WINCHESTERSYSTEMS®
Purpose-Built Storage

Using FlashDisk iSCSI-Host Storage Subsystems

with

VMware vSphere 5

Abstract

This application note explains configuration details for using Winchester Systems FlashDisk iSCSI-host storage systems with VMware vSphere 5.x to deliver high efficiency, flexibility, and availability in data center applications.

<u>Contents</u>

Products covered by this document

These application notes apply to the following products:

- **Winchester Systems FX Series FlashDisk iSCSI-host storage systems**

For more information regarding individual models and their VMware compatibility, please visit www.winsys.com

VMware virtualization

The concept of virtualization originated in the 1960s but was not applied to x86 architecture until the 1990s. However, since the 1980s, x86 servers have been widely adopted in IT environments because they are much cheaper than mainframe computers. The distributed system of computing the architecture enables allows for reduced total cost of ownership but may create other challenges, such as low infrastructure utilization, increased physical infrastructure requirements and higher IT management costs, plus insufficient failover and disaster protection. Virtualization is an effective way to deal with these challenges.

In VMware virtualization technology, ESX Server has been a foundation of virtualized environments.
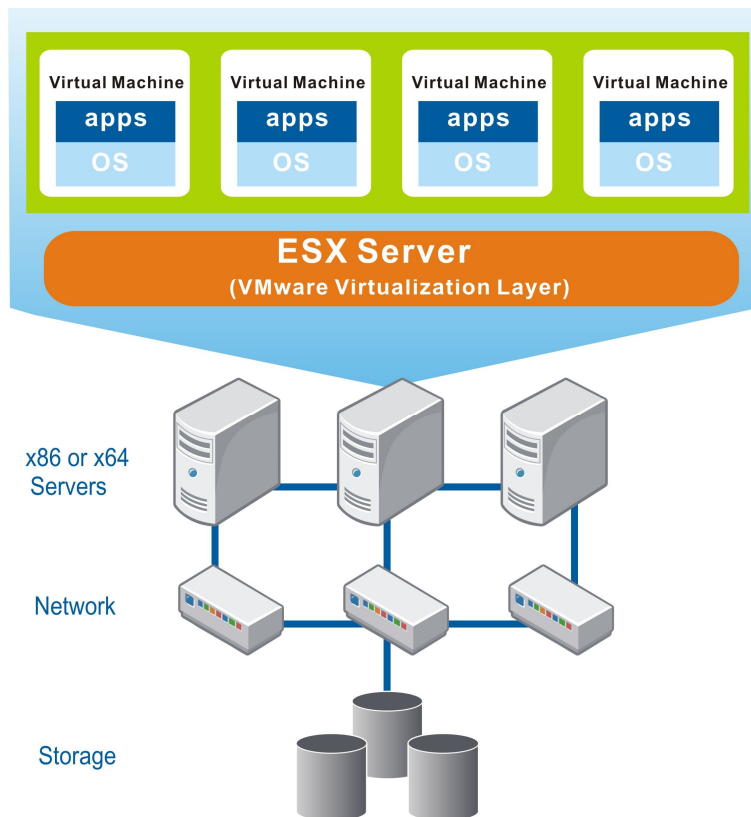
Figure 1: VMware ESX Server

Installed on an x86 or x64-based server, VMware ESX Server provides a virtualization layer on the host OS to consolidate all hardware resources, including processors, memory, storage, and networking. It applies them to virtual machines (i.e. virtual servers) running on the physical server. Each virtual machine can have its own OS and applications. By sharing hardware resources across multiple virtual machines, users can improve resource utilization and in turn greatly reduce costs involved in building physical data center infrastructure.

Besides optimized resource utilization, VMware virtualization also reduces deployment efforts and simplifies management tasks. Free from physical considerations and requirements, deploying virtual machines can be done in as little as just a few minutes. After deployment, managers can easily monitor the entire virtual data center through a unified management pane. When any of the physical devices fail, the high availability features of VMware ensure continuous system operation.

FlashDisk Storage Systems in VMware Virtualized Environments

Storage area network (SAN) is an architecture that brings storage resources into a pool and shares them among multiple hosts. SAN is the most suitable storage architecture for virtualized environments because when operating systems and applications are moved around virtual machines, data does not have to be copied and moved accordingly. Winchester Systems provides both FC-host RAID arrays and iSCSI-host RAID arrays to support SAN in VMware virtualized environments. FlashDisk arrays feature centralized management and configuration, redundant designs, and smart scalability to offer many benefits in SAN and virtualization environments.

In a data center featuring multiple storage systems, a powerful storage management tool is absolutely necessary. FlashDisk Global Manager allows system managers to configure, administer, and monitor multiple FlashDisk arrays locally or remotely through a user friendly interface. Integrating storage management tools into a VMware virtualized environment can make infrastructure more robust and easier to maintain.

In addition to the software component, the fault tolerant hardware modules and RAID functionalities of FlashDisk arrays further improve system availability. When controllers, power supplies, cooling modules or hard drives fail, they can all be hot-swapped without causing downtime or data loss.

In keeping up with data growth, the capacity of a single FlashDisk subsystem can be scaled by connecting expansion enclosures, which do not compromise industry-leading RAID performance. By allowing users to start with the capacity they need and expand when future needs arise, flexible scaling minimizes unnecessary investment and contributes to enhancing the core virtualization value of optimized resource utilization.

To ensure seamless integration of FlashDisk SAN storage into VMware virtualized environments, Winchester Systems performs comprehensive testing to verify compatibility with VMware products. For details about compatibility, please refer to the VMware Compatibility Guide.

Effective software suites optimize and manage IT environments through virtualization. They greatly reduce operating costs and increase IT service availability, security, and scalability while providing the flexibility to choose any OS, application, and hardware. VMware vSphere 5.x delivers many enhanced

features in terms of management, application services, infrastructure services, compatibility, and third party extensibility. For more details about VMware products, you can refer to www.vmware.com.

Configuration Considerations

Data Formats

To make data volumes on FlashDisk arrays accessible to ESX Server, they have to be configured as either a VMFS (Virtual Machine File System) volume or RDM (Raw Device Mapping) volume. VMFS is a VMware proprietary clustered file system and the most common access method. If users would like to allow multiple virtual machines and multiple physical servers to access a single volume, they should configure with the VMFS format.

Another way to allow virtual machines to access data volumes on storage is RDM. Virtual machines access VMFS volumes and RDM volumes in different ways. As shown in **Figure 2**, virtual machines can directly access a virtual disk in the VMFS format but their access to the RDM volume is enabled through a mapping file in the VMFS volume. This mapping file contains metadata that redirects disk access to physical devices.
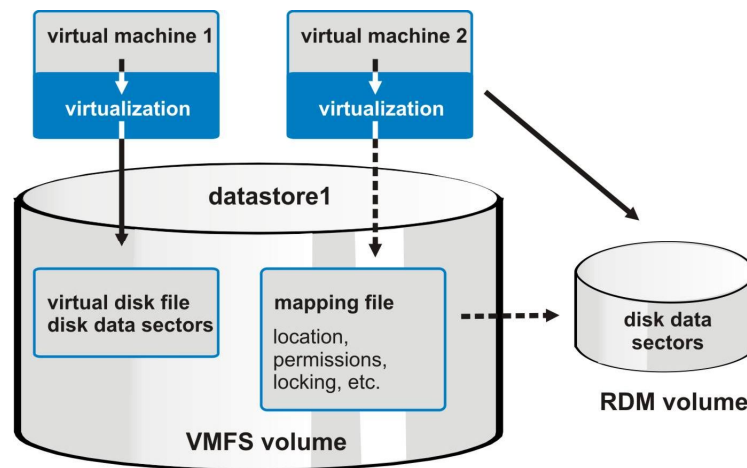
Figure 2: Accessing a VMFS volume and an RDM volume

Treating the RDM volume as a local disk, virtual machines can format it in the proper way. RDM is especially useful in the following applications:

1. SAN-based snapshot/volume copy or other layered applications on virtual machines.
2. Leveraging Microsoft Clustering Services (MSCS) to implement virtual-to-virtual clusters or physical-to-virtual clusters. Clustered data and quorum disks have to be configured as RDM volumes.

