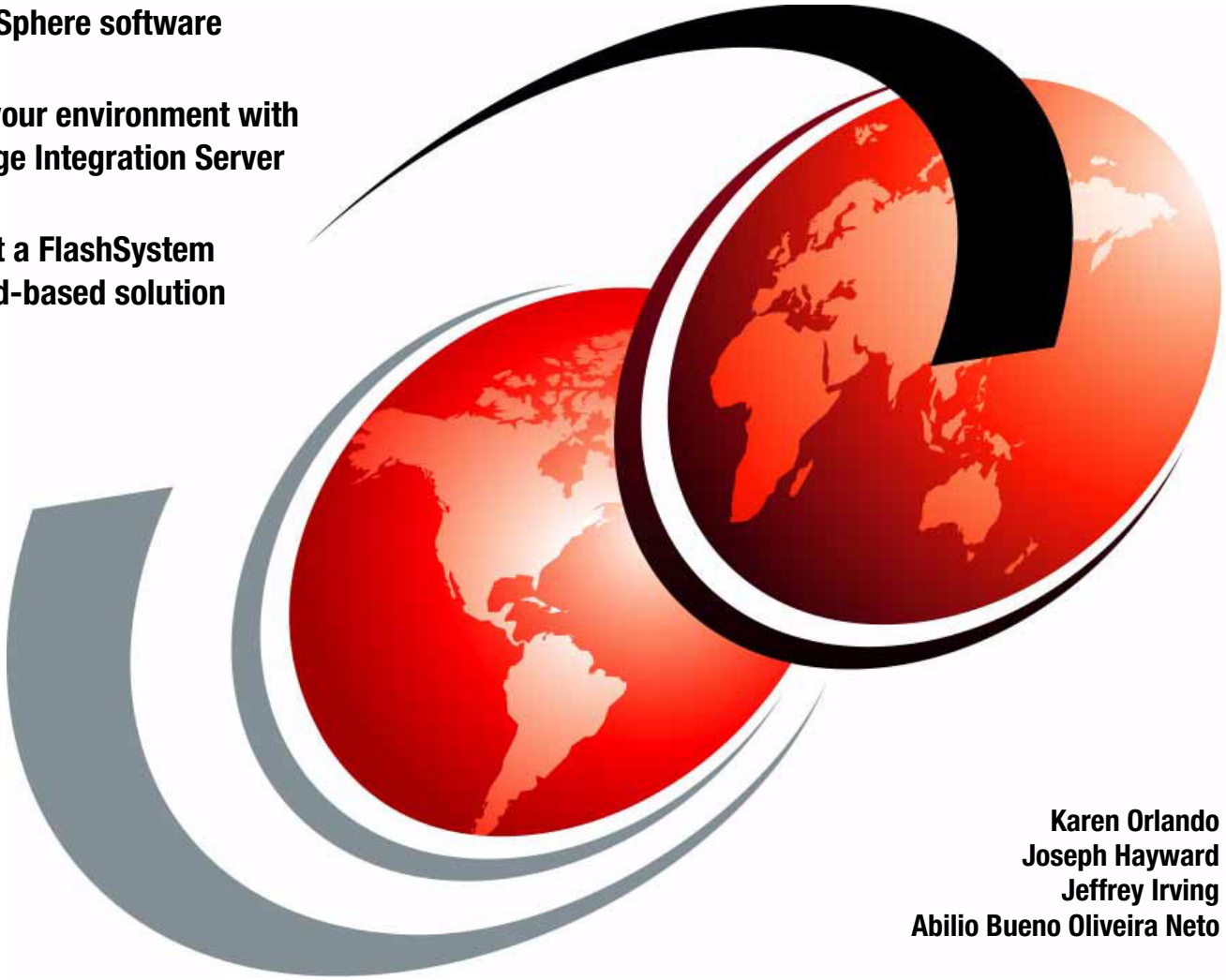
IBM

Deploying IBM FlashSystem V840 Storage in a VMware and Cloud Environment

- Integrate FlashSystem V840 and VMware vSphere software
- Optimize your environment with IBM Storage Integration Server
- Implement a FlashSystem V840 cloud-based solution



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International Technical Support Organization

Deploying IBM FlashSystem V840 Storage in a VMware and Cloud Environment

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Contents

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Preface

This IBM® Redpaper™ publication describes how to implement a cloud-based solution with IBM FlashSystem™ V840 in a VMware and IBM Storage Integration Server environment. It walks the reader through planning, setup, configuration, and operations. It also provides tips for implementing FlashSystem V840 in a VMware environment by using IBM Storage Integration Server and VMware tools for optimizing and provisioning V840 storage.

The chapters cover the following topics:

- FlashSystem V840 integration with VMware and IBM Storage Integration Server concepts
- The value that IBM Storage Integration Server brings to business
- Default installation and configuration of IBM Storage Integration Server
- Stability and functions in a lab environment created by using these tools

This paper is for presales and post-sales technical support professionals and storage administrators and for anyone who wants to understand and learn how to implement FlashSystem V840 and VMware as a cloud-based solution.

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1

Introduction and concepts

This chapter provides a reference for implementing IBM FlashSystem V840 storage with VMware and the IBM Storage Integration Server software. It covers the following topics:

If the configuration that you want is not available for selection on the IBM System Storage® Interoperation Center (SSIC) web page, submit a Solution for Compliance in a Regulated Environment (SCORE) to IBM, requesting approval. Another name for this procedure is submitting an RPQ (Request for Price Quotation).

Note: To submit a SCORE or RPQ, contact your IBM Sales Representative.

1.1 Value of this solution

The advanced storage services technology of virtualization is transforming organizations. Current storage capacity, performance, and independent software vendor (ISV) integration requirements are growing faster than ever, while infrastructure budgets are shrinking in the same proportion.

IBM FlashSystem V840 storage addresses business performance and capacity requirements, but a viable ISV integration that is needed by a software-defined environment (SDE) remains a challenge. The IBM Storage Integration Server addresses this requirement by bringing automation, elasticity, *storage as a service* capabilities, and operations management for storage management.

The Storage Integration Server provides the capability of an IBM disk array to be automatically orchestrated and monitored in a cloud environment (currently VMware only).

For more information about supported cloud interfaces, see “Supported storage systems” in the IBM XIV Storage System section of the IBM Knowledge Center:

http://ibm.co/1zOxaD5

1.2 FlashSystem V840, VMware, and Storage Integration Server

The storage administrator uses the Storage Integration Server to control preferred IBM storage systems and to identify which storage pools should be available for use in the VMware environment. The administrator also controls the specific VMware vCenter servers that can use the IBM storage resources.

The Storage Integration Server can be managed through a standard web browser, graphical user interface (GUI), or a terminal and command-line interface (CLI).

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 (as defined by the IBM FlashSystem V840 storage administrator). In parallel, the Storage Integration Server allows registered vCenter servers to connect and to use VMware vSphere APIs for Storage Awareness (VASAs).

Specifically for a VMware target environment with IBM FlashSystem V840, Storage Integration Server version 1.5 provides a single-server backend location and enables centralized management of these components:

- **VMware vCenter Server (VMware Virtual Center)**

  The vCenter Server is the central management and monitoring component of VMware vSphere environments. It gives IT administrators dramatically improved control over virtual environments through a single console application. Starting with vSphere vCenter 5.5, all new features are available only through the vSphere Web Client:

  - vCenter Single Sign-on
  - vSphere Web Client
  - vCenter Inventory Service
  - vCenter Server database

- **VMware vSphere Web Client**

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

- **VMware vSphere APIs for Storage Awareness (VASA)**

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

1.2.1 Benefits and uses

The diagram in Figure 1-1 shows how the Storage Integration Server works as an abstraction layer between the VMware environment and IBM FlashSystem V840, thereby consolidating and reducing the VMware component's generated requests against the storage system.

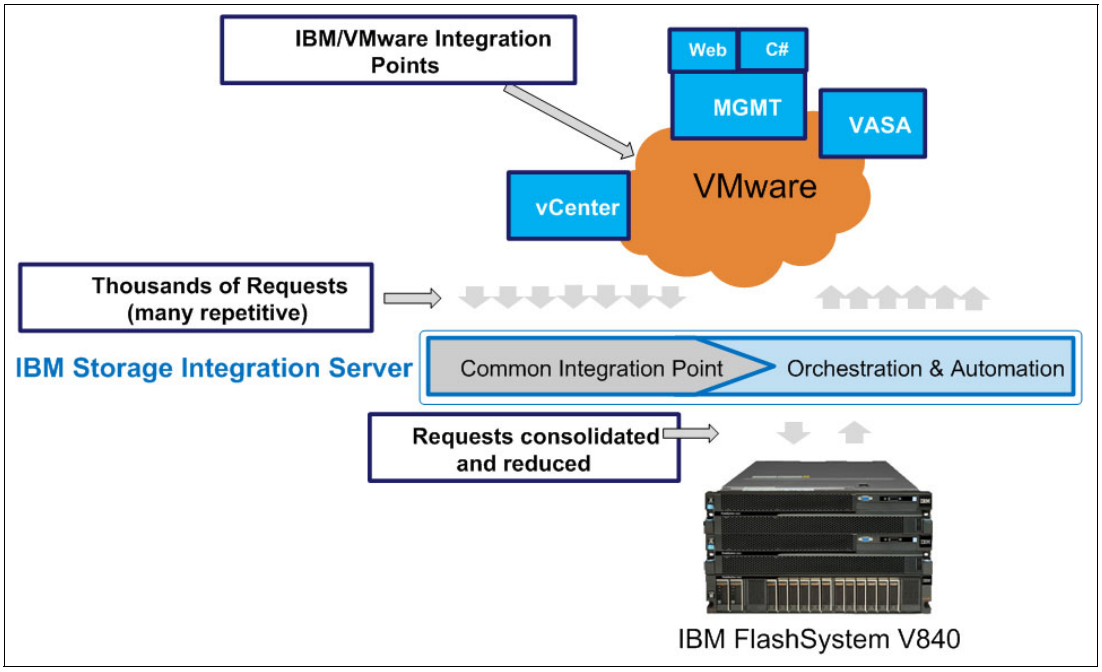


Figure 1-1 V840 and VMware Integration with IBM Storage Integration Server

There are many integration points in VMware, including vCenter, vRealize Orchestrator, management capabilities in both traditional vSphere client and the vSphere Web client or VASA. These VMware entities generate thousands of requests against the storage system to gather the information that they need.

Note: At the time of the writing, VMware vCenter Operations Manager and VMware vRealize Orchestrator are not supported with version 1.5.0 of the Storage Integration Server. They are currently supported only by the IBM XIV storage array.

Moreover, these entities are requesting the same information from the storage system. This approach, with many redundant requests against the storage system, does not scale well in very large environments that have multiple virtual centers.

In large environments, those numerous requests cannot be handled regularly in a timely manner. For example, when using the IBM System Storage plug-in for vCenter in such large environments, the time spent to refresh that agent (plug-in) can be easily 30 minutes 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) polling the storage system for each vCenter or ESX host is the cause of the long refresh time.

The Storage Integration Server runs as a host application under Linux, with minimum requirements and a straightforward installation and configuration process. For more information about installation, see Chapter 2, “Planning and configuration” on page 19.

1.3 Assumptions for use cases in this paper

The use cases in this paper are based on these assumptions:

- We assume that the storage area network (SAN) switches used in the use cases are already running and the zones are configured.
- We do cover the installation and configuration of IBM FlashSystem V840. We assume that it is already running in the test environment.
- We do not cover the VMware environment deployment. This paper is based on the assumption that the VMware is already installed.

This paper is not intended as any type of formal certification. For detailed information about hardware capability and supported configurations, see the VMware hardware compatibility list and IBM System Storage Interoperation Center (SSIC) web pages:

- VMware Compatibility Guide

  http://www.vmware.com/resources/compatibility/search.php
- IBM SSIC

  http://ibm.com/systems/support/storage/ssic/interoperability.wss

If a configuration that you want is not available for selection on the on the System Storage Interoperation Center (SSIC) web page, submit a Solution for Compliance in a Regulated Environment (SCORE) to IBM, requesting approval. Another name for this procedure is submitting an RPQ (Request for Price Quotation).

Note: To submit a SCORE or RPQ, contact your IBM Sales Representative.

The component descriptions and details of integrating the Storage Integration Server, VMware, and FlashSystem V840 are covered in the next topic.

1.4 Component overview

This section describes the components required to create a private cloud environment using V840, Storage Integration Server, and VMware.

1.4.1 Component environment diagram

Figure 1-2 shows a conceptual diagram of the consolidation that the Storage Integration Server can realize with various target environments and storage systems. The main goal of using Storage Integration Server is to provide common services for the whole environment, reducing the management effort and making the deployment of cloud services easier, for example VMware VCloud Suite. For a description of the setup and component integration in our lab environment, see Figure 2-1 on page 20.

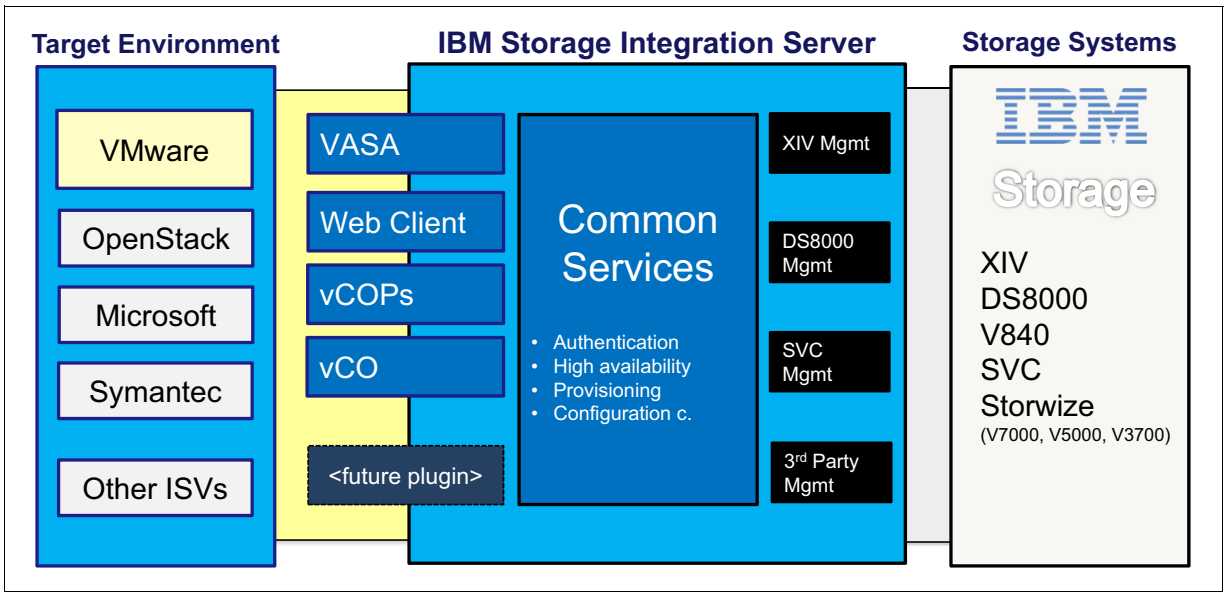


Figure 1-2 IBM Storage Integration Server logical architecture

1.4.2 IBM FlashSystem V840

Today's storage capacity and performance requirements are growing faster than ever before, and the costs of managing this growth are eating up more and more of the typical IT budget. Flash storage addresses performance requirements, and software-defined storage simplifies data management, improves data security, and preserves your investments in existing storage methods.

Now, flash technology and software-defined storage are available in one solution that provides flexible deployment architectures, extreme performance, simplified management, and a faster return on investment (ROI).

IBM FlashSystem V840 is an all-flash storage system that is used to make applications and data centers faster and more efficient. It is engineered to lower latency for data access. The value that your business gets from an all-flash system is directly related to its low latency.

Figure 1-3 on page 6 shows the FlashSystem V840 single building block, which includes one storage enclosure and two controllers.

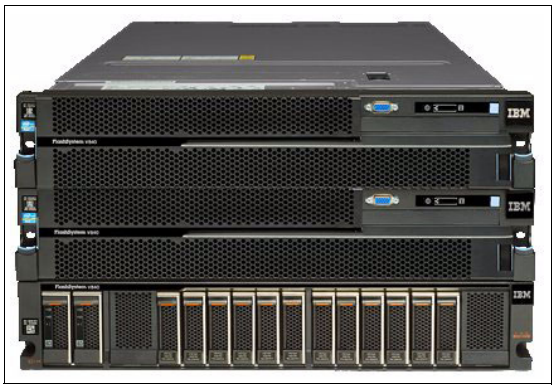


Figure 1-3 FlashSystem V840

FlashSystem V840 is a rack-mounted shared flash storage device that is based on enterprise multilevel cell (eMLC) flash technology. It provides macro efficiency with 40 TB of protected capacity in a 6U form factor, enterprise reliability through IBM Variable Stripe RAID™ and two-dimensional flash RAID, and extreme performance with IBM MicroLatency®. FlashSystem V840 also offers enterprise-level availability and reliability with no single point of failure, multiple layers of data correction, chip redundancy, or redundant hot swap components.

Component overview

The FlashSystem V840 baseline configuration is a single building block that is composed of the following components:

- Two FlashSystem V840 control enclosures
- One FlashSystem V840 storage enclosure

FlashSystem V840 control enclosure

FlashSystem V840 control enclosure provides advanced data services for flash memory. It is a 2U, 19-inch rack-mount enclosure. The FlashSystem V840 includes two control enclosures, also called *controller nodes*, for redundant host access. The control enclosures include up to 16 ports that are used for connectivity, with options for 8 Gb Fibre Channel, 16 Gb Fibre Channel, or 10 Gb Ethernet (FCoE) and iSCSI.

The FlashSystem V840 control enclosure consists of the following components:

Two control enclosures in each FlashSystem V840 provide redundancy. Each enclosure consists of the following items:

- 2U server node
- Dual eight-core processor
- 64 GB memory
- New options for connectivity including four host interface cards (8 Gb FC, 16 Gb FC, and 10 Gb Ethernet)
- Two integrated AC power supplies and battery units

FlashSystem V840 control enclosures support Fibre Channel protocol, with point-to-point (FC-P2P), arbitrated loop (FC-AL), and switched fabric (FC-SW) topologies. FC interfaces can be configured as N_port or NL_port types. Full active-active multipathing across all interfaces is supported, although host software support for this function might vary.

The control enclosure includes integrated AC power supplies and battery units that supply power to the control enclosure if there is a sudden power loss or failure to correctly commit all transactions to the storage medium.

IBM FlashSystem V840 storage enclosure

FlashSystem V840 storage enclosure is a purpose-built, all-flash storage shelf. It is a 2U 19-inch rack-mount enclosure with twelve slots for flash modules. The storage enclosure provides sixteen 8 Gb Fibre Channel ports to connect to FlashSystem V840 control enclosures, either directly or through dedicated internal switches (with the scalable building block).

Flash modules within any individual building block are available in 1 TB, 2 TB, or 4 TB capacity and capacities cannot be mixed.

The FlashSystem V840 storage enclosure has the following attributes and components:

- Provides Flash storage:
- FlashSystem V840 storage enclosure has full internal redundancy:
  - Redundant and hot-swappable Flash interface controllers
  - Redundant and hot-swappable batteries
  - Redundant and hot-swappable power and cooling
- 12 Flash modules in 1 TB, 2 TB, or 4 TB capacities:
  - Can be ordered in 4, 6, 8, 10, or 12 module configuration
  - All Flash modules must be the same capacity

Up to 40 TB RAID 5 configuration, up to 200 TB effective capacity with optional IBM Real-time Compression™.

Software-defined flash services

FlashSystem V840 data services are provided through FlashSystem V840 software, which offers a rich set of software-defined flash features that include IBM FlashCopy®, thin provisioning, remote mirroring, external virtualization, IBM Easy Tier® 3rd Generation, and IBM Real-time Compression.

FlashSystem V840 merges IBM software-defined storage with the scalable performance of IBM FlashSystem technology to help make your entire storage environment easier to manage while preserving your investments in storage. Software-defined storage services enable you to use the following features across all of your storage.

Thin provisioning	Enable dynamic growth. Purchase only the storage you need when you need it.
Easy Tier flash storage management	Optimize performance at lower overall cost.
High availability configurations	Enable near-continuous data availability.
Copy services	Create space-efficient backups.
Disaster recovery techniques	Validate business continuity plans.
Simple GUIs	Quickly deploy and efficiently manage storage.
External virtualization	Leverage SAN storage investments by using existing capacity, tiering to or from it, to maximize your existing storage investment.

The FlashSystem V840 software runs on the control enclosures.

Value to business and IT objectives

The strategic value of FlashSystem is to help make businesses more agile and analytics-driven by providing up-to-the-minute analytics based on real-time data. FlashSystem products transform the data center environment and help consolidate resources to gain the most from business processes and critical applications. The FlashSystem family also enhances system resiliency without sacrificing performance or usable capacity.

FlashSystem V840 can deliver up to 2,520,000 IOPS with latency as low as 200 microseconds. With FlashSystem V840, it is possible to scale up to 1.2 million IOPS and 1.6 PB effective capacity when using IBM Real-time Compression. They also offer enterprise availability and reliability with no single point of failure, multiple layers of data correction, chip redundancy or redundant hot swap components.

FlashSystem V840 provides advanced data services, including business continuity with replication services, data protection with FlashCopy services, and higher storage efficiency with thin provisioning, Real-time Compression, IBM Easy Tier, external virtualization, and space-efficient copies.

FlashSystem V840 provides high performance, effective data management, and protection with the following benefits:

Extreme performance	Enables businesses to unleash the power of performance, scaling, and insight to drive services and products to market faster
MicroLatency	Deliver microsecond-level response time to accelerate critical applications and achieve competitive advantages
Macro efficiency	Efficiency that is driven by consolidation of hardware and software, power and cooling savings, data efficiencies of snapshots, thin provisioning, and advanced copy services
Enterprise reliability	Durable and reliable designs that use enterprise class flash with remote mirroring to provide business continuity

Scalability

FlashSystem V840 has a scalable architecture that allows flash capacity to be added (scaled up) to support multiple applications. The virtualized system can also be expanded (scaled out) to support higher IOPS and bandwidth. Or the solution can be simultaneously scaled up and out to improve capacity, IOPS, and bandwidth, while maintaining IBM MicroLatency. As a result, your organization can gain a competitive advantage through a more flexible, responsive, and efficient storage environment. FlashSystem V840 has the following scalability features per building block:

- Slots for up to 12 hot-swappable flash storage modules (1 TB, 2 TB, or 4 TB modules)
- Configurable 2 - 40 TB of capacity for increased flexibility per storage enclosure
- FlashSystem V840 has the following flexible scalability configuration options:
  - Base configuration
  - Scale up: Add more flash capacity
  - Scale out: Expand virtualized system
  - Scale up and out: Add more flash capacity and expand virtualized system

A single FlashSystem V840 storage platform consists of two FlashSystem V840 control enclosures directly cabled to one FlashSystem V840 storage enclosure (SE). That represents a *building block*. FlashSystem V840 can be ordered in scalable configurations from a single building block up to three additional scalable building blocks. For balanced increase of performance and scale, up to four FlashSystem building blocks may be clustered into a single storage system, multiplying performance and capacity with each addition.

The scalable building blocks require dedicated internal Fibre Channel switches. These scalable configurations also allow for the addition of up to four individual FlashSystem storage enclosures to be added to the storage system. If 160 TB from four building blocks isn't enough capacity, up to four additional storage enclosures can be added. In total, a FlashSystem V840 storage system can contain a maximum of eight FlashSystem V840 storage enclosures, which offer a potential storage capacity of 320 TB. Up to 1.6 PB effective capacity is available at 80% compression. IBM Real-time Compression is available with feature code 5639-FS7 for the AE1 storage enclosure. This feature code satisfies the license requirement for Real-time Compression and remote mirroring.

Figure 1-4 illustrates the scalable capacity of FlashSystem V840. It also shows that additional storage enclosures (SEs) can be added to a single building block (BB) or to two, three, or four building blocks.

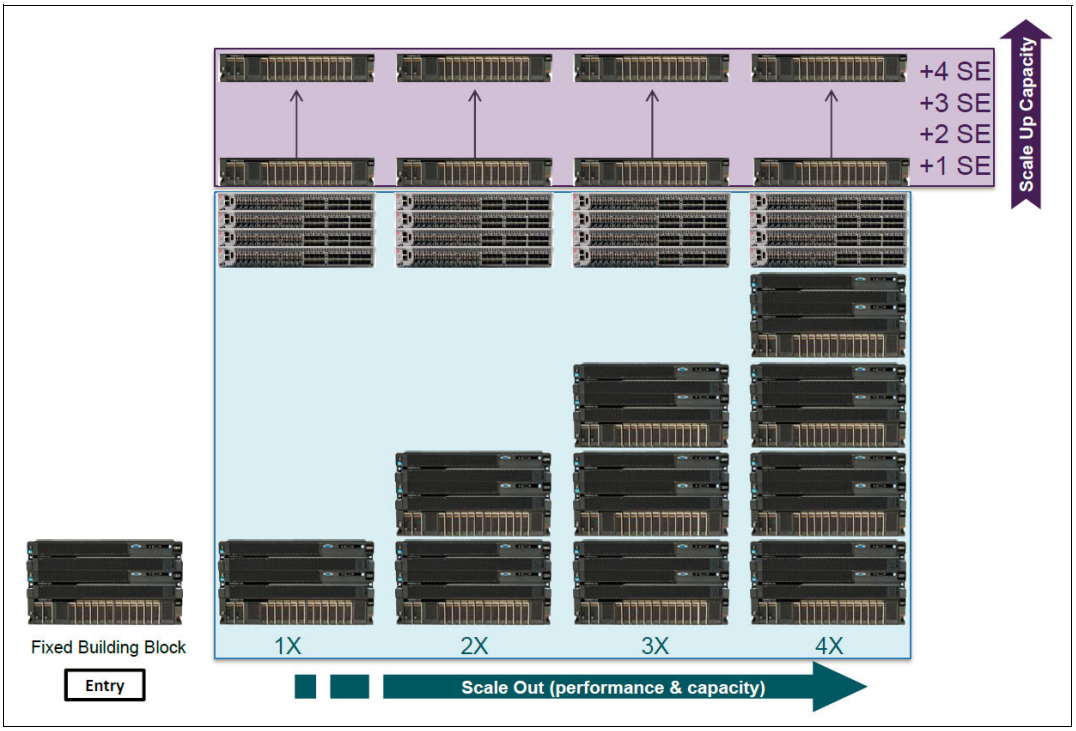


Figure 1-4 FlashSystem V840 scalable capacity

Table 1-1 shows the host port count per building block configuration (one, two, three, or up to four building blocks).

Table 1-1 Host port count per building blocks

	8 GB FC	16 GB FC	10 GB FCoE	8 GB and 10 GB IP mirror	16 GB FC and 10 GB mirror
	10	Fixed	8	N/A	N/A
1X	16	8	8	8, 8	4, 8
2X	32	16	16	16, 16	8, 16
3X	48	24	24	24, 24	12, 24
4X	64	32	32	32, 32	16, 32

For more information, see the IIBM Redbooks Product Guide for IBM FlashSystem V840:

http://www.redbooks.ibm.com/abstracts/tips1158.html?Open#contents

1.4.3 V840 offerings

This section describes the main options and feature codes of FlashSystem V840 and provides the necessary information to build a V840 configuration.

For software and licensing information, see the IBM FlashSystem V840 product guide cited previously. For a price quote, contact your IBM Sales Representative.

Host connectivity interface cards

There are many options to provide a high-speed connection from the hosts to Flash system. Table 1-2 shows the host connectivity options for FlashSystem V840.

Table 1-2 Host connectivity interface cards options

Item	Feature code	Description
FC Host Interface Card	AF15	8 GB FC 8 port host optics: Set of 8 GB Fibre Channel optics to enable 8 ports
8 GB FC 8 port host optics	AF18	Set of 8 GB Fibre Channel optics to enable 8 ports
16 GB FC 4 port host optics	AF19	Set of 16 GB Fibre Channel optics to enable 4 ports
8 GB FC with 4 port host optics	AF10	8 GB Fibre Channel card with optics to enable 4 ports
16 GB FC with 2 port host optics	AF11	16 GB Fibre Channel card with optics to enable 2 ports
10 GB Ethernet with 4 port host optics	AF12	10 GB Fibre Channel card with optics to enable 2 ports
8 GB FC with 4 port host optics	AF10	8 GB Fibre Channel card with optics to enable 4 ports

Supported flash modules

FlashSystem V840 provides configurable flash module capacity. All modules are hot-swappable. FlashSystem V840 can be populated with 4, 6, 8, 10, or 12 flash modules. The available modules are displayed Table 1-3. You can add modules up to a maximum of 40 TiB by putting together 12 4-TB flash modules with RAID 5 protection, for example.

Table 1-3 Supported Flash Modules

Description	Feature code	Maximum quantity
1 TB eMLC Flash Module	AF1B	12
2 TB eMLC Flash Module	AF10	12
4 TB eMLC Flash Module	AF11	12

For more information about the FlashSystem V840, see the Product Guide:

http://www.redbooks.ibm.com/abstracts/tips1158.html?Open

1.4.4 VMware

VMware, Inc.® was founded in 1998 to bring virtual machine (VM) technology to industry-standard computers. VMware vCenter is a software that enables the deployment of multiple, secure, independent virtual machines on a single physical server. For more information, see the VMware website:

http://www.vmware.com

Since its inception, VMware has pushed for advancements in storage use for virtualized environments. VMware uses a purpose built, virtualization friendly, clustered file system which is enhanced with storage-centric features and functions aiming to ease the management and maximize the performance of the storage infrastructure used by virtualized environments.

VMware has also led the industry in working with partners to create integrations between storage systems and VMware. The following sections outline some of the storage features provided by VMware.

Figure 1-5 shows a virtualized environment.

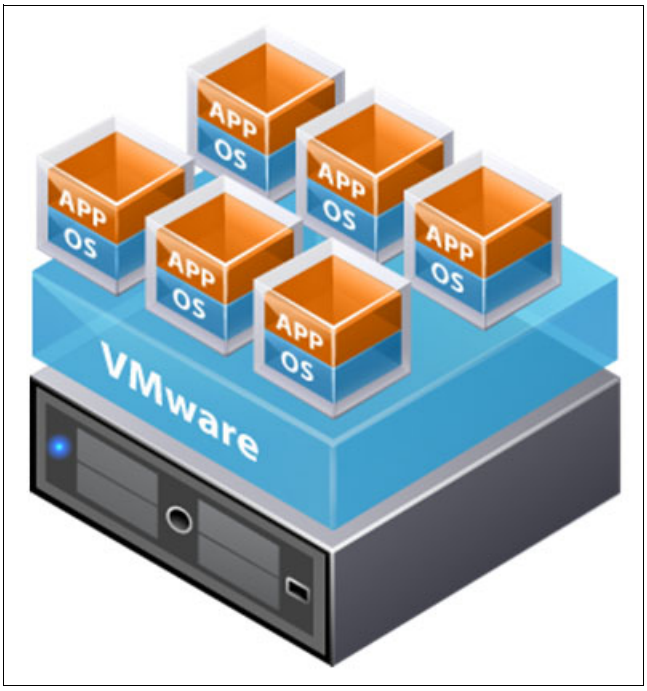


Figure 1-5 VMware stack

Figure 1-5 shows that VMware presents individual portions of hardware to each virtual machine. In this way, the operating systems and applications installed in the virtual machines are not aware that the hardware is virtual.

Due to the virtualization, the guest operating system is not aware where the resources, for example, where CPU and memory are coming from, allowing easier maintenance of physical machines.

One virtual machine is isolated from the other, and this is possible because of the virtualization layer, and it enables the sharing of physical devices with the virtual machines.

VMware vSphere

VMware vSphere is a virtualization platform capable of transforming a traditional data center and industry-standard hardware into a shared mainframe-like environment. Hardware resources can be pooled together to run varying workloads and applications with different service-level needs and performance requirements.

VMware vSphere is the enabling technology to build a private or public cloud infrastructure.

The components of VMware vSphere fall into three categories:

- Infrastructure services
- Application services
- VMware vCenter Server

Figure 1-6 shows a representation of the VMware vSphere platform. Note that to provide performance and resilience to this infrastructure, you can use physical resources of a private or public cloud. This option provides the benefit to use existing hardware and software of your legacy datacenter.

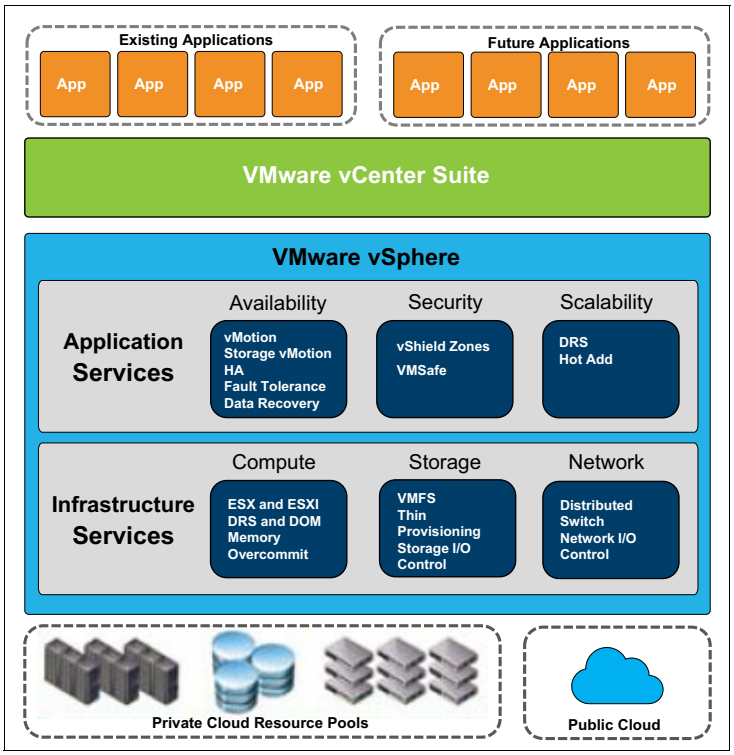


Figure 1-6 VMware vSphere platform

Infrastructure services

Infrastructure services perform the virtualization of server hardware, storage, and network resources. The services within the infrastructure services category are the foundation of the VMware vSphere platform.

Application services

The components categorized as application services address availability, security, and scalability concerns for all applications running on the vSphere platform, regardless of the complexity of the application.

VMware vCenter Server

VMware vCenter Server provides the foundation for the management of the vSphere platform. VMware vCenter Server provides centralized management of configurations and aggregated performance statics for clusters, hosts, virtual machines, storage, and guest operating systems. VMware vCenter Server scales to provide management of large enterprises, granting administrators the ability to manage more than 1,000 hosts and up to 10,000 virtual machines from a single console.

VMware vCenter Server is also an extensible management platform. The open plug-in architecture allows VMware and its partners to directly integrate with vCenter Server, extending the capabilities of the vCenter platform, and adding additional functions.

Figure 1-7 shows the main pillars of the functions provided by VMware vCenter Server.

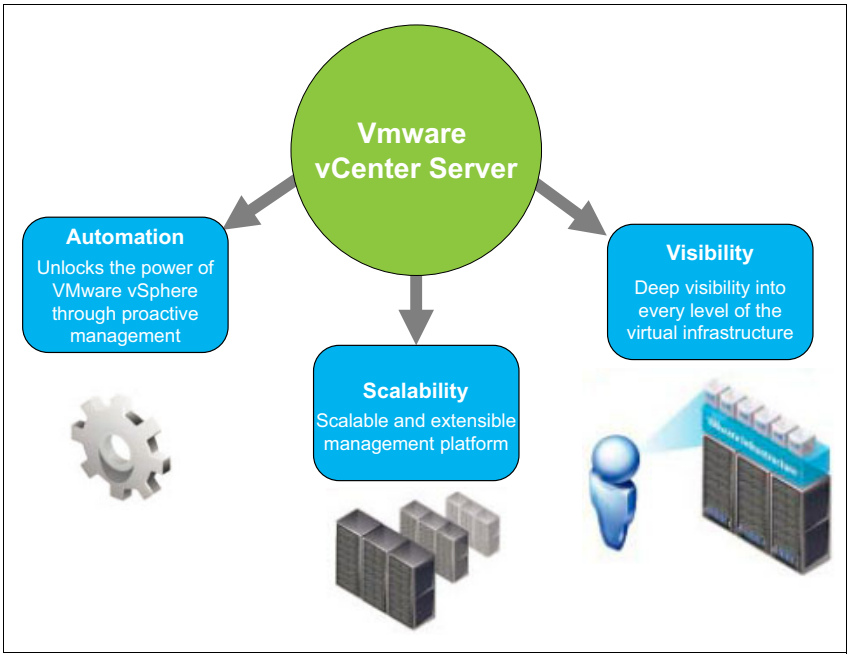


Figure 1-7 Pillars of VMware vCenter Server

Value to customers

Many IT organizations are stuck in a constraint-focused spiral. Business executives don't see value generated in proportion to the amount of IT spending. As a result, they view IT as a department that needs to be constrained. Unfortunately, a primary focus on cost reduction minimizes IT's ability to deliver strategic value, which erodes business confidence in IT management.

