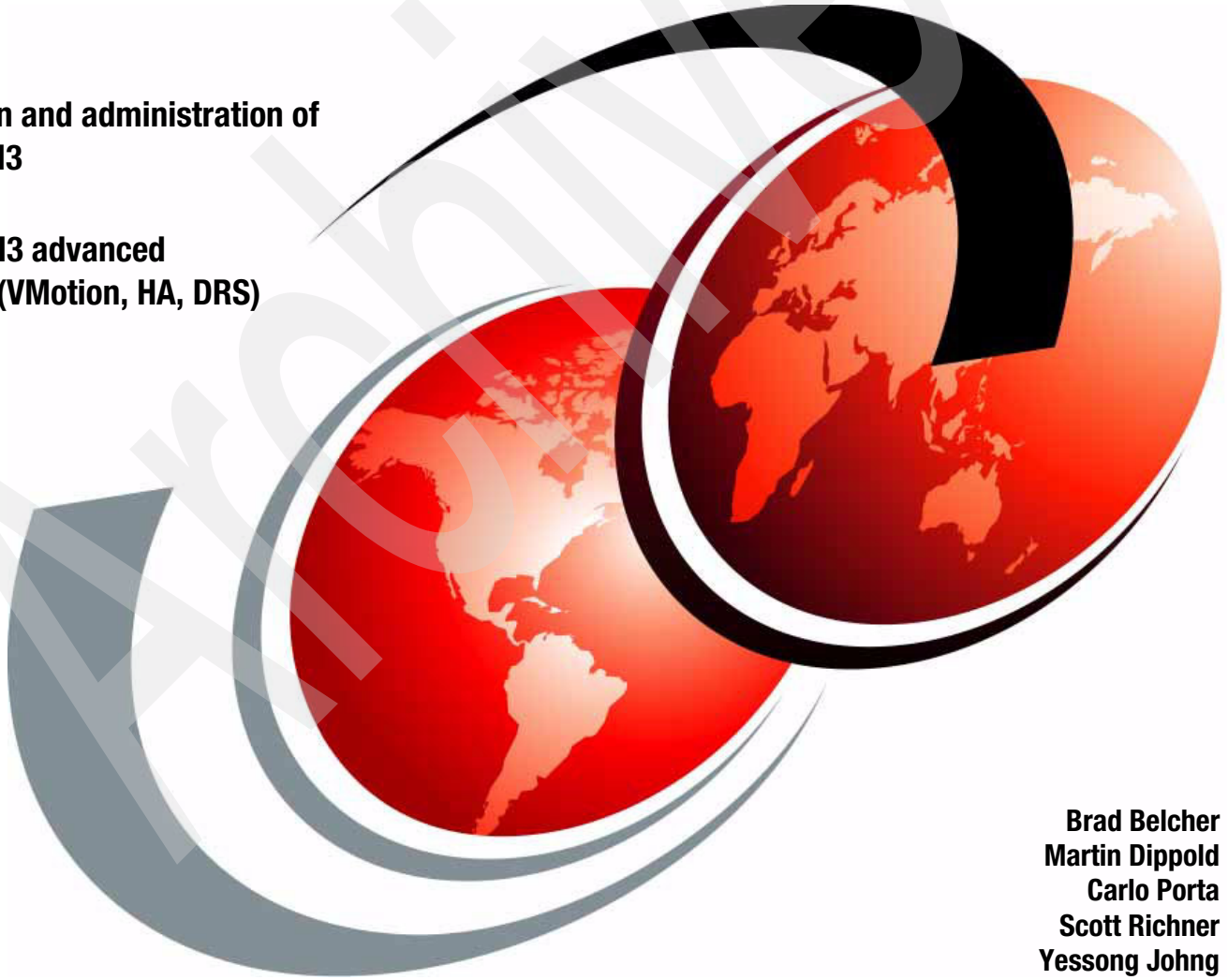
IBM

VMware VI3 on BladeCenter and System x Integrated with System i

- Planning for VMware VI3
- Installation and administration of VMware VI3
- VMware VI3 advanced functions (VMotion, HA, DRS)



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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

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Contents

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Preface

IBM® i integration with BladeCenter® and System x™ allows businesses to operate heterogeneous environments that include Intel®-compatible servers running VMware® ESX Server in addition to core business applications on the IBM i platform. VMware ESX Server is the host server for abstracting processor, memory, storage and networking resources of a physical server into multiple virtual machines. The ESX Server is part of the VMware Infrastructure.

Implementing VMware Infrastructure 3 with System i® integration with BladeCenter and System x brings together the strengths of System i along with the benefits that VMware Infrastructure 3 brings to the BladeCenter and System x.

This IBM Redbooks® publication presents some of the reasons for considering implementing VMware Infrastructure 3 through System i integration with BladeCenter and System x and guides you through the following important topics:

- Planning and installation VMware Infrastructure 3 via System i integration with BladeCenter and System x
- Summary of VMware Infrastructure 3 advanced capabilities
- Backup and recovery
- Managing integrated ESC server
- Administration and management of a VMware infrastructure
- Migration

The team that wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, Rochester Center.