Deployment of VMFS Volumes

The following guidelines can help you properly deploy VMFS volumes:

1. Virtual machine boot disks and application data should be stored in separate VMFS volumes. Most I/O issued to boot disks involves paging activities and is sensitive to response time. By separating boot disks from application data, the risk of prolonged response time due to application related I/O can be mitigated.

2. Database platforms for enterprise data management, such as Microsoft SQL Server or Oracle, often use active logs and/or recovery data structures to track data changes. In cases of unplanned application or operating system disruptions, these active logs or recovery data structures are critical in ensuring system recovery and data consistency. Therefore, all virtual machines supporting such database platforms should be provided with an independent VMFS volume for storing active log files and recovery data structures. Furthermore, if files or structures are mirrored, the source and the target should be stored in separate VMFS volumes.

3. Application data, including database files, should be stored in a separate VMware file system. This file system should not contain any structures that are critical for application and/or database recovery.

4. It is recommended that VMFS volumes are no more than about 80% full. This ensures that administrators do not suddenly run out of space to accommodate user data and VMware snapshots for virtual machines.

RAID level

FlashDisk storage arrays allow users to protect data volumes with various RAID levels, including RAID 1, RAID 3, RAID 5, RAID 6, and RAID 10. Data volumes in the same storage array can be protected with different RAID levels. The following are general guidelines to configure RAID levels for data volumes in a VMware virtualized environment:

1. Virtual machine boot volumes are generally subject to low I/O rates. They can be configured with RAID 5 or 6 protection.

2. For most applications, RAID 5 or 6 is a proper level to protect virtual disks with. However, if the application involves extensive log ins, such as financial applications, RAID 10 may be a better option.

3. Infrastructure servers, such as Domain Name System (DNS), perform most of their activities utilizing CPU and RAM and therefore are often subject to low I/O rates. If users use virtual machines as infrastructure servers, it is proper to provide them with RAID 5 or 6 protected volumes as storage space.

4. Log devices for databases should be RAID 10-protected volumes. Furthermore, if databases or application logs are mirrored, the source and

the target should be located on separate sets of disks (in VMFS format, if applicable).

5. Virtual machines that generate high workloads of small-block random read I/O, such as Microsoft Exchange, should be allocated RAID 10-protected volumes for better performance.

6. Large file servers with the vast majority of the storage consumed by static files can be provided with RAID 5 or 6 protected volumes since I/O rates are expected to be low.

Configuration Example: Using FlashDisk iSCSI-host Storage with VMware vSphere 5.x

The below example explains how to make ESX Server boot from and leverage FlashDisk iSCSI-host storage using QLogic iSCSI initiator hardware.

Note: booting from SAN requires installing the operating system on one or more LUNs. By booting from SAN environments, you can enjoy easier server replacement, simplified backup, and improved management. To configure VMware ESX Server to boot from SAN, install an iSCSI host bus adapter (HBA) approved by both the VMware compatibility guide and Winchester Systems FlashDisk Compatibility Matrix.

Step 1: Create logical volume (LV) on FlashDisk and map storage to the server

This configuration step can be done by utilizing the Winchester Systems proprietary storage management suite – FlashDisk Global Manager. Please refer to your firmware user manual or the FlashDisk Global Manager user manual for details.

Step 2: Add FlashDisk iSCSI channel port IPs

In the SANsurfer iSCSI HBA Manager GUI, select the HBA port you mapped the LV to in the left-hand system tree pane. Select the Target Settings tab in the right-hand panel and click the ⊞ icon beside the target IP list. In the pop-up window, enter the IP address of the iSCSI channel port as shown in **Figure 3**, and click OK. The IP address will appear in the target IP list.
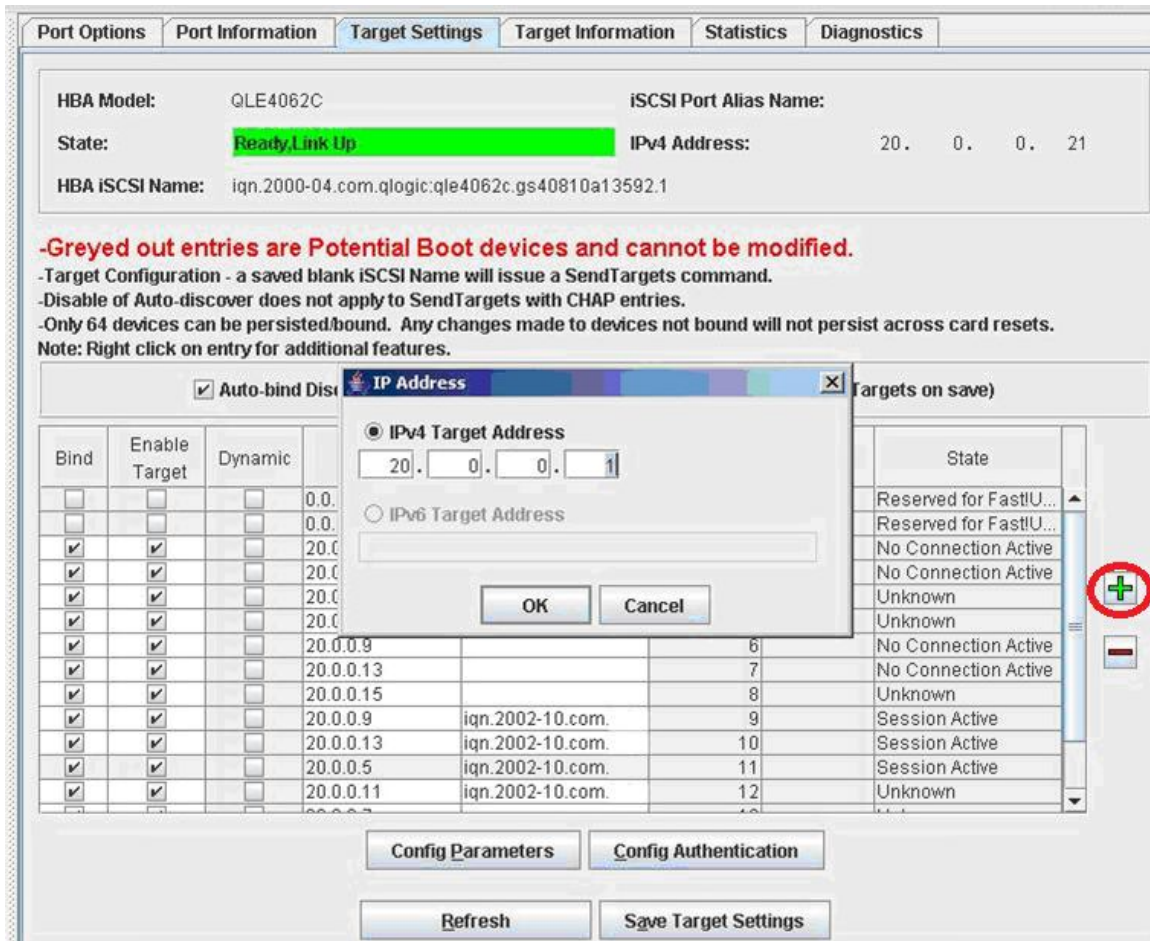
Figure 3: Adding a target IP address