The cost savings associated with server consolidation efforts are significant. IT can dramatically increase datacenter capacity, delay capital investments, and reduce energy costs.

Virtualization also improves service visibility because the deployment of virtual servers can be tracked easily, and resource use information can be consolidated at the service level. Accounting for service use is a prerequisite for breaking aggregated cost data into unit-cost information.

Key measures at this transformation stage are related to hardware and operational cost savings:

- Hardware replacement cost
- Power and cooling costs
- Server to system administrator ratio
- Ease of servicing

Latest features

VMware vSphere 5.5 introduces many new features and enhancements to extend the core capabilities of the vSphere platform. This section describes features and capabilities of the vSphere platform, including vSphere ESXi Hypervisor, VMware vSphere High Availability (vSphere HA), virtual machines, VMware vCenter Server, storage, networking, and vSphere Big Data Extensions.

The new features are organized into the following sections:

vSphere ESXi Hypervisor Enhancements

- Hot-Pluggable SSD PCI Express (PCIe) Devices
- Support for Reliable Memory Technology
- Enhancements for CPU Monitoring

Virtual machine enhancements

- Virtual machine compatibility with VMware ESXi 5.5
- Expanded Virtual Graphics Support
- Graphic Acceleration for Linux Guests

VMware vCenter Server enhancements

- VMware vCenter single sign-On
- VMware vSphere Web Client
- VMware vCenter Server Appliance
- vSphere App HA
- vSphere Big Data Extensions
- vSphere HA and VMware vSphere Distributed Resource Scheduler (vSphere DRS) Virtual Machine-Virtual Machine Affinity rule enhancements

vSphere storage enhancements

- Support for 62 TB Virtual Machine Disk (VMDK) format
- MSCS updates
- vSphere 5.1 feature updates
- 16 GB E2E support
- Permanent Device Lost (PDL) monitoring
- vSphere Replication Interoperability
- vSphere Replication Multi-Point-in-Time Snapshot Retention
- vSphere Flash Read Cache

vSphere networking enhancements

- Link aggregation control protocol enhancements
- Traffic filtering
- Quality of service tagging
- Single root I/O virtualization (SR-IOV) enhancements
- Enhanced host-level packet capture
- 40 GB NIC support

For detailed information about each of the enhancements, see the VMware document titled *What`s new in VMware vSphere 5.5 Platform*:

http://www.vmware.com

Components and licensing

VMware vCloud Suite combines multiple components into a single product to cover the complete set of cloud infrastructure capabilities. When used together, the vCloud Suite components provide virtualization, software-defined data center services, policy-based provisioning, disaster recovery, application management, and operations management.

A vCloud Suite edition combines components such as vSphere Enterprise Plus, vCloud Director, vCloud Networking and Security, and others, under a single license. vCloud Suite editions are licensed on a per-processor basis. Many of the vCloud Suite components are also available as stand-alone products licensed on a per-virtual machine basis. However, when these components are obtained through the vCloud Suite, they are licensed on a per-processor basis.

Figure 1-8 shows what VMware components require licenses.

Components	Description
VMware vSphere	Provides virtualization technology to serve as the platform for cloud infrastructure.
VMware vCloud® Director	Provides the ability to build secure, multi-tenant clouds by pooling virtual infrastructure resources into virtual datacenters.
VMware vCloud Networking and Security	Provides a security suite for VMware vSphere. vCloud Networking and Security (formerly vShield) is a critical security component for protecting virtualized datacenters from attacks and misuse to help you achieve your compliance-mandated goals.
VMware vCenter Operations Management Suite	Automates operations management and provides integrated performance, capacity, and configuration management for virtualized and cloud infrastructure.
VMware vCenter Site Recovery Manager	Provides business continuity and disaster recovery capabilities that help you plan, test, and perform recovery of virtual machines between one site (the protected site) and another site (the recovery site).
VMware vCloud Automation Center	Provides functionality for deploying and provisioning of business-relevant cloud services across private and public clouds, physical infrastructure, hypervisors, and public cloud providers. vCloud Automation Center Enterprise includes vCloud Automation Center Application Service that automates application provisioning in the cloud including deploying and configuring the application's components and dependent middleware platform services on infrastructure clouds.

Figure 1-8 vCloud Suite components that require licenses

The components from the vCloud Suite edition are activated with a single license key. For example, if you have a license key for vCloud Suite Standard, you can use the same key to activate vSphere Enterprise Plus, vCloud Director, vCloud Networking and Security.

All virtual machines running on a processor licensed with a vCloud Suite edition can use all components included in that vCloud Suite edition. To run virtual machines on processors that are not licensed for vCloud Suite, you need individual licenses for the products that you want to use.

Integration components

VMware provides an ecosystem in which partners can integrate their products and provide additional functions for the virtualized infrastructure.

Storage partners have the opportunity to integrate with several VMware application programming interfaces (APIs) to provide additional functions, enhanced performance, and integrated management.

The integration with IBM Storage Provider for VMware VASA provides features such as: viewing IBM storage capabilities and optimizing VM storage placement automatically for VMware Storage Distributed Resource Schedule (VMware DRS)

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

With the IBM Storage Enhancements for VMware vSphere Web Client, you can discover data store relationships down to the IBM Storage volumes and file shares. You can view native IBM storage arrays, pools and volumes, or file share properties, and set provision volumes and file shares from delegated pools. The 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.

1.4.5 IBM Storage Integration Server

The Storage Integration Server is a centralized server system that consolidates a range of IBM storage provisioning, virtualization, cloud, automation, and monitoring solutions through a unified server platform.

The Storage Integration Server facilitates the integration of Storage System resources by using options (user credential, storage system, and storage pool management) with supported independent software vendor (ISV) platforms and frameworks. It provides a foundation for integration with IBM systems and ISV solutions.

The IBM Storage Integration Server provides a single-server backend location and enables centralized management of IBM storage resources for different virtualization and cloud platforms, including:

- VMware vCenter Server
- VMware vSphere Web Client
- VMware vSphere APIs for Storage Awareness (VASA)
- VMware vCenter Operations Manager (vCops)
- VMware vRealize Orchestrator

Note: In version 1.5.0, the IBM Storage Integration Server for VMware vCenter Operations Manager and VMware vRealize Orchestrator are currently only supported by the IBM XIV storage array.

Through unique credentials, storage array, and storage pool management options, the Storage Integration Server facilitates the integration of IBM storage system resources with the supported virtualization and cloud platforms such as VMWare. The Storage Integration Server also provides a base foundation for integration with future IBM systems and independent software vendor (ISV) Cloud solutions.

The Storage Integration Server can be managed through a standard web browser and a graphical user interface (GUI), or through terminal and a command-line interface (CLI).

Value to customers

Use of the Storage Integration Server creates an abstraction layer between the storage system and the operating systems.

This abstraction reduces the complexity of storage services in a cloud environment by focusing on the business and workload goals of IT storage infrastructure by delivering the following customer values:

- Discover data store relationships down to IBM storage volumes and file shares
- View native IBM storage array, pool, and volumes/shares properties
- Self-provision volumes and file shares from delegated pools
- View IBM storage capabilities
- Optimize VM storage placement automatically (VMware Storage DRS)

Latest features

The following solution components, referred to as cloud interfaces, are included and supported by V840 in the Storage Integration Server version 1.5 software package:

- IBM Storage Provider for VMware VASA

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

- 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.

Where to download IBM Storage Integration Server

You can download the latest version at no charge from the IBM Fix Central web page:

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

1.4.6 IBM Storage Integration Server compatibility and requirements

There is compatibility and requirements information that needs to be reviewed before beginning an IBM Storage Integration Server installation procedure.

To insure a successful installation procedure, check the following compatibility and minimum requirements information:

- Supported operating systems
- Supported storage Systems
- Minimum server hardware requirements
- Supported browsers
- Supported VMware platforms

For detailed information about compatibility and requirements of version 1.5.0 of the Storage Integration Server. visit the Storage Integration server website:

http://ibm.co/1AkxMl4

Supported operating systems

The Storage Integration Server software can be installed on Red Hat Enterprise Linux (RHEL) 6.3 through 6.5 (64-bit versions).

For more information, see “Supported operating systems” in the IBM XIV Storage System section of the IBM Knowledge Center:

http://ibm.co/1DcPYOX

Supported storage systems

IBM Storage Integration Server version 1.5 supports different IBM storage systems and features. For FlashSystem V840, there are two cloud interfaces that are supported:

- IBM Storage Provider for VMware VASA
- IBM Storage Enhancements for VMware vSphere Web Client

For more information about the supported storage systems, see the IBM FlashSystem and VMware vSphere configuration guide:

http://ibm.co/1w2LDhk

Minimum server hardware requirements

Storage Integration Server is installed should meet the following minimum hardware requirements:

- 64-bit dual-core CPU
- At least 4 GB of RAM
- At least 16 GB of free disk space

Supported browsers

The Storage Integration Server can be accessed and managed with the following web browsers:

- Microsoft Internet Explorer 10.0 or later
- Mozilla Firefox 21.0 or later
- Google Chrome 29.0 or later

Supported VMware platforms

The versions of VMware that are supported by version 1.5.0 of the IBM Storage Integration Server are shown in Table 1-4

Table 1-4 Supported VMware platforms

VMware platform or framework	Version
vSphere Web Client Server	5.1 or 5.5.x
vSphere APIs for Storage Awareness (VASA)	5.0, 5.1, or 5.5.x

For the latest information about this interoperability, see “Supported VMware platforms” in the IBM Knowledge Center:

http://ibm.co/1wQwHfT

2

Planning and configuration

This chapter provides the requirements to connect IBM VMware vSphere to FlashSystem V840 by using the IBM Storage Integration Server. The approach is to plan how we will set up our system, adjust for environments, and describe techniques for troubleshooting.

2.1 Our lab environment

Our setup is intentionally simple, but this system scales with multiple FlashSystem V840 and VMware ESX servers. Figure 2-1 shows an overall view of the environment.

Note: FlashSystem V840 has a highly scalable architecture that allows flash capacity to be added (scaled up) to support multiple applications and to be expanded (scaled out) to support higher IOPS and bandwidth. For more information, see the IBM Redbooks Solution Guide titled *IBM FlashSystem V840*, TIPS1158.

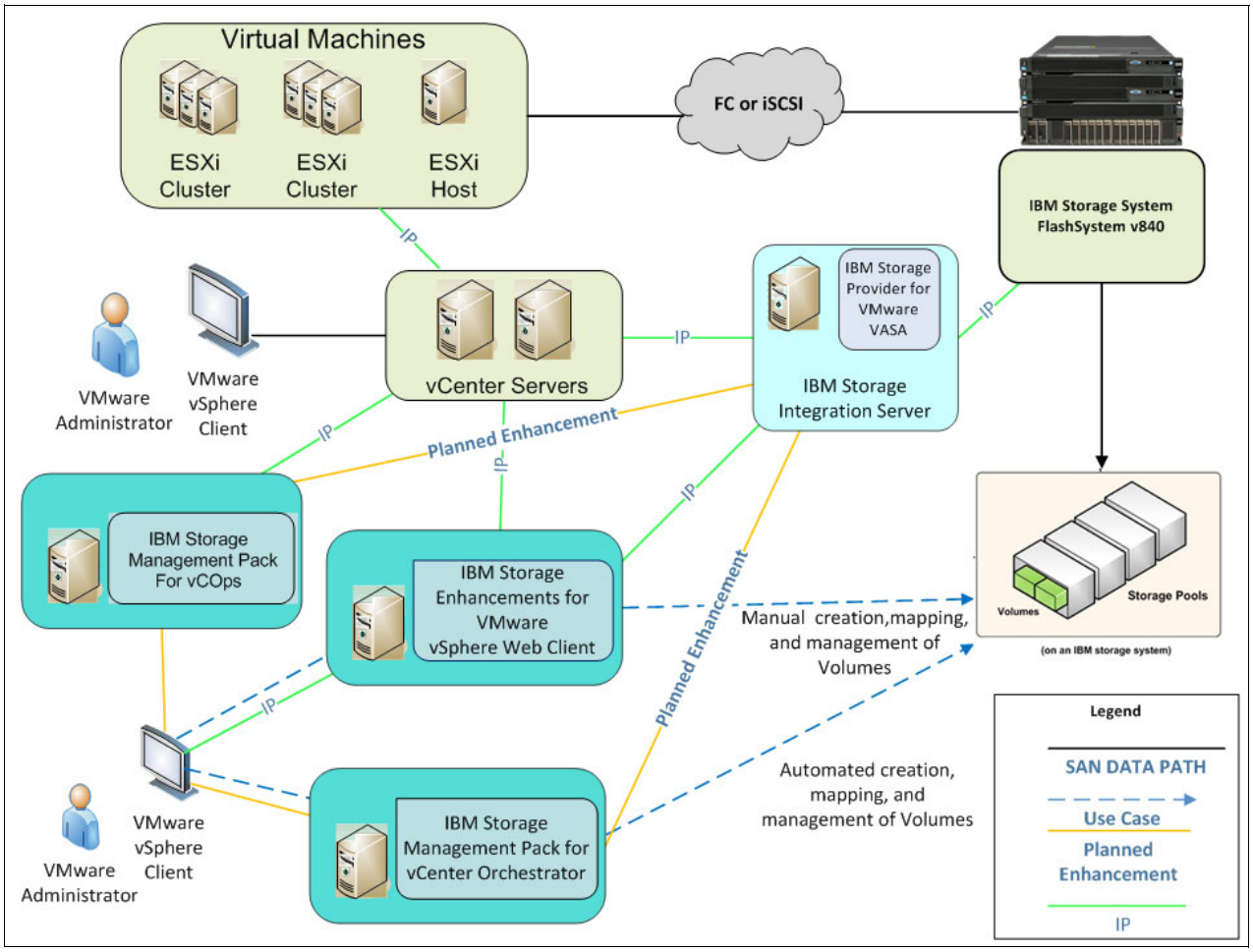


Figure 2-1 IBM Storage Integration Server registers FlashSystem V840, vSphere Web Client, and VMware VASA

2.1.1 Resources

This section provides the product configurations that we used for the Storage Integration Server in our FlashSystem V840 lab environment. For a broader view of compatibility with other IBM storage products, see the IBM Storage Integration Server release notes:

http://ibm.co/1yn0wdx

Supported operating systems

The Storage Integration Server is installed on Red Hat Enterprise Linux (RHEL). Versions 6.3 through 6.5 are supported.

Minimum server hardware requirements

The Linux server on which the Storage Integration Server is installed must meet the following minimum hardware requirements:

- 64-bit dual-core CPU
- At least 4 GB of RAM
- At least 16 GB of free disk space

The same requirements apply if a virtual machine is used rather than a physical server.

Tip: For best performance, use a dedicated server. The minimum requirements are for supporting up to 20 storage arrays and up to 1000 objects (storage pools, volumes, host, mappings, snapshots, mirroring groups, consistency groups).

Supported VMware platforms

Version 1.5.0 of the Storage Integration Server supports the VMware platforms and frameworks shown in Table 2-1. VMware interfaces that are not yet supported for FlashSystem V840 are not included in this table.

Table 2-1 FlashSystem V840 VMware versions

VMware platform or framework	Version
vSphere Web Client Server	5.1, 5.5.x
vSphere APIs for Storage Awareness (VASA)	5.0, 5.1, 5.5.x

Tip: The IBM Storage Enhancements for VMware vSphere Web Client are automatically deployed and enabled by registering vCenter servers on the Storage Integration Server.

Supported browsers

The Storage Integration Server can be accessed and managed with the following web browsers and versions:

- Microsoft Internet Explorer 10.0 or later
- Mozilla Firefox 21.0 or later
- Google Chrome 29.0 or later

The required screen resolution for GUI management is 1024×768 or higher.

2.2 Install IBM Storage Integration Server

This section describes the configuration of the Storage Integration Server environment. It is based on the assumption that a suitable Red Hat Enterprise Linux server is running. In our environment, we used a guest OS called IBMSIS that was installed on our VMware vSphere ESXi server.

2.2.1 Install Storage Integration Server RPM packages

The Storage Integration Red Hat Package Manager package can be downloaded from IBM Fix Central:

`https://ibm.biz/IBM_Storage_Integration_Server`

The installation instructions are in the Storage Integration Server User Guide in Chapter 2, “Extracting and installing the Integration Server software.” You can download the User Guide from Fix Central:

`https://ibm.biz/IBM_Storage_Integration_Server_UG`

Follow these instructions to unpack and install the RPM packages.

2.2.2 Define the storage array administrative account

Storage Integration Server uses a single login account to access all of the IBM storage arrays. It is advisable to create a unique storage administrator account for traceability in the environment. Most storage controllers have a default storage administrator account of *superuser*, for example. In the following section, a new account is created called `IBMSIS`.

1. From the IBM FlashSystem V840 AC1 Controller GUI page, hover your cursor over the security icon, and then select **Access** → **Users**, as shown in Figure 2-2.

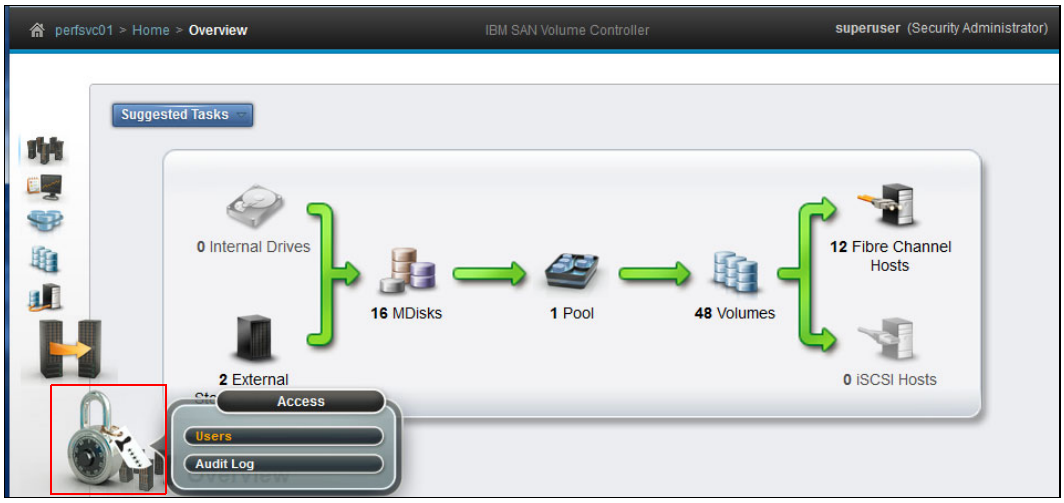


Figure 2-2 Select the Users menu in the V840 GUI

2. Select **+Create User** to create a new user that represents your Storage Integration Server Installation. This should be an administrative user, as shown Figure 2-3.

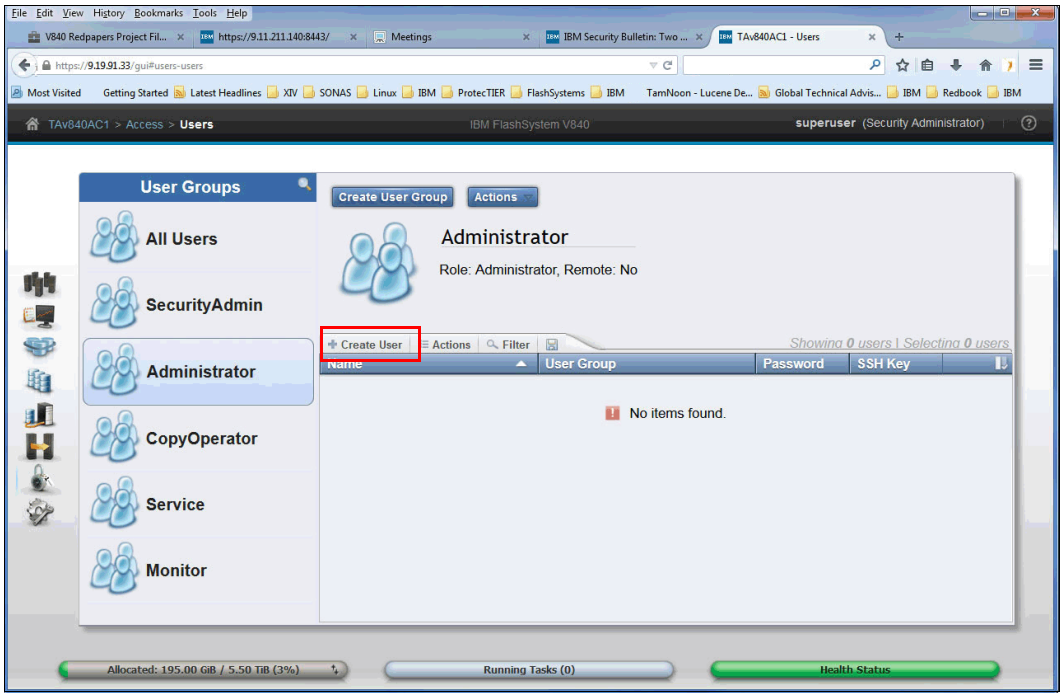


Figure 2-3 Create a specific user for IBM Storage Integration Server

3. Create the user, as shown in Figure 2-4 on page 24,and note the password for use during the Storage Integration Server array configuration. Using a specific administrative user name is beneficial for traceability. This user is registered in each array to be managed.

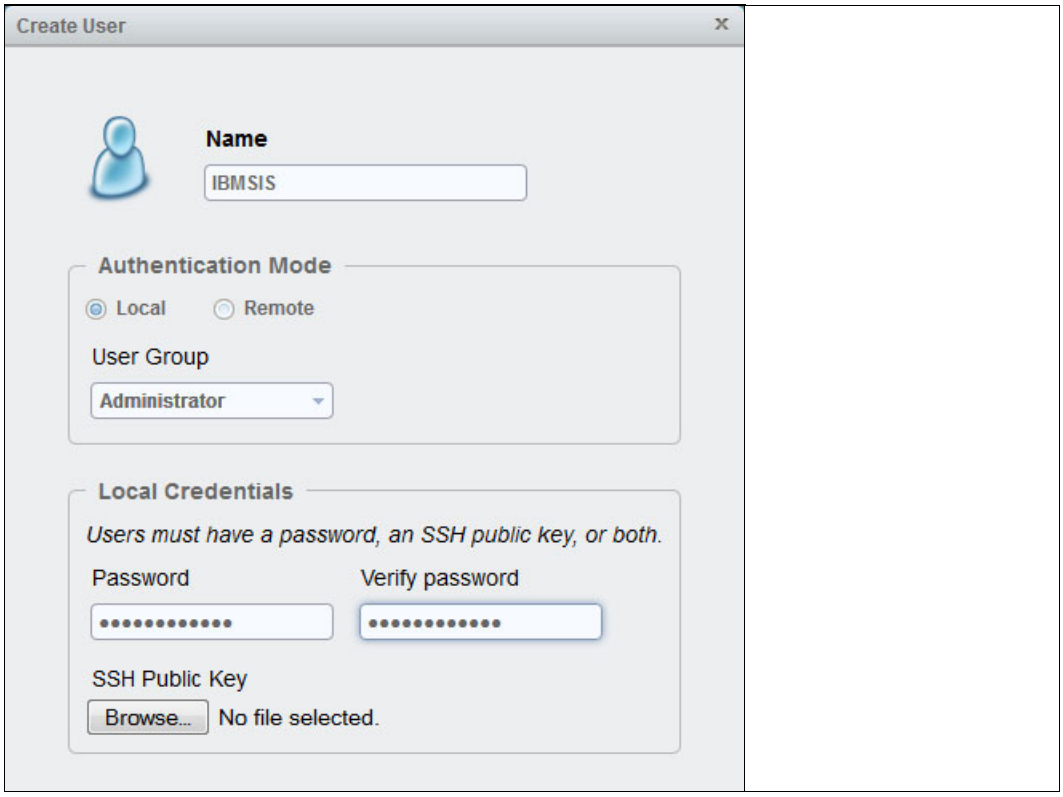


Figure 2-4 Define the IBMSIS user on the V840 storage controller

Tip: Secure Shell (SSH) is a client/server network application. FlashSystem V840 acts as the SSH server in this relationship. Command-line access is not required for the Storage Integration Server user.

4. Close the Create User dialog window. You can see the command-line equivalent by expanding the **View more details** drop-down menu (see Figure 2-5).

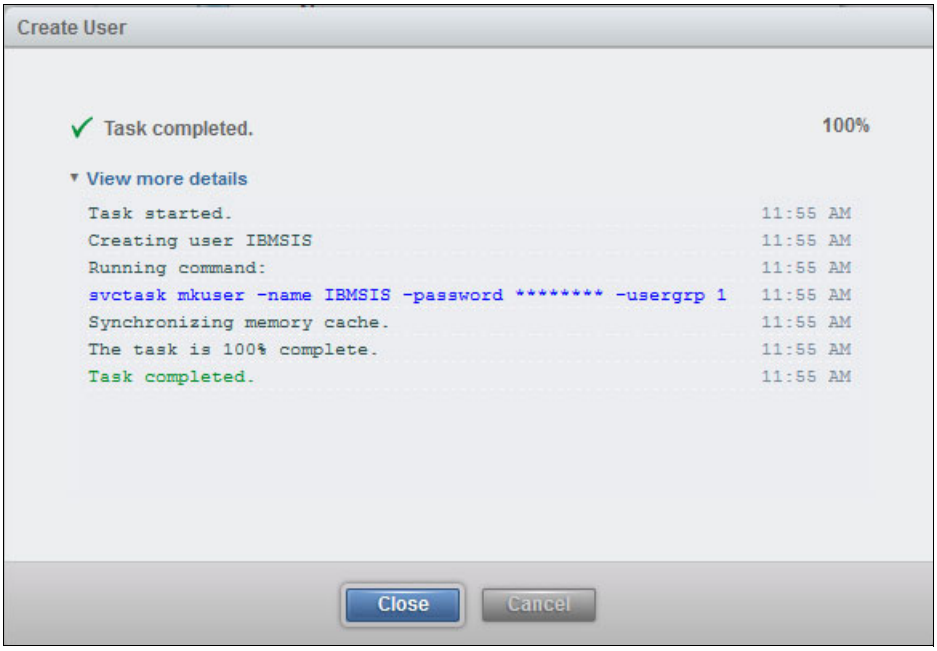


Figure 2-5 Command completion window

The resulting FlashSystem V840 controller window with the new user is displayed in Figure 2-6.

Figure 2-6 New User Created

Tip: After this account is registered with the Storage Integration Server, any storage administration tasks initiated by VMware vSphere are logged as performed by this user account.

2.2.3 Register IBM V840 array with the Storage Integration Server

Next, we configure the Storage Integration Server with the user that was defined in section 2.2.2, “Define the storage array administrative account” on page 22.

1. Log in to the server where the Storage Integration Server GUI is running to ensure that the array login matches the storage controller login (IBMSIS in this example), as shown in Figure 2-7.

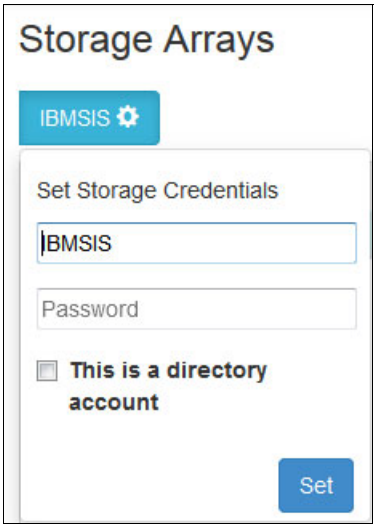


Figure 2-7 Window to log in to the storage controller

2. Select **Arrays** and then the **Add** tab to add an array, as shown in Figure 2-8.

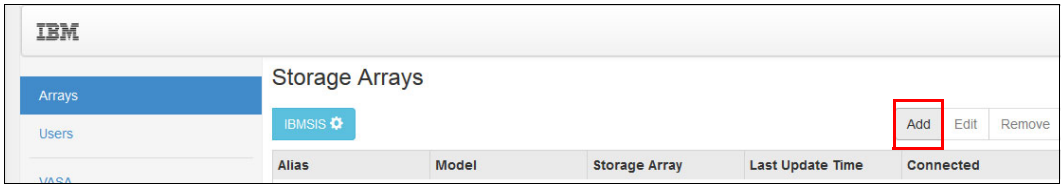


Figure 2-8 Add opens the dialog window to enter the FlashSystem V840 array

3. Specify the host name or IP address of the storage controller. The FlashSystem V840 is a Storage Array type of the IBM Storwize® family of products, as shown in Figure 2-9.

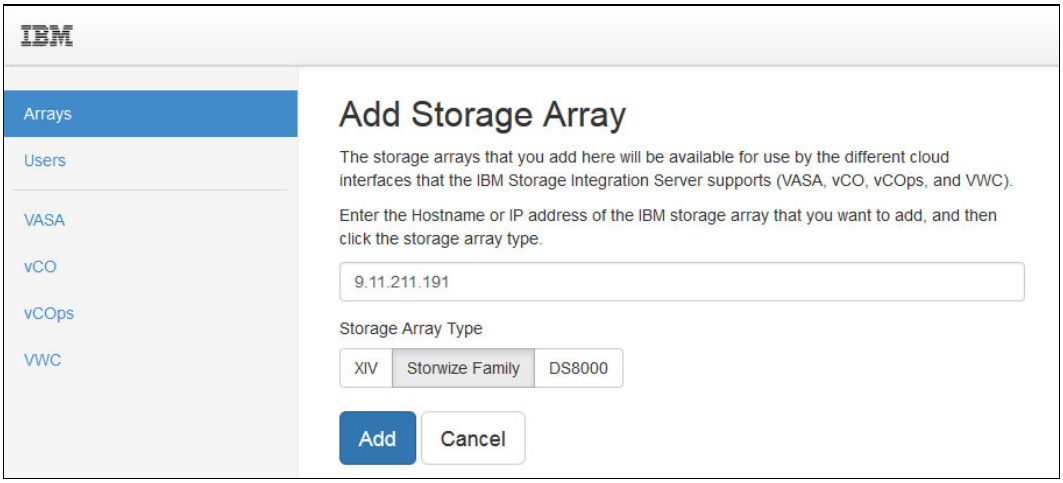


Figure 2-9 Add storage array

4. The results are displayed in the Storage Arrays pane shown in Figure 2-10

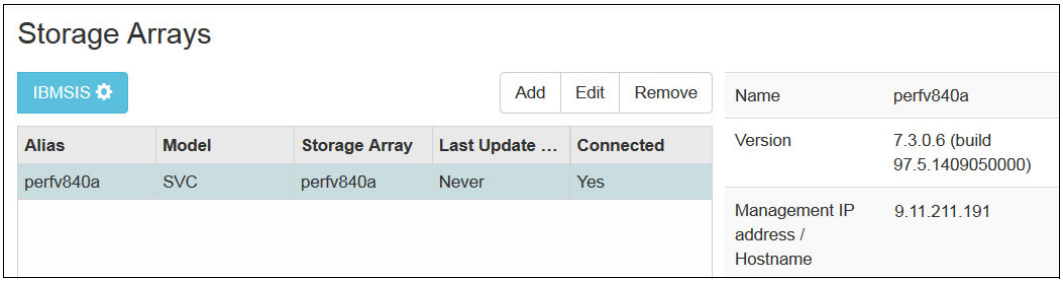


Figure 2-10 Add Storage Array results

Tip: Any storage arrays in the environment that will have storage allocated from vSphere can be added by using this process.

2.2.4 Register the Integration Server as a storage provider for VMware VASA

To use the IBM Storage Provider for VMware VASA component, you need to register the Storage Integration Server as a storage provider in VMware vCenter Server.

Tips: When the Storage Provider for VMware VASA and the IBM Tivoli® Storage Productivity Center storage provider, which provides the functionality of IBM Spectrum™ Control, are registered on the same VMware vCenter server, vCenter uses Tivoli Storage Productivity Center provider as the only source of information for that array's storage views on vSphere Client. This is true even while the same storage array is configured for both. See the IBM Storage Integration Server User Guide.

The date and time defined on both the vCenter server and on the Storage Integration Server must be identical. To accurately synchronize the date and time between the two servers, you can connect both to a Network Time Protocol (NTP) server.

These steps are a summary of the Storage Integration Server 1.5.0 User Guide, which you can download from Fix Central:

https://ibm.biz/IBM_Storage_Integration_Server_UG

There are two phases to configuring VMware VASA:

- Phase 1 is defining the credentials on Storage Integration Server.
- Phase 2 is registering the VASA provider on VMware vCenter.Phase 1. Defining the credentials on Storage Integration Server

1. Log in to the Storage Integration Server.
2. Select the **VASA** tab at the left. Under "Set VASA Credentials" in the section to the right, provide the following information:

   a. Enter a login ID to be used when exchanging certificates with vCenter.
   b. Enter matching credentials.
   c. Then, click **Set**.

   Figure 2-11 on page 29 illustrates the procedure of setting the VASA credentials on the Storage Integration Server.

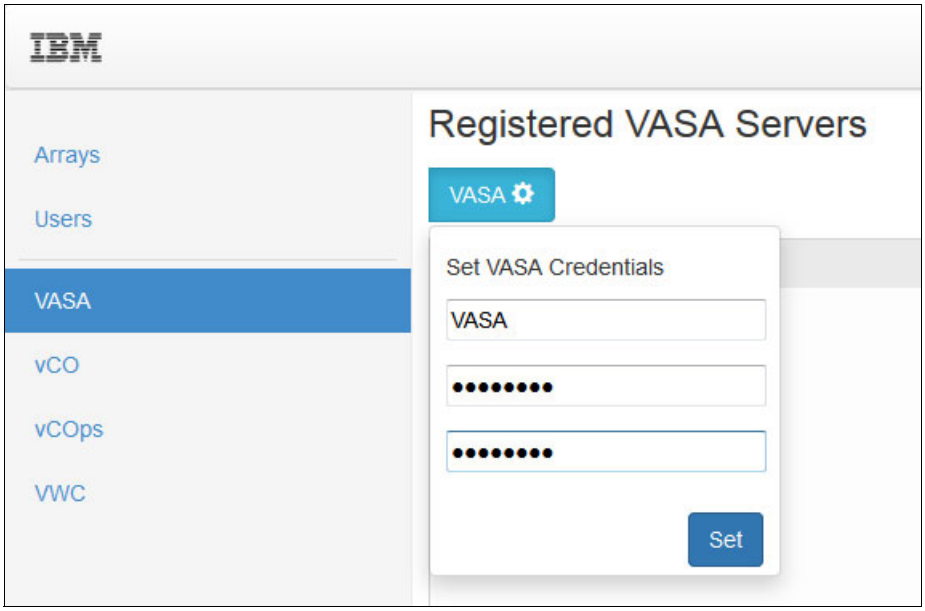


Figure 2-11 Set VASA credentials on IBMSIS

Note: The login credentials are case-sensitive.

These credentials are used in the next section, “Phase 2. Registering the VASA provider on VMware vCenter” on page 29,to exchange security certificates with VMware vCenter.

Phase 2. Registering the VASA provider on VMware vCenter

This procedure explains steps to register the VASA VMware vSphere Web Client certificate with Storage Integration Server.

1. Log in to the VMware vSphere Web Client.
2. Select the Home option at the left.
3. Then, under the Home tab display at the right, select the **Storage** icon, as indicated in Figure 2-12 on page 30.