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Introduction

Implementing VMware Infrastructure 3 with System i integration with BladeCenter and System x brings together the strengths of System i along with the benefits that VMware Infrastructure 3 brings to the BladeCenter and System x. This chapter presents some of the reasons for considering implementing VMware Infrastructure 3 through System i integration with BladeCenter and System x and guides you through planning, installation, backup and recovery, and the administration and management of a VMware infrastructure.

Note: VMware Server (formerly known as VMware GSX) is not covered in this book. VMware Server is a different virtualization product that installs on top of a host operating system (either Windows or Linux) and has been supported on System i integration with BladeCenter and System x for several years now. VMware Server would be the virtualization product to look at for smaller virtualization environments with a small number of physical servers and no desire to take advantage of the advanced VMware features like VMotion®, high availability, or distributed resource scheduling. VMware Infrastructure 3 is not supported on the older integration technologies of Integrated xSeries Server (IXS) and Integrated xSeries Adapter (IXA), so VMware Server would be the product to consider in this situation also.

1.1 System i integration overview

This section discusses general topics of System i integration.

1.1.1 What is System i integration with BladeCenter and System x

System i integration with BladeCenter and System x is one of a number of infrastructure simplification technologies employed in System i. It provides a method of unifying your BladeCenter and System x servers and your i5/OS environment.

Note: Throughout this book, the terms x86 server and x86-based server are used. In the context of this book, these terms refer to BladeCenter blade servers or System x servers. This terminology does not imply that non-IBM servers can participate in System i integration.

1.1.2 System i integration benefits

System i integration with BladeCenter and System x provides you with a number of unique benefits over what a non-integrated server does. These benefits include:

- Reliability: Use more reliable System i storage instead of x86-based storage.
- Protection: Take advantage of System i data protection schemes such as data striping, RAID 5, RAID 6, and mirroring.
- Performance: Data is spread across multiple System i disks, preventing bottlenecks on a particular drive.
- Flexibility: Add disk storage on-the-fly.
- Disaster recovery: Back up as part of i5/OS backup, and recover with i5/OS recovery.
- User management: When the VMware environment is implemented entirely with System i integrated servers, i5/OS users can be enrolled on the VirtualCenter server.

1.1.3 System i integration components overview

System i integration with BladeCenter and System x consists of a number of components:

- System i with i5/OS and integration prerequisite software
- iSCSI Host Bus Adapter (HBA) for System i hardware the enables the SCSI over Ethernet connectivity
- System i storage provides virtual disks for the integrated server
- x86 servers either BladeCenter with one or more supported blade servers installed or supported System x servers with no disks installed
- iSCSI HBA for x86 server expansion card for blade server or adapter card for System x connects to iSCSI network
- Service processor hardware for x86 a management module (management module or Advanced Management Module) for a BladeCenter or a Remote Supervisor Adapter II SlimLine or Baseboard Management Controller for System x
- Gigabit Ethernet switch BladeCenter switch module or external switch
- Cabling to connect the network either copper or fiber Ethernet depending on switches and adapters

1.2 VMware Infrastructure 3 overview

This section provides an overview of VMware Infrastructure 3.

1.2.1 VMware Infrastructure 3 benefits

VMware Infrastructure 3 is a suite of virtualization products that can help you realize a number of benefits:

- Native architecture: The VMware ESX Server installs directly on the x86 hardware, giving virtual machines near native performance characteristics.
- Resource virtualization: Virtualizes processor, memory, network, and storage so they can be used where most needed, increasing overall utilization.
- Server consolidation: Higher utilization of server resources reduces the need for additional hardware.
- Scalability: Virtual machines can scale up to 64 GB of virtual memory onto large servers with up to 128 GB of physical memory.
- Performance: A number of considerations:
  - Page sharing reduces the number of physical memory accesses.
  - Memory over-commitment to increase utilization.
  - Memory ballooning to prevent starvation.
- Portability: Workloads implemented as virtual machines can be easily moved between physical x86 servers.
- Rapid deployment: Repository of virtual appliances that implement many popular workloads
- Operating system flexibility: Supports a broader range of operating systems than System i integration with BladeCenter and System x does natively.

1.2.2 VMware Infrastructure 3 components overview

VMware Infrastructure 3 includes the following components, which are identified in the topology shown in Figure 1-1 on page 4:

- VMware ESX Server: Virtualization layer that runs on the x86 hardware virtualizing processor, memory, storage, and networking resources.
- VirtualCenter Server: The centralized management point for configuring, provisioning, and managing the virtualized environment.
- VMware Infrastructure Client: The Windows-based primary interface for remote connection to VirtualCenter Server or ESX Servers.
- VMware Infrastructure Web Access: Web browser based interface to VirtualCenter Server or ESX Servers that supports management and virtual console access for virtual machines.
- VMware Virtual Machine File System (VMFS): VMware's high-performance file system for virtual machines.
- VMware Virtual Symmetric Multi-Processing (Virtual SMP®): Enables a virtual machine to use several physical processors simultaneously.
- VMware VMotion: Enables migration of running virtual machines from one physical ESX Server to another with no interruption.

- VMware High Availability (HA): Enables virtual machines running on a physical ESX Server that fails to automatically restart on another ESX Server.
- VMware Distributed Resource Scheduler (DRS): Based on VMotion technology, enables automatic balancing of virtual machine workloads across a group of ESX Servers.
- VMware Consolidated Backup (Consolidated Backup): Provides agent-free backup of virtual machines.