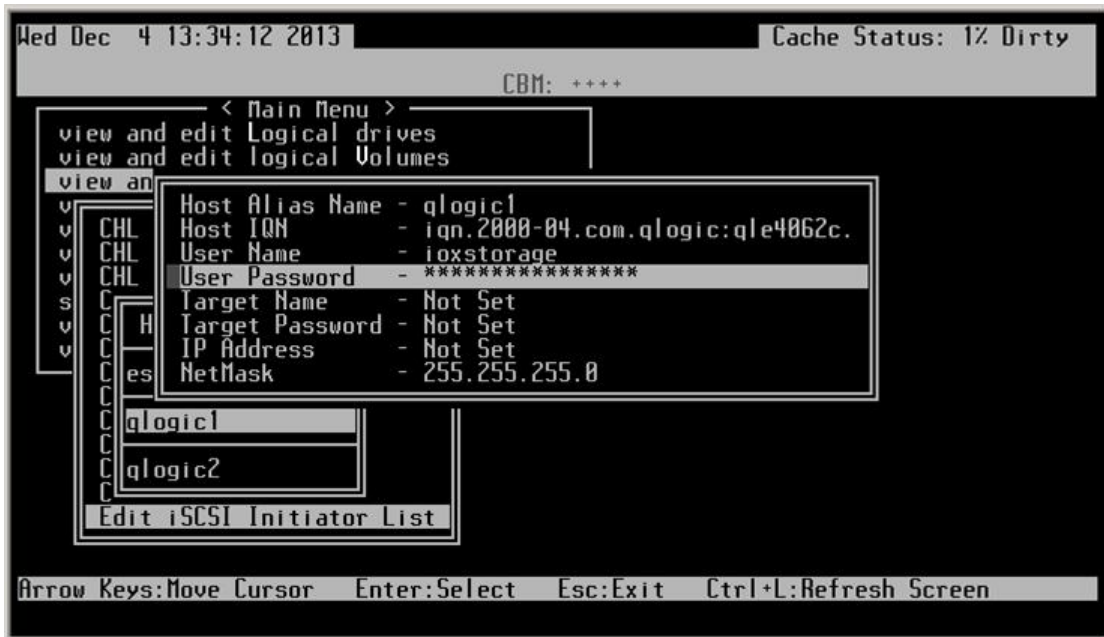Repeat the process until all IP addresses are added.

Step 3: Configure CHAP settings

In the SANsurfer iSCSI HBA Manager GUI, select the HBA port you would like to configure CHAP authentication on in the left-hand system tree pane. Select the Target Settings tab in the right-hand panel and click Configure Authentication. Both the storage system and the HBA need to have CHAP configured. In the FlashDisk console terminal, enable CHAP as shown in **Figure 4**: View and Edit Configuration Parameters > Host-side Parameters > Login Authentication with CHAP.
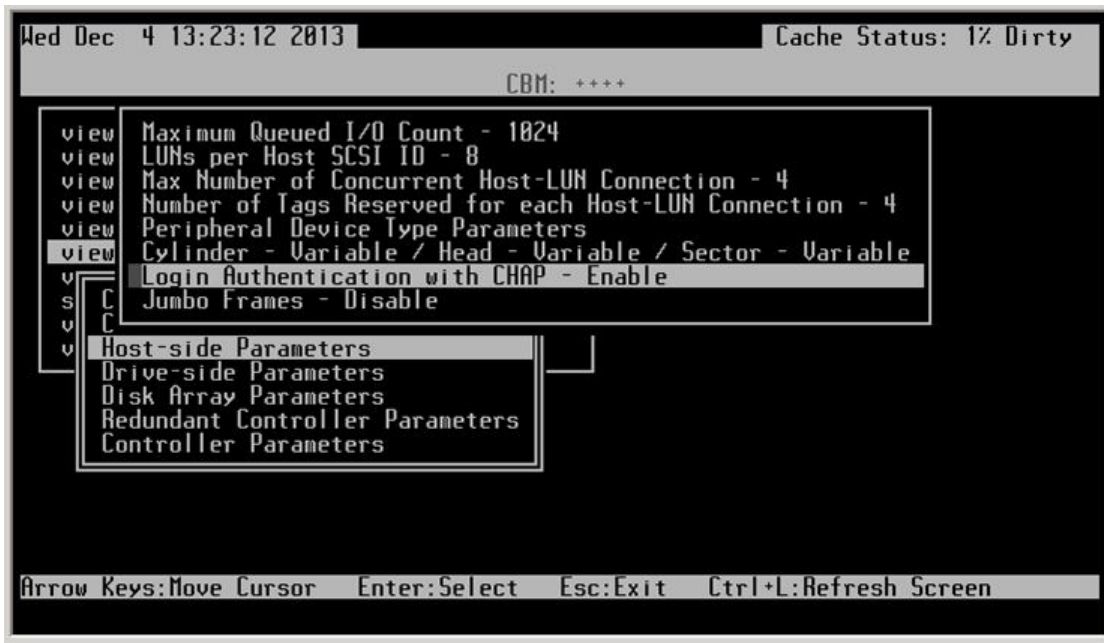
Figure 4: Enabling CHAP in the console terminal

After enabling CHAP, select View and Edit Configuration Parameters > Edit iSCSI Initiator List as shown below to configure CHAP authentication.