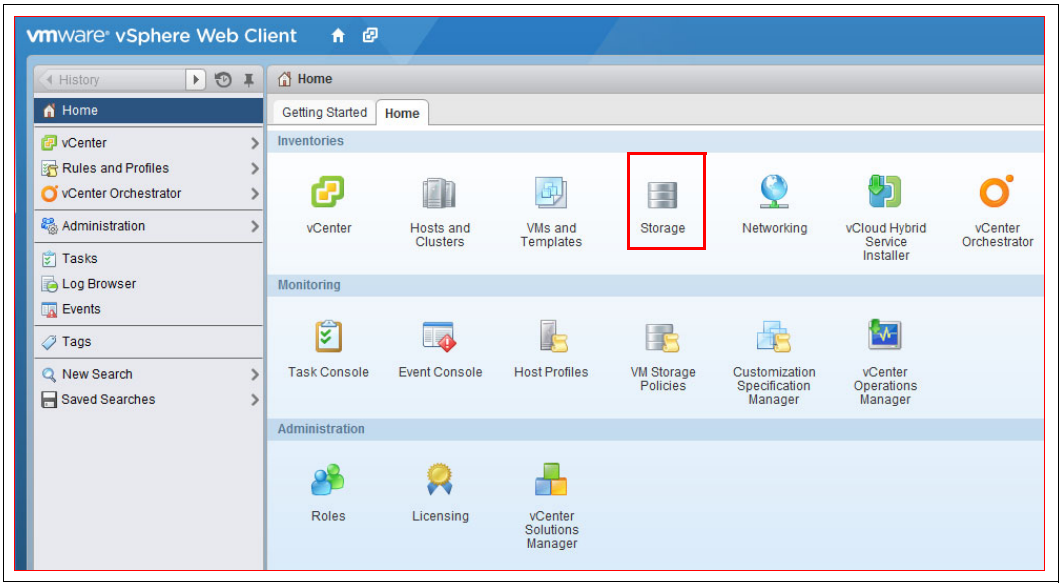


Figure 2-12 Home panel for vSphere Web Client

4. Select **WIN-70507KRD40** at the left, and then select the **Manage** tab, as shown in Figure 2-13.

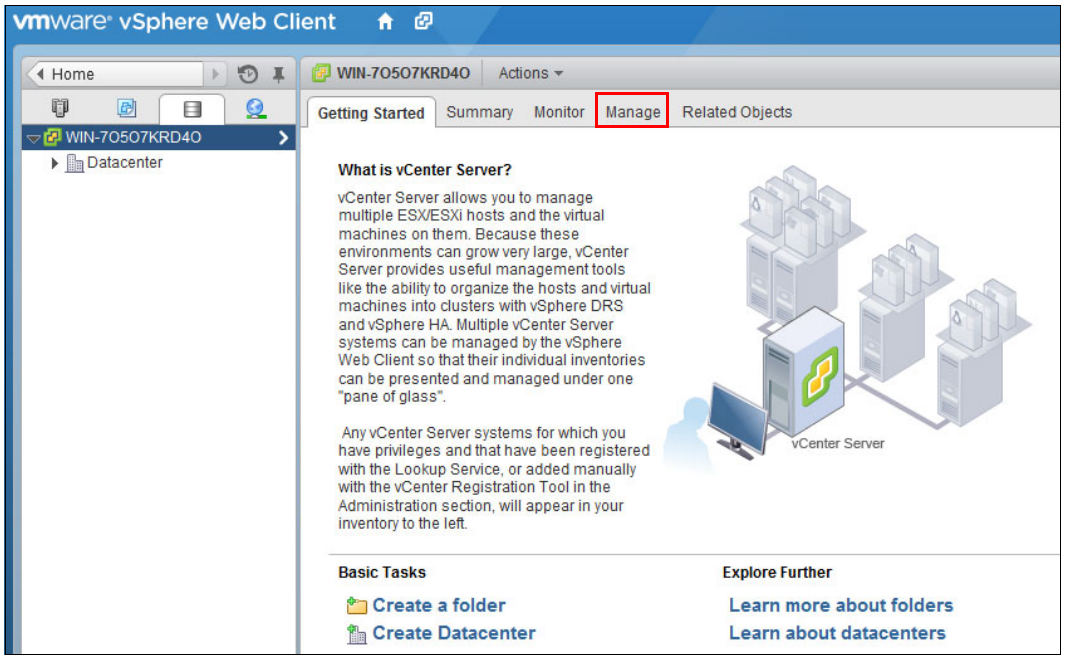


Figure 2-13 The Manage tab for storage provider selection

5. Add a storage provider by selecting the **Storage Providers** tab(1) and the plus symbol **+** (2) in the right pane as shown in Figure 2-14.

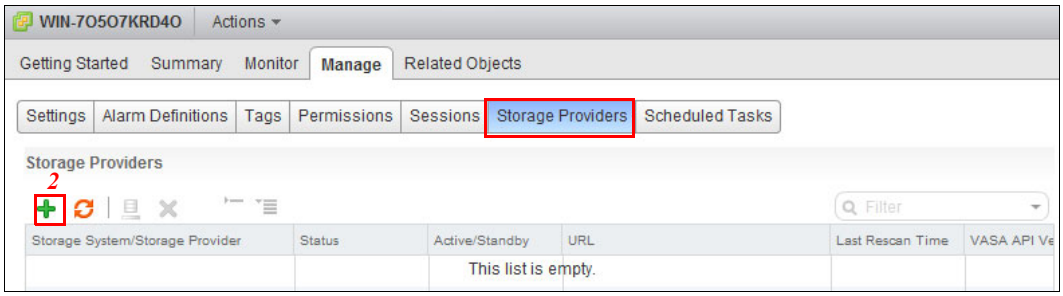


Figure 2-14 Add a storage provider by selecting +

6. In the next window, complete the New Storage Provider form for your installation as the example in Figure 2-15 shows, and then click **OK**.

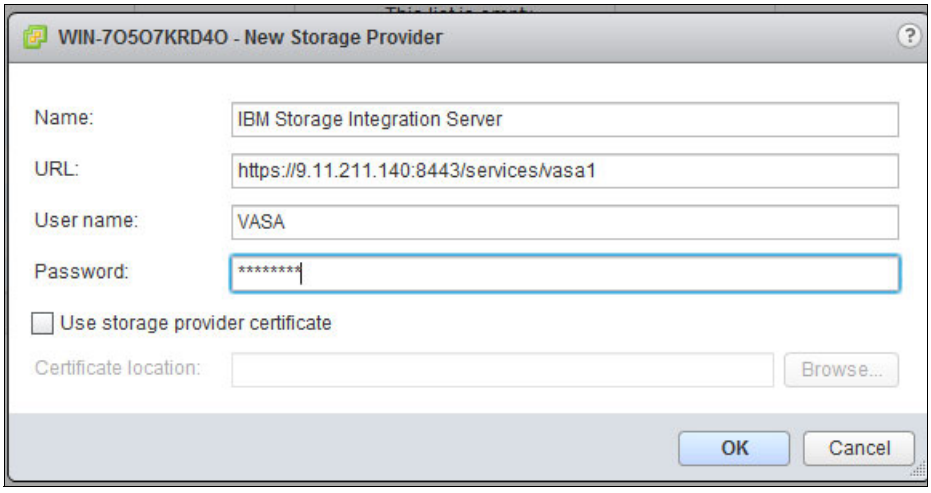


Figure 2-15 New Storage Provider form

Tip: The VASA user name and password were created in “Phase 2 is registering the VASA provider on VMware vCenter.Phase 1. Defining the credentials on Storage Integration Server” on page 28.

It might take as long as a few minutes for the certificate exchange to take place, as Figure 2-16 on page 32 shows.

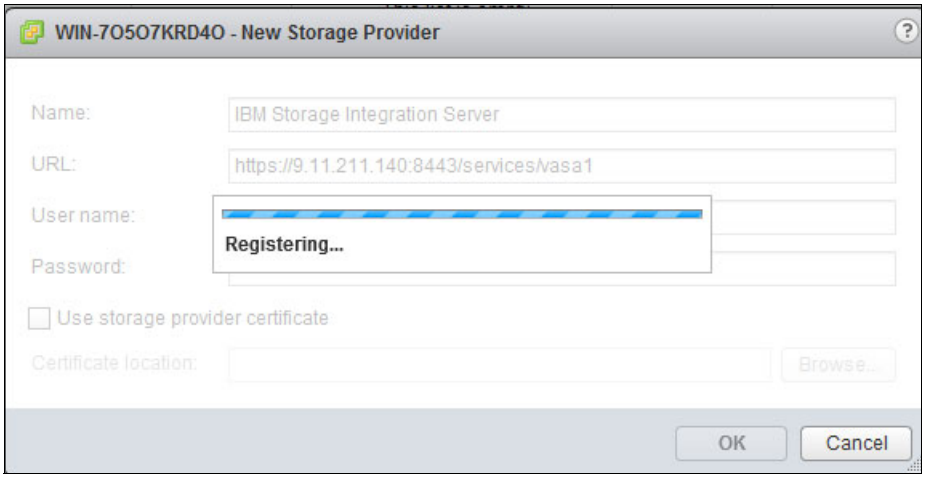


Figure 2-16 vCenter and IBMSIS Storage Provider registration

Figure 2-17 shows the results of the vCenter storage provider registration.

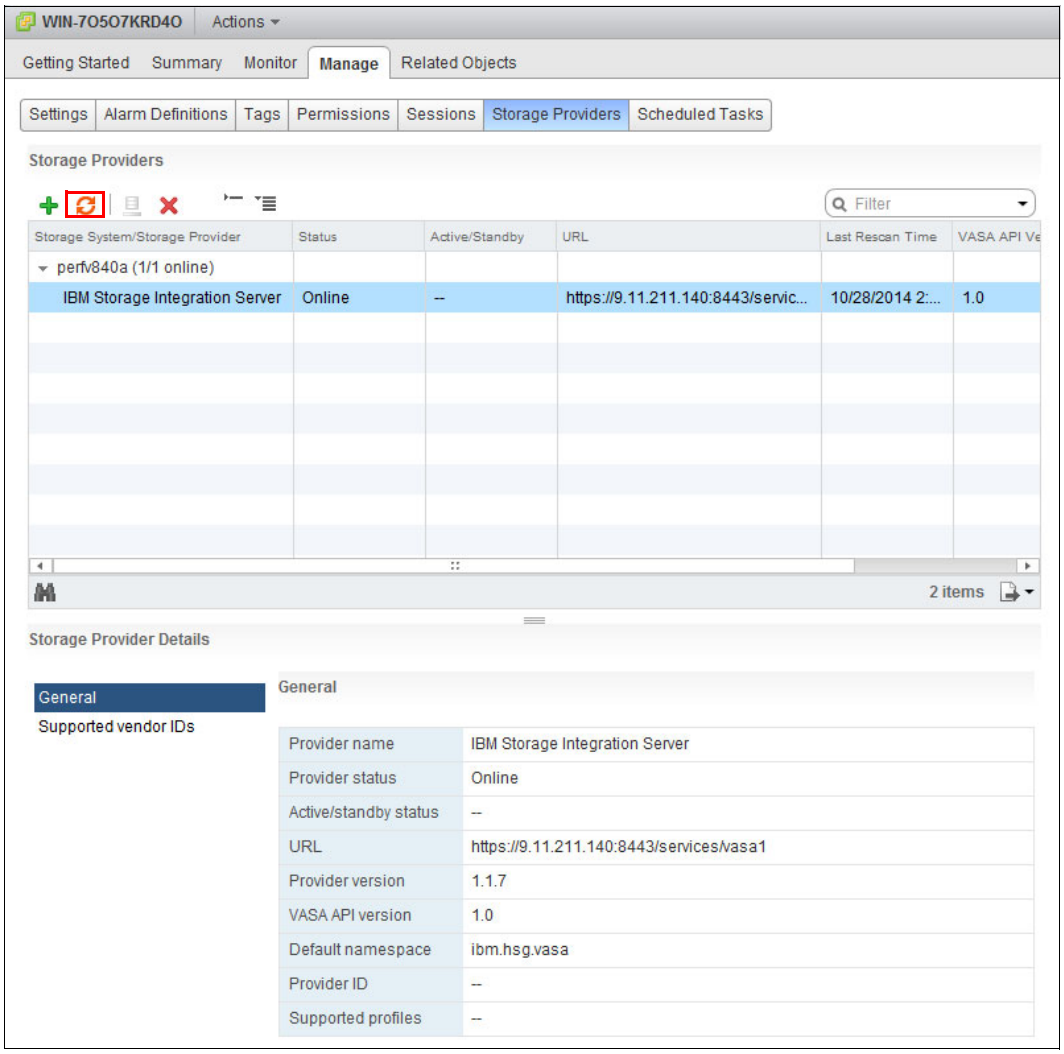


Figure 2-17 Storage provider registration results

Note: You might have to use the Refresh icon, as shown in Figure 2-17 (1).

7. Now, back on the IBM Storage Integration Server screen, confirm the storage provider registration in Storage Integration Server by selecting the VASA table and refreshing the display. Make a note of the certificate (seeFigure 2-18).

Figure 2-18 Confirm storage provider registration

Tip: Additional vCenter Servers can be registered by repeating this process.

2.2.5 Register IBM Storage Enhancements for VMware vSphere Web Client

This section describes configuration of the VMware vSphere Web Client (vSphere Web Client) with the Storage Integration Server. We start with a review of the vSphere Web Client user definition. Our assumption is that this user has already been created.

This section is followed with detailed instructions for configuring vSphere Web Client in the IBM Storage Integration Server.

vSphere Web Client user definition

These windows show what the vSphere Web Client user looks like in vCenter. There is no requirement to use this IBMSIS user. We use this account in the example to illustrate that credentials are required as VMware and IBMSIS cross-certify to authenticate.

1. On the vSphere Web Client Home screen *(*Figure 2-19 on page 34), select **Administration** to launch the vCenter Users and Groups pane.

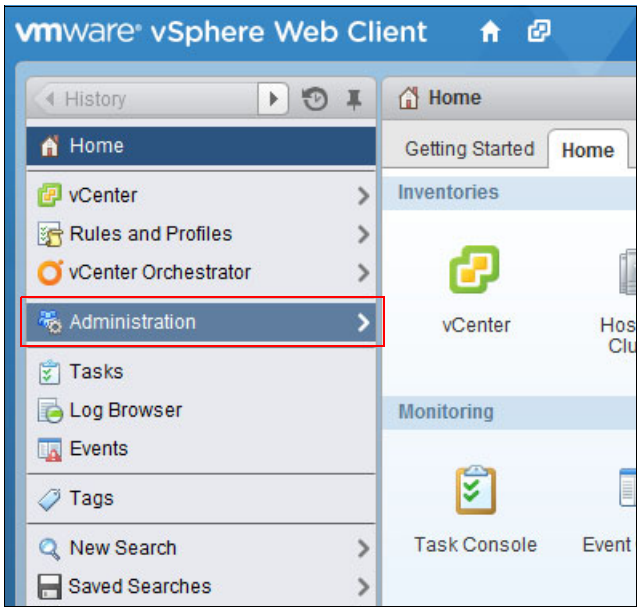


Figure 2-19 Administration option

Tip: Multiple VMware Web Client administrators can execute IBM storage operations from the vSphere Web Client. The IBMSIS user is used in this scenario by Storage Integration Server to update vSphere with information about attached storage pools.

2. From the Administration pane at the left (Figure 2-20), select **Users and Groups** (1) and each ESX server domain (2). The user account is under the Users tab (3).

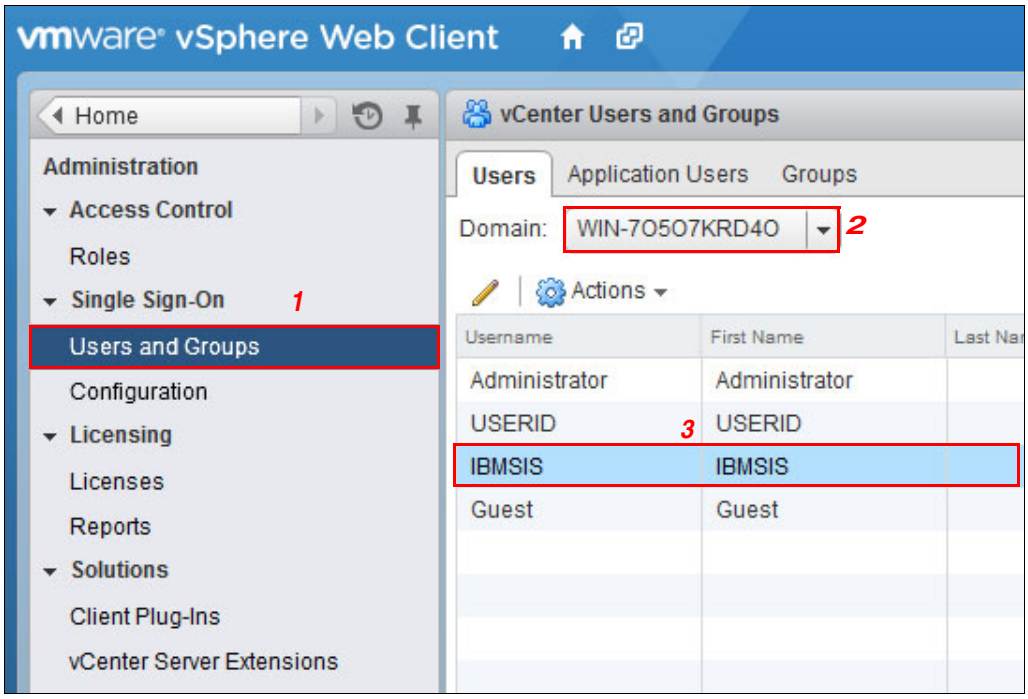


Figure 2-20 Predefined user IBMSIS for example

Configuring the vSphere Web Client in the IBM Storage Integration Server

In this section, we move back to the IBMSIS interface to configure the connection to vSphere Web Client. Together with supported IBM storage systems that are managed by the Storage Integration Server, the deployed IBM Storage Enhancements enable the following management features on vSphere Web Client for registered vCenter servers:

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

Follow these steps to configure the vSphere Web Client:

1. In the Storage Integration Server interface, select vSphere Web Client (1) in the left pane, as shown in Figure 2-21 on page 36, and then click **Add** (2) in the right pane.

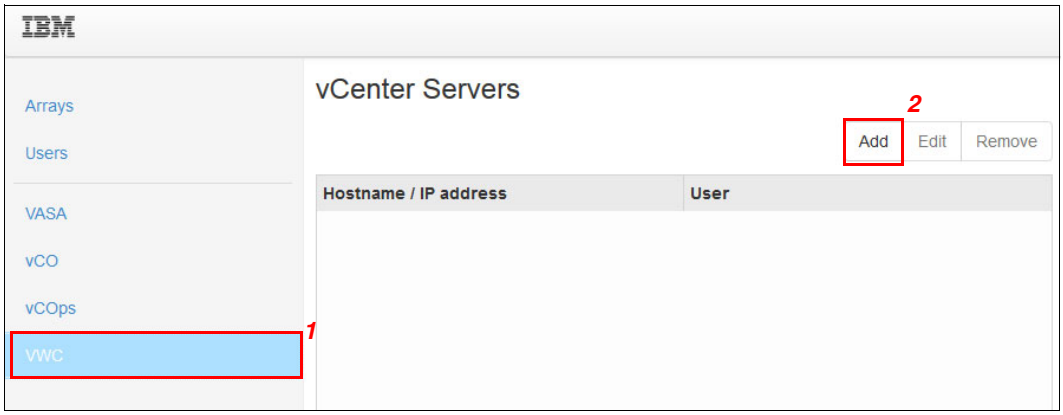


Figure 2-21 Add the vCenter Server

2. Complete the information required in the Add vCenter Server pane (Figure 2-22) by completing the fields, for example*:*
   - Hostname/IP Address (`9.11.211.163` for this example)
   - Username (`IBMSIS`)
   - Password

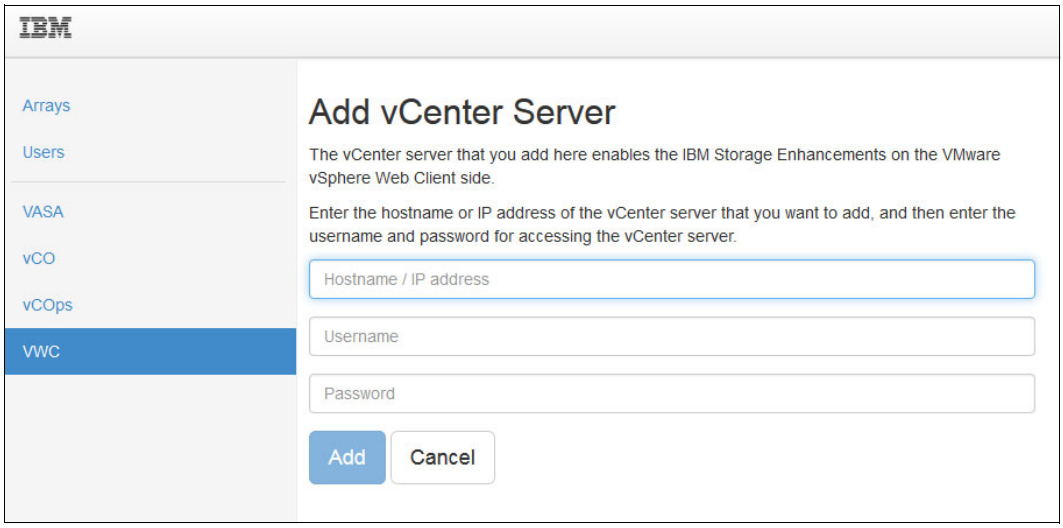


Figure 2-22 Complete the Add vCenter Server form

Tip: This user must be a registered administrative user on the vCenter Server.

The server has been added in Figure 2-23. Our figure includes only the left pane of the display to enhance readability.

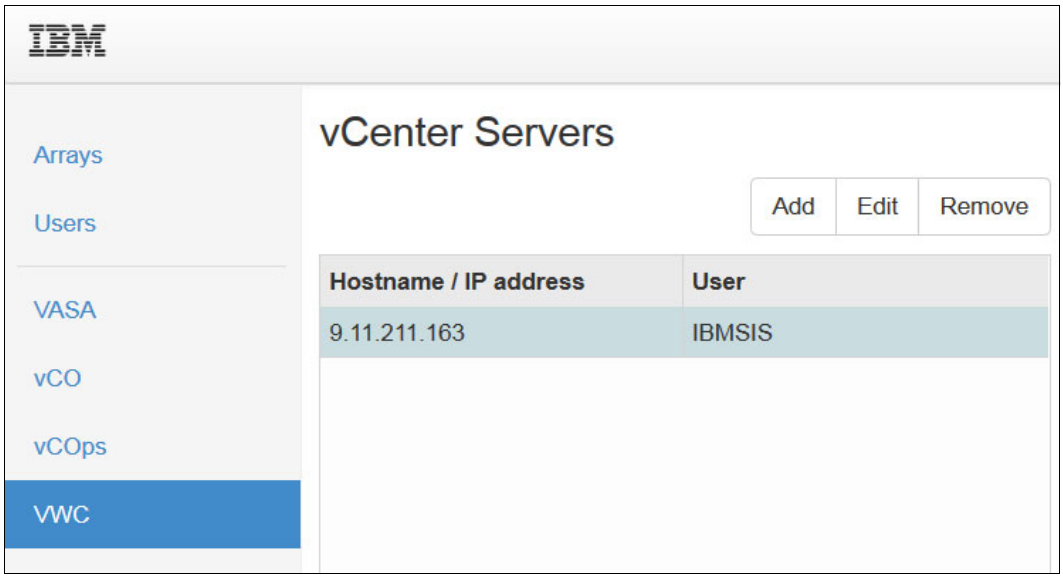


Figure 2-23 Results of adding the vCenter Server

3. In the pane shown in Figure 2-24,select **Attach** to attach the a storage pool.

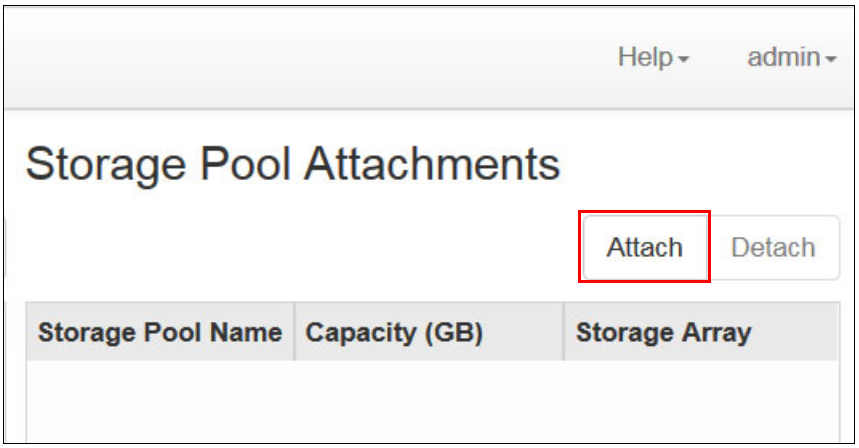


Figure 2-24 Attach the storage pool

4. Complete the Attach Storage Pools pane by selecting storage device **perfV840** (1), clicking the **Pool1** check box (2)**,** and then clicking **Attach Pools** (3)**,** as shown in Figure 2-25 on page 38.

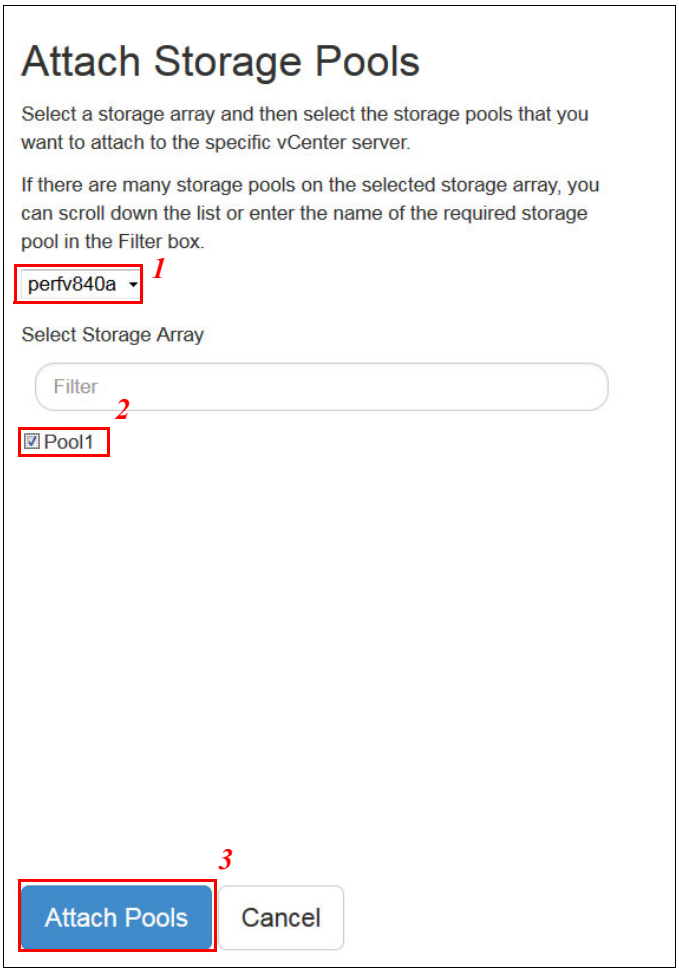


Figure 2-25 Attach the storage pools

Tip: FlashSystem V840 system configurations can vary, especially with *scale up, scale out* configurations. It is not unusual to have multiple storage pools to select from, depending on the configuration of the environment.

Results of attaching the storage pools are shown in Figure 2-26.

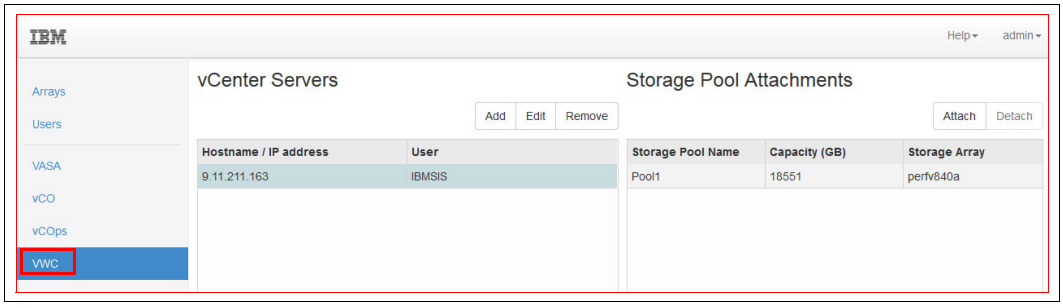


Figure 2-26 Storage pool attachment results

Note: vCenter Operations Manager (vCops) is not currently available for the V840.

2.2.6 Add a VMware ESXi server to FlashSystem V840

This section describes the standard process for determining a host worldwide name (WWN) on the VMware ESX server and demonstrates how these names are used on the FlashSystem V840 AC1 controller to define a host.

Tip: Each ESXi server is defined as a separate host on the FlashSystem V840.

The section is based on the assumption that the storage area network (SAN) zoning is established to allow the VMware ESXi Fibre Channel (FC) ports to see the FlashSystem V840 AC1 FC HBA ports. Having the zoning available allows the WWN to be viewed in the FlashSystem V840 AC1 interface GUI interface.

Determine the WWN for the ESXi host

The following steps are performed on the VMware vSphere Web Client:

1. Start from the **vCenter Home** screen, and select **Hosts**, as indicated in Figure 2-27.

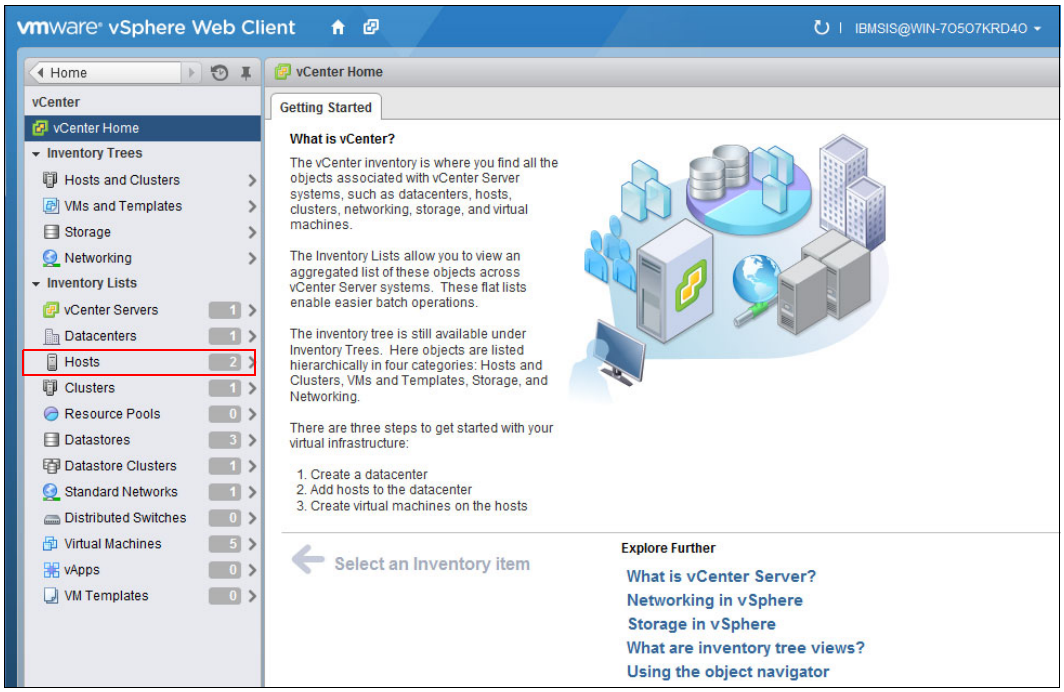


Figure 2-27 Select Hosts on vCenter Home pane

2. From the VMware vSphere Web Client Hosts display, select the ESX server to add to the environment, as shown in Figure 2-28.

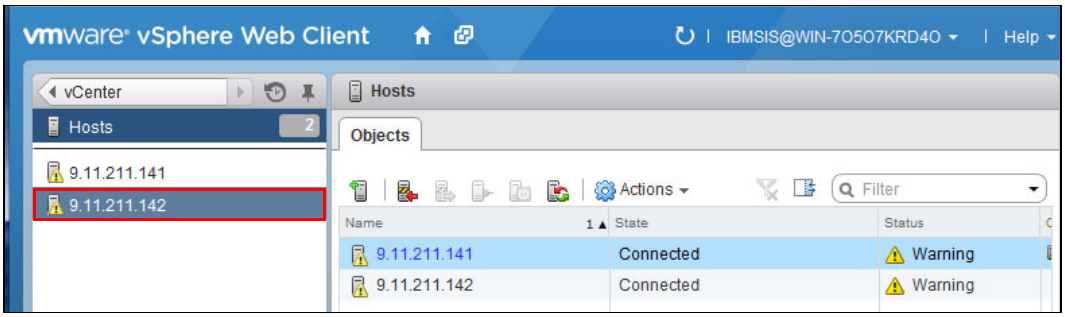


Figure 2-28 Select the ESX host that you need to determine the WWN

3. In the right pane, select the **Manage** tab, as shown in Figure 4. This will display the object (9.11.211.142) that can be managed for this ESX host.

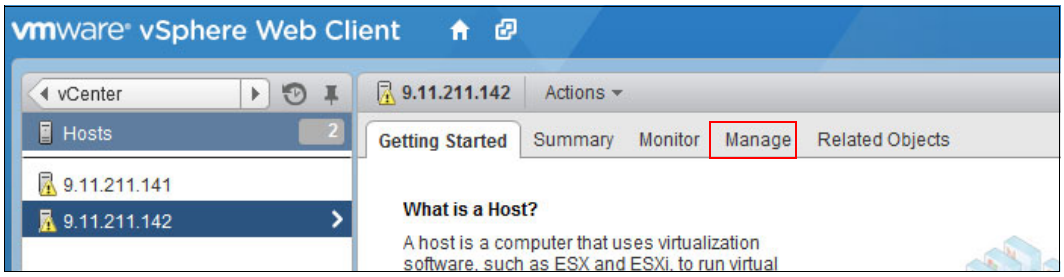


Figure 2-29 Select the Manage tab

4. Select the **Storage** tab in the right pane, as shown in Figure 2-30.

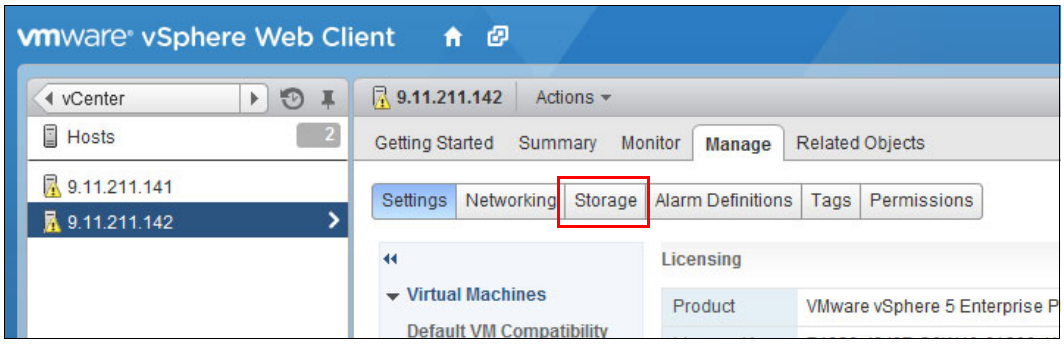


Figure 2-30 Select the Storage tab

5. The **Storage Adapters** option is on the left column of the right pane. Scroll down until you find the FC HBAs of interest. Record enough of the WWNs so that you can identify them when viewed in the FlashSystem V840 AC1 controller management GUI. See Figure 2-31.

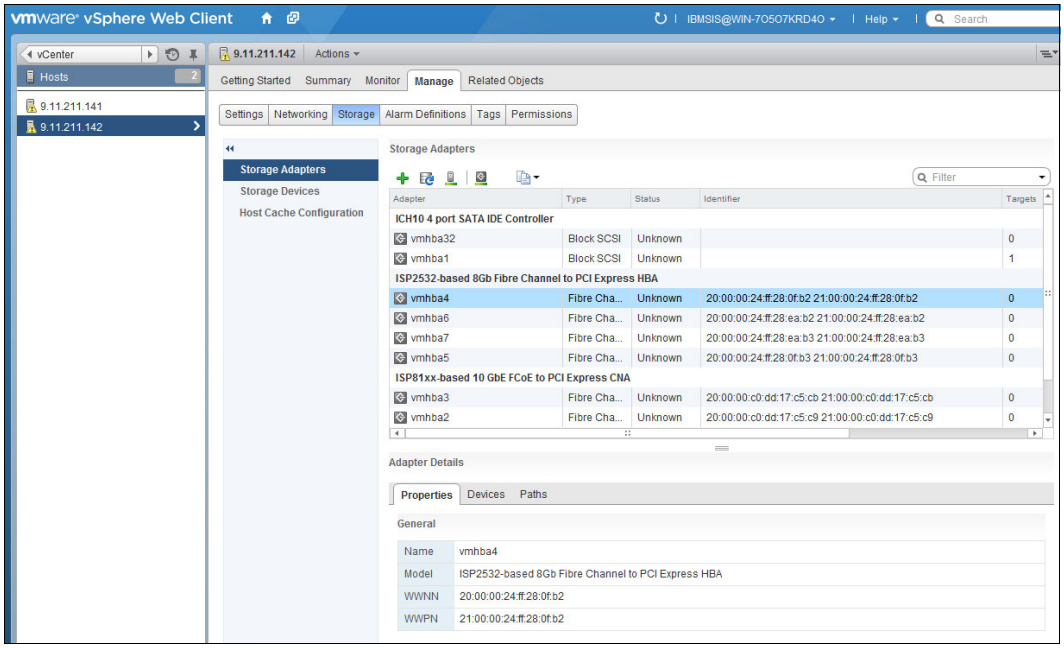


Figure 2-31 FC HBA WWN list on the ESX host

In the next section, these WWNs are available in the Host Definition on the FlashSystem V840 controller interface.

Create the host on the IBM FlashSystem V840

Use the IBMSIS login created earlier or any administrator account to log in to the FlashSystem V840 AC1 controller. This set of steps describes defining a host and associating the definition with the WWN on our ESX server.