1.3 VMware Infrastructure 3on System i topology

When you implement VMware Infrastructure 3 with System i integration with BladeCenter and System x, the System i is more or less acting as a self-managing Storage Area Network with regard to VMware. In other words, all the storage for the VMware Infrastructure 3 environment physically resides on the System i.

Referring to Figure 1-1, you see that the VMware infrastructure actually runs on the physical x86 hardware. Figure 1-1 shows a BladeCenter. The VMware components shown are described above. The x86 servers are connected to the System i over a private gigabit Ethernet network. The switch shown in the figure would in most cases be an integrated switch for a BladeCenter, but is shown externally to emphasize the network components. The iSCSI HBAs in the BladeCenters are not explicitly shown, but they would be connected internally to an I/O bay, from which the network connections are made. Several iSCSI HBAs are shown in the System i, indicating the multiple HBAs required to support a BladeCenter fully populated with blade servers. These are shown connecting to the private network.

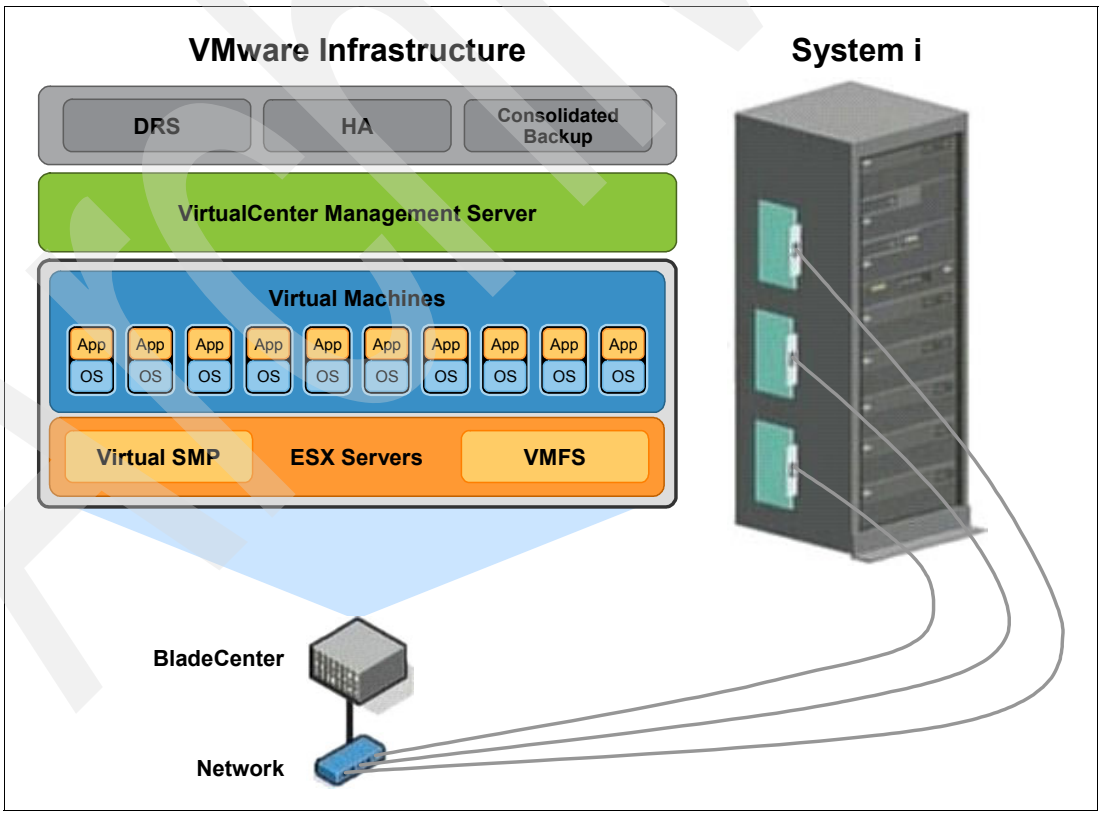

Figure 1-1 VMware Infrastructure 3 on System i integration with BladeCenter and System x

Not shown are the network connections from each x86 server's service processor hardware and from the System i to the external (non-private) network. These out-of-band connections control the power on the x86 hardware.

1.4 Why implement VMware Infrastructure 3 on System i integrated servers

In addition to the benefits already mentioned in 1.1.2, "System i integration benefits" on page 2, and 1.2.1, "VMware Infrastructure 3 benefits" on page 3, there are some other considerations for implementing VMware Infrastructure 3 on System i integrated servers. First, consider that VMware customers have reported a short-term return on investment (ROI), and couple this with a ROI on System i integration of about six months (three years ROI of 258%)[1].

Another consideration is that many customers that implement VMware Infrastructure 3 require a storage area network to deliver the storage that they need. With this System i implementation, you, in fact, have a SAN, without the a lot of the costs of a SAN. You essentially let the SAN manage itself, by managing your System i.

All this adds up to a strong case for considering VMware Infrastructure 3 on System i integration with BladeCenter and System x.

[1] see IDC white paper at http://www.ibm.com/servers/eserver/iseries/idcroi

2

Planning and sizing

This chapter describes the planning and sizing for a VMware Infrastructure 3 on System i integration with BladeCenter and System x.

