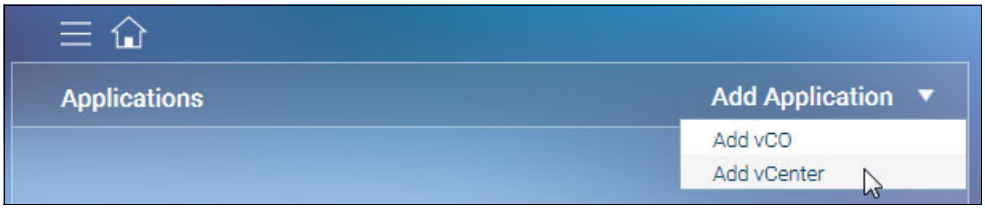

Figure 6-18 Calling Add vCenter

3. Enter the appropriate IP address and credentials as depicted in Figure 6-19, and then click **APPLY**.

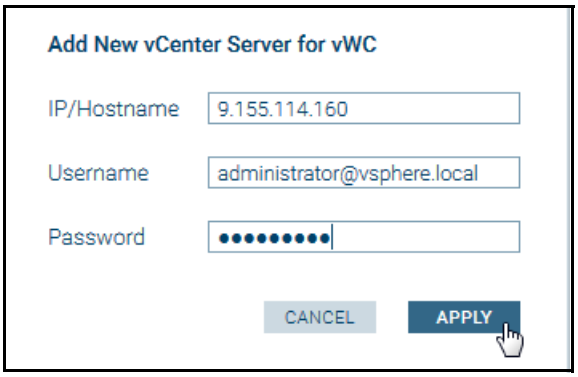

Figure 6-19 Adding a vCenter

4. The vCenter now appears in Applications, as shown in Figure 6-20.

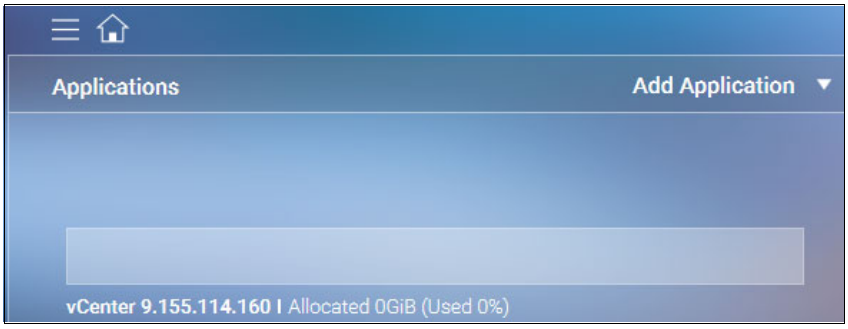

Figure 6-20 Created vCenter

When a vCenter Server is added to Spectrum Control Base, it automatically deploys the IBM Storage Enhancements for VMware vSphere Web Client plug-in to the vSphere Web Client.

6.2.7 Control IBM Storage Enhancements for vSphere Web Client plug-in on vCenter

Complete the following steps to confirm that the plug-in was successfully deployed and enabled in vSphere.

1. To log in to vSphere Web Client, open a browser and enter `https://vCenter_IP_address:9443`.

   Enter the credentials and click **Login**, as shown in Figure 6-21.