1. Hover your cursor over the icons in the left panel until you see the Hosts menu shown in Figure 2-32 on page 42.

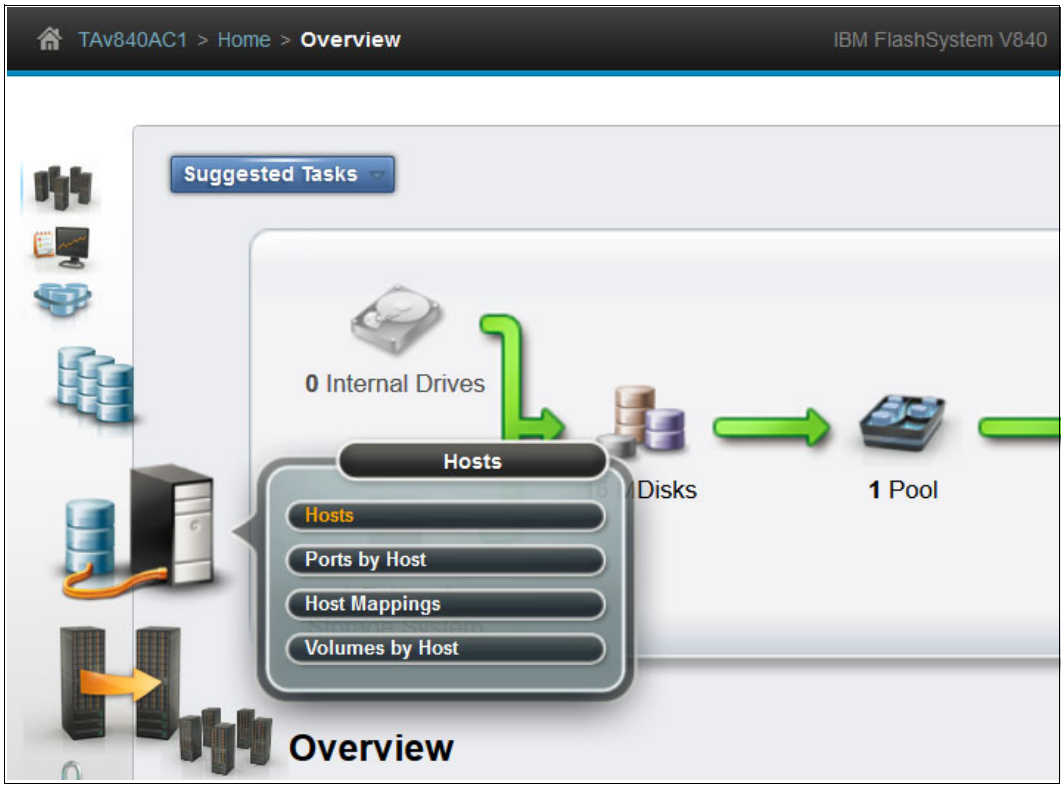


Figure 2-32 Hosts menu

2. The Hosts pane contains a list of hosts that are currently defined for the system. Select the **+ Create Host** tab (see Figure 2-33).

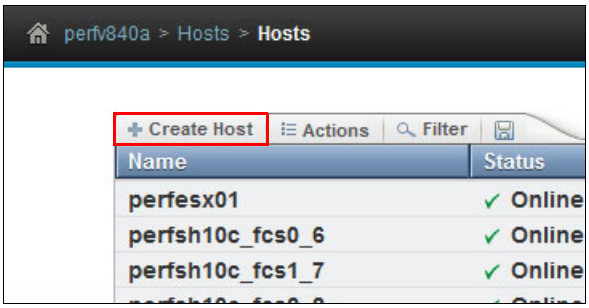


Figure 2-33 Select the + Create Host tab

3. Our lab environment uses Fibre Channel connectivity, so under Choose the Host Type, we select the **Fibre Channel Host** icon (see Figure 2-34).

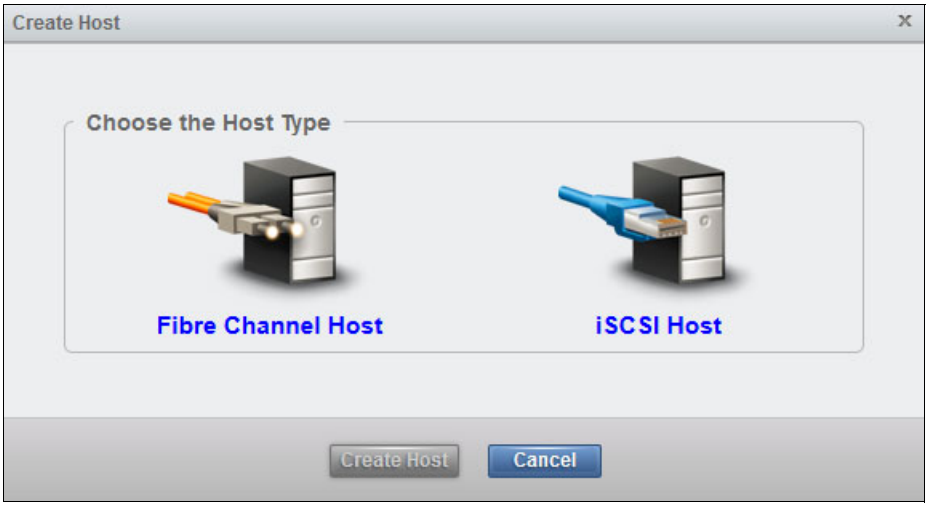


Figure 2-34 Fibre Channel Host icon selected

4. This opens the Create Host pane. As shown in Figure 2-35 on page 44, enter the host name (1), use the list of WWPNs that is available from the pull-down menu (2) and select each port, followed by **Add Port to List** (3).

   The Rescan option is available to refresh the list of WWPNs. The Advanced Settings were all selected by default.

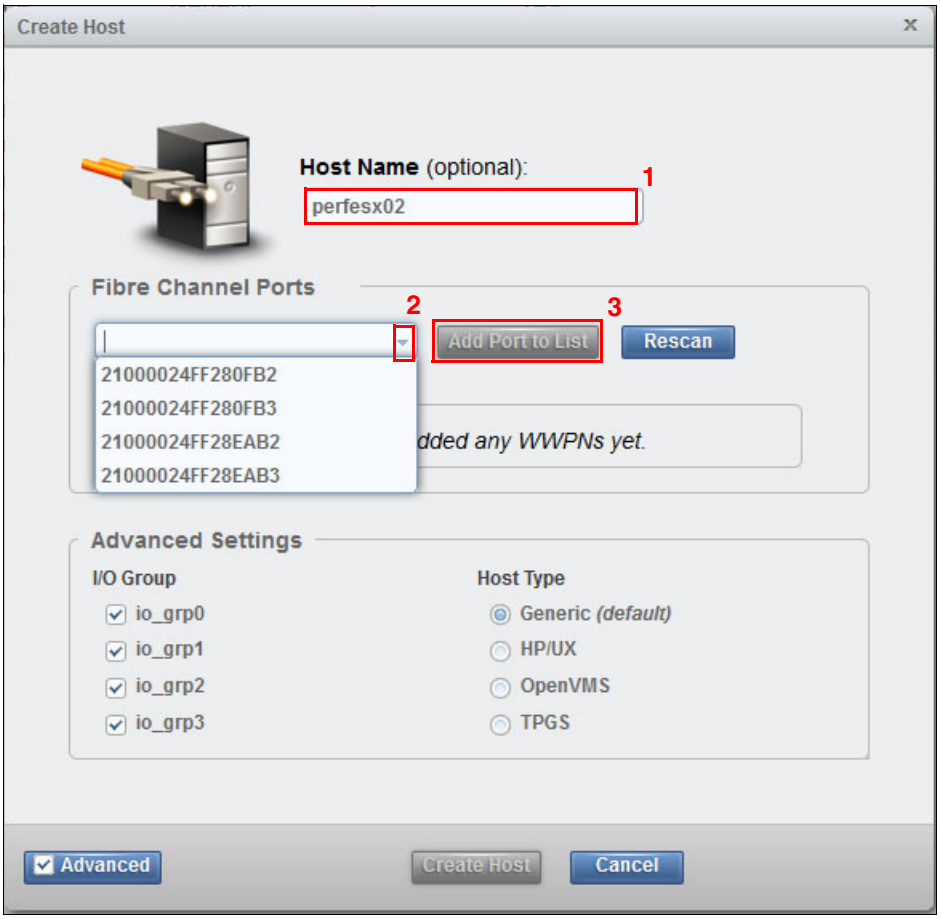


Figure 2-35 Host definition form

5. The example in Figure 2-36 on page 45 shows the results of the completed Create Host pane. Finish creating the host by selecting **Create Host**.

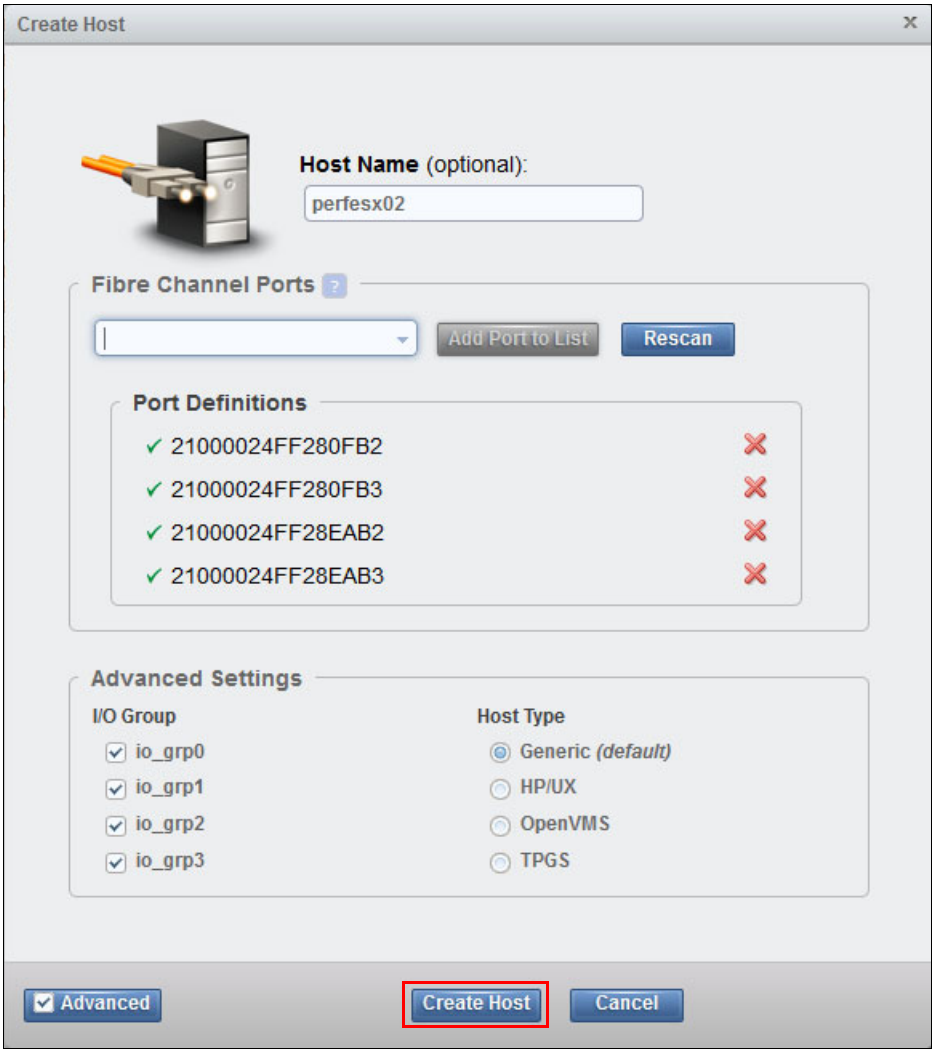


Figure 2-36 Select Create Host to define the host

Tip: This list of WWPNs will be used for assigning volumes to this host.

Figure 2-37 on page 46 shows results of the host creation. More details are shown in the results screen that provides an example of the command line that can be used.

6. Select **Close** to close the window (Figure 2-37 on page 46).

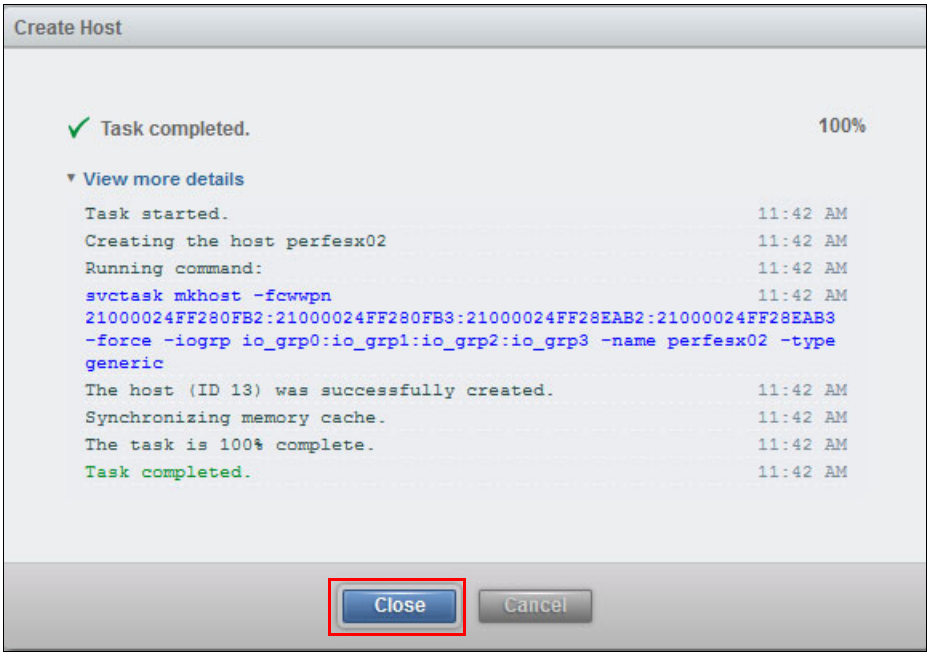


Figure 2-37 Details of the Host Creation, with Close selected

In Figure 2-38, the new host definition appears on the list of host definitions when the results window is closed.

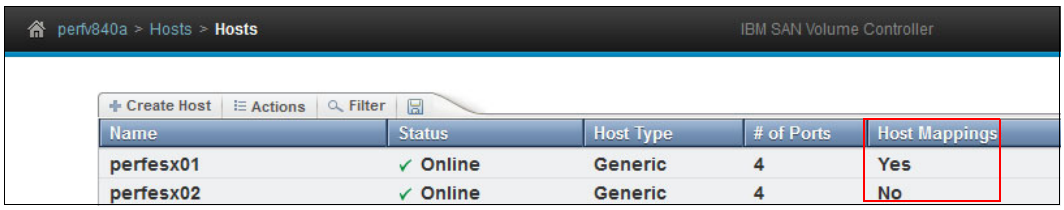


Figure 2-38 Hosts display after a new host is defined

Note: There are currently no host mappings defined for this host, `perfesx02`, because we just created it. Mappings are created from VMware as volumes are created by using the capabilities provided in the Storage Integration Server.

3

Integration and operations

This chapter provides information about how to use the IBM Storage Enhancements for the VMware vSphere Web Client plug-in to create and manage IBM FlashSystem V840 volumes in pools that have been attached to the IBM Storage Integration Server. It also highlights a single site high availability (HA) configuration that uses volume mirroring on the FlashSystem V840.

This chapter describes the following scenarios:

3.1 Use case: Provisioning FlashSystem V840 volumes using VMware

The IBM Storage Enhancements for the VMware vSphere Web Client plug-in is used to create and manage FlashSystem V840 volumes in storage pools that have been attached to the IBM Storage Integration Server. As Figure 3-1 illustrates, the plug-in enables you to create new FlashSystem V840 volumes directly from vCenter.

Through the plug-in, make the following selections: **WIN-70507KRD4O** → **Actions** → **All IBM Storage Enhancements for VMware vSphere Web Client Actions** → **Create New Volume**.

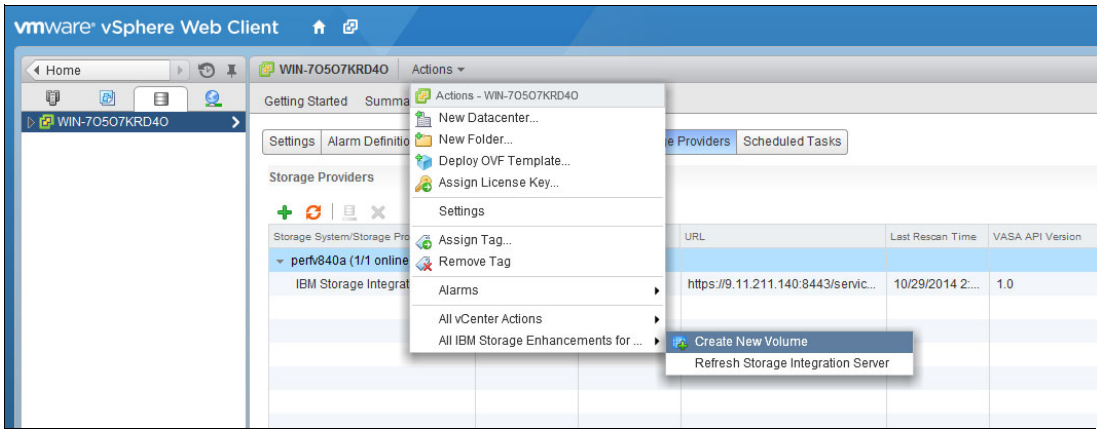


Figure 3-1 The IBM Storage Enhancements for VMware vSphere Web Client plug-in

This opens the **Create New Volume** window (Figure 3-2 on page 49).In the Create New Volumes window, the Host Mappings drop-down menu in Figure 3-2 on page 49 shows that **ITSO-Cluster** is the selected host that will be mapped to the newly created volumes. In this example, there will be two 500 GB volumes created and mapped to ITSO-Cluster:

- The initial volume is named `ITSO-Cluster_Vol_1` and is created in the `Pool1` on the `perfv840a` storage array. The number in the brackets sequentially increases by one.
- The second volume is called `ITSO-CLuster_Vol_2`. The Storage Array/Pool drop-down menu lists the storage pools that were configured on the IBM Storage Integration Server.

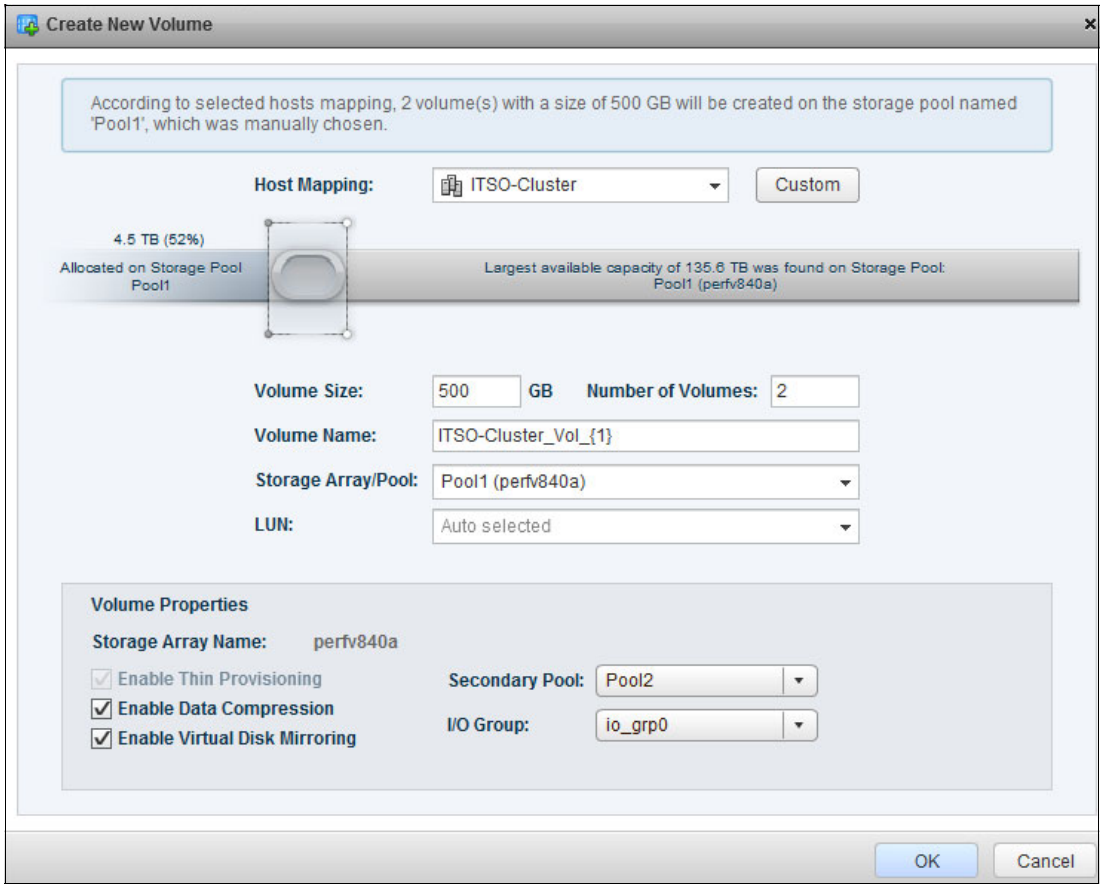


Figure 3-2 Create a new FlashSystem V840 volume with the VMware Web Client plug-in

Figure 3-3 on page 50 shows that additional volume properties can be selected when creating a volume from the Storage Enhancements for VMware vSphere Web Client plug-in. These volume properties are available to select:

- Enable thin provisioning
- Data compression
- Virtual disk mirroring

Note: Data compression requires the volume to be thinly provisioned. If you select data compression, thin provisioning is automatically selected for the volume. The thin provisioning selection will be grayed out and a check mark will be placed in the selection box.

During volume creation, a mirrored copy of the volume can also be defined. When Enable Disk Mirroring is selected, a secondary pool and I/O Group must be provided. The Secondary Pool drop-down menu lists the pools that are available on the storage array. We selected the secondary pool, **POOL2**.

The I/O Group drop-down menu lists the I/O groups that are available on the storage array. We selected the **io_grp0** IO group.

Your selections here determine where the mirrored volume will be placed on the storage array. Having a second pool on a second storage controller is a recommended practice for redundancy. These pools should have similar performance characteristics.

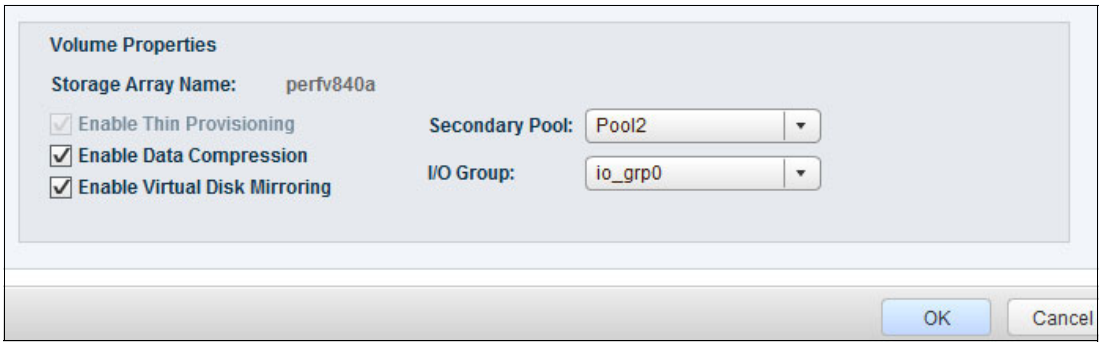


Figure 3-3 Additional volume properties

Figure 3-4 shows the new FlashSystem V840 volumes created and mapped directly from the vSphere Web Client, without the need for the VMware administrator to access the FlashSystem V840 GUI or command-line interface directly. This view lists the storage array where the volumes are located. The names and size of the volumes can also be seen in this view.

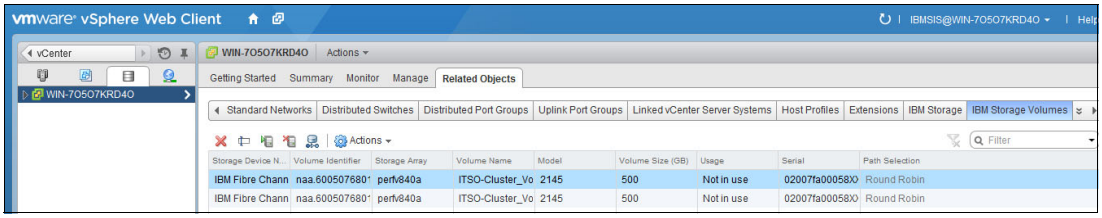


Figure 3-4 FlashSystem V840 volumes created and mapped from the vSphere Web Client

The results of the volume created by the VMware vSphere Web Client plug-in can also be seen in the FlashSystem V840 GUI, as shown in Figure 3-5. I. This particular view of the GUI, lists the volumes that were defined on the FlashSystem V840. Figure 4-5 shows the two volumes that were created from the plug-in. These volumes are named `ITSO-Cluster_Vol_1` and `ITSO-Cluster_Vol_Cluster_2`.

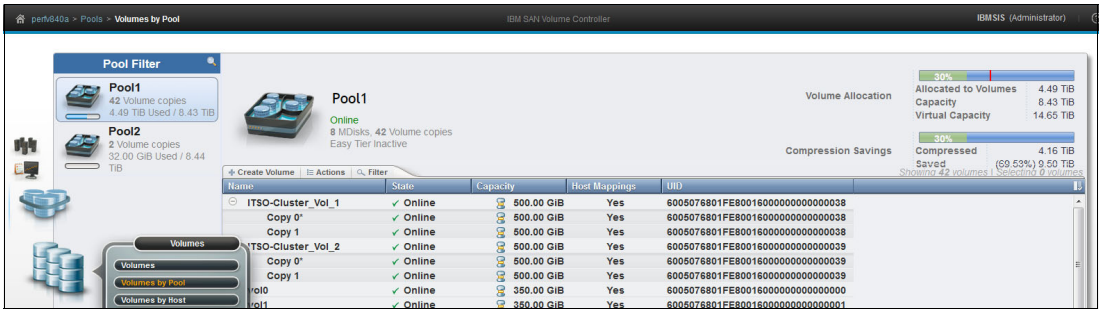


Figure 3-5 FlashSystem V840 GUI view, Volumes by Pool window

3.2 Use cases: Availability solutions

In this section we highlight two availability solutions of FlashSystem V840. A single site high availability (HA) solution using volume mirroring is covered in the first topic. The second topic highlights cross-site (extended distance) solutions: metro and global mirroring and global mirroring with changed volumes.

3.2.1 Single-site HA (volume mirroring to another storage system)

Replication of data within a single site is typically used to protect against failure of a single subsystem by mirroring the data to another subsystem, usually within the same site. FlashSystem V840 supports volume mirroring, which maintains a synchronous copy of the volume within the same storage pool or in different storage pools. Typically, the two copies are allocated in different storage pools. By using volume mirroring, having two copies of a volume provides a basic RAID-1 function at the storage level.The first storage pool (in our example Pool1) contains the primary copy. The second pool, Pool2, contains the secondary copy. If one of the storage pools fails, a volume copy is not affected if it has been placed in a different storage pool. Volume mirroring is apparent to the host. If one of the subsystems fails, the host continues without any impact. After the failed subsystem has been repaired, the mirrors must be resynchronized.

Figure 3-6 shows volumes by pools that are defined on the FlashSystem V840. The ITSO-Cluster_Vol_1 has two copies: Copy 0 and Copy 1. The (*) indicates that Copy 0 is the primary copy of the volume.

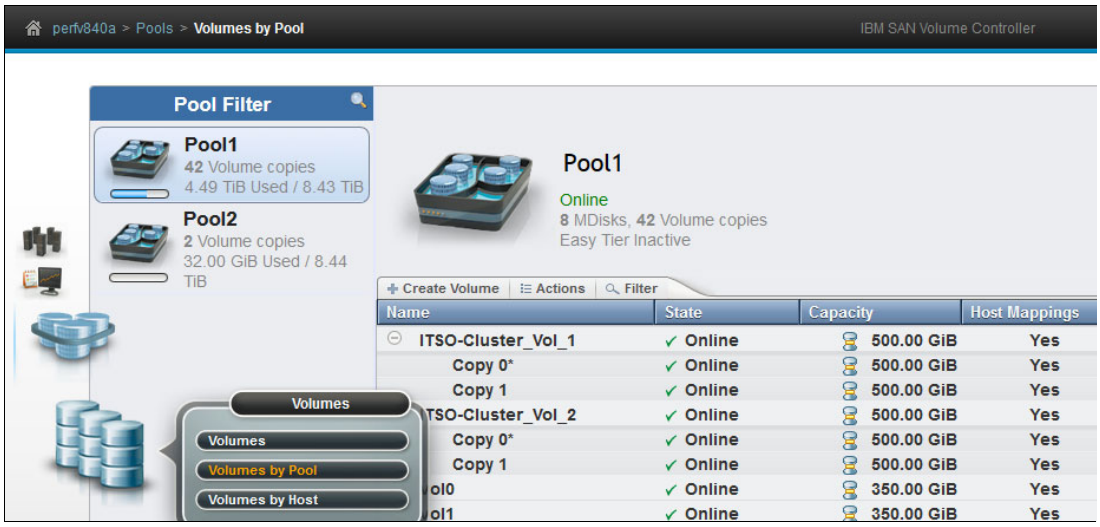


Figure 3-6 Mirrored volumes

When a server writes to a mirrored volume, FlashSystem V840 completes the writes to both volumes. Similarly, when a server reads a mirrored volume, FlashSystem V840 reads the copy from the primary volume. In the use case where one of the copies is in flash storage and the other copy is on a spinning disk, a preferred read configuration can be put in place.

In a preferred read configuration, the copy in flash is typically defined as the copy used to satisfy all read requests from a host or application to the mirrored volume. The write performance in a preferred read is determined by the I/O performance of the slowest device. This provides the highest read performance back to the application. This configuration is typically used in database environments, but it can be implemented for any workload where you want to enhance the read performance.

3.2.2 Cross-site high availability: extended distance

If a greater level of protection is required, such as protection against fire or flooding at the primary site, it is necessary to locate the auxiliary storage at another location. FlashSystem V840 provides additional copy services to protect data by creating a copy of the data at the secondary site. FlashSystem V840 is capable of replicating data to another FlashSystem

V840 at another location. It can also replicate to a IBM Storwize SAN Volume Controller or Storwize V7000 at a separate location. FlashSystem V840 offers the following copy services:

- *FlashCopy* creates a point-in-time copy and gives the application continuous operation during backups.
- *Metro Mirror* is an synchronous remote copy function. In a synchronous mirror relationship, updates are committed to both the primary and secondary copy before the host I/O completes. This slightly increases latency, depending on the distance and type of technology used as the link between the two sites. It is suitable for disaster recovery solutions for limited distances. Metro Mirror is supported up to 300 km. It keeps consistent and current images of primary volumes. Figure 3-7 shows a simplified view of a Metro Mirror relationship.

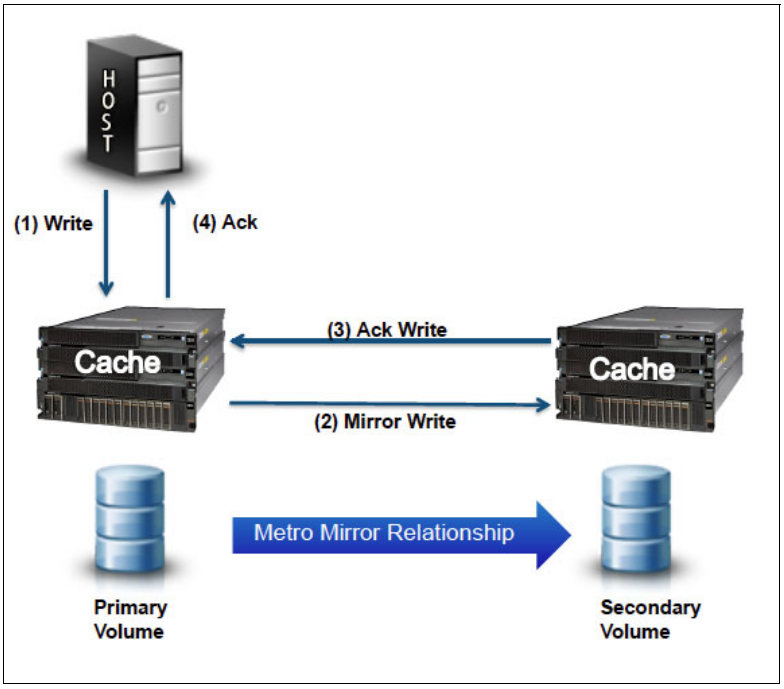


Figure 3-7 Metro Mirror relationship

- *Global Mirror* offers an asynchronous copy function for distances greater than 300 km. Global Mirror is an asynchronous process, so the host I/O completes after the primary copy has been updated. The update is then queued to the remote subsystem to update the secondary copy. This prevents the host from seeing any additional latency from delays on the remote link, but it means that the remote copy is always slightly out of date.

  Global Mirror keeps consistent images of data at all times, even when the sites are separated by long distances. To maintain integrity, FlashSystem V840 ensures that all remote updates are sent in the order that they are received from the host. Global Mirror supports up to 80 ms of round-trip latency. Figure 3-8 on page 53 shows the relationships.

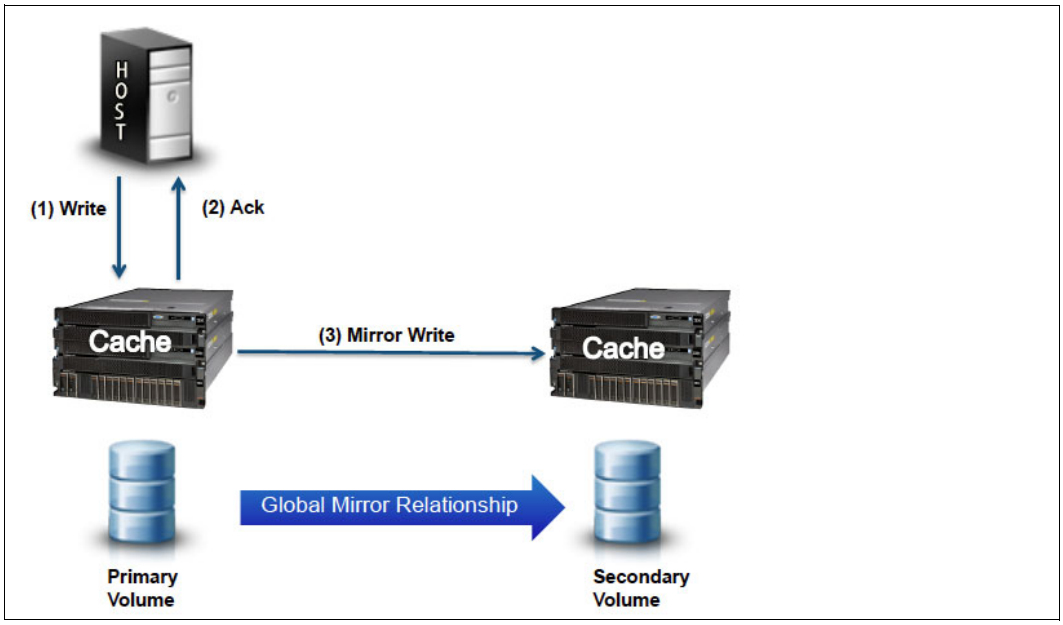


Figure 3-8 Global Mirror relationship

- *Global Mirror with Change Volumes* is an asynchronous function that is based on adjustable point-in-time copies of data. Global Mirror with Change Volumes was designed for replication over lower-bandwidth networks. Figure 3-9 shows a simplified Global Mirror with Change Volumes relationship.

Figure 3-9 Global Mirroring with Change Volumes

VMware offers Site Recovery Manager (SRM) as an optional element of VMware Infrastructure to enable automated disaster recovery. A Storage Replication Adapter (SRA) for the SRM is the link between VMware SRM and FlashSystem V840. It makes VMware software fully aware of FlashSystem V840 features, such as Flash Copy and Remote Copy. It gives the SRM the possibility to automate a recovery process by using FlashSystem V840 storage replication services.

The benefit of adding the SRM is that it enables VMware to manage the remote copy function of the FlashSystem V840 as well as the VMware hosts and guest virtual machines. It aids in the following tasks:

- Setting up the recovery infrastructure
- Creation of recovery plans
- Testing recovery plans
- Automating failover

The combination of VMware Site Recovery Manager, Storage Replication Adapter, and FlashSystem V840 enable the automated failover of virtual machines from one location to another location that is connected by IBM Metro Mirroring or Global Mirroring technology. This ensures that, in the event of a disaster at the primary location, VMware vCenter is able to restart all of the required virtual machines at the secondary location with minimal delay and manual intervention and the shortest recovery time. For more information about the SRM, see the “VMware vCenter Site Recovery Manager Documentation” page on the VMware website:

https://www.vmware.com/support/pubs/srm_pubs.html

4

Tips and troubleshooting

This chapter contains practical information about using IBM FlashSystem V840 storage in an environment that is running with IBM Storage Integration Server and vSphere Web Client tools. Sample scenarios are provided for resolving an out-of-space condition, for getting performance information, for auditing, and for collecting logs.