2.1 Hardware and software prerequisites

In this chapter we list the hardware and software prerequisites for a VMware Infrastructure 3 installation on System i integration with BladeCenter and System x.

2.1.1 Hardware prerequisites

You can use any supported System i (POWER5™, POWER5+™, or POWER6™ based) with iSCSI-attached integrated servers for a VMware Infrastructure 3 installation.

On the System i side we need an iSCSI host bus adapter (iSCSI HBA). The iSCSI HBAs are available with a copper/RJ45 port (System i feature 5783) or with a fiber port (System i feature 5784).

The complete list of supported iSCSI HBAs and System i models is available at:

http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/#support

Supported System x are rack-mounted systems like x3550, x3650, x3850, and x3950 with PCI-X iSCSI HBAs P/N 30R5201 (1 copper port) or P/N 30R5501 (1 fiber port).

We recommend installing a Remote Supervisor Adapter II (RSA II) in System x coming only with a Baseboard Management Controller (BMC).

The recommended BladeCenter Chassis is the BladeCenter E (8677). BladeCenter H (8852) is also supported, but the high-speed networking option cannot be used for iSCSI integrated servers because the expansion card slot is already occupied by the iSCSI HBA.

Currently, all available BladeCenter x86 blade servers are supported (HS21, LS21, LS41). For the iSCSI connection in these systems we need the Qlogic iSCSI expansion card for IBM BladeCenter (StFF Adapter P/N 32R1923).

For the complete list of supported System x and BladeCenter systems go to:

http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/servermodels/

Note: We recommend a dedicated network for the iSCSI connection because the data traffic is not encrypted. For smaller environments using a single BladeCenter chassis you can use the internal switch modules connecting them directly to the System i iSCSI HBAs. In environments using System x or more than one BladeCenter chassis we recommend using dedicated network switches or VLANs.

More information about network switch requirements and configuration considerations is available at:

http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/switches.html

2.1.2 Software prerequisites

The software requirements for VMware Infrastructure 3 on System i integration with BladeCenter and System x are basically the same as Linux iSCSI integrated servers. To enable shared storage support on System i you need to be at i5/OS level V6R1 or later. For VMware ESX support you also need to install the licensed program product IBM Extended Integrated Server Support for i5/OS (5761-LSV).

You can find the complete list in the Information Center document *System i integration with BladeCenter and System x iSCSI-attached System x and blade systems*.

You also need to install the required i5/OS PTFs documented at:

http://www.ibm.com/systems/i/advantages/integratedserver/ptfs.html

Note: If you want to use System i Navigator to configure shared storage you have to use V6R1M0 or later.

On BladeCenter or System x we need to use VMware ESX 3.0.1 or later. The corresponding VMware VirtualCenter version is 2.0.1 or later.

Software requirements for VMware VirtualCenter are Windows 2000 Server or Windows Server® 2003 with a Microsoft® SQL Server® or Oracle® database. A list of the supported database software versions is available in the VMware *Installation and Upgrade Guide*, available at:

http://www.vmware.com/support/pubs/vi_pubs.html

2.2 What your HW configuration will be

This section shows the main differences between BladeCenter and System x related to VMware Infrastructure 3 on System i integration with BladeCenter and System x.

2.2.1 BladeCenter to System x comparison

In a BladeCenter up to 14 blade servers share a common chassis that provides power, cooling, and network and storage connectivity. BladeCenter E needs only seven rack units (7U) for these 14 servers. BladeCenter H needs 9U because of the additional high-speed network switch bays.

Note: With iSCSI integrated blade servers you cannot take advantage of high-speed networking options available with BladeCenter H because the expansion card slot is already occupied by the iSCSI HBA.

Table 2-1 shows a quick comparison of the main feature differences between BladeCenter and System x in a VMware Infrastructure 3 implementation on System i integration with BladeCenter and System x.

Table 2-1 Main feature differences between BladeCenter and System x

Feature	BladeCenter	System x
Power cabling	Simple. Only four power connectors (two on BladeCenter H) for up to 14 blade servers.	More complex. Each System x needs one or two power cables.
Power efficiency	Better than System x. Only four power supplies and two fans for up to 14 blade servers.	Not as efficient as blade servers, dedicated power supplies, and fans in each System x.

Feature	BladeCenter	System x
Cooling requirements	Lower than comparable System x environments.	Higher than comparable BladeCenter environments.
Network cabling	Simple. Only uplink connections for integrated network switches.	More complex. Each network card must be connected individually.
Ethernet connections	Restricted. Only two Ethernet connections available per blade server.	Expandable. Additional network cards can be installed.
Additional option cards	Not possible. The option card socket is used by iSCSI HBA card.	Possible. Additional option cards can be installed.
Service processor object on i5/OS	Only one SRVPRC object per BladeCenter for up to 14 blade servers.	One SRVPRC object for each System x.

2.2.2 Networking scenarios

In blade servers we only have two Ethernet ports available. For our standard configuration we implement a simple networking concept using the first Ethernet port for the VMware Console OS and for the vmkernel network. The second Ethernet port provides network connectivity for the virtual machines running on the blade servers. Figure 2-1 shows that simple networking scenario.