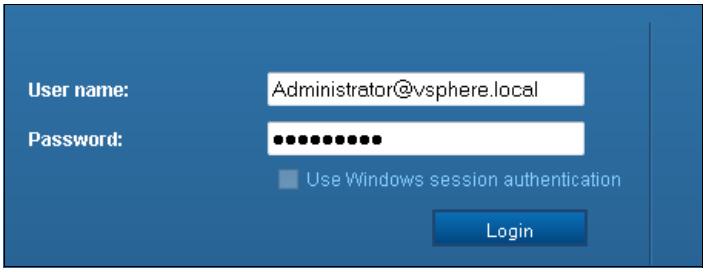

Figure 6-21 Log in to vSphere Web Client

2. Select **Administration** → **Solutions** → **Client Plug-ins**, as shown in Figure 6-22.

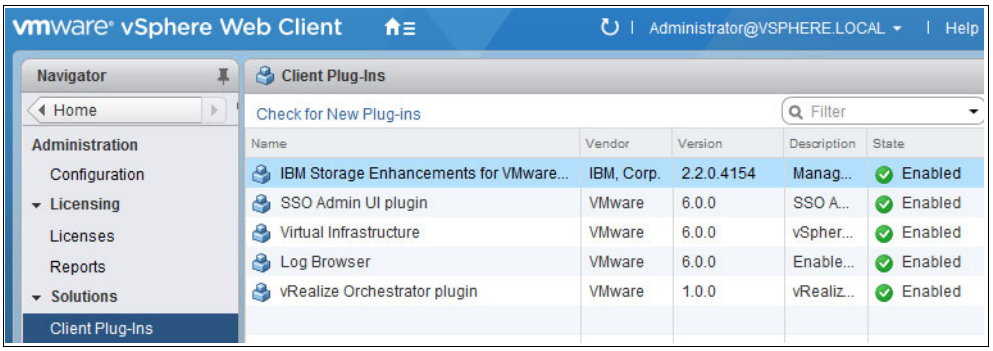

Figure 6-22 Verifying the IBM Storage Enhancements for VMware vSphere Web Client plug-in

6.2.8 Add IBM Spectrum Control Base server as a storage provider on vCenter

Complete the following steps to register Spectrum Control as a storage provider in vCenter:

1. Click **Home** → **Hosts and Clusters**, and then click the vCenter server and select the **Manage** tab and the **Storage Providers** tab. This opens the storage provider page shown in Figure 6-23.

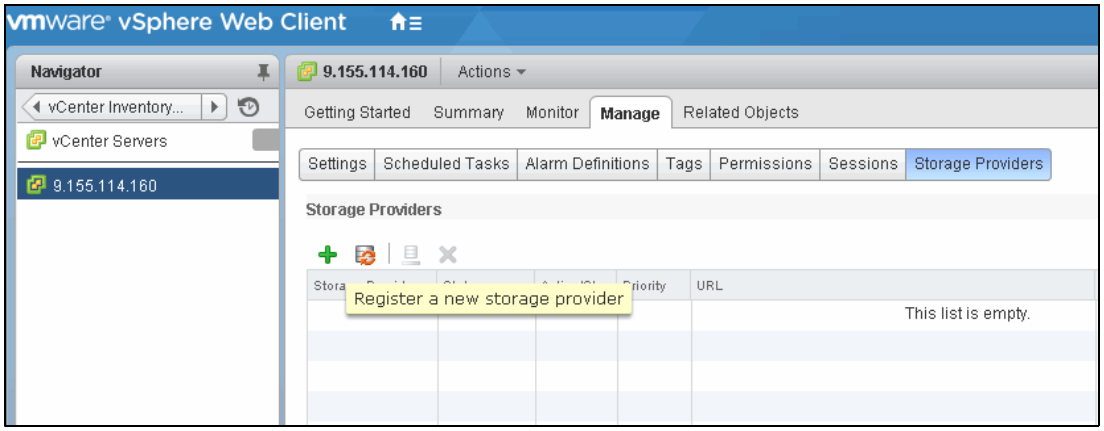

Figure 6-23 Displaying storage provider vCenter page

2. Click the **+** icon. The New Storage Provider window in Figure 6-24 on page 85 is displayed. Complete the fields with the following information:

Name	Any name describing your Spectrum Control server
URL	`https://IBM_Spectrum_Control_IP_address:8443/services/vasa`
User name	The VASA user name as defined in Figure 6-11 on page 80
Password	The VASA password as defined in Figure 6-11 on page 80

Figure 6-24 Adding IBM Spectrum Control Base as a storage provider in the vSphere Web Client

3. Next, vCenter asks you to verify the IBM Spectrum Control security certificate, as shown in Figure 6-25. Click **Yes** to proceed.