4.1 Resolving an out-of-space condition

This section discusses how to resolve an out-of-space condition and demonstrates how this condition can be immediately addressed by using FlashSystem V840 and VMware in an integrated environment. These two methods are described:

- “Extend an existing data store volume” on page 57
- “Expanding a data store by creating a new volume” on page 61

Out-of-space conditions occur when either initializing new VM guests or allocating additional storage to existing guests. In addition, if *thin* VMDKs are being used and they have grown, an out-of-space condition can result. VMware vCenter recognizes the out-of-space condition and uses the vSphere Web Client to alert the administrator to the condition. In Figure 4-1 you can see the initial alarms starting to display on our vSphere Web Client.

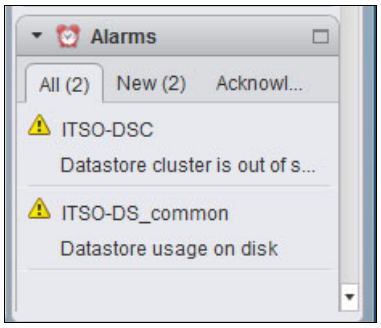


Figure 4-1 Running out-of-space alarm

Note: The alarm pane is available on the vSphere Web Client dashboard.

1. Move to the vCenter home (1), select the **Actions** menu (2), and **IBM Storage Enhancements** (3), shown in Figure 4-2.
2. Start by clicking **Refresh Storage Integration Server**.

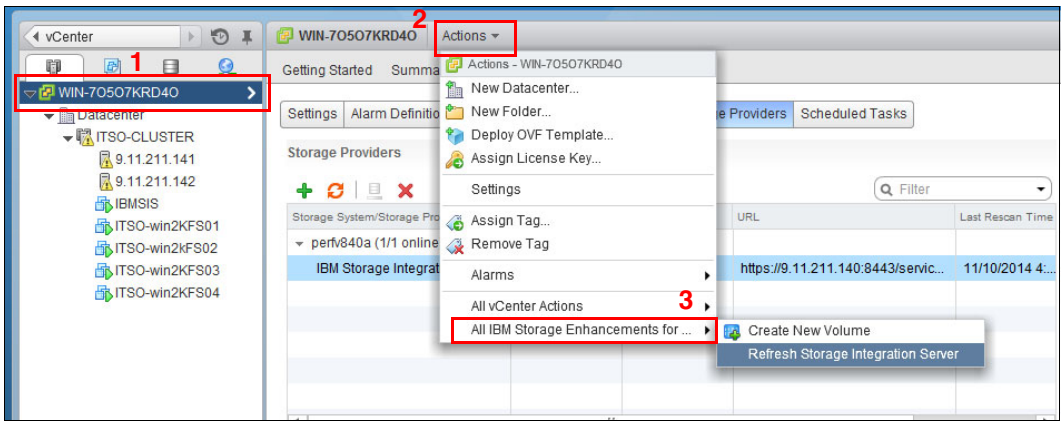


Figure 4-2 Refresh Storage Integration Server selection

Tip: Refreshing the Storage Integration Server is not always necessary. Be sure that you have up-to-date information about your VMware environment.

Our monitoring pane (Figure 4-3) shows that the out-of-space condition is getting worse, as indicated by the ! icons.

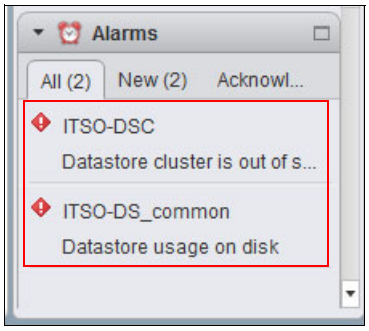


Figure 4-3 Alerts for out-of-space condition in vCenter

Resolving this quickly is a high priority for most VMware administrators. Fortunately, because our FlashSystem V840 solution is integrated with VMware, the tools to address it are readily available.

4.1.1 Extend an existing data store volume

Extending an existing volume is a task that is available to the VMware administrator. In our test environment, this took less than a minute, manually. The following provides the steps:

1. Start with the alarm pane in Figure 4-4. Double-click the **ITSO_Cluster** alarm to select the data store.

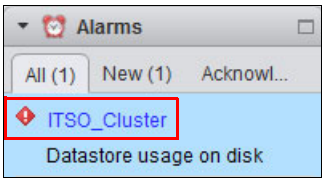


Figure 4-4 Select the ITSO Cluster data store alarm

2. vSphere takes you directly to the pane that shows the problems for this data store, where you can see the triggered alarm (Figure 4-5). Select the **Related Objects** tab to investigate objects that are associated with this data store.

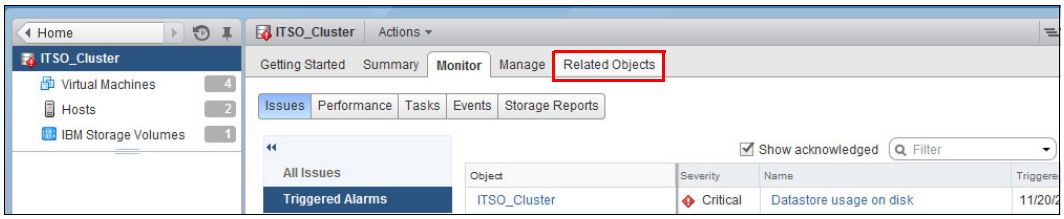


Figure 4-5 Data store Issues pane with triggered alarm notice

3. Select the **IBM Storage Volumes** tab (1) in the Related Objects pane to see the volume that is currently assigned to the data store. Select that volume (2), as shown in Figure 4-6.

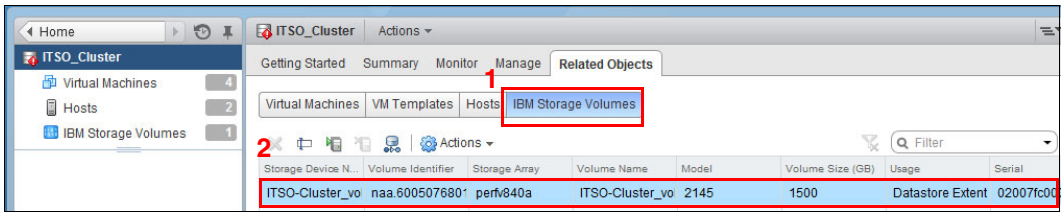


Figure 4-6 IBM Storage Volumes tab with the data store volume

4. Use the Actions pull-down menu (1) with the volume selected and select **Extend** (2), as shown in Figure 4-7.

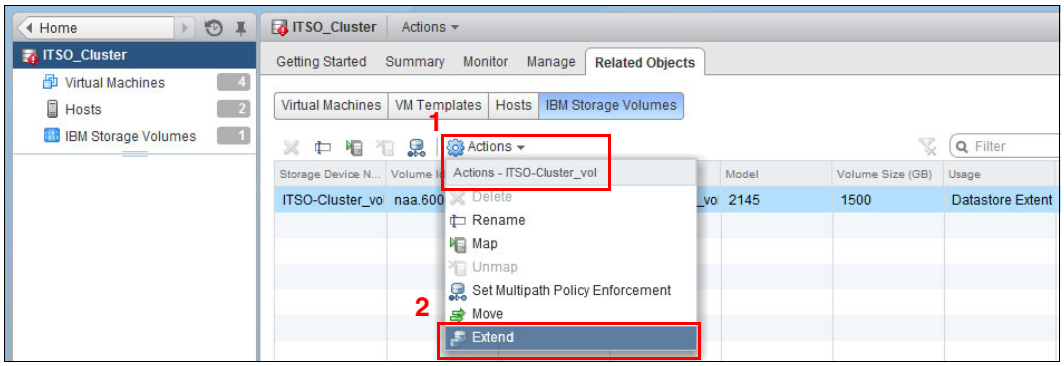


Figure 4-7 Actions menu that is specific to the selected volume

The Extend Volume pane appears with the current attributes of the FlashSystem V840 storage pool that is providing the volume. Current Volume Size (1) and New Volume Size (2) of two terabytes are displayed in Figure 4-8 on page 59.

Click **OK** (3) to extend the volume.

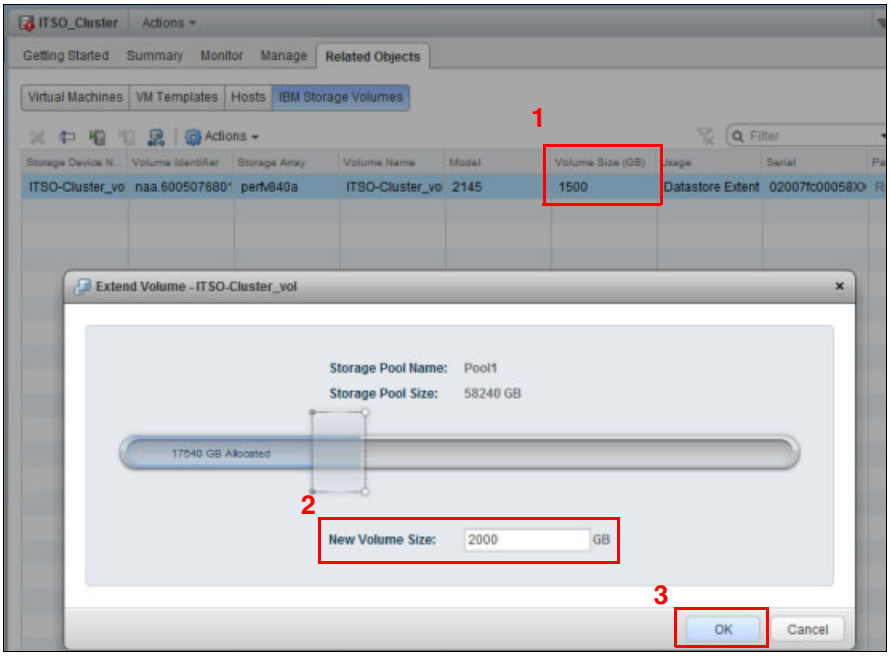


Figure 4-8 Extend Volume display

5. The operation is monitored in the Recent Tasks pane shown in Figure 4-9. It is on the right side of the vSphere Web Client dashboard.

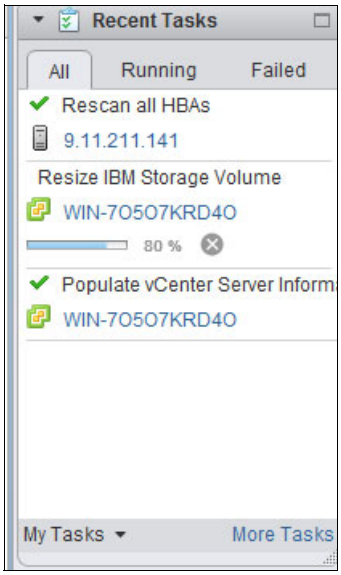


Figure 4-9 Recent Task pane

6. Wait for the Resize IBM Storage Volume task to complete, and then select the **Actions** pull-down menu (1) at the top of the Datastore pane shown in Figure 4-10. Select **Increase Datastore Capacity** (2) from the menu.

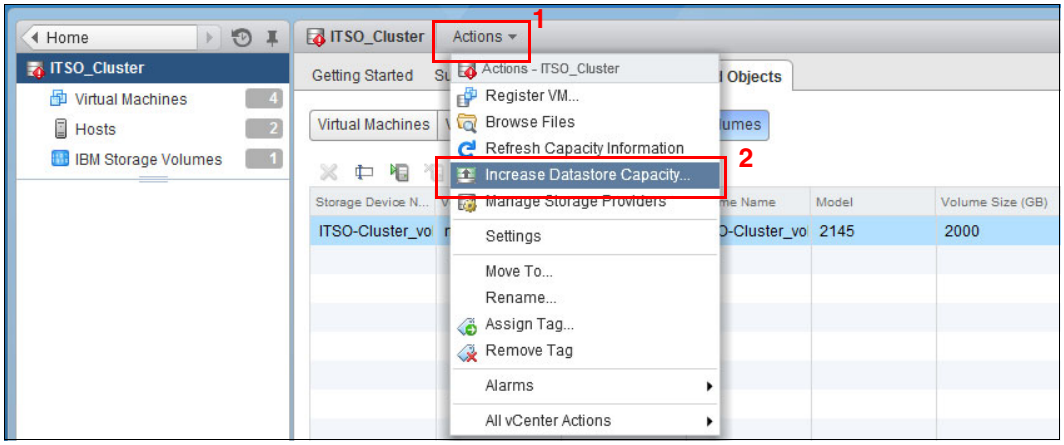


Figure 4-10 Increase Datastore Capacity selected

7. Follow the steps in the vSphere wizard to increase data store capacity, starting with selecting the *volume*(1). Then, click **Next** (2), as shown in Figure 4-11.

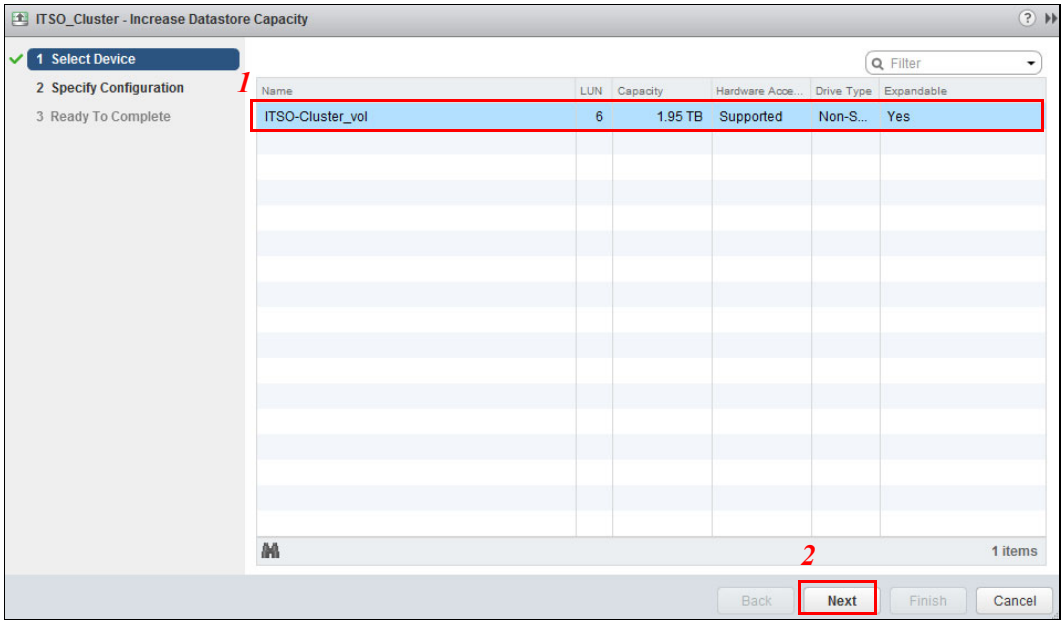


Figure 4-11 Select the Device in the Increase Datastore Capacity wizard

8. Select **Use Free space 500.00 GB to expand the datastore** (1) from the partition menu, and then select **Next** (2), and click **Finish** (3),as shown in Figure 4-12.

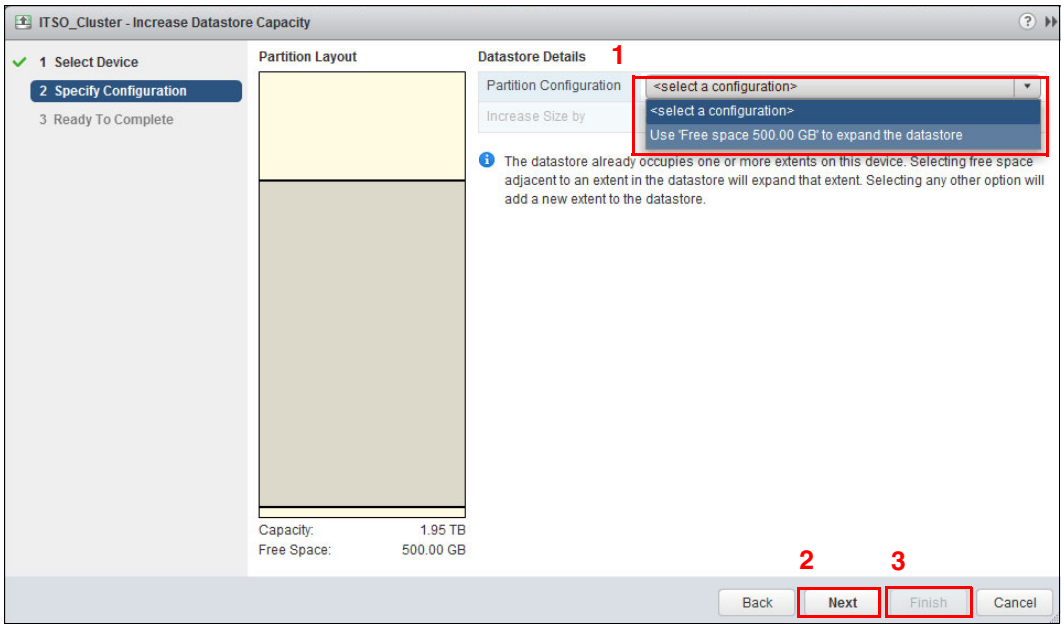


Figure 4-12 Increase Datastore Capacity wizard completion

Tip: These are the manual steps for the VMware administrator to resolve the out-of-space condition. Automation in cloud infrastructures is expected to simplify this.

4.1.2 Expanding a data store by creating a new volume

Extending the volume is usually the preferred method for increasing data store size. The Create New Volume process is shown here to illustrate the automation that is provided through the IBM Storage Enhancements plug-in.

1. In the FlashSystem V840 the wizard, use the IBM Storage Enhancement plug-in (see Figure 4-13) by selecting **Actions** (1) and **Create New Volume** (2).

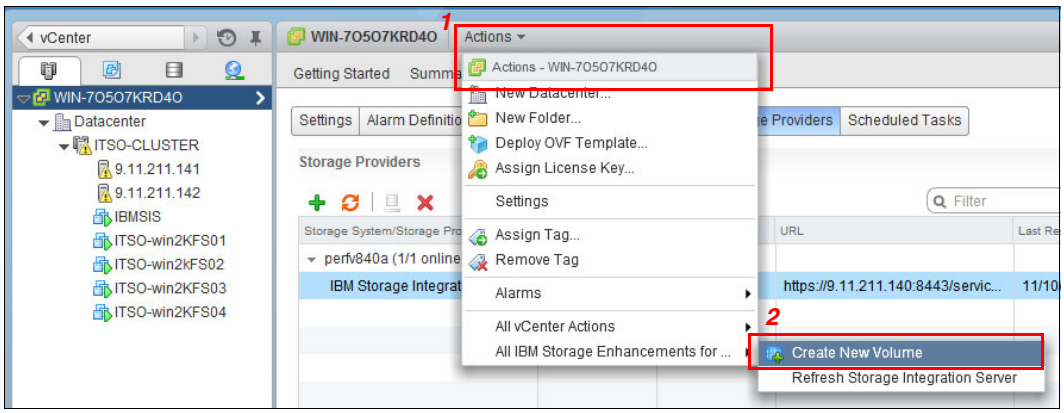


Figure 4-13 Initiate Create New Volume action

Tip: Maintaining a 1:1 relationship of data store to volume is typically preferable. Using multiple volumes can become cumbersome from a management perspective.

2. Complete the following fields in the Create New Volume pane, which is shown in Figure 4-14 on page 63:
   - Host Mapping (1)
   - Volume Size (2)
   - Volume Name (3)
   - Number of Volumes (4)
   - Volume Properties Selections (5)
3. The next step (Figure 4-14 on page 63) shows the fields where we entered information.

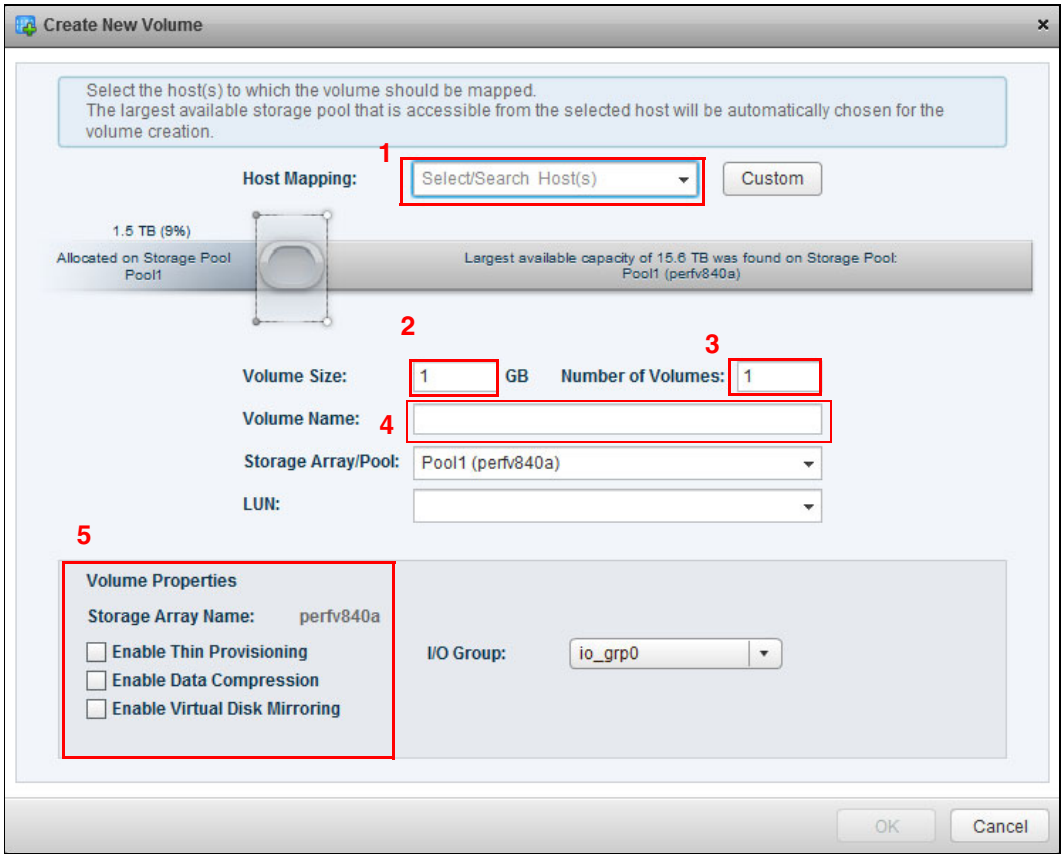


Figure 4-14 Create New Volume form

4. Enter the pane information by using the pull-down menu (1) and selecting the *cluster level* (2), as shown in Figure 4-15 on page 64. This maps the storage to all hosts that belong to this cluster.

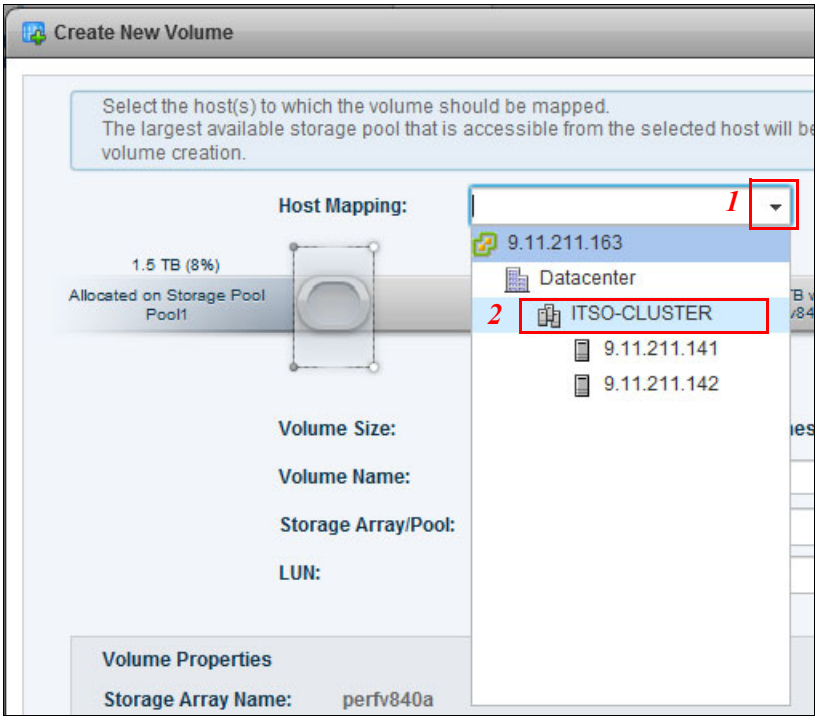


Figure 4-15 Select the Cluster Level in this menu

5. Complete the information by defining Volume Size (1), Volume Number (2), Volume Name (3), and Storage Array Pool (4) as shown in Figure 4-16 on page 65. The Volume Properties (5) have been marked to take advantage of data compression and virtual disk mirroring on our FlashSystem V840.

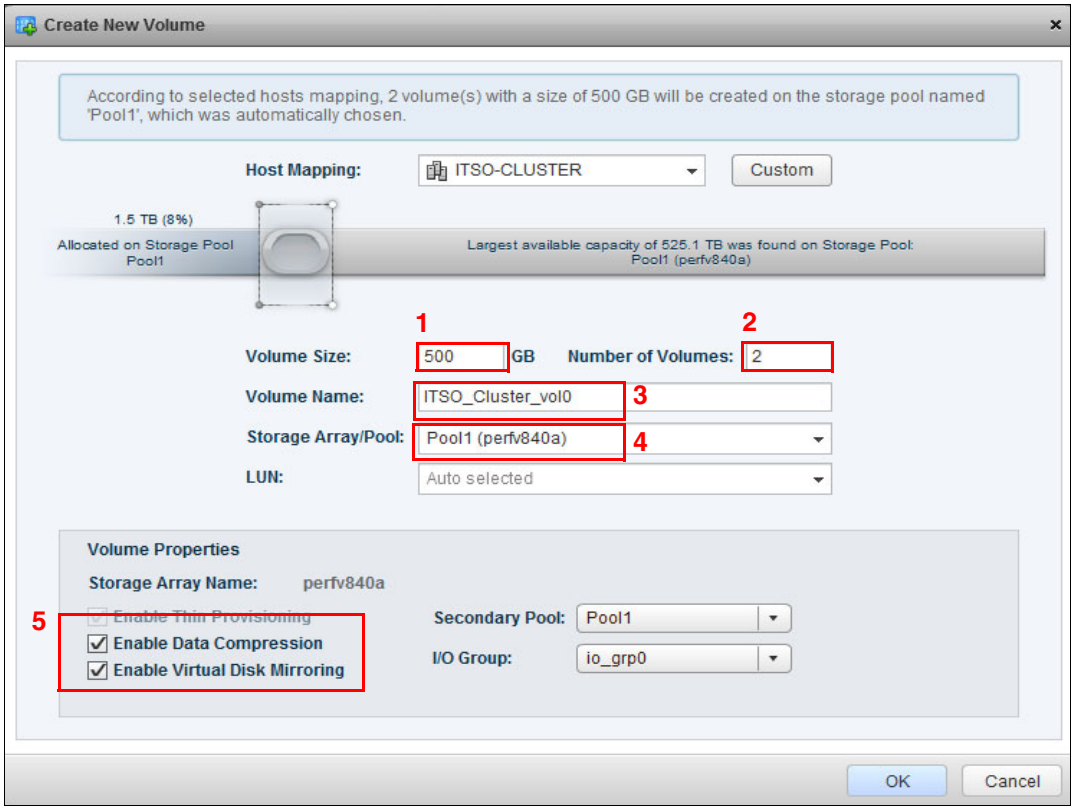


Figure 4-16 Complete the Create New Volume form

6. Monitor the creation progress by using the Recent Task window shown in Figure 4-17.

Tip: The screen capture in Figure 4-17 displays a progressive status of the Running tabs in Recent Task windows (currently 50% complete).

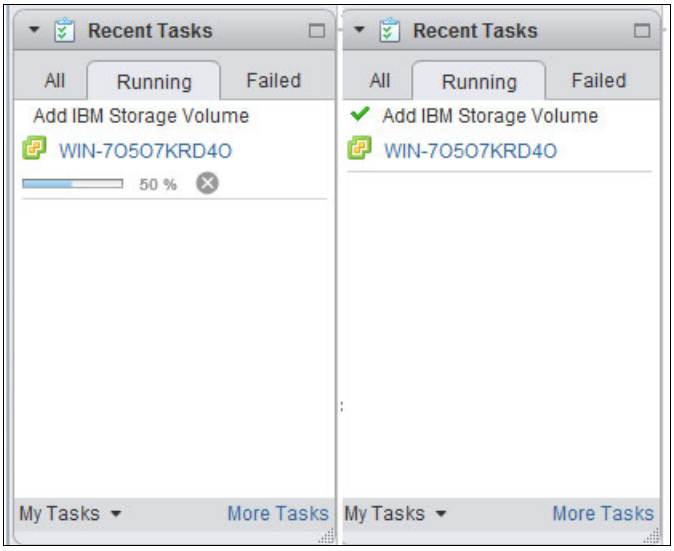


Figure 4-17 Running Recent Tasks

Tip: If the Running Task window does not show the Create Volume task, that might be due to lost communication with the IBM Storage Integration Server. This was resolved in our test environment by restarting the server.

7. Wait for the creation task to complete in Step 5. Then, use the vSphere Web Client to select the volumes just created to add to the data store. As Figure 4-18 shows, we selected **ITSO-DS_common datastore** (1) and **Increase Datastore Capacity** (2).

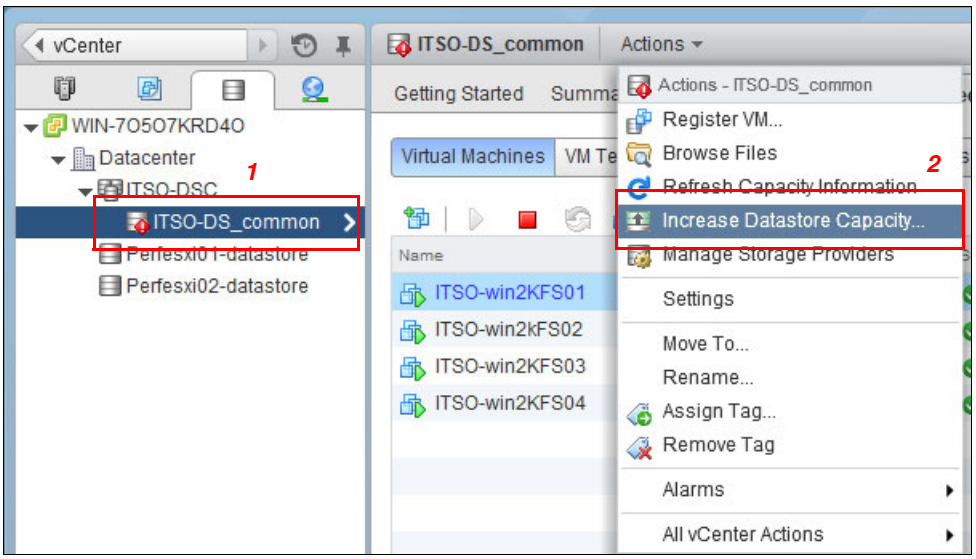


Figure 4-18 Select Increase Datastore Capacity

8. Click **Select Device** to see the volumes created. Select a volume, as in Figure 4-19.

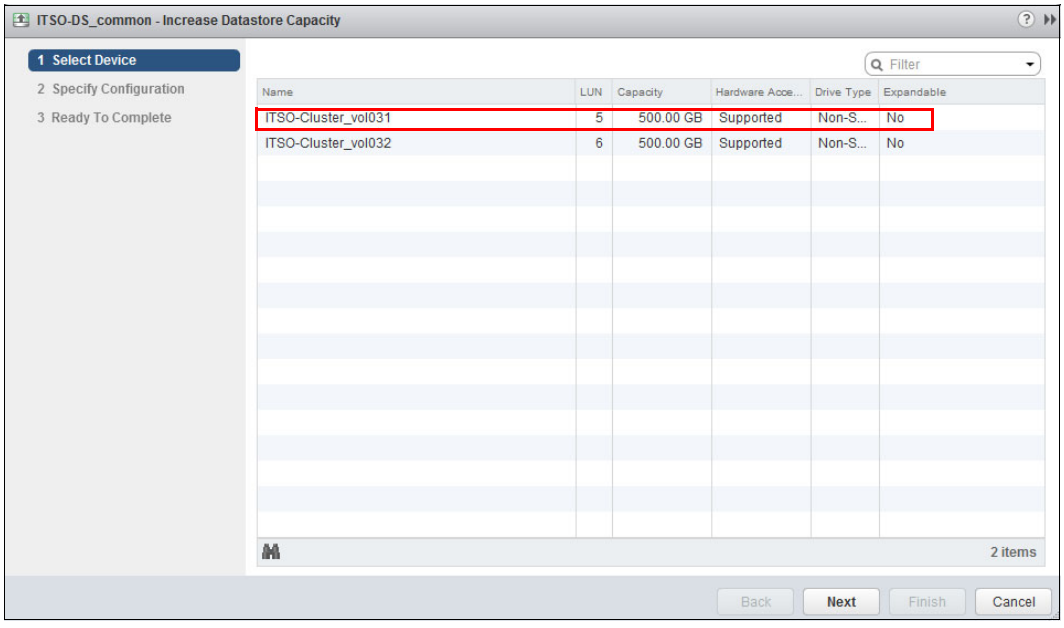


Figure 4-19 Select the volume to add to the data store

Tip: Only one volume can be selected at a time.

9. Figure 4-20 illustrates selecting the Partition Layout. In most cases, it is **Use all available partitions**.

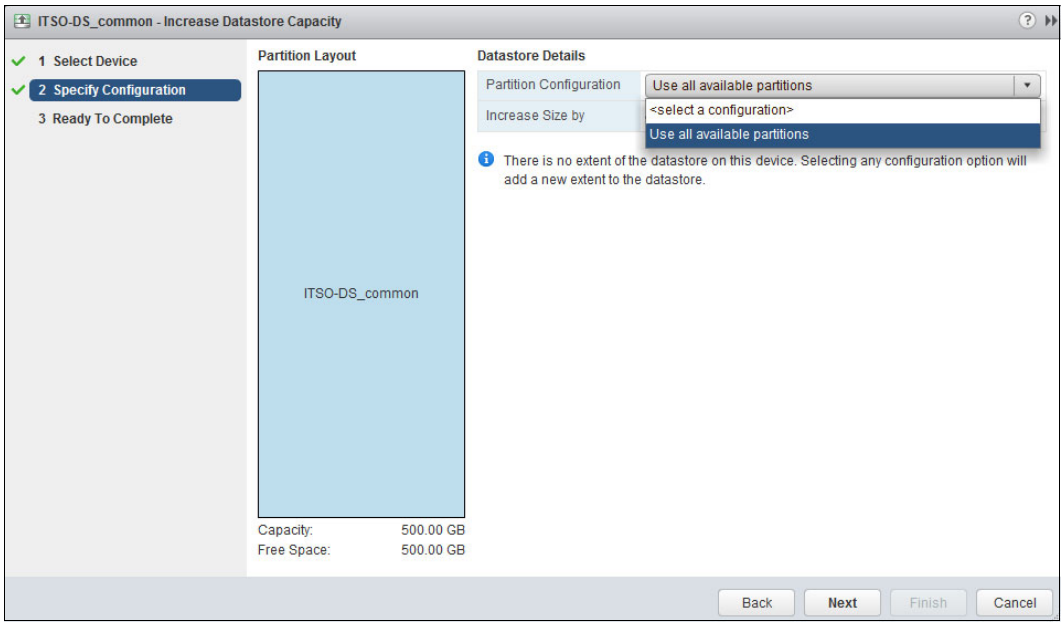


Figure 4-20 Select Use All Available Partitions

10. Click **Finish** to add the capacity, as shown in Figure 4-21.

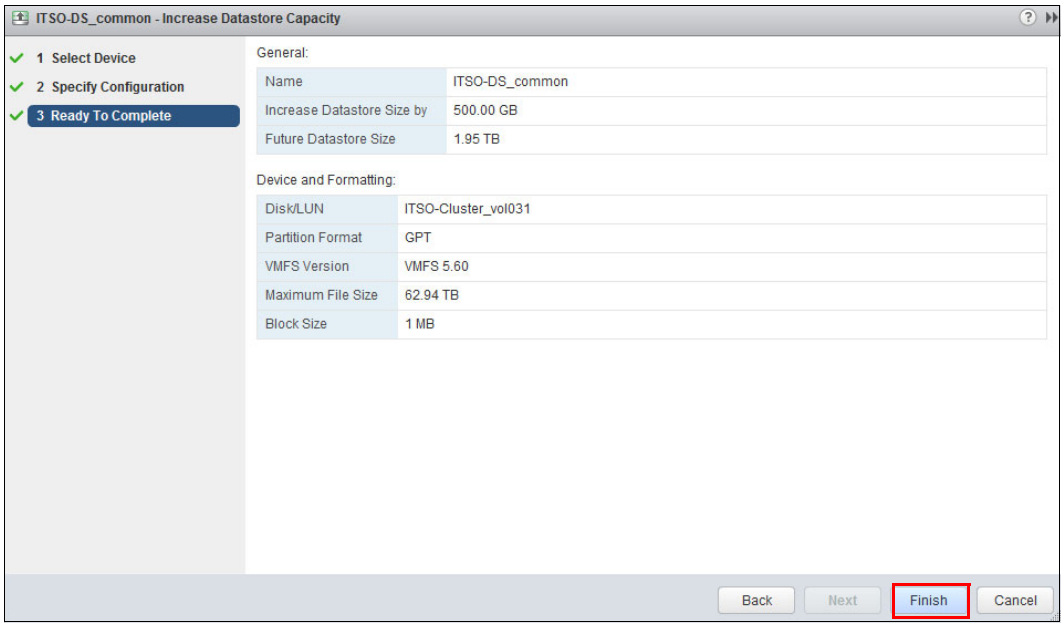


Figure 4-21 Select Finish to add the capacity

Notice that the alarm for the out-of-space condition is gone in Figure 4-22 on page 68.