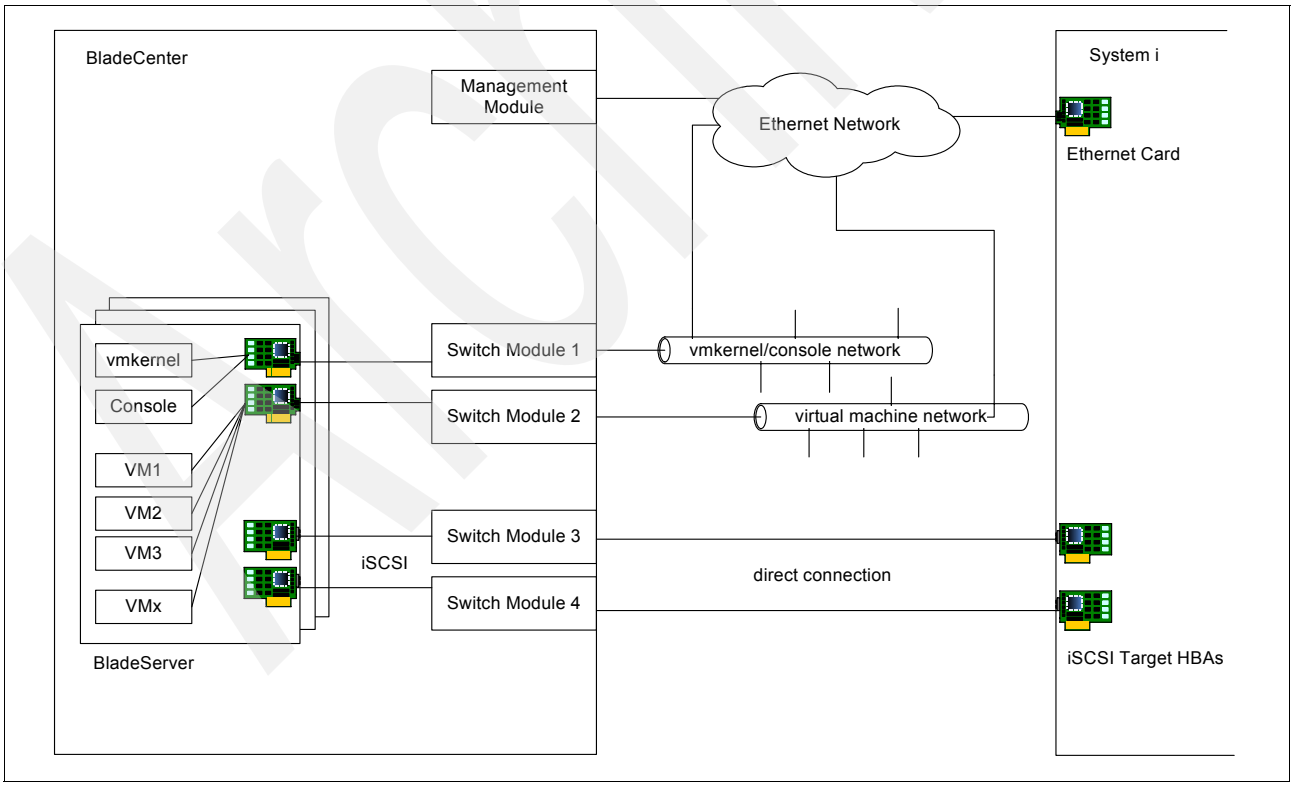

Figure 2-1 Simple networking concept for blade servers

If network port redundancy is required you need to team both Ethernet ports together and set up different VLANs for console/vmkernel networking and for the virtual machine network. This scenario is shown in Figure 2-2.

Additional VLANs can be defined when more than one dedicated network is required for the virtual machines.