Figure 5: CHAP password settings for iSCSI initiator

Configure the CHAP authentication of the iSCSI HBA through VMware. Go to vCenter > Storage Adapter > iSCSI Initiator > Properties > CHAP as shown below.
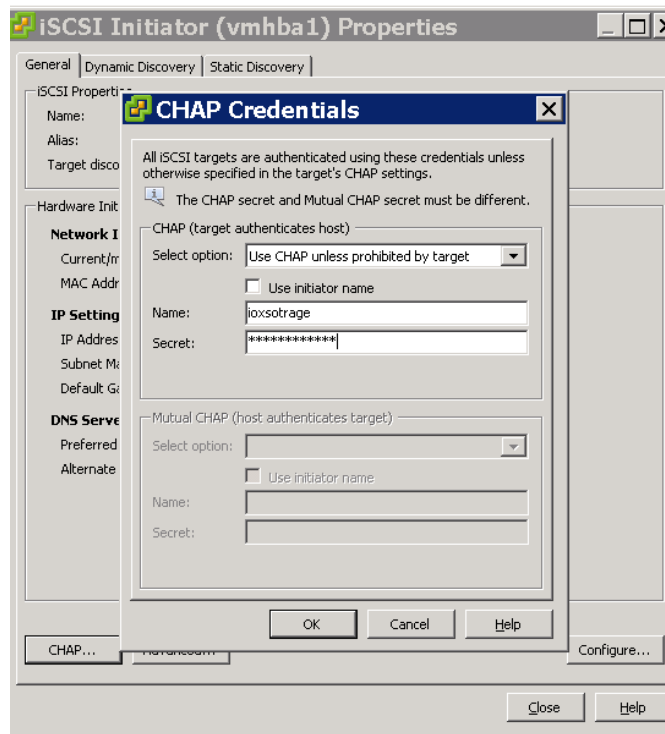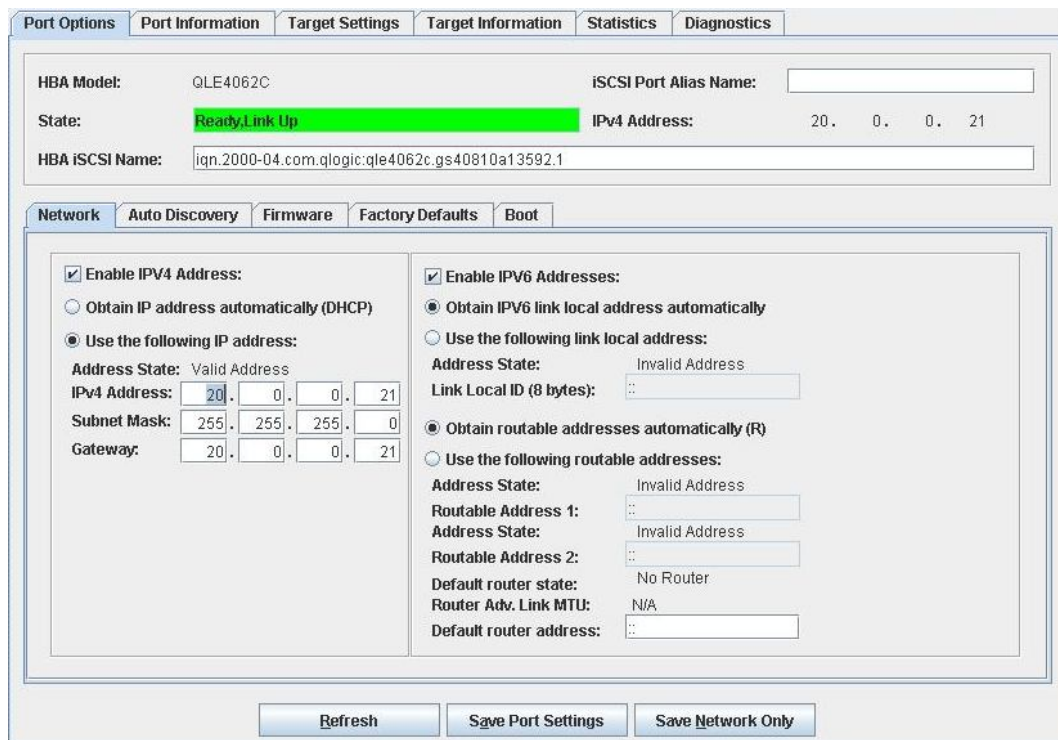
Figure 6: CHAP configuration for iSCSI initiator

Step 4: Configure network settings

In the SANsurfer iSCSI HBA Manager GUI, select the HBA port you would like to configure network settings on in the left-hand system tree pane. Then select the Port Options tab in the right-hand panel and click the Network tab, as shown below. Configure all required network settings here.

Figure 7: Configuring network settings

Repeat the process until all ports are properly configured.

Step 5: Configure boot settings

In the SANsurfer iSCSI HBA Manager GUI, select the HBA port you would like to establish boot-from-SAN access for in the left-hand system tree pane. Then select the Port Options tab and click the Boot tab. In BIOS Boot Mode Setting, select Manual Mode from the drop-down list. Then specify the LUN you would like to use as the boot disk by selecting Primary Boot Device IP and Primary Boot LUN from the drop-down lists, as shown below.
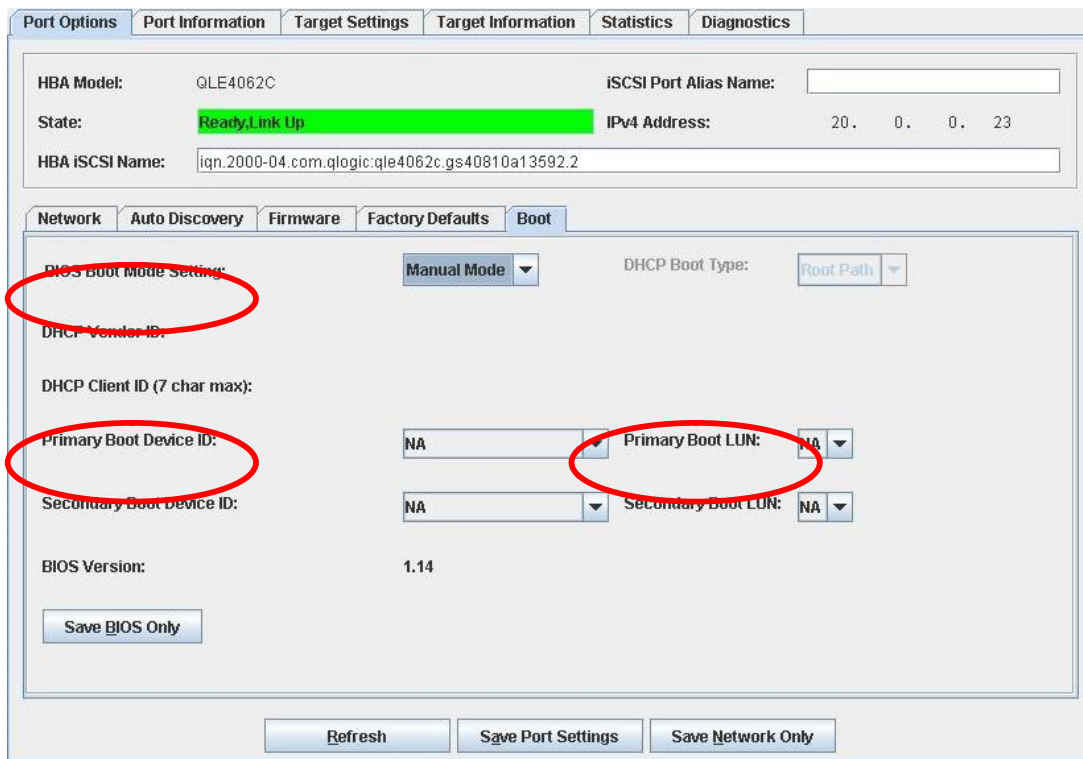
Figure 8: Configuring boot settings

Note: After the above steps are done, we suggest you enter the QLogic HBA BIOS (press ctrl + Q during server reboot) to check if all settings are successfully and correctly implemented.

Step 6: Set up the server to boot from a CD

Reboot the server. During server power up, enter the system BIOS configuration/setup utility. Select Startup Options and press enter. Select Startup Sequence Options and press enter. Then change First Startup Device to [CD-ROM].

Step 7: Install ESX Server

Use a CD-ROM to install ESX Server and choose the LUN on the FlashDisk as

the boot disk during installation. After going through the installation wizard, ESX Server is successfully installed.