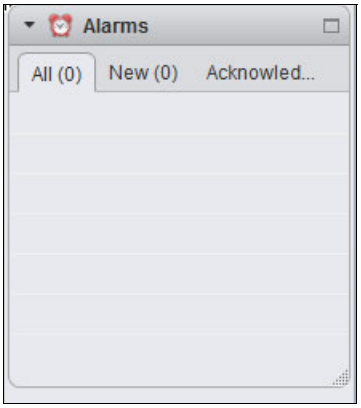


Figure 4-22 Alarm automatically clears

Tip: The volume names used in this process need to be unique, including the numeric suffix automatically added, or the process might fail. Volumes can be renamed easily from vSphere. The change will be propagated to the FlashSystem V840.

4.2 Performance troubleshooting

The IBM Storage Integration Server is a centralized server system that consolidates a range of IBM storage provisioning, virtualization, cloud, automation, and monitoring solutions through a unified server platform. Performance data collection is not a capability that is included with the product, because it operates only in the control plane and is not part of the data path.

The FlashSystem V840 solution with VMware offers methods to look at performance by using the tools in the products. Figure 4-23 on page 69 illustrates the environment that we examine in these examples. The environment contains two VMware ESXi hosts: `perfesx01` and `perfesx02`. Each host has two virtual machines (VMs), FS01 - FS04, that use a cluster data store called ITSO-DS_Common.

The sections that follow provide brief descriptions of tools that are available to examine performance for a vSphere cluster and FlashSystem V840.

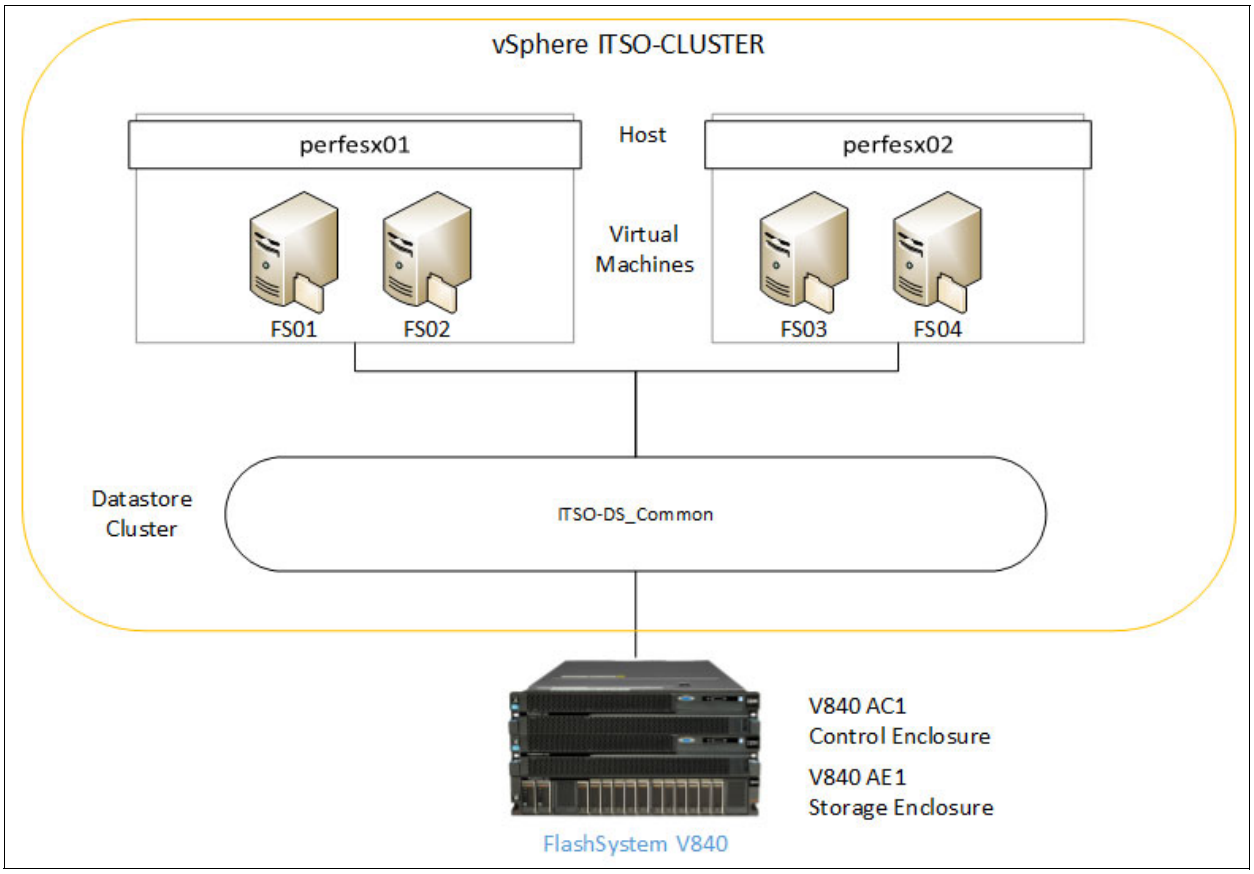


Figure 4-23 IBM International Technical Support Organization (ITSO) test environment

4.2.1 Performance tips

Performance tuning is notwithin the scope of this paper. However, these tips will help you consider the best approach for your environment.

Tip: The following excerpt is from the IBM FlashSystem and VMware vSphere Configuration Guide, which you can download from the IBM Techdocs Library:

https://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD106284

Always check for updates to performance information.

This list contains key points from that guide:

- Figure 4-24 addresses multipath configuration options. Notice that the preferred round robin configuration has additional tuning.

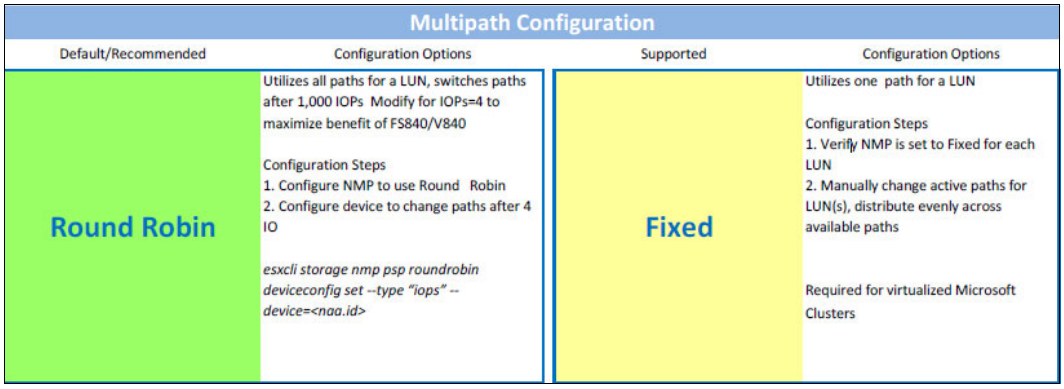


Figure 4-24 Round robin is the best, with the IOPs setting

- In Figure 4-25, virtual SCSI controllers are recommended.

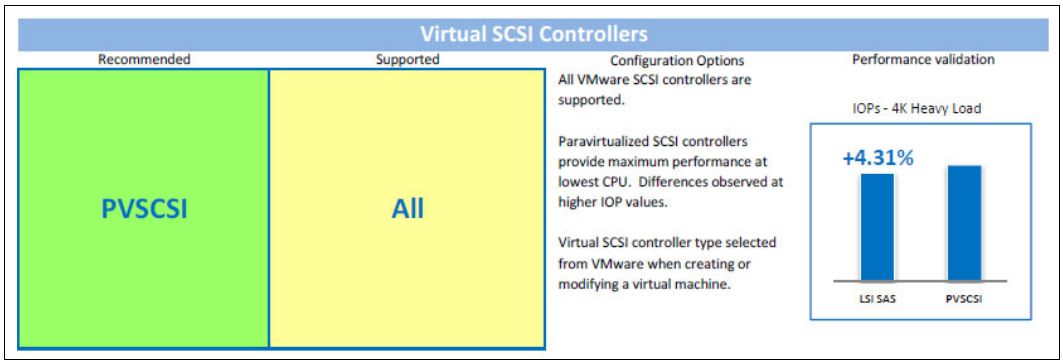


Figure 4-25 Paravirtualized SCSI controllers

- Raw device mappings (RDMs) rather than virtual machine device disks (VMDK) or virtual machine file system (VMFS) have shown good performance (Figure 4-26).

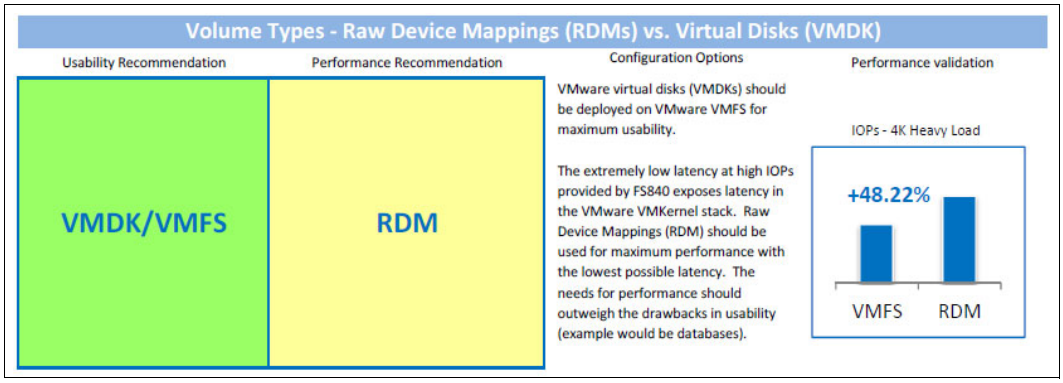


Figure 4-26 Volume types

4.2.2 Examining VMware vSphere performance

VMware vSphere Web Client provides multiple objects to monitor performance. This section focuses on the ITSO-Cluster and the elements of our example, as shown previously in Figure 4-24 on page 70.

Tip: This example focuses on using the vSphere Web Client GUI to look at performance. VMware also provides a tool called *esxtop* to identify storage performance issues for ESX or ESXi. See the article titled “Using esxtop to identify storage performance issues for ESX / ESXi (multiple versions)” (1008205) in the VMware Knowledge Base for more information:

`http://vmw.re/1ylPDYf`

Gather performance data at the datastore cluster level

The data store cluster level is the closest vSphere object to our storage and is directly in the data path. This data store, called, ITSO-DS_Common, is shared with all ESX servers that belong to the cluster. The next steps walk you through where to find performance information for the data store cluster.

1. From the vCenter Home page, select the **Storage** object in the left pane, under Inventory Trees (see Figure 4-27).

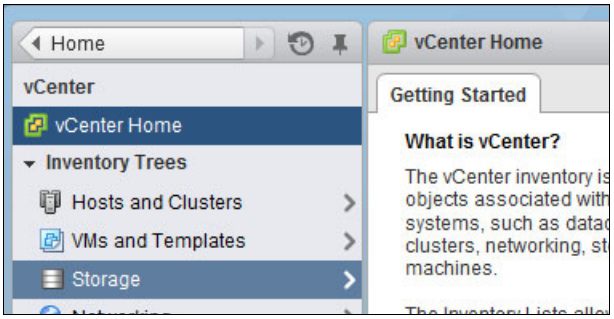


Figure 4-27 Select the Storage object from the Inventory Trees options

2. Open the **Datacenter** menu (1), data store cluster, **ITSO-DS_common** (2), and select the **Manage** tab (seeFigure 4-28).

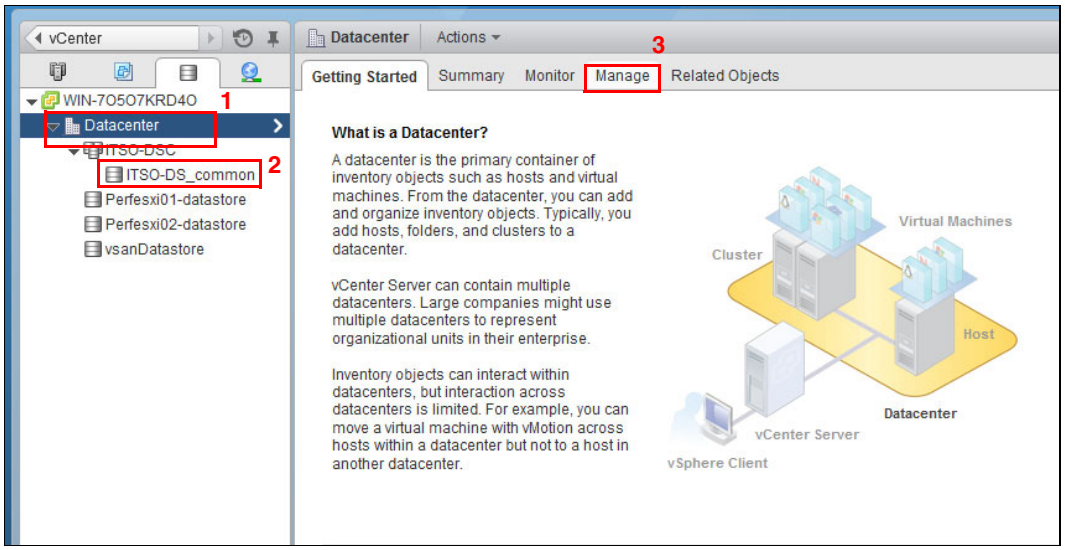


Figure 4-28 Select the Manage tab for the data store cluster

Tip: vSphere Web Client remembers the last tab viewed, so your display might default to one of the other tabs in the right pane.

3. After selecting **Monitor** (1), a second row of tabs opens where you select **Performance** (2), as shown in Figure 4-29 on page 73.

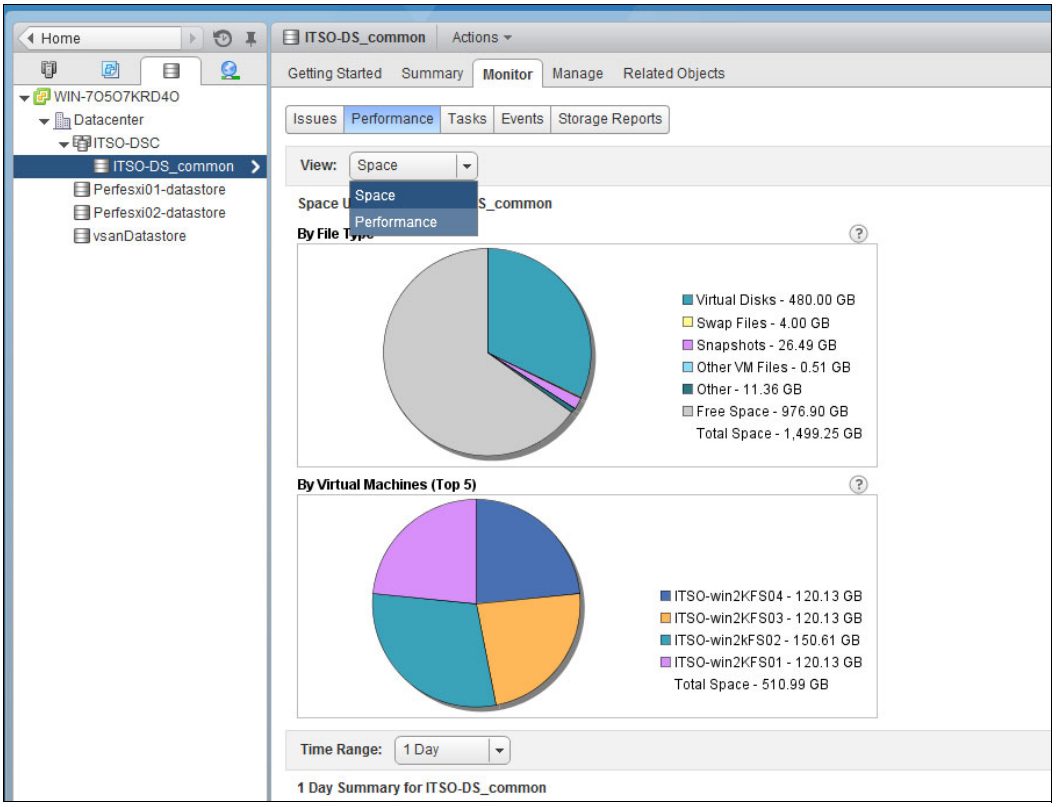


Figure 4-29 Select the performance tab from the second row

Note: This default display shows the space allocations for the virtual machines, using the cluster data store that is using ITSO-DS_Common.

4. Performance selection opens the Performance summary pane. The statistics displayed depend on the length of time that they have been collected. In our example, this is less than a day. Change the Time Range to **real time**, as shown in Figure 4-30.

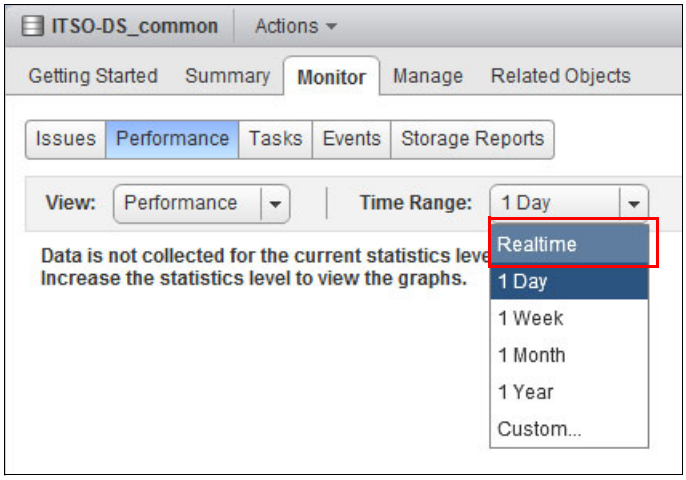


Figure 4-30 Change time range to Realtime

5. The vSphere performance chart in Figure 4-31 shows two of the graphs that are available for our common data store that is supported by FlashSystem V840. This is an example with a test workload running on four virtual machines.

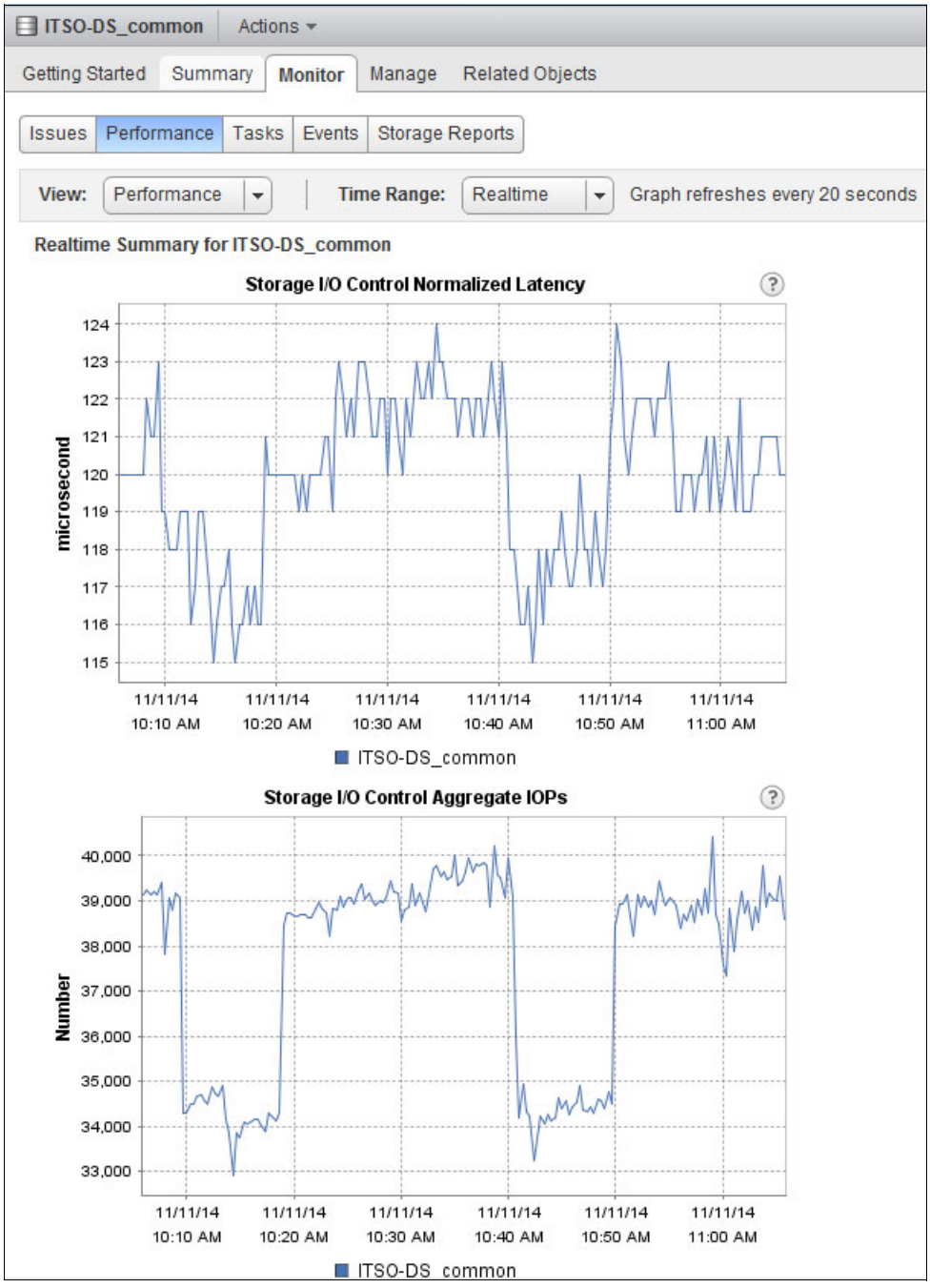


Figure 4-31 Common data-store performance served by FlashSystem V840 LUNs

Note: This is an example of where to look for performance information, not a measurement of absolute performance on IBM FlashSystem V840.

4.2.3 Performance at the virtual machine level

The test environment virtual machines (VMs) are all running Microsoft Windows 2012 R2 with a sample workload. Each VM is encapsulated in the ITSO-DS_Common shared data store.

There are multiple ways to access this information in the vSphere Web Client. This one method.

1. Start at the vCenter Home screen shown in Figure 4-32, and select **Hosts and Clusters** from the left pane.

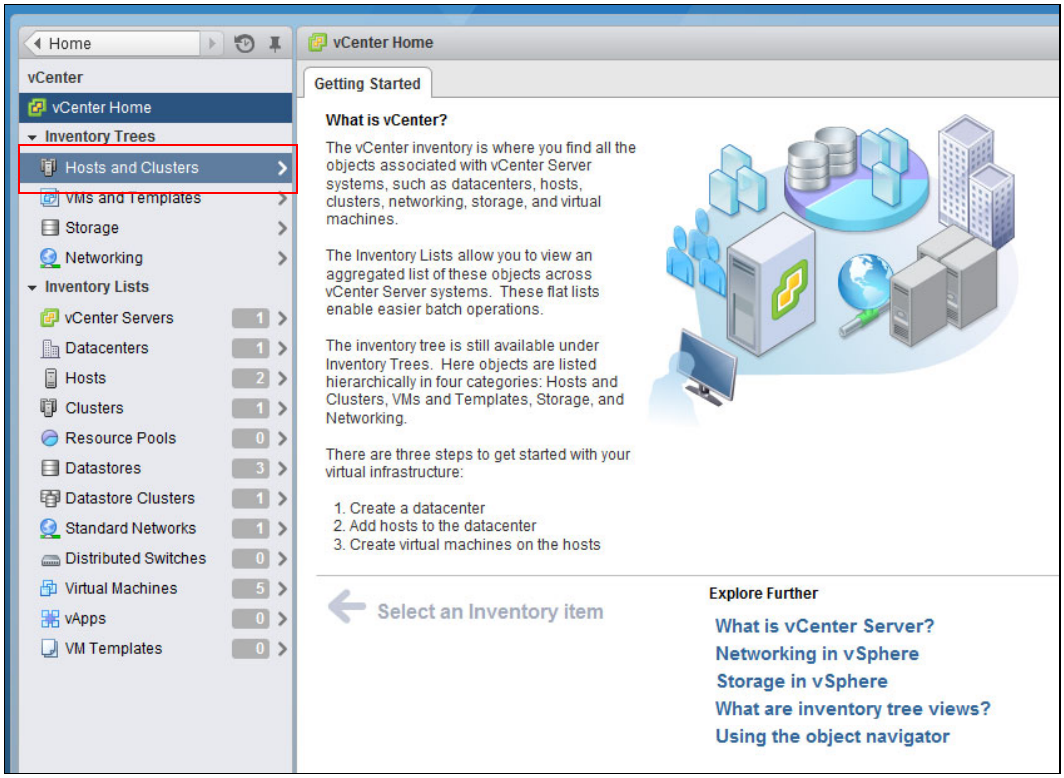


Figure 4-32 Select Hosts and Clusters

2. In the Hosts and Clusters window, select your VM (1). Our test environment VM is ITSO-win2kFS01, as shown in Figure 4-33 on page 76.

   Next, select the **Monitor** tab (2).

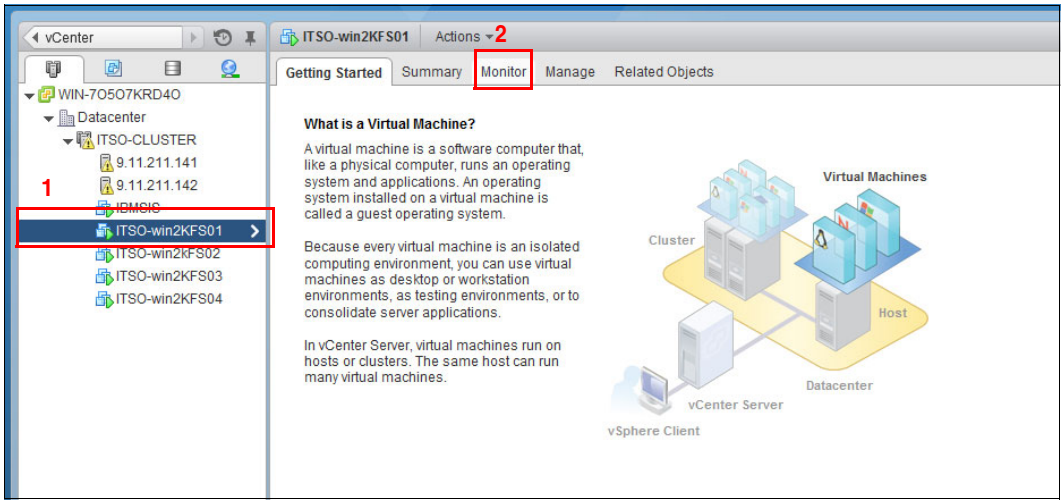


Figure 4-33 Select a VM to find performance.

3. The display will show something similar to Figure 4-34. Select the **Performance** tab to see the Performance page.

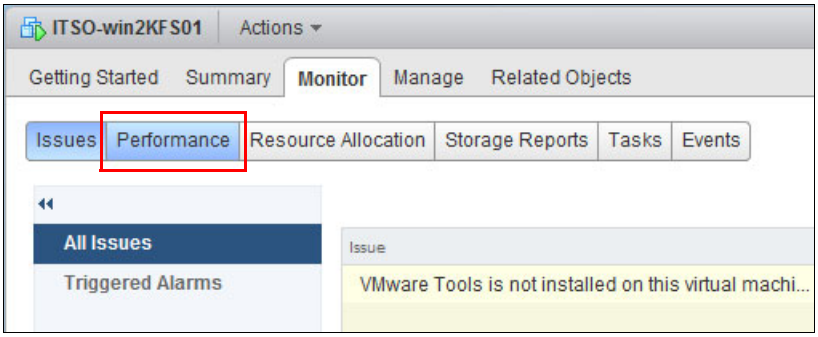


Figure 4-34 Select the Performance tab

4) Figure 4-35 shows the default Performance pane, which shows CPU use. Select the **Advanced** tab to see information related to storage performance.

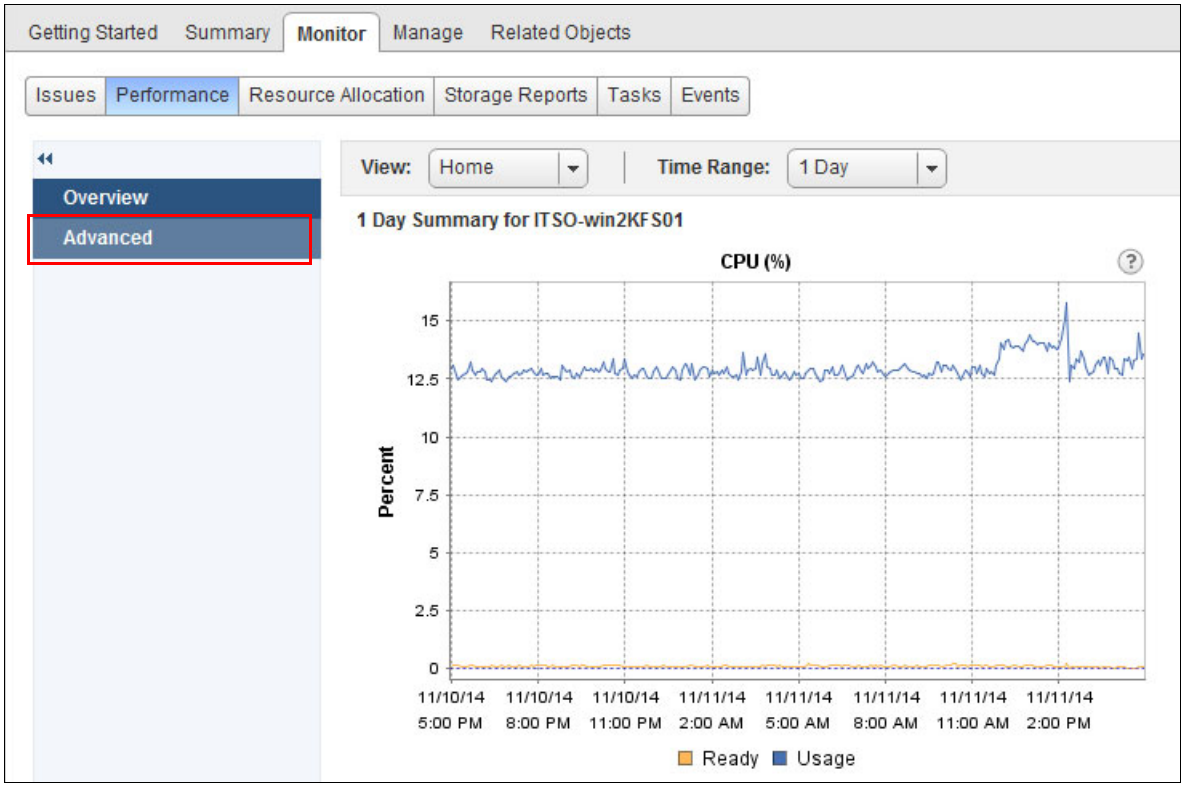


Figure 4-35 Select the Advanced tab

4. In Figure 4-36, the disk real-time performance is shown by default. Because FlashSystem V840 latency is less than zero, this chart is of limited value. To display the details, hover your cursor over the graph line at the bottom of the chart.

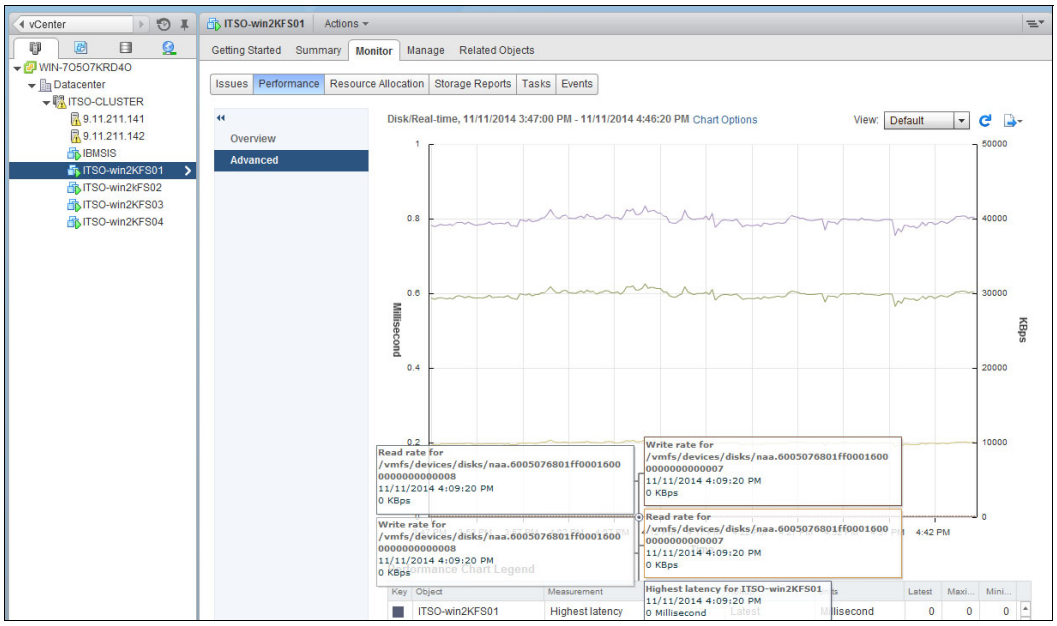


Figure 4-36 Disk real-time performance

4.2.4 Performance at the host level

In this example, we look at the ESXi host to our VMs. It is the ESX host that provides access to storage, using the host bus adapters (HBA) installed. The steps that follow begin at the Host and Cluster level used in section 4.2.3, “Performance at the virtual machine level” on page 75.

Note: This goal of this section is to show where this information is located. The performance on a production server is likely to be different.