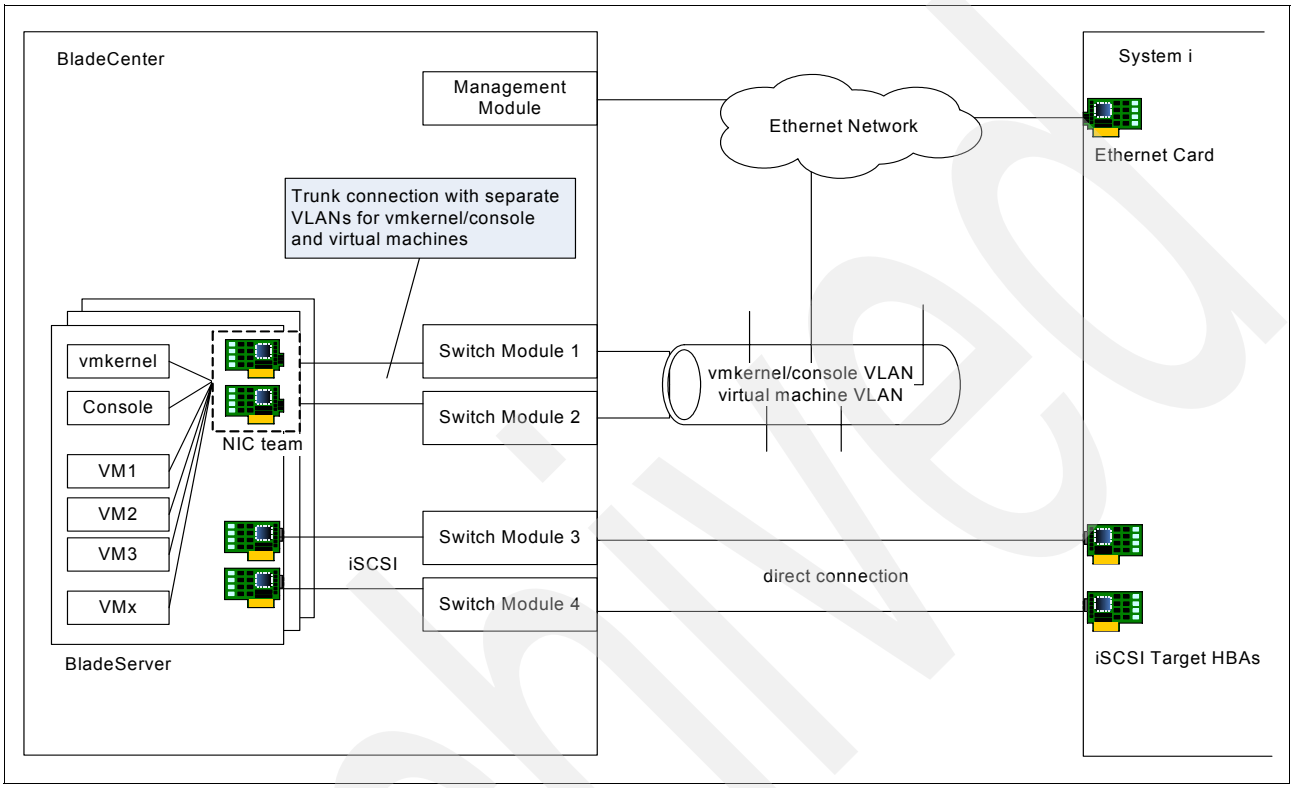

Figure 2-2 Teaming network adapters with VLAN for blade servers

Some networking environments require dedicated network interface cards for different virtual machines. To satisfy this requirement you need to use System x servers, which provide additional expansion slots for network cards. Figure 2-3 shows an example network scenario for such an environment.

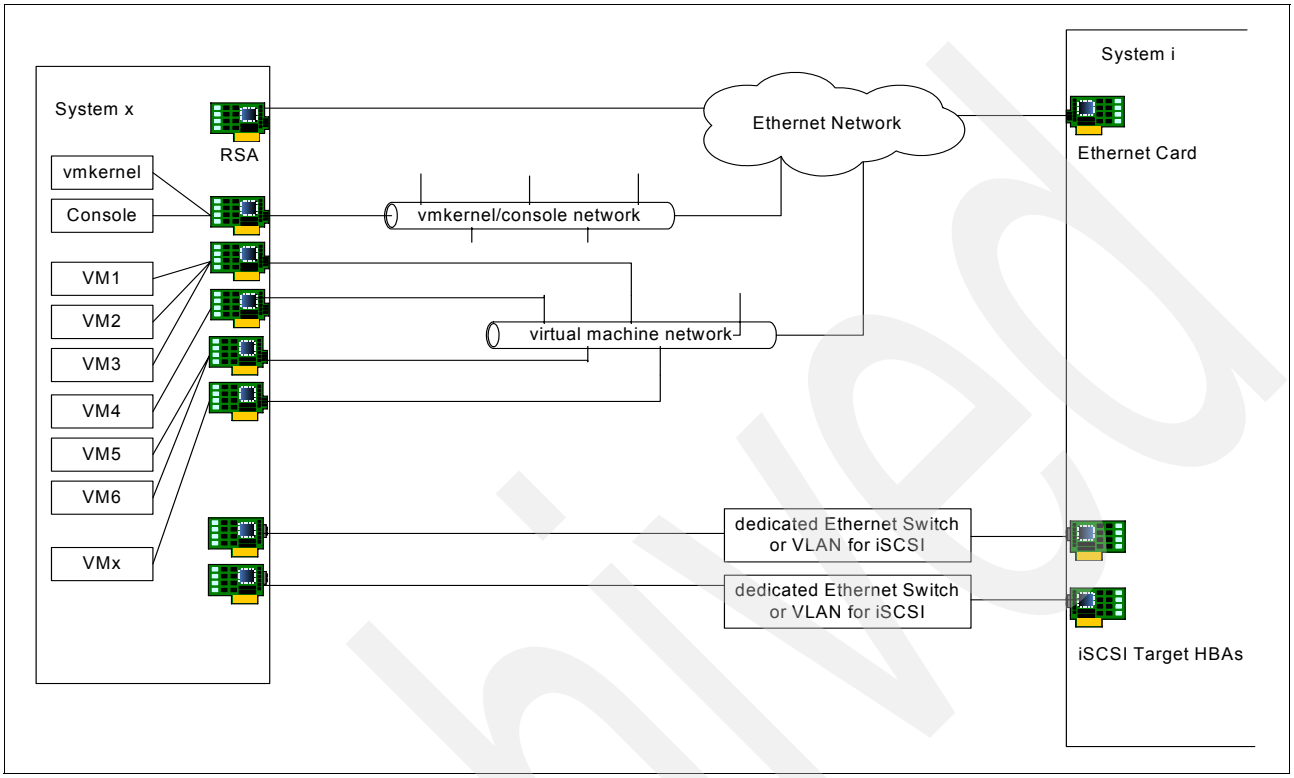

Figure 2-3 Network scenario with dedicated NICs in System x

2.2.3 Virtualization guidelines

Candidates for virtualization are smaller Windows or Linux servers like systems already running on older, less powerful hardware. With current hardware and VMware Infrastructure 3 you can consolidate many of these servers onto one blade server or System x, optimizing the hardware utilization.