Step 8: Add a VMFS datastore

In the vCenter GUI, select ESX Server from the inventory panel and click Storage in the Hardware panel. Click Add Storage as shown below.
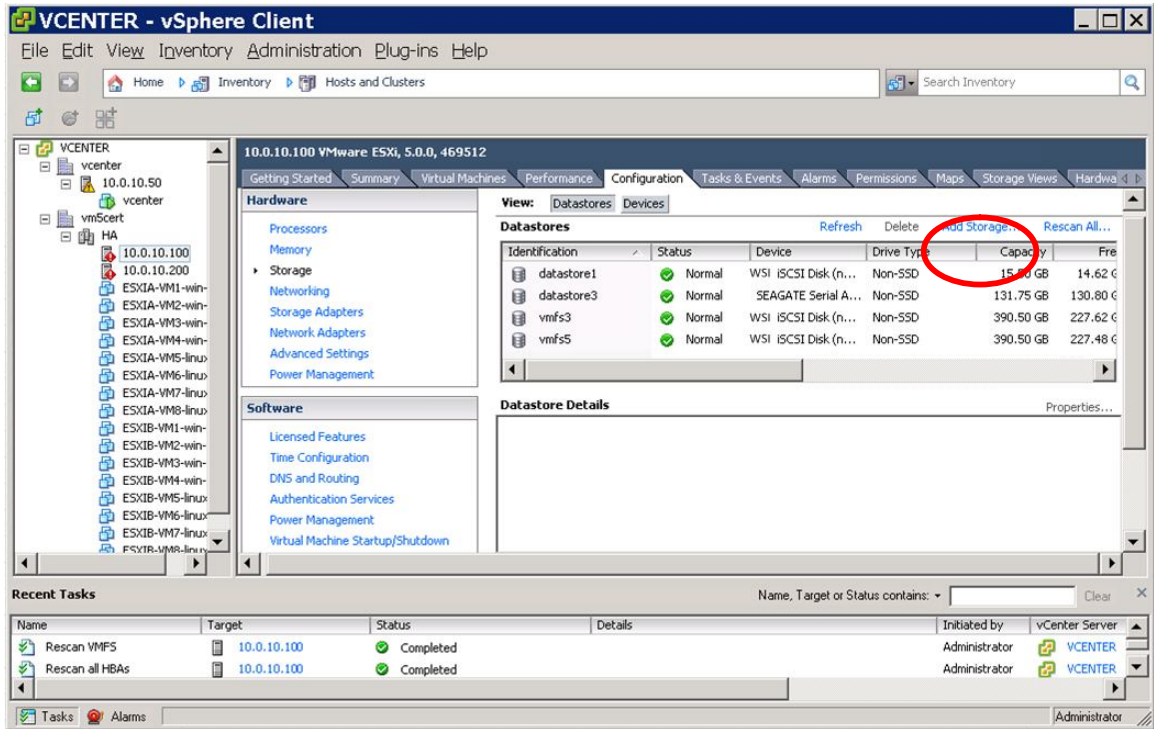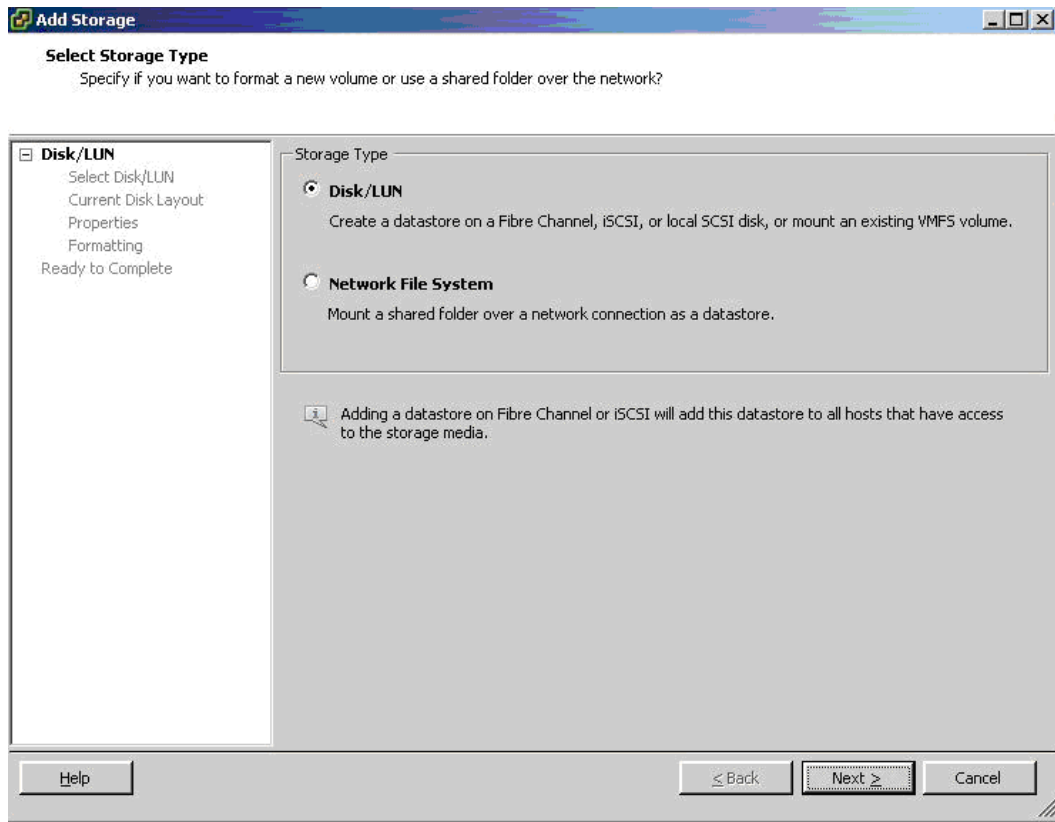

Figure 9: Adding storage

The Add Storage window will pop up. First select Disk/LUN as the storage type as shown below, and then click Next.

Figure 10: Selecting Disk/LUN as storage type

In the list of all available iSCSI disks, select the one you would like to add as the new VMFS datastore as shown below. Click Next.
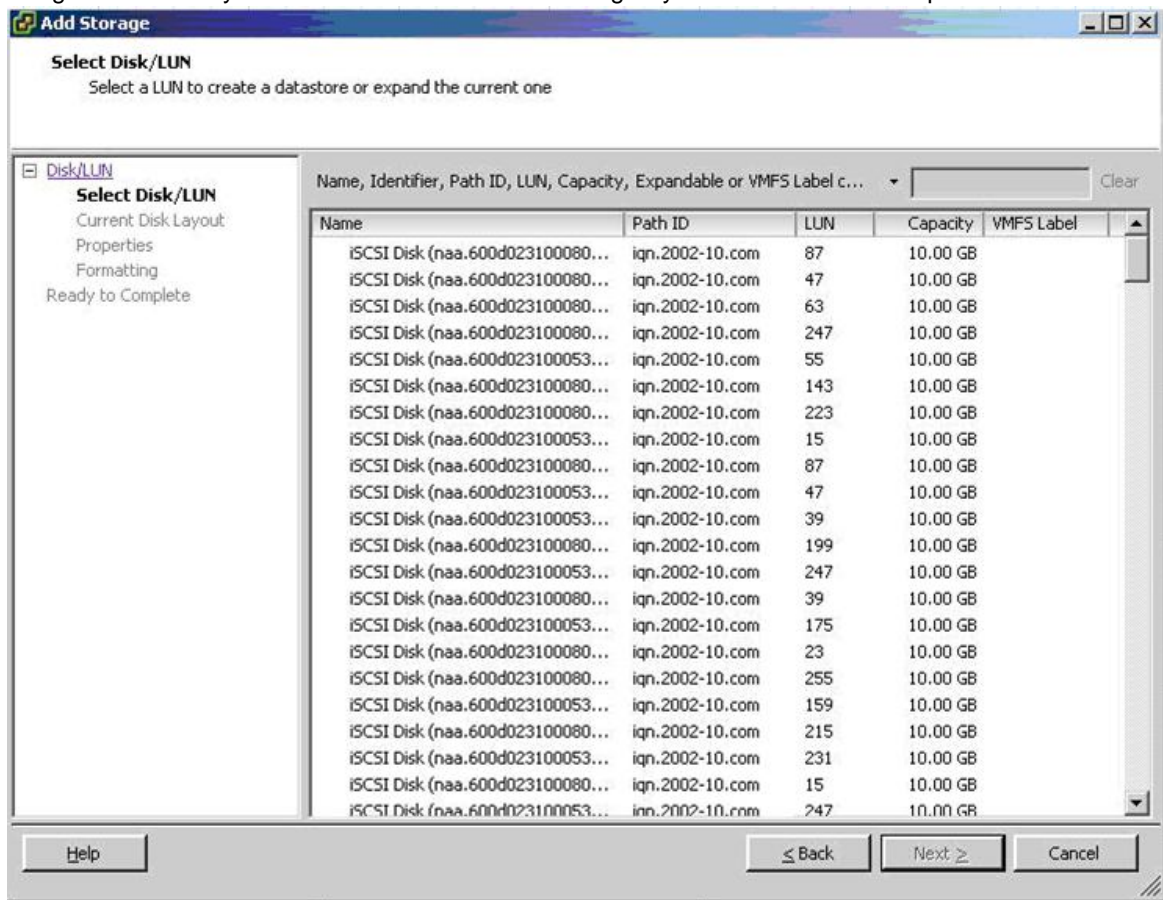
Figure 11: Selecting an iSCSI Disk