1. After selecting your host (1) select the **Monitor** (2) tab, as shown in Figure 4-37.

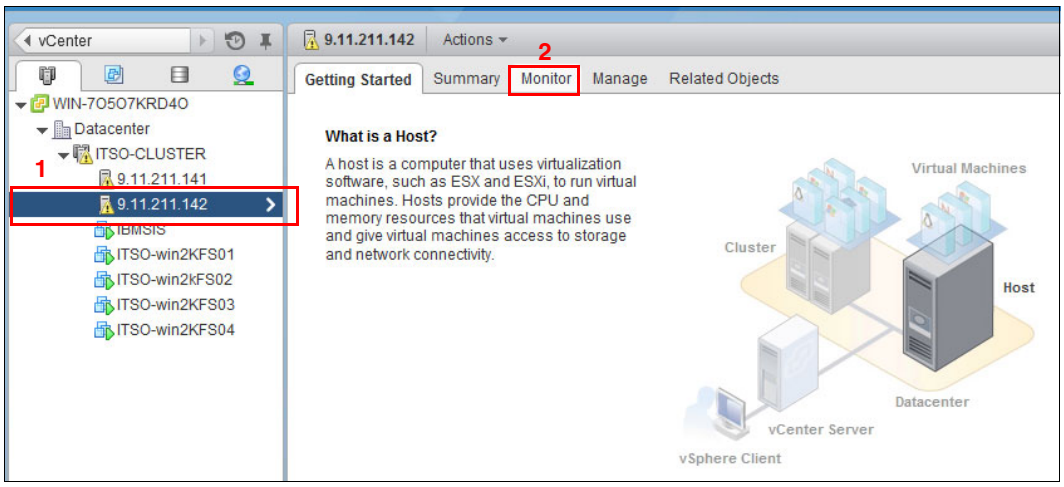


Figure 4-37 Select the Monitor tab

2. Select the **Performance** tab (1), **Advanced** (2), and **Datastore** (3) views, as shown in Figure 4-38.

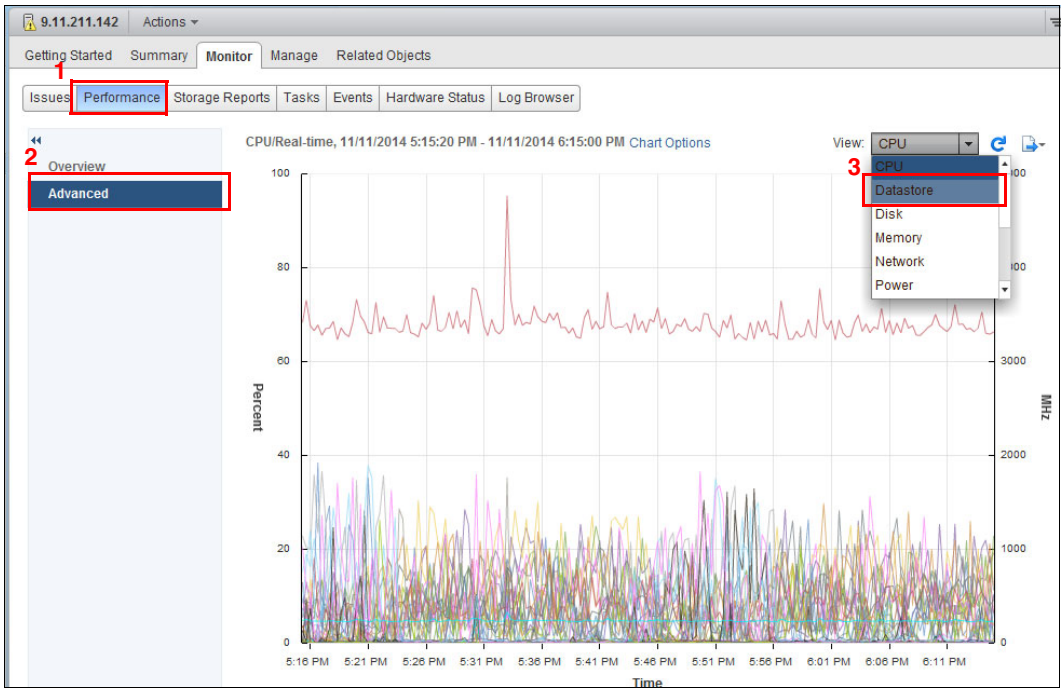


Figure 4-38 Move to the Advanced pane and select Datastore

The screen capture in Figure 4-39 shows the performance for the ITSO-DS_common data store on this ESXi sever.

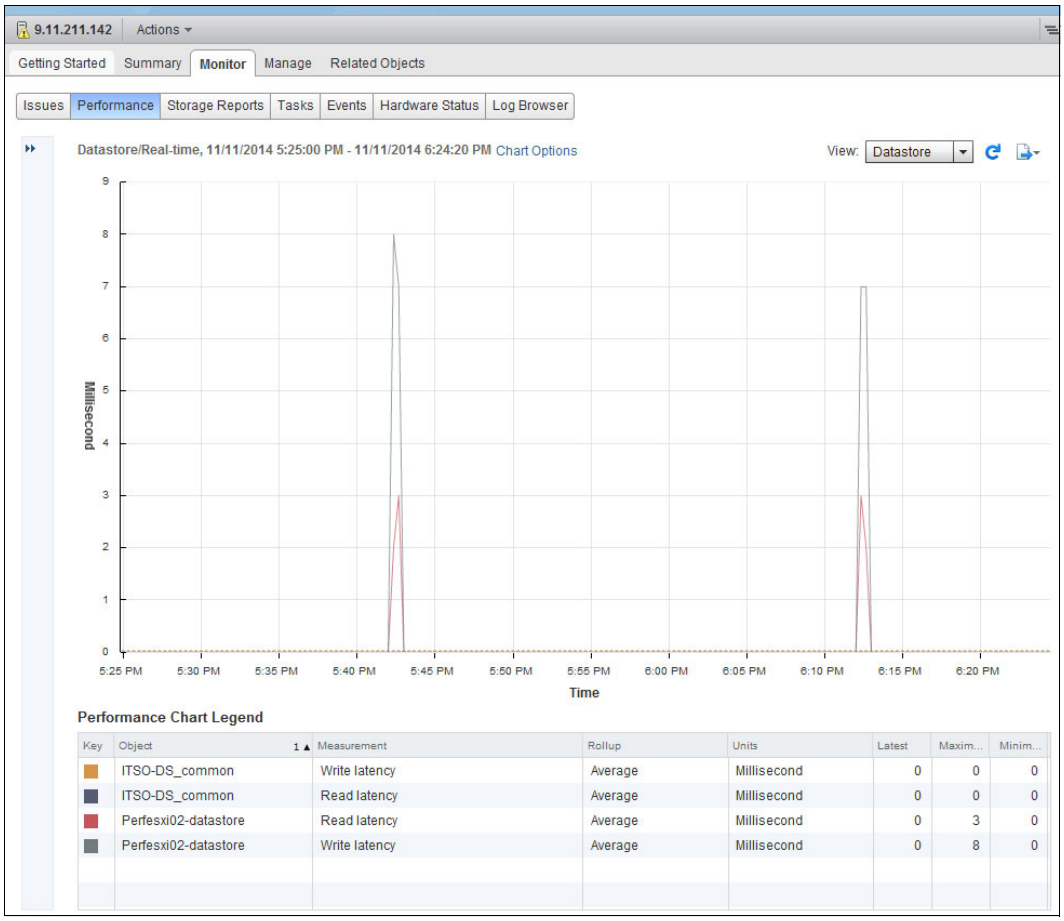


Figure 4-39 ITSO-DS_common data store with less than a millisecond latency

4.2.5 Performance on FlashSystem V840

The FlashSystem V840 Controller (AC1) is connected via the SAN to ESXi hosts in the test environment. The physical storage is provided by the storage enclosure (AE1). Both devices can be found in the following sections.

Performance data is collected either through the graphical user interface (GUI) in real time or by using the command-line interface (CLI). This section focuses on simple performance collectionby using the GUI.

Using FlashSystem V840 Controller (AC1) GUI to monitor performance

1. From the Monitoring menu (1) and select **Performance** (2), as shown in Figure 4-40 on page 81.

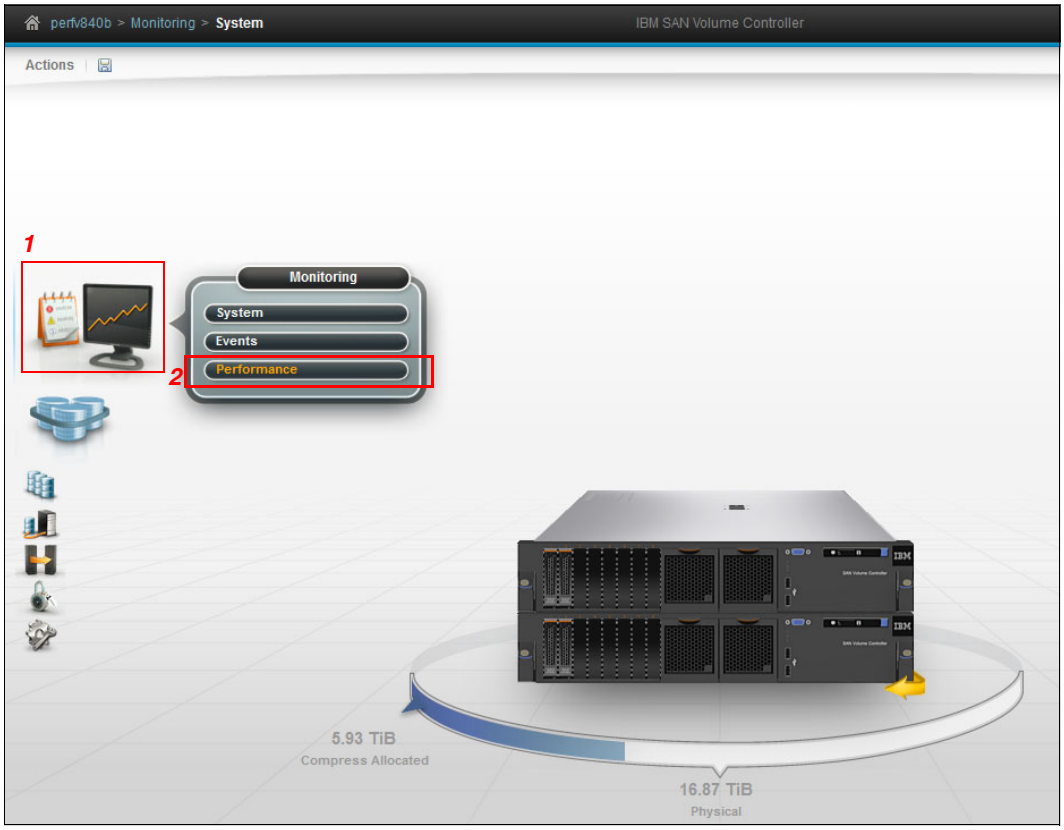


Figure 4-40 Select Performance from the Monitoring menu

2. This opens the System Statistics pane (1) with IOPS (2) as the default display, as shown in Figure 4-41.

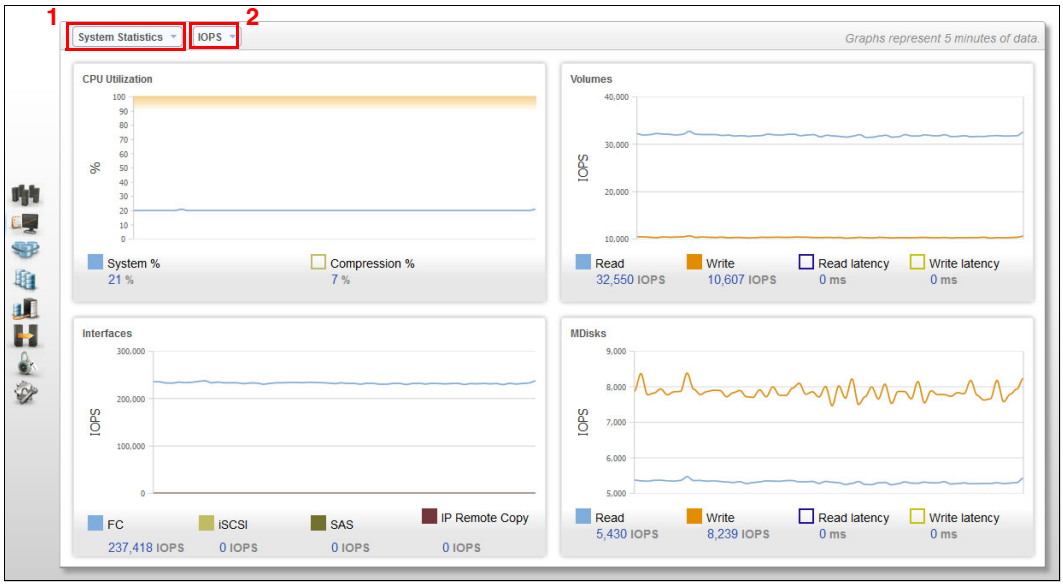


Figure 4-41 System Statistics pane with IOPS

3. The statistics display can be changed to MBps easily by using the pull-down menu shown in Figure 4-42.

Figure 4-42 Change to MBps by using pull-down menu

Tip: The FlashSystem V840 controller inherits a robust set of statistic collection tools from the IBM SAN Volume Controller (SVC) family of products. They can be accessed by using the CLI. See Chapter 8, “Performance data and statistics gathering,” in the Redbooks publication titled *IBM SAN Volume Controller 2145-DH8 Introduction and Implementation*, SG24-8229:

`http://www.redbooks.ibm.com/abstracts/SG248229.html?Open`

Using the FlashSystem V840 enclosure (AE1) GUI to monitor performance

In this section, we show examples of locating detailed performance data on the FlashSystem V840 storage enclosure.

1. Log in to the management interface of the storage enclosure:
2. On the Home screen, select the **Monitoring** menu (1) and the **Performance** option under that (2), as shown in Figure 4-43.

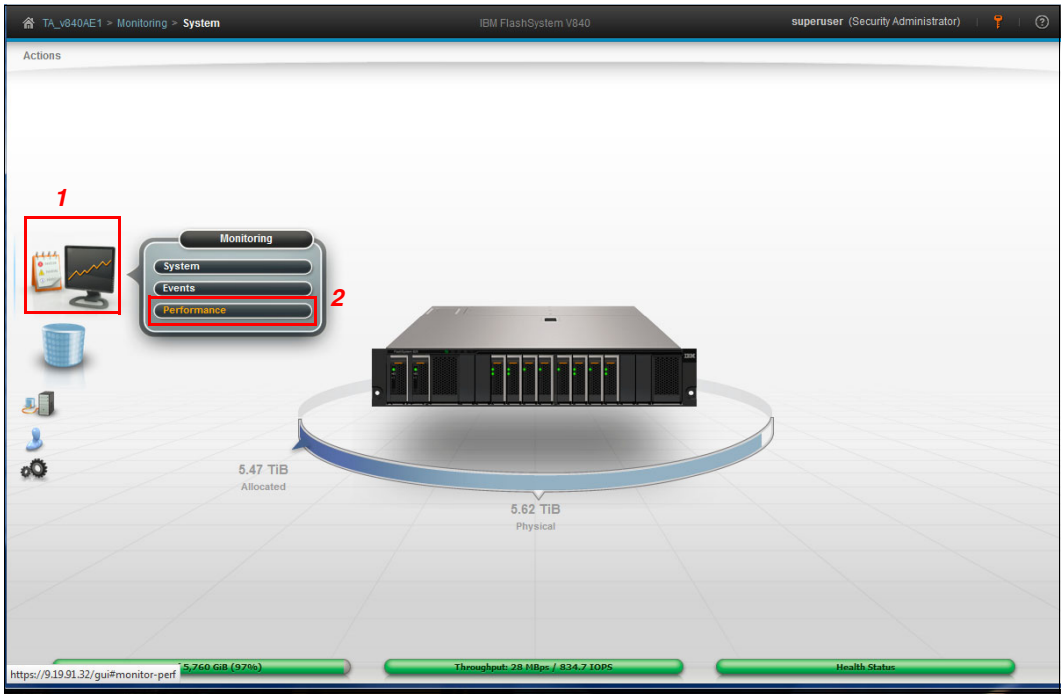


Figure 4-43 Navigate to the Performance selection on the Monitoring menu

3. Figure 4-44 on page 84 shows the Graphs menu (1). By selecting System I/O view (2) and by hovering the cursor over a data point, you can see the values (3).

Figure 4-44 System I/O graph display

4. Next, look at the System Latency graph (Figure 4-45) by selecting it from the Graphs menu.

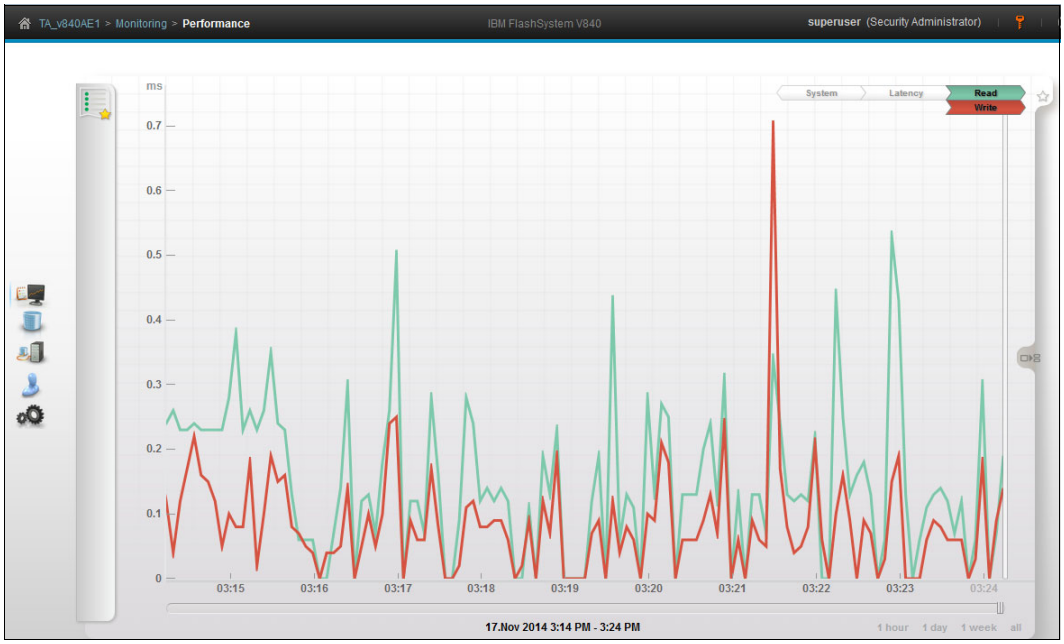


Figure 4-45 System Latency graph

Tip: A significant amount of read I/O is being served by the FlashSystem V840 controller and not being served from the storage enclosure. This is application-dependent, so applications such as VMware ESXi server can scale significantly by using this technology.

4.3 Auditing

Traceability is often important when auditing objects created in the environment. Techniques described in the following section can be used to identify objects that are created in each element of the environment.

4.3.1 FlashSystem V840 Controller Audits

In the following example, this IBMSIS account is used to create any objects in the FlashSystem V840 controller. This was shown in 2.2.2, “Define the storage array administrative account” on page 22.

To get to the audit log, follow these steps:

1. In the FlashSystem V840 AC1 Controller GUI interface, from the Access menu, select **Audit Log**, as shown in Figure 4-46.

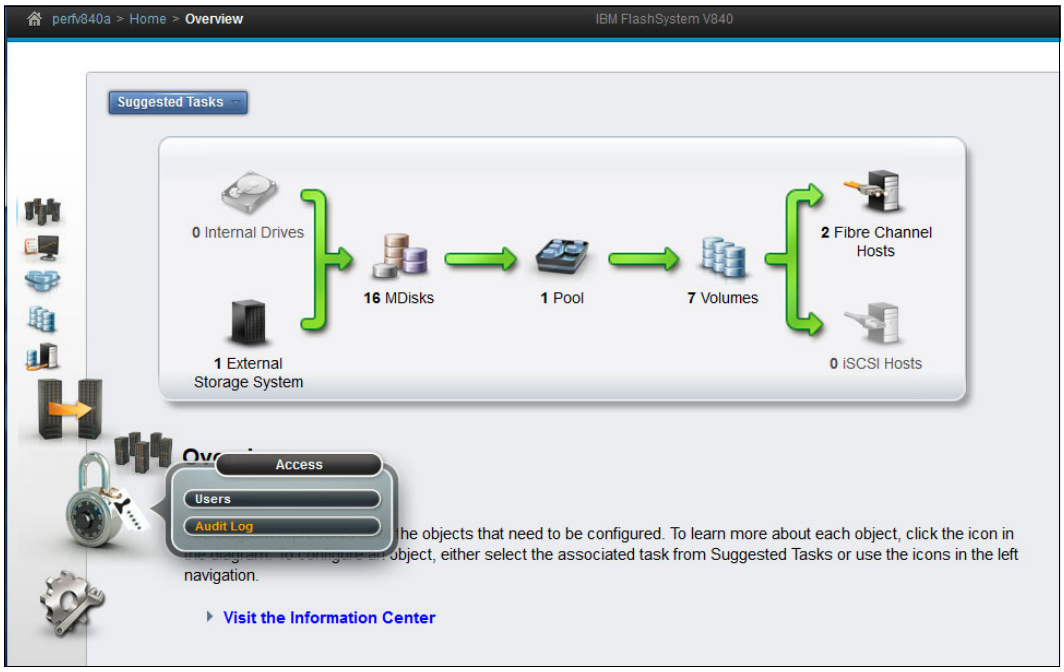
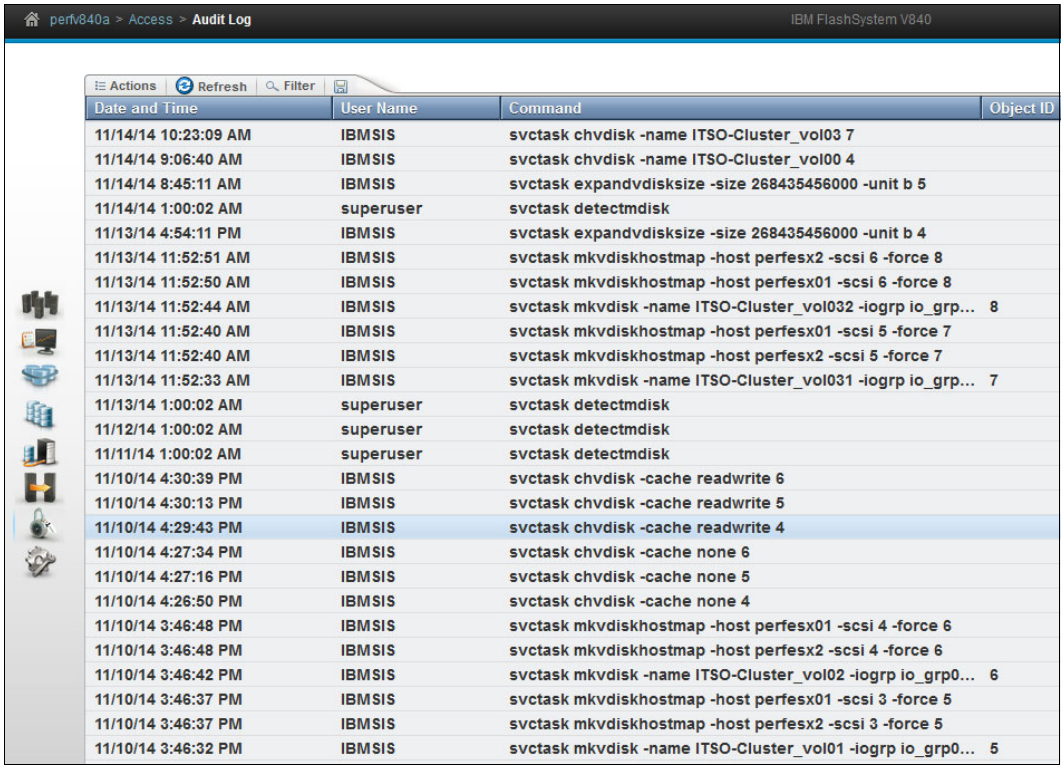


Figure 4-46 Select the Audit Log from the Access menu

2. In Figure 4-47, notice how the IBMSIS user name appears in the audit log. This volume was created from VMware. However, because we have the specific account, we can see from this log that our IBM Storage Integration Server environment facilitated volume renames, creating volumes, and host mappings.



Date and Time	User Name	Command	Object ID
11/14/14 10:23:09 AM	IBMSIS	svctask chvdisk -name ITSO-Cluster_vol03 7	
11/14/14 9:06:40 AM	IBMSIS	svctask chvdisk -name ITSO-Cluster_vol00 4	
11/14/14 8:45:11 AM	IBMSIS	svctask expandvdisksize -size 268435456000 -unit b 5	
11/14/14 1:00:02 AM	superuser	svctask detectmdisk	
11/13/14 4:54:11 PM	IBMSIS	svctask expandvdisksize -size 268435456000 -unit b 4	
11/13/14 11:52:51 AM	IBMSIS	svctask mkvdiskhostmap -host perfesx2 -scsi 6 -force 8	
11/13/14 11:52:50 AM	IBMSIS	svctask mkvdiskhostmap -host perfesx01 -scsi 6 -force 8	
11/13/14 11:52:44 AM	IBMSIS	svctask mkvdisk -name ITSO-Cluster_vol032 -iogrp io_grp...	8
11/13/14 11:52:40 AM	IBMSIS	svctask mkvdiskhostmap -host perfesx01 -scsi 5 -force 7	
11/13/14 11:52:40 AM	IBMSIS	svctask mkvdiskhostmap -host perfesx2 -scsi 5 -force 7	
11/13/14 11:52:33 AM	IBMSIS	svctask mkvdisk -name ITSO-Cluster_vol031 -iogrp io_grp...	7
11/13/14 1:00:02 AM	superuser	svctask detectmdisk	
11/12/14 1:00:02 AM	superuser	svctask detectmdisk	
11/11/14 1:00:02 AM	superuser	svctask detectmdisk	
11/10/14 4:30:39 PM	IBMSIS	svctask chvdisk -cache readwrite 6	
11/10/14 4:30:13 PM	IBMSIS	svctask chvdisk -cache readwrite 5	
11/10/14 4:29:43 PM	IBMSIS	svctask chvdisk -cache readwrite 4	
11/10/14 4:27:34 PM	IBMSIS	svctask chvdisk -cache none 6	
11/10/14 4:27:16 PM	IBMSIS	svctask chvdisk -cache none 5	
11/10/14 4:26:50 PM	IBMSIS	svctask chvdisk -cache none 4	
11/10/14 3:46:48 PM	IBMSIS	svctask mkvdiskhostmap -host perfesx01 -scsi 4 -force 6	
11/10/14 3:46:48 PM	IBMSIS	svctask mkvdiskhostmap -host perfesx2 -scsi 4 -force 6	
11/10/14 3:46:42 PM	IBMSIS	svctask mkvdisk -name ITSO-Cluster_vol02 -iogrp io_grp0...	6
11/10/14 3:46:37 PM	IBMSIS	svctask mkvdiskhostmap -host perfesx01 -scsi 3 -force 5	
11/10/14 3:46:37 PM	IBMSIS	svctask mkvdiskhostmap -host perfesx2 -scsi 3 -force 5	
11/10/14 3:46:32 PM	IBMSIS	svctask mkvdisk -name ITSO-Cluster_vol01 -iogrp io_grp0...	5

Figure 4-47 Audit log shows IBM Storage Integration Server login window

4.3.2 VMware vSphere Web Client events

Follow these steps to find VMware event information:

1. Figure 4-48shows the navigation bar (on the left) to get to the Events pane. With the vSphere server displayed, select the **Monitor** tab (1) and then **Events** (2).

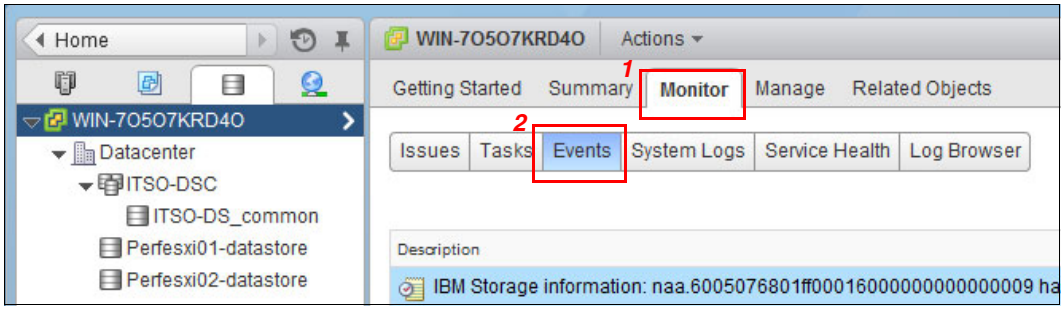


Figure 4-48 Navigate to the Events tab

2. The example in Figure 4-49 on page 87 shows the high-level tasks that were performed to rename a volume. This is displayed at the right side of most panes in the VMware Web Client interface.

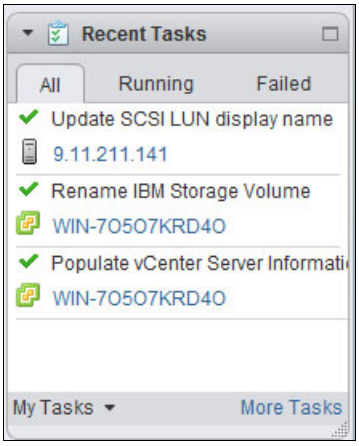


Figure 4-49 Recent Taskspane showing activites for volume renaming

3. Additional details can be found on the vSphere server Events page shown in left and right partial views, starting with Figure 4-50 on page 88.

Note: The single event screen shown in Figure 4-50 and Figure 4-51 was broken into two parts for readability.

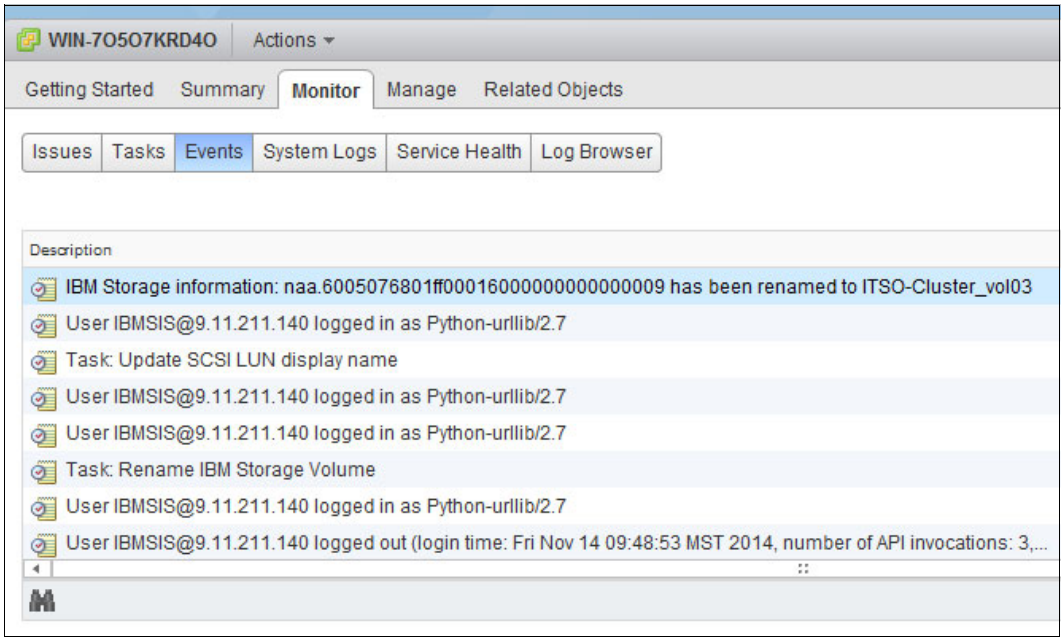


Figure 4-50 vSphere Events page, Part 1

Figure 4-51 shows the far-right columns of the same window.

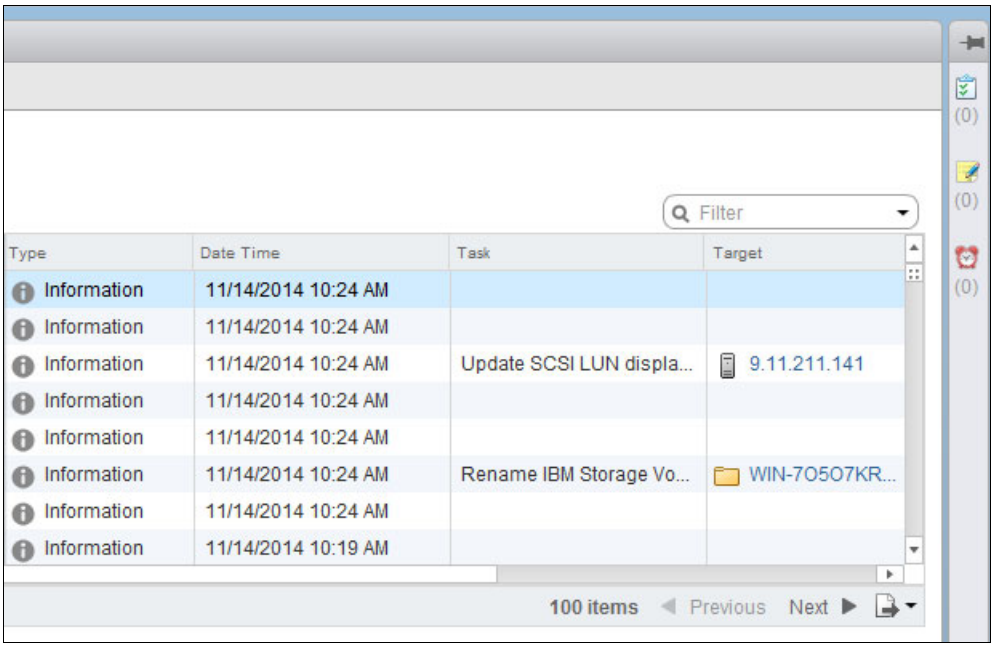


Figure 4-51 vSphere Server Events, Part 2

4.4 Collecting logs from each element of the environment

Logs are often required by support organizations when responding to inquiries from customers about issues with products.

4.4.1 VMware vSphere vCenter

Collecting logs in vSphere captures useful information for the support teams. These logs can be loaded to active support tickets. VMware support might direct you to add specific options not covered here. This section provides tips about where to look.

The following steps can be used to generate and download these support logs:

1. Log in to the vSphere Web Client, and select your vCenter server (1).
2. Using the **Actions** menu (2), navigate to **All vCenter Actions** (3), and select **Export System Logs** (4),as shown in Figure 4-52.

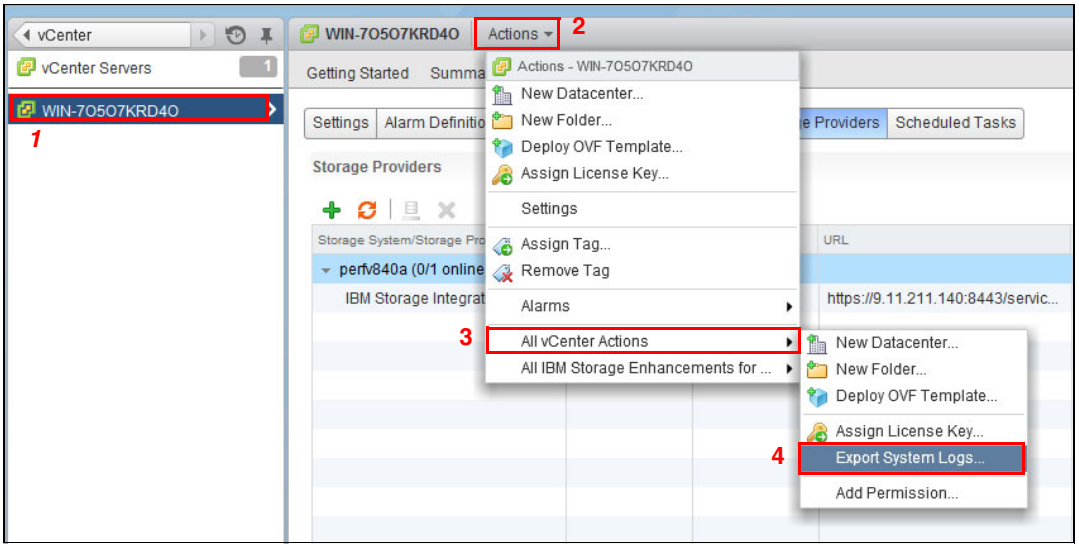


Figure 4-52 Select Export System Logs

3. The Export Logs pane requests that you select an ESX host log of interest (1) and, optionally, include vCenter Server and vSphere Web Client logs (2).

   Select **Next** (3) to continue (see Figure 4-53 on page 90).

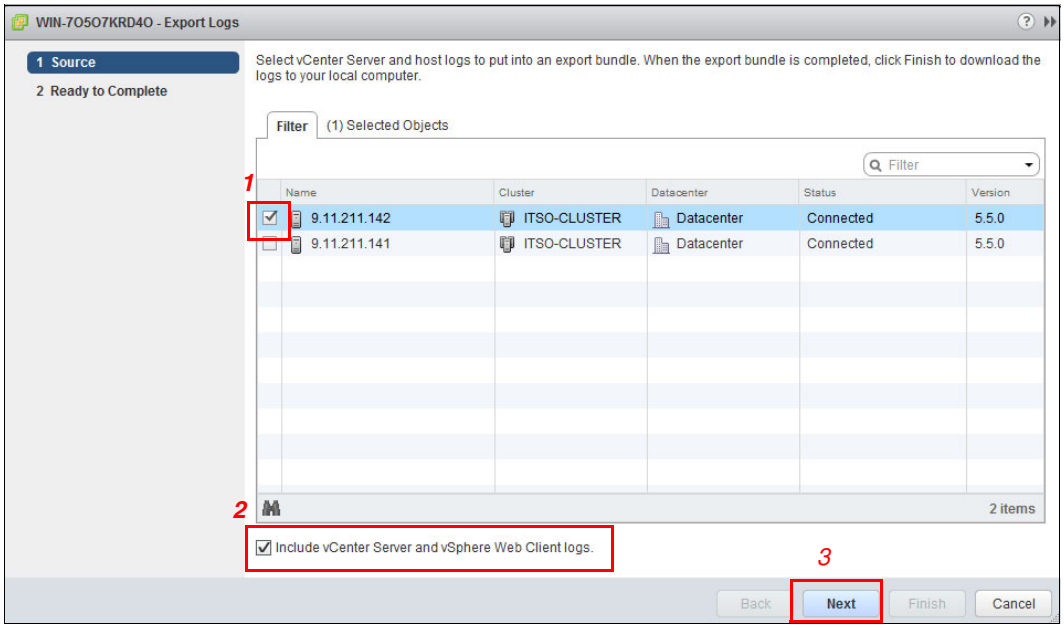


Figure 4-53 Select the source of the logs

4. In our example, we used the defaults, which include the storage logs that are likely to be needed to investigate any storage issues. Select **Generate Log Bundl**e, as shown in Figure 4-54.