For systems with high performance requirements like big database servers, we recommend using dedicated servers without the virtualization overhead.

The typical size of a virtual server is 1–2 CPUs and 1–2 GB RAM. Servers requiring more than two CPUs and more than 4 GB RAM perform best on dedicated hardware because they can take advantage of all system resources.

2.3 Sizing

This chapter shows the main sizing rules for a VMware VI3 in an iSCSI integrated server environment.

2.3.1 BladeCenter and System x sizing

The number of virtual machines that you can deploy on a VMware ESX Server depends mainly on memory and CPU requirements.

A rule of thumb is that you can run 3–5 VMs per CPU core (2–4 for the first CPU core because VMware ESX also needs some CPU resources), which results in a number from 11–19 VMs on a system with two dual-core CPUs. This rule is based on VMs running Windows 2000 Server with low to medium CPU utilization. For Windows 2003 Server these numbers are lower because of the higher resource requirements.

The main limiting factor is the memory requirement for the virtual machines. Here you can just add the memory amount needed for each VM. Currently, in most cases a blade server with four memory sockets will be configured with 8 GB RAM because the 4 GB memory modules are still too expensive. A blade server with eight memory sockets (HS21 XM, LS21) will have 16 GB RAM.

If you define typical Windows Server 2003 virtual machines with 2 GB RAM each, you can run up to three VMs on a blade server with 8 GB RAM and up to seven VMs on a eight socket server with 16 GB RAM. (You need to reserve 512 MB–1 GB RAM for VMware ESX). Therefore, you will not reach the VM per CPU core limit in such an environment.

You can optimize memory usage when you define the virtual machines with 1.8–1.9 GB RAM. Then you can put four VMs with 1.8 GB RAM each on a 8 GB blade server (4*1.8+0.5 = 7.7 GB) or eight VMs with 1.9 GB RAM each on a 16 GB blade server (8*1.9+0.5 = 15.7 GB)

When you define Windows 2000 Server or Linux virtual machines that need only about 1 GB RAM per VM you can double the number of VMs per integrated server.

Summary: The number of VMs per server = (installed RAM - 0.5 GB) / (RAM per VM).

Or, if the VMs on a server have different memory requirements, installed RAM >= sum of VM memory + 0.5 GB for VMware ESX.

If you plan to implement VMware High Availability you need to size your ESX Servers with enough spare capacity for the virtual machine takeover in case of a server failure. For example, with three ESX Servers each running four VMs, you need to size each server for six VMs (see also 4.3, “VMware High Availability (HA)” on page 97).

2.3.2 System i storage sizing

The amount of storage needed for a VMware Infrastructure 3 on the System i integration with BladeCenter and System x environment varies with the number of integrated servers used and the number of virtual machines implemented.

We recommend keeping the default storage sizes for VMware ESX integrated servers. The storage space for the system drive for each ESX Server is created with a size of 15 GB. The size of the storage space for the installation drive is 1 GB.

The storage space needed for each VMware ESX integrated server is 15 GB + 1 GB.

The storage space needed for the virtual machines depends on the disk requirements of the server running inside the virtual machine. We recommend a 20 GB virtual disk for the system drive of a Windows Server 2003 virtual machine and a separate virtual disk for the data drive.

To simplify backup and restore on System i we recommend a single storage space for each virtual machine containing all virtual disks of that VM. This storage space must be sized with an additional 5–10% of space for VMware configuration, log files, and other temporary files. If snapshots are used, the additional free space should be 20–30%. (VMware Consolidated Backup also uses snapshots during backups.)

- Storage space size for a VM *without* snapshot usage: size of system drive + size of data drives + 5–10% free space
- Storage space size for a VM *with* snapshot usage: size of system drive + size of data drives + 20–30% free space

Note: You also need to size of the data drives to satisfy future growth because the storage spaces cannot be increased without shutting down the servers.

We also recommend defining one storage space of 200 GB–500 GB as a main storage location for virtual machine templates, operating system installation sources, and temporary VM storage space.

3

Installation

This chapter covers the tasks required to install and configure a VMware Infrastructure 3 environment using System i integrated servers. The environment described here is a multiple-server environment, set up as a basic configuration to use the VMware advanced features such as VMware VMotion, VMware High Availability (HA), and VMware Distributed Resource Scheduler (DRS). More complex configurations can be built by referring to the documentation provided by VMware.

3.1 Installing VMware VirtualCenter

VMware VirtualCenter must be installed as a part of a multiple ESX Server environment to enable the VMware advanced features of VMotion, HA, and DRS. VirtualCenter provides a single point of control for all of the servers.