VMware vSphere 5.X has a new file system format called VMFS-5, supporting more than 2TB of data capacity via VMware virtualization.
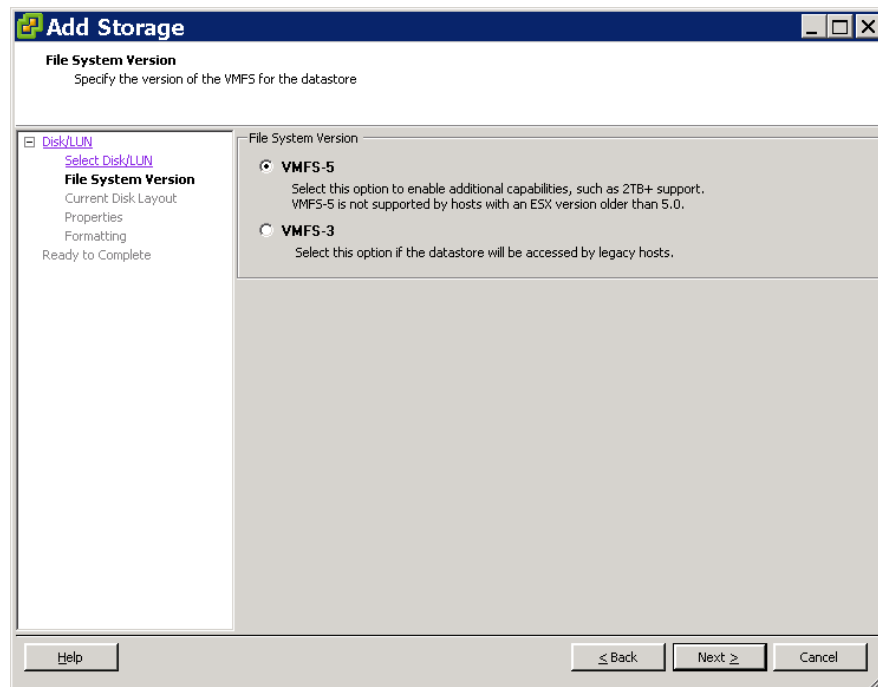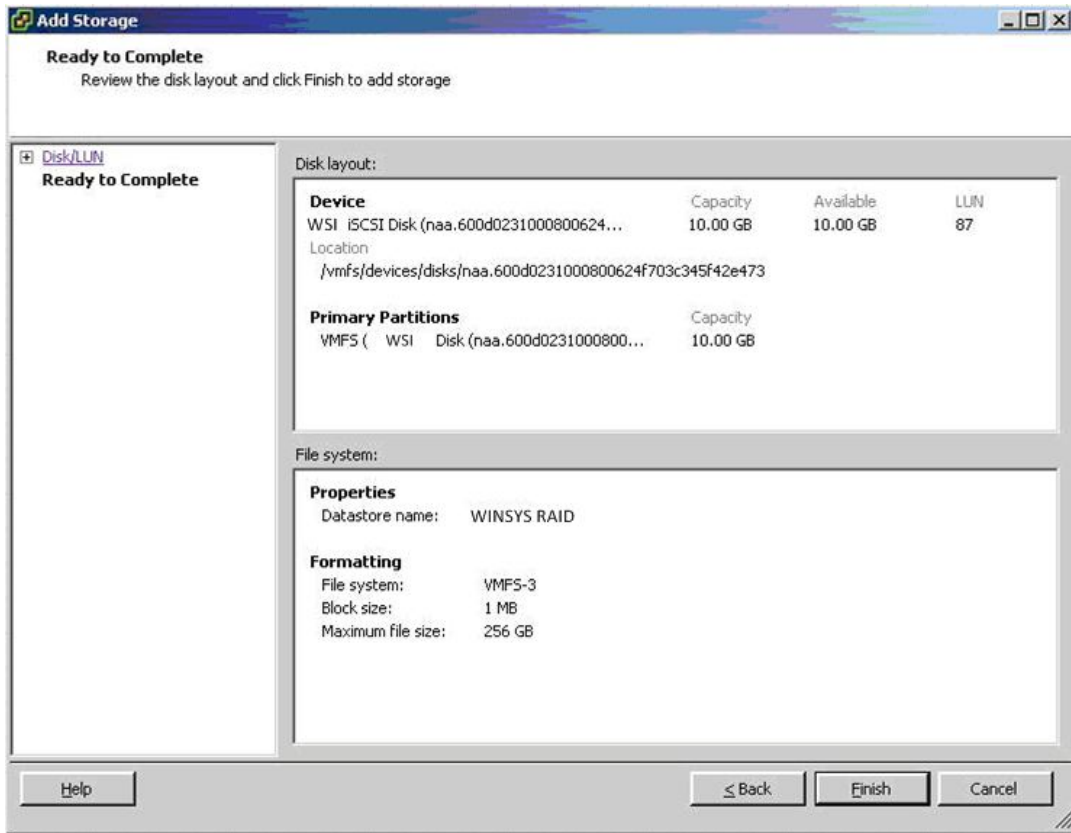

Figure 12: VMFS-5 options for additional capacity

After going through the configuration process of entering the datastore name and maximum file size, click Finish.