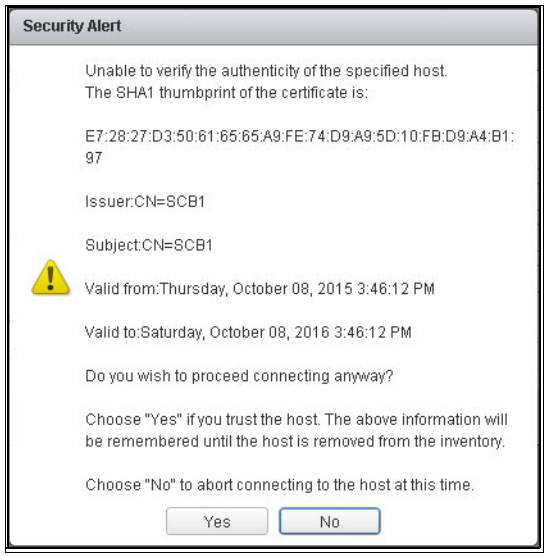

Figure 6-25 Configuring IBM Spectrum Control Base as new storage provider in vSphere Web Client

4. Figure 6-26 shows the Spectrum Control Base server, which is configured as a storage provider in the vSphere Web Client.

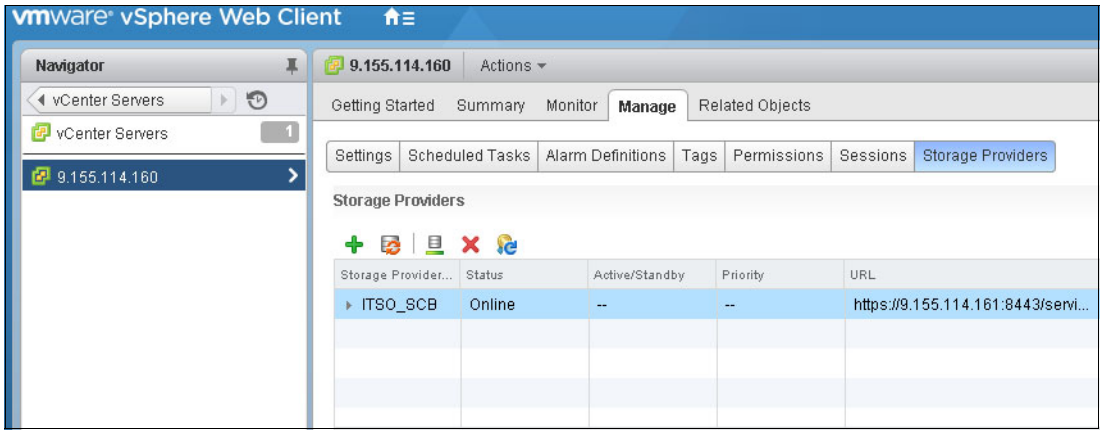

Figure 6-26 IBM Spectrum Control Base configured as a storage provider in the vSphere Web Client

Related publications

The publications listed in this section are considered particularly suitable for more detailed information about the topics covered in this paper.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topics in this document. Some publications referenced in this list might be available in softcopy only.

- *XIV Storage System in a VMware Environment*, REDP-4965
- *IBM XIV Storage System Architecture and Implementation*, SG24-7659
- *IBM XIV Storage System: Host Attachment and Interoperability*, SG24-7904

You can search for, view, download, or order these documents and other Redbooks, Redpapers, Web Docs, drafts, and additional materials on the Redbooks website:

ibm.com/redbooks

Other publications

These publications are also relevant as further information sources:

- *IBM Spectrum Control Base Edition User Guide,* SC27-5999-13

Online resources

These websites are also relevant as further information sources:

- IBM Spectrum Control Base Edition section of the IBM Knowledge Center

  http://ibm.co/1ILYwTB
- IBM Fix Central:

  http://www.ibm.com/support/fixcentral/

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