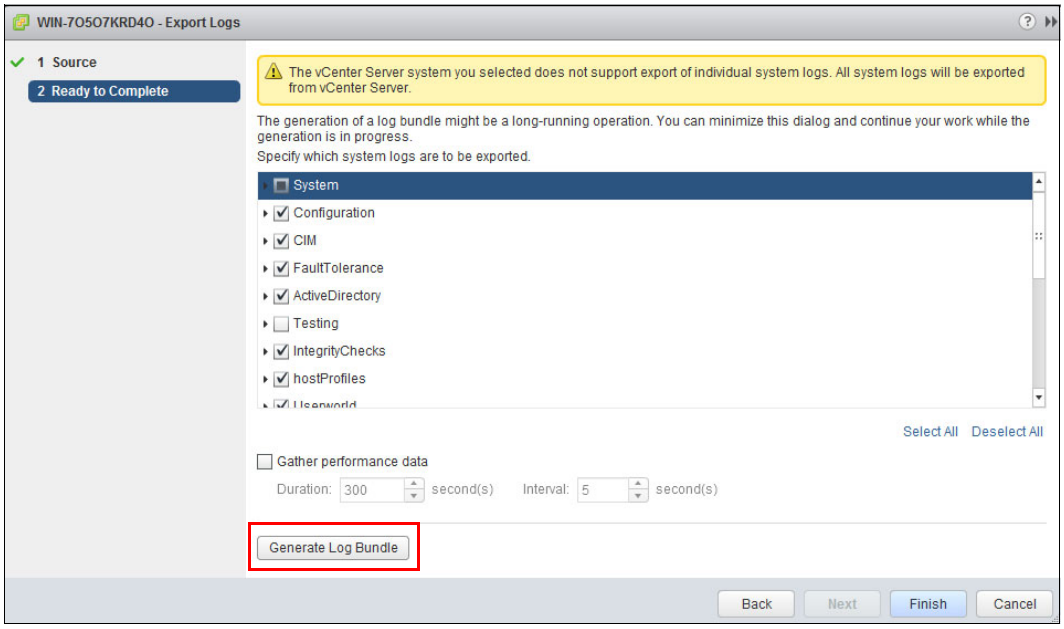


Figure 4-54 Generate the Log Bundle selected

Tip: Use the scroll bar at the right side of the pane to look at other options.

5. The process can take awhile. Our test system took 20 minutes, for example (see Figure 4-55). The time is dependent on the configuration of the system.

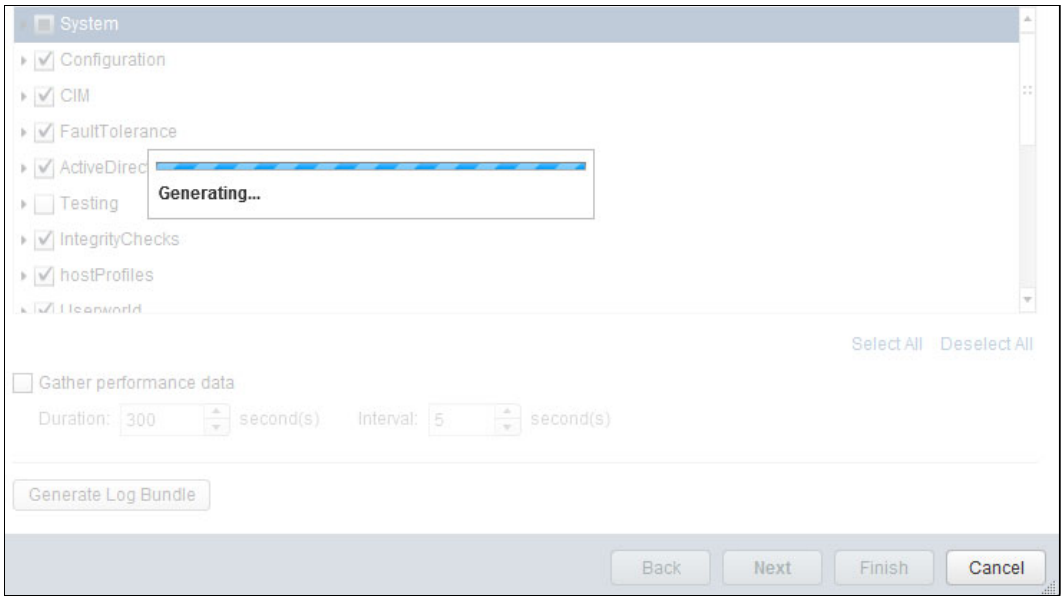


Figure 4-55 Waiting for the logs to be generated

6. The vSphere Web Client offers the **Download Log Bundle** option (1) for the bundled just generated (Figure 4-56). After the download finishes, select **Finish** (2).

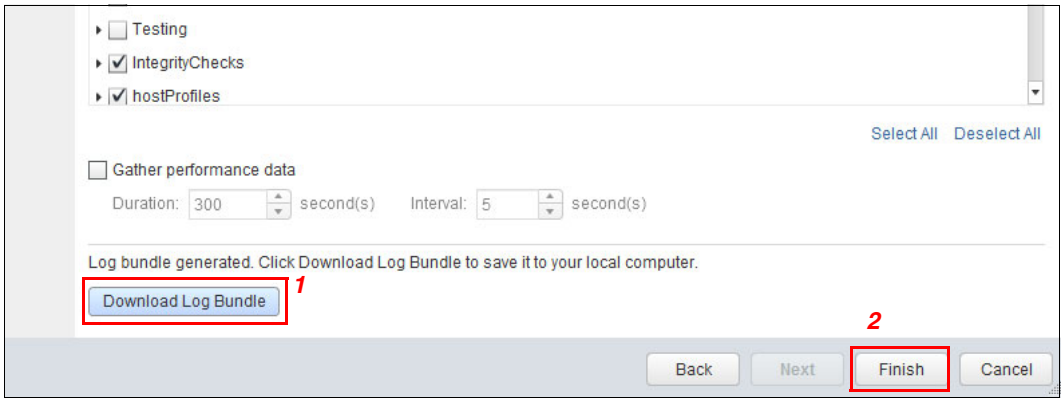


Figure 4-56 Download the file

Tip: Often, it is useful to rename these files with the support ticket tracking number, ifapplicable.

4.4.2 IBM Storage Integration Server

Logs for the IBM Storage Integration Server are required in situations where the issue involves control communications to the storage. Here are the steps for collecting the logs.

1. Log in to the IBM Storage Integration Server (Figure 4-57).

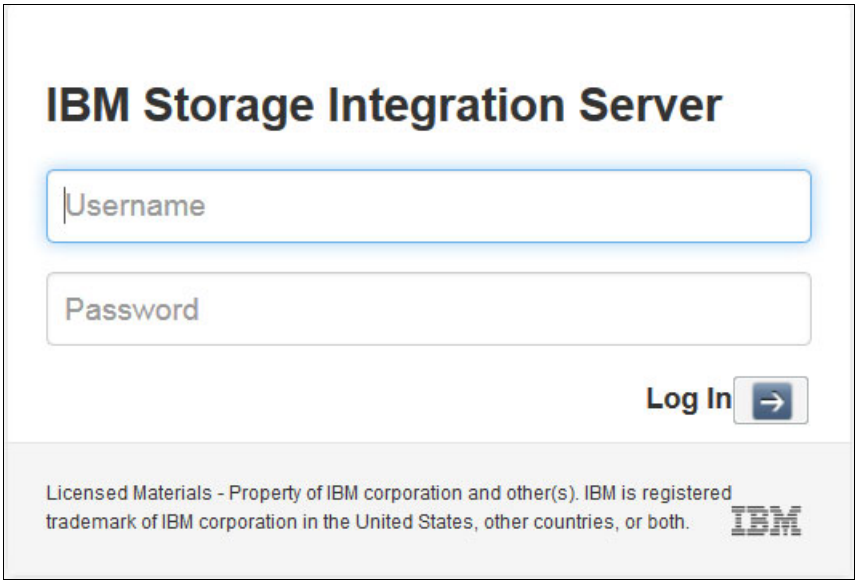


Figure 4-57 Log in to IBM Storage Integration Server

Tip: The web GUI is on the server where the IBM Storage Integration Server was installed.

2. Log collection is initiated by selecting the **Help** menu (1) and **Collect Logs** (2), as shown in Figure 4-58.

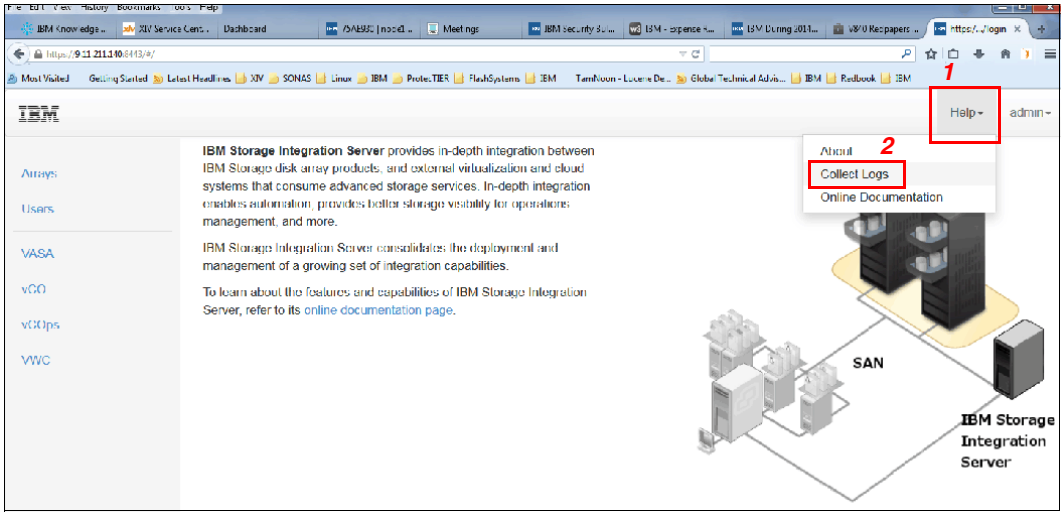


Figure 4-58 Initiate log collection

3. Select **Save File** (1), and use a meaningful name to save the support file, for example:

```
PMR12345isis_logs_2014-11-19_09-30-32.tgz
```

Then, click **OK** (2), as shown in Figure 4-59.

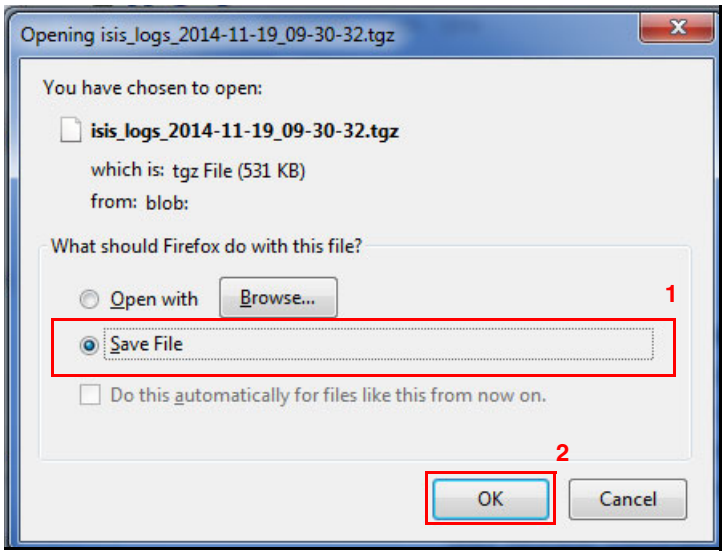


Figure 4-59 Select Save File to upload to a support ticket

Important: Synchronizing times by using Network Time Protocol (NTP) is highly recommended.

4.4.3 FlashSystem V840

FlashSystem V840 logs are required for the majority of support tickets opened. To review, there are two elements to the FlashSystem V840:

- Controller Models AC0 and AC1
- Enclosure Models AE0 and AE1

Each of these devices is managed separately with a distinct management addressthat is used to connect the GUI. Collecting logs is similar for each device. Our VMware environment and IBM Storage Integration Server is the only interface with the FlashSystem V840 Controller, so that is the device where logs will probably be needed.

FlashSystem V840 Controller

FlashSystem V840 Controller is the array device registered with the IBM Storage Integration Server. The storage array management IP address is described in Chapter 2, “Planning and configuration” on page 19. For more information,see “Introduction to the FlashSystem V840 control enclosure management GUI” in the IBM Knowledge Center:

http://ibm.co/1ymzFju

Define the storage array administrative account

The FlashSystem V840 GUI is used to connect to the FlashSystem V840 controller.

1. Start by logging into the FlashSystem V840 management interface in Figure 4-60.

Figure 4-60 Log in to management interface

2. Move the mouse down the icons on the left side of the display to the Settings (1) menu shown in Figure 4-61, and select **Support** (2).

Figure 4-61 Select the Support selection

3. In the Support window (Figure 4-62), select **Download Support Package**.

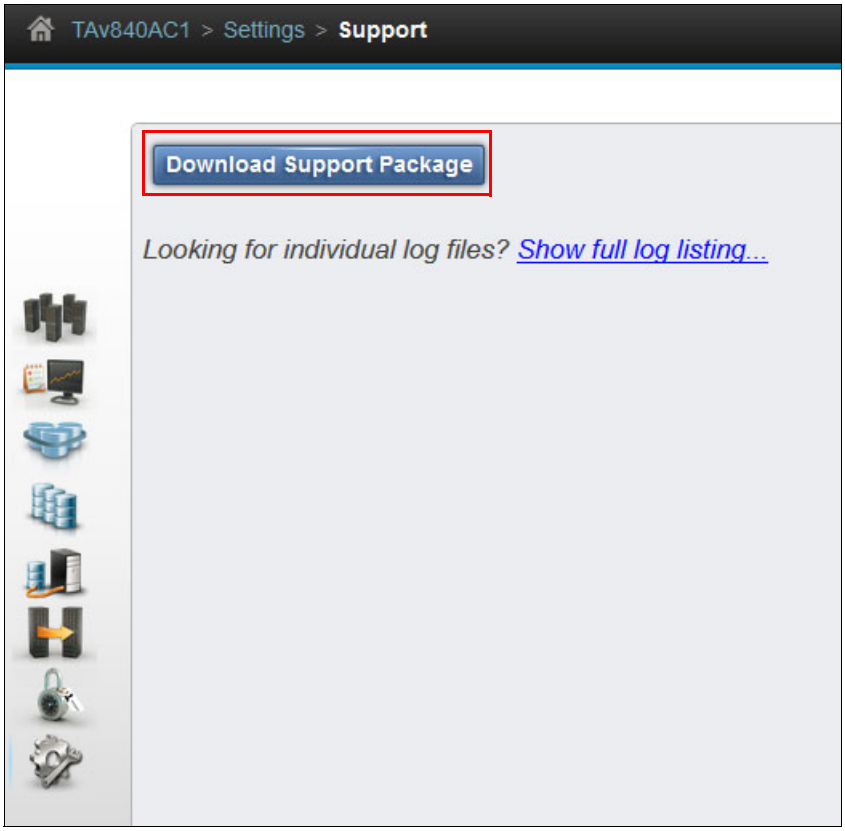


Figure 4-62 Support window

4. In the Download Support Package window shown in Figure 4-63 on page 96, unless the IBM Support team has stated otherwise, select **Standard logs plus one existing statesave** (1), and then click **Download** (2).

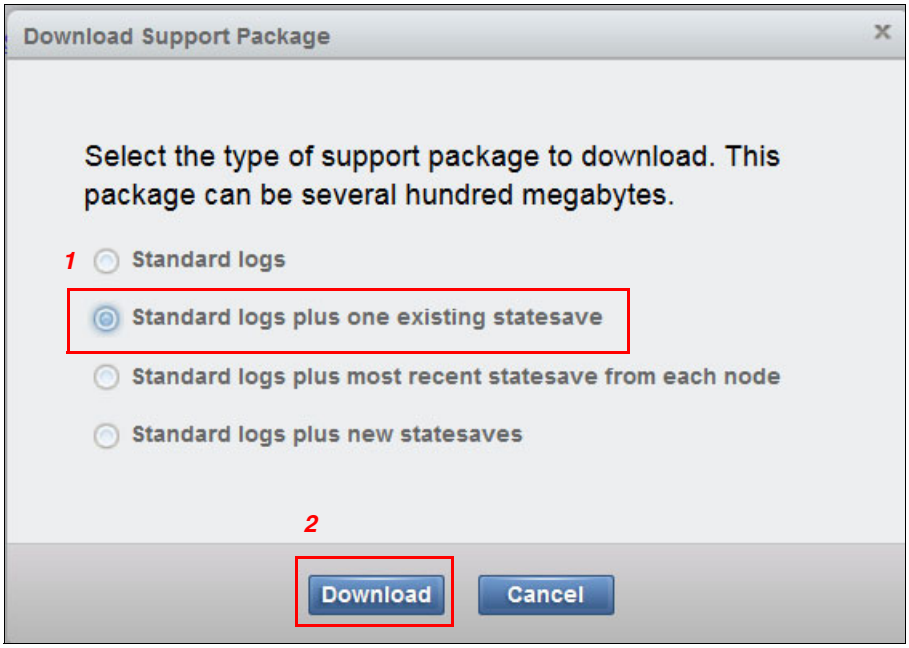


Figure 4-63 Download Support Package window

Tip: Depending on the configuration of the system, these logs can be quite large. Ensure your workstation has enough space to hold the file.

5. It can take a while to gather all of the logs, as shown in Figure 4-64. Select **Close** when it completes.

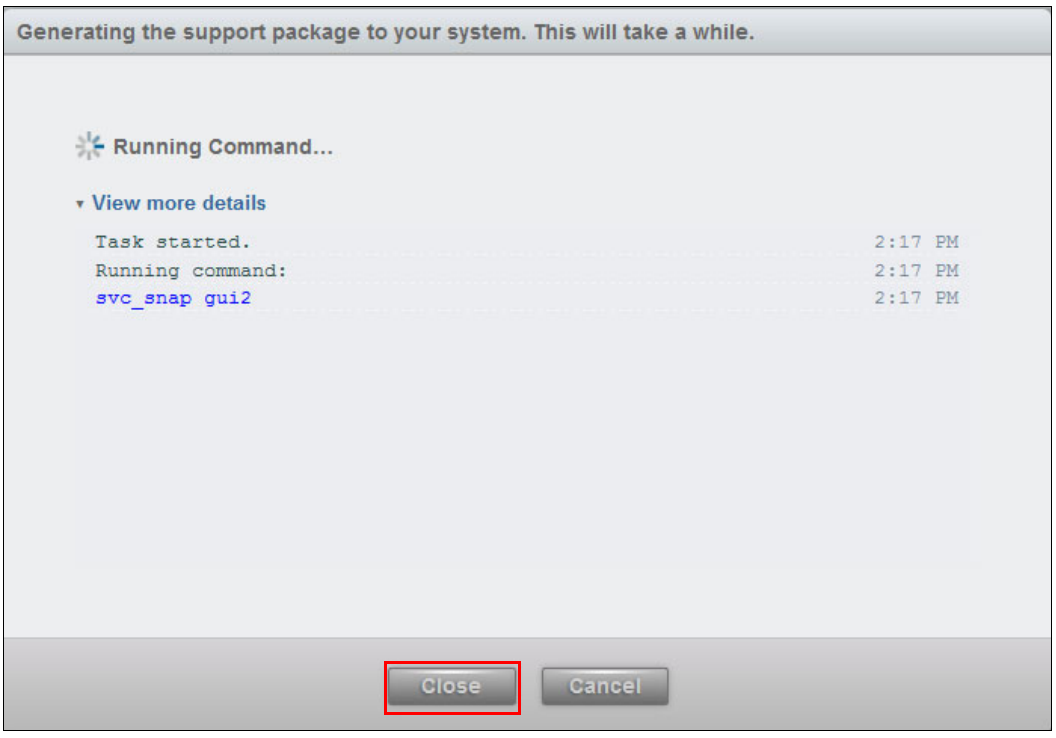


Figure 4-64 Generating the support package

6. On completion, select the **Save File** (1) option, as in Figure 4-65, and then click **OK** (2).

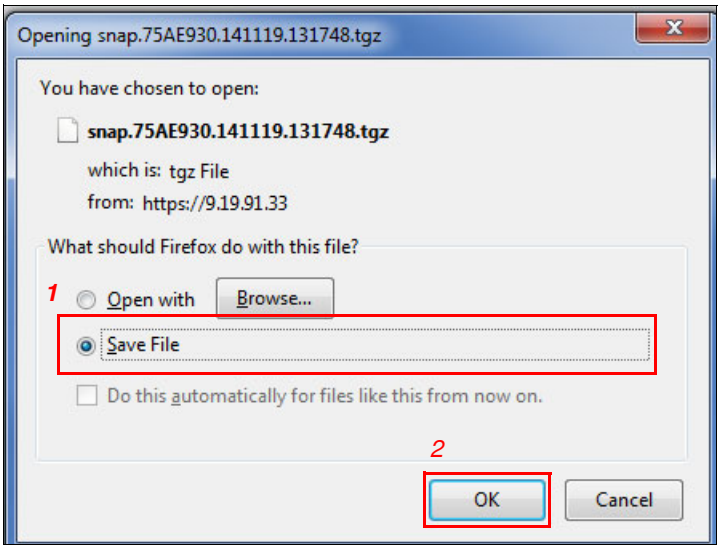


Figure 4-65 Select Save File

7. Select **File Save As** and prefix the file name with the support ticket number, as shown in Figure 4-66.

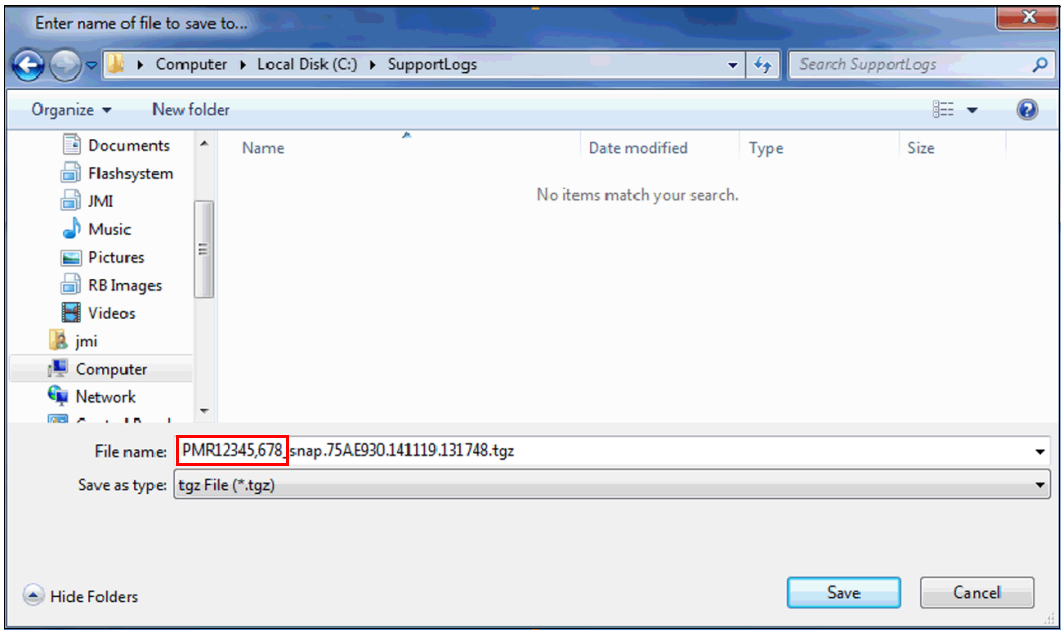


Figure 4-66 Use File Save As to save the file with the support ticket number as the prefix

Tip: IBM Support usually needs these logs to investigate issues. Collecting them in advance, before they ask for them, saves time.

FlashSystem V840 storage enclosure

FlashSystem V840 storage enclosure (AE0/AE1) is not in the control path that is used by the IBM Storage Integration Server. The storage enclosure is the high-speed storage device that provides the storage, and it is part of the data path. This section explains the steps to collect logs for this device when required. These steps are nearly identical to the steps for the controller.

1. Log in to the storage enclosure by using the defined management IP address. Figure 4-67 shows the login window.

Figure 4-67 Log in windowforthe storage enclosure

2. Storage enclosures have a summary screen that is specific to a storage device, as shown in Figure 4-68. Select the **Settings** (1) icon, and then select **Support** (2).

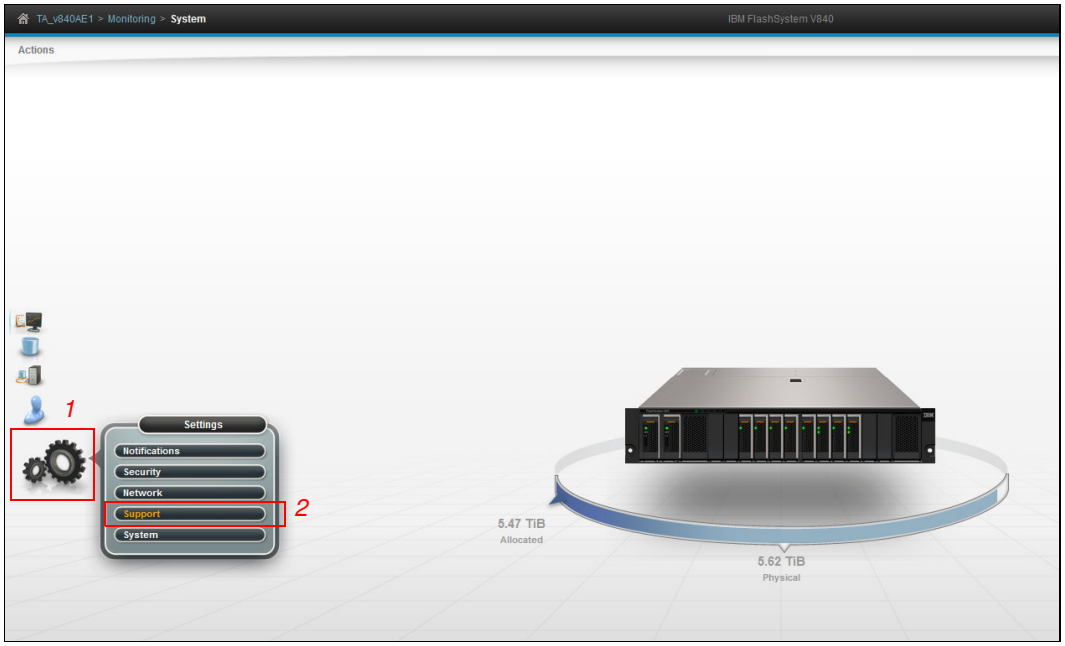


Figure 4-68 Settings menu with Support selection

3. From the Support pane, select **Download Support Package** (Figure 4-69).

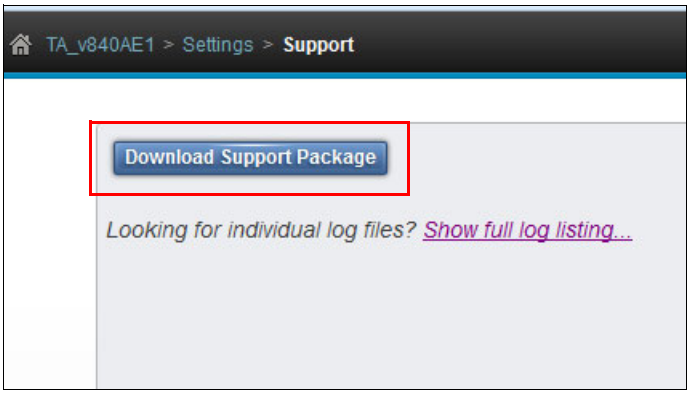


Figure 4-69 Support pane with Download Support Package button

4. In the Download Support Package window, select **Standard logs plus one existing statesave** (1) unless IBM Support has instructed something different. Then, click **Download** (2), as shown in Figure 4-70.

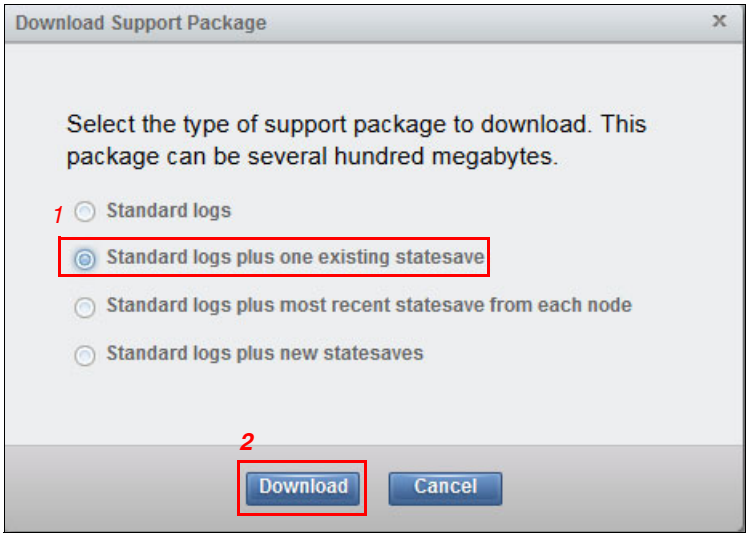


Figure 4-70 Download Support Package options

5. Wait for the command to complete. It can take a while, depending on system configuration. Click **Close** when that button becomes active, as shown in Figure 4-71.

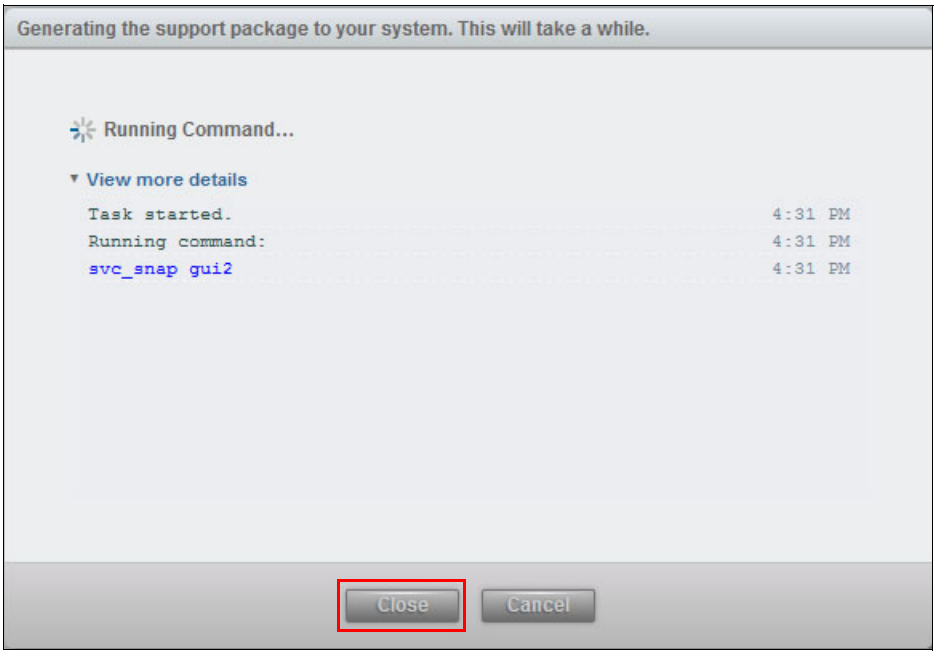


Figure 4-71 Generating support package display

6. On completion, select the **Save File** (1) option, and then click **OK** (2), as in Figure 4-72.

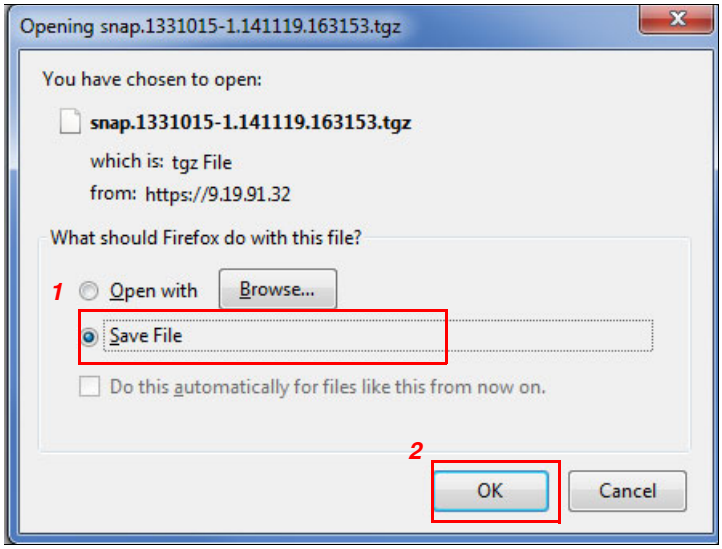


Figure 4-72 Select Save File andclick OK

7. Use **Save As** and add the support ticket number as the prefix (1), as Figure 4-73 shows. Then, click **Save** (2).

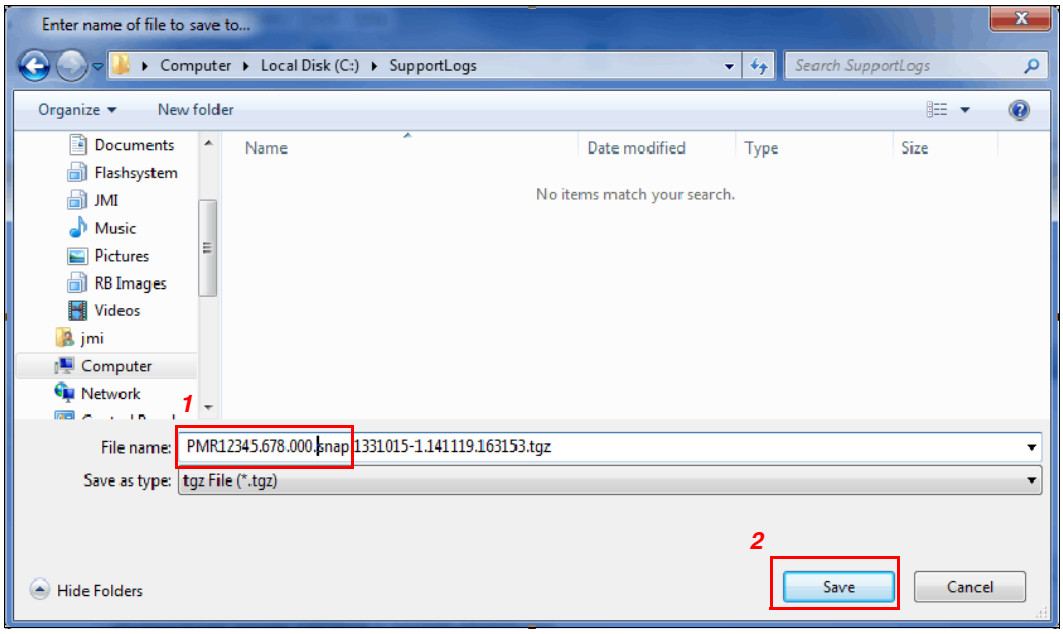


Figure 4-73 Save As display

Tip: These devices have methods to delete old files and snapshots if the sizemakes them unmanageable.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed description of the topics covered in this paper.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Note that some publications referenced in this list might be available in softcopy only.

- *IBM FlashSystem V840*, TIPS1158
- *IBM SAN Volume Controller 2145-DH8 Introduction and Implementation*, SG24-8229
- *IBM XIV and VMware Synergy with the IBM Storage Integration Server*, REDP-5131

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

ibm.com/redbooks

Online resources

These web pages are also relevant as further information sources:

- IBM FlashSystem 840 and V840 VMware vSphere Configuration Guide

  https://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD106284
- IBM FlashSystem V840 in the IBM Knowledge Center

  http://www.ibm.com/support/knowledgecenter/ST2HTZ
- IBM FlashSystem family product page

  http://www.ibm.com/storage/flash
- IBM System Storage Interoperation Center (SSIC)

  http://www.ibm.com/systems/support/storage/ssic/interoperability.ws

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

Deploying IBM FlashSystem V840 Storage in a VMware and Cloud Environment

Redpaper™

Integrate FlashSystem V840 and VMware vSphere software

Optimize your environment with IBM Storage Integration Server

Implement a FlashSystem V840 cloud-based solution

This IBM Redpaper publication describes how to implement a cloud-based solution with IBM FlashSystem V840 in a VMware and IBM Storage Integration Server environment. It walks the reader through planning, setup, configuration, and operations. It also provides tips for implementing FlashSystem V840 in a VMware environment by using IBM Storage Integration Server and VMware tools for optimizing and provisioning V840 storage.

The chapters cover the following topics:

- FlashSystem V840 integration with VMware and IBM Storage Integration Server concepts
- The value that IBM Storage Integration Server brings to business
- Default installation and configuration of IBM Storage Integration Server
- Stability and functions in a lab environment created by using these tools

This paper is for presales and post-sales technical support professionals and storage administrators and for anyone who wants to understand and learn how to implement FlashSystem V840 and VMware as a cloud-based solution.

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