Figure 13: Finishing datastore creation

Basic troubleshooting and FAQ

1. What information should I prepare when I need technical assistance?

Please provide the following information:

- ESX Server version (for example, ESXi 5.0)

- Storage model, its firmware version, and event logs

- Topology of your ESX Server, switch, and storage as shown below:
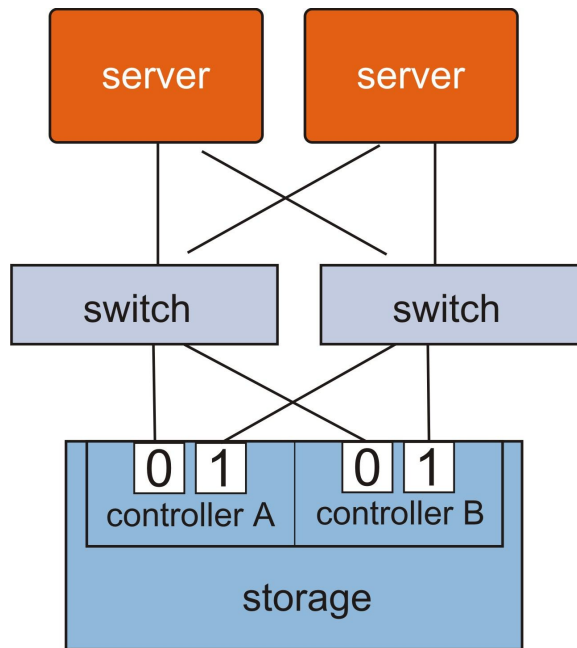

- Storage configuration including logical drives, logical volumes, partitions, and LUN mapping. You can obtain this information using FlashDisk Global Manager.

- Description of system behavior and associated problems

- ESX Server configuration with screenshots of Networking, Storage Adapters and Maps from the vCenter/VirtualCenter GUI
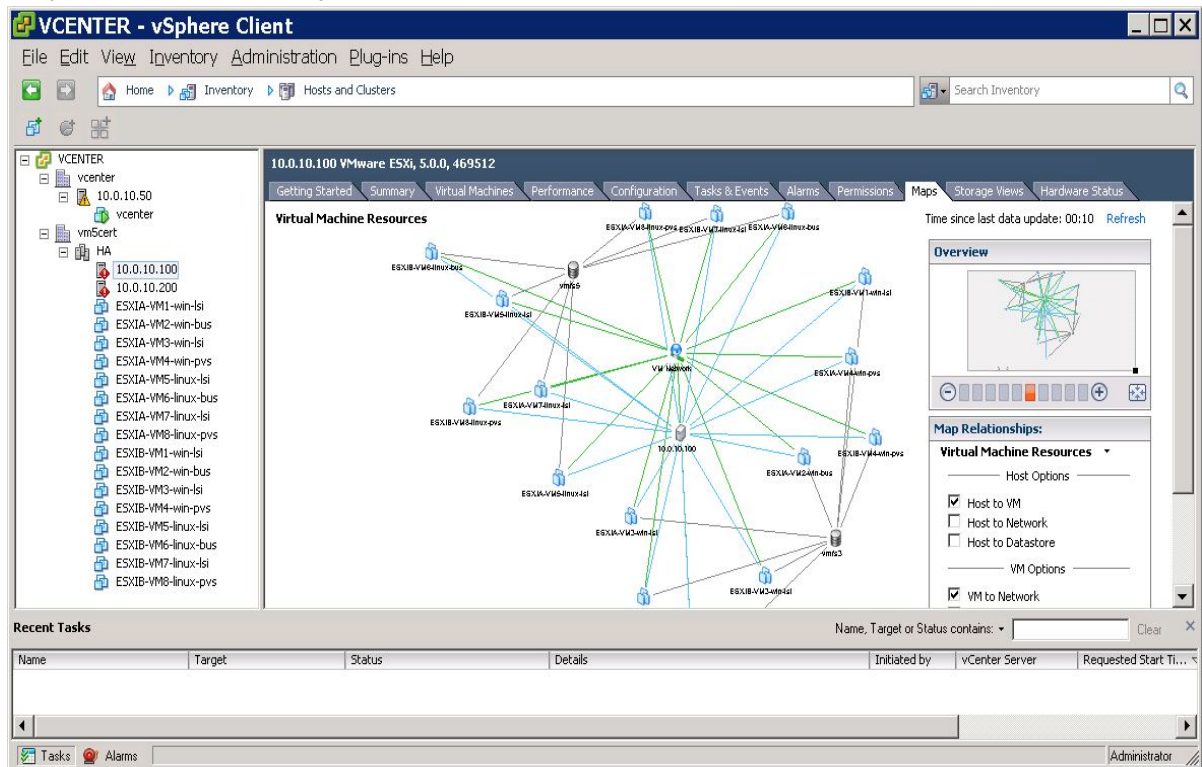
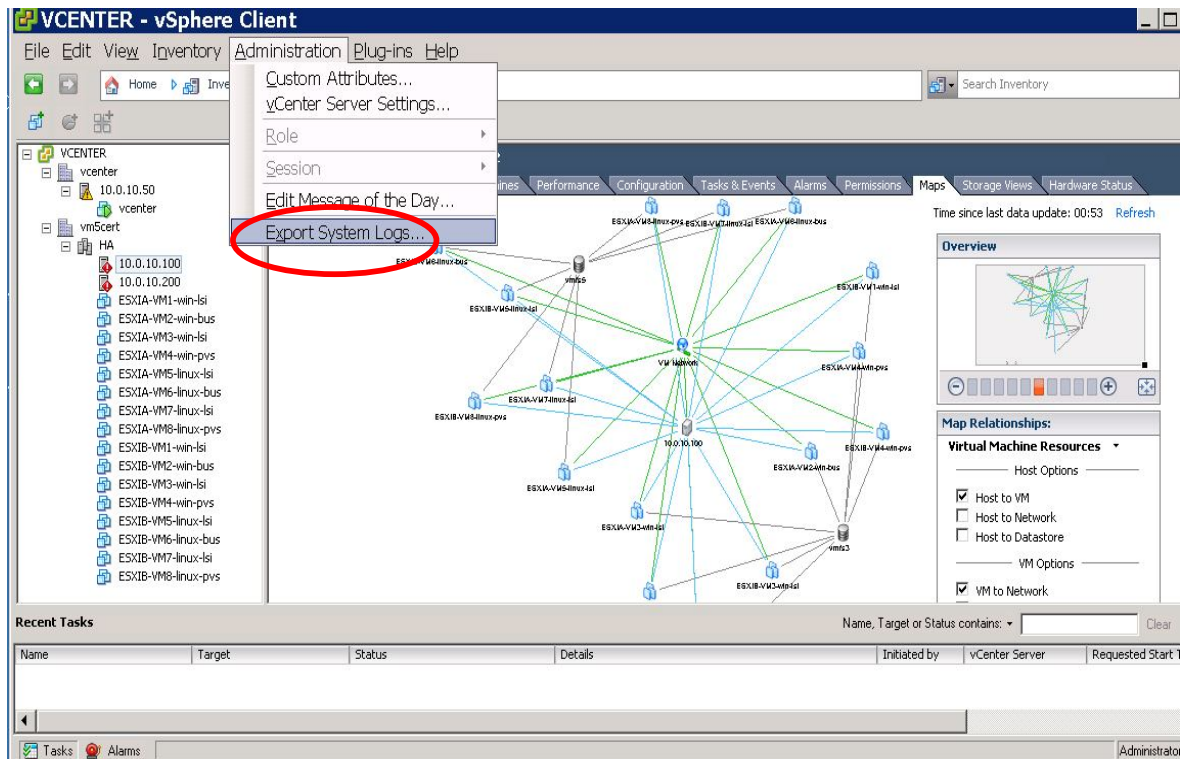Networking screenshot example:
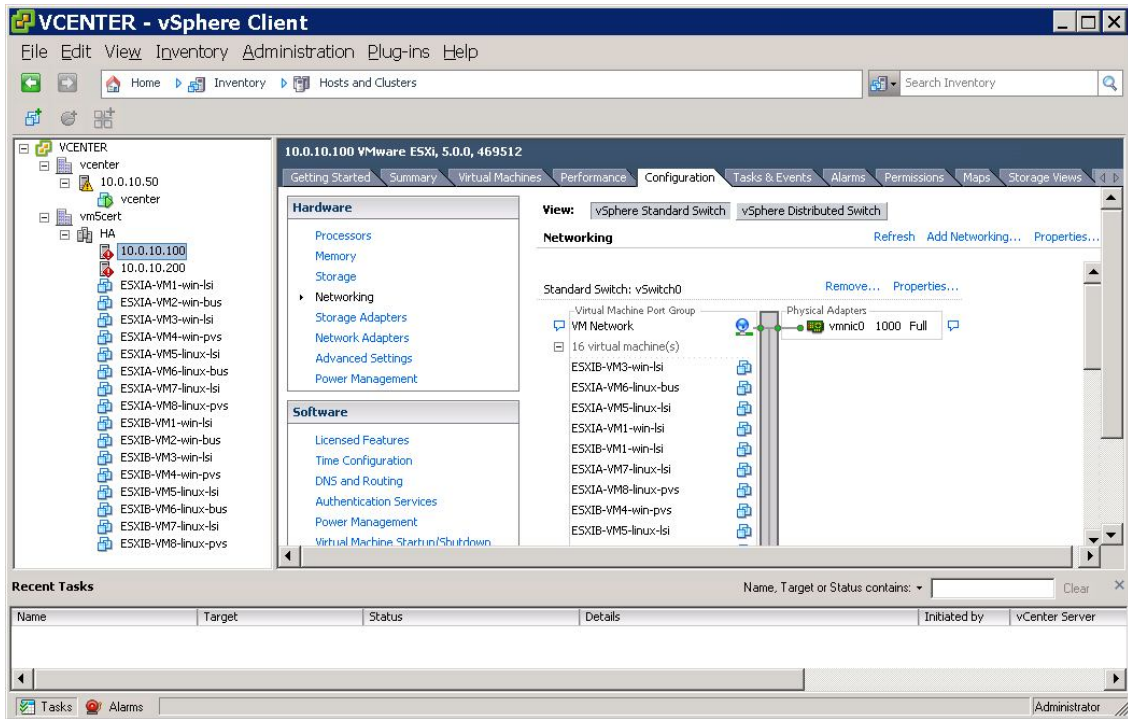
Storage Adapters screenshot example:
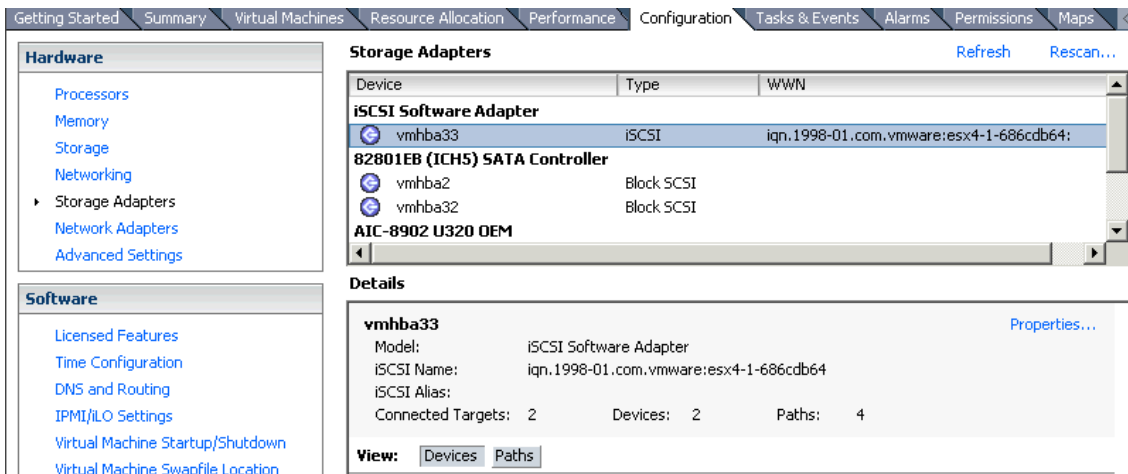
Maps screenshot example:

- ESX Server event logs can be obtained from the vCenter/VirtualCenter GUI. Click Administration in the top menu and select Export System Logs from the drop-down menu

2. **Why am I unable to see the VMFS data volume I created before?**

First check whether you can see the physical storage device you used to create the VMFS data volume in vCenter/VirtualCenter GUI. If not, check whether all cables are correctly connected and that storage LUN mapping is properly configured. Then execute Rescan in the Storage Adapters screen.
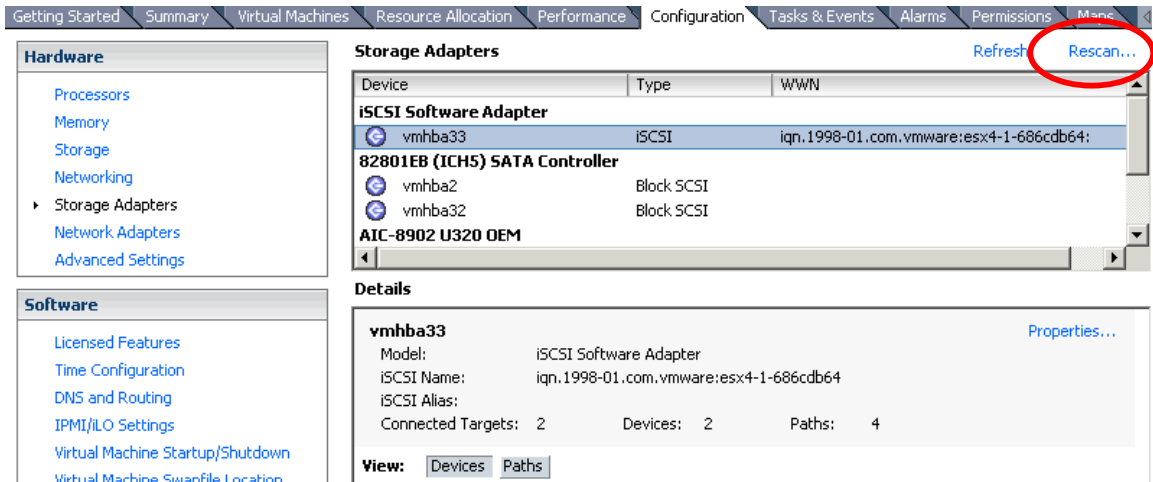
If the problem is still not solved, please prepare the information mentioned in question 1 and contact us for further troubleshooting.

3. What are the storage configuration limitations in a VMware virtualized environment?

Please check:
http://www.vmware.com/pdf/vsphere5/r50/vsphere-50-configuration-maximums.pdf for details.

4. How can I ensure data paths successfully conduct failover with redundant controllers?

If you are using ESXi 5.0 with FlashDisk storage arrays and firmware version 3.64 or later, the system automatically handles this without any manual configuration.

5. Can virtual machines be migrated to a different datastore without interruption?

Yes, virtual machines can be migrated online to another data volume.

6. If I would like to implement multipathing, are there any special settings I should use on my storage? Should I install FlashPath?

No, there are no special settings required. FlashDisk storage supports MRU (Most Recently Used) in VMware, as shown below. Since VMware supports native multipathing, you do not need to install other software, including FlashPath, for multipathing implementation.