3.1.1 Configuring the VirtualCenter database

VMware VirtualCenter Server requires a database to maintain data about servers that it manages. Currently, VirtualCenter supports Oracle or Microsoft SQL Server for production environments. Refer to the *VMware Installation and Upgrade Guide*, found at the following Web site, for supported database versions:

`http://www.vmware.com/support/pubs/vi_pubs.html`

Note: VMware does not support the Microsoft MSDE database for production, but it can be used for demonstration or testing purposes. VirtualCenter contains a bundled version of MSDE, and it can be installed during the VirtualCenter installation process.

The production database needs to be installed and configured to work with VirtualCenter. Refer to the *VMware Installation and Upgrade Guide* for instructions on how to configure the different databases.

Note: The VirtualCenter database can be installed on the same server as VirtualCenter, but you will need to take into account any additional hardware requirements. The *VMware Installation and Upgrade Guide* can help with this.

3.1.2 Setting up the license server

The VMware Infrastructure 3 environment supporting the VMware advanced features (VMotion, HA, DRS) requires the use of a license server to administer the VMware licenses. We strongly recommend that the license server is installed with and resides on the same physical server as VirtualCenter.

Note: A separate license server can be used, if desired. The license server installation code resides on the same CD as the VirtualCenter install. The hardware and software requirements for the license server and the installation procedure can be found in the *VMware Installation and Upgrade Guide*.

The installation of a separate license server must be done prior to starting the VirtualCenter installation. You will need this server's host name or static IP address for use during the VirtualCenter installation.

You will need a license file for the license server to serve. Refer to the VMware *Installation and Upgrade Guide* for information about obtaining a license file. This license file must be accessible to the Windows server on which the license server will reside.

3.1.3 VirtualCenter software installation

The VMware VirtualCenter Server software is packaged on a CD. The CD image can be downloaded from the VMware products Web page or can be obtained on CD directly from VMware.

You will need a Windows server, in addition to any you plan to install the ESX Server on, for VirtualCenter and the license server to reside on. Refer to the *VMware Installation and Upgrade Guide* for detailed hardware and software requirements for this server.

Note: We recommend that the Windows server that VirtualCenter resides on also be a System i integrated server to preserve the benefits of an integrated server throughout the VMware Infrastructure 3 implementation. We further recommend that this integrated server is iSCSI-attached, for future flexibility. Otherwise, an Integrated xSeries Server (IXS) or an xSeries or System x attached using an Integrated xSeries Adapter (IXA) can be used.

Before installing VirtualCenter Server, you must first assign a static IP address and a corresponding host name to the Windows server that you will be using. The Windows server name should exactly match the host name and should properly resolve from all of the ESX Server hosts to be managed.

You should have your database properly configured for VirtualCenter Server use, along with your license file (or the host name or IP address of an existing license server) before beginning to install the VirtualCenter Server. Refer to the *VMware Installation and Upgrade Guide*, found at:

`http://www.vmware.com/support/pubs/vi_pubs.html`

Use the installation steps there along with the following steps:

1. Sign on to the Windows host server with administrator authority and insert the VirtualCenter Server installation CD. Wait for the VirtualCenter Installer window (as shown in Figure 3-1) to appear. If the window does not appear, navigate to the CD contents and double-click the autorun.exe icon.

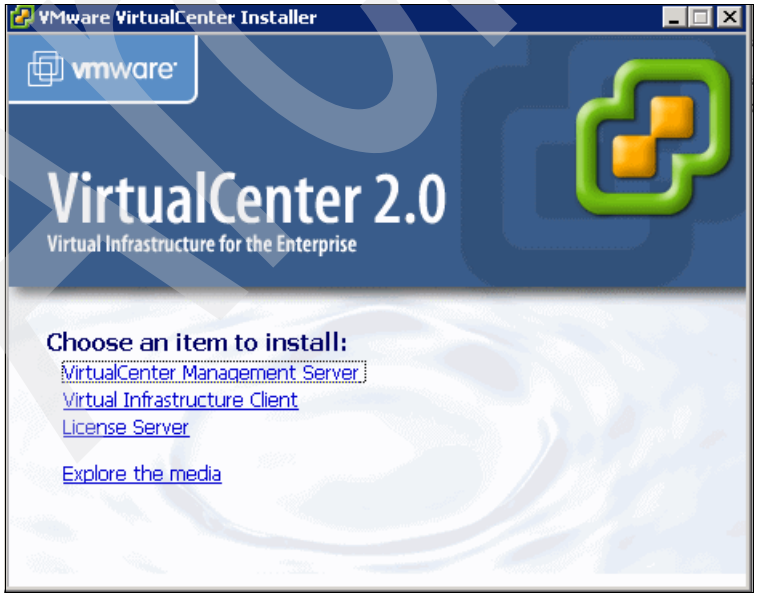

Figure 3-1 VMware VirtualCenter Installer window

2. Click **VirtualCenter Management Server** to start the install.
3. You might be prompted to install Microsoft .NET Framework on your server. Click **Yes** to proceed with the installation, if prompted.
4. On the Welcome window shown in Figure 3-2, verify that a VirtualCenter Server install is occurring and click **Next**.

Figure 3-2 VMware VirtualCenter Installer Welcome window

5. Figure 3-3 shows the License Agreement window. Read the end user license agreement, select **I accept the terms of the license agreement**, and click **Next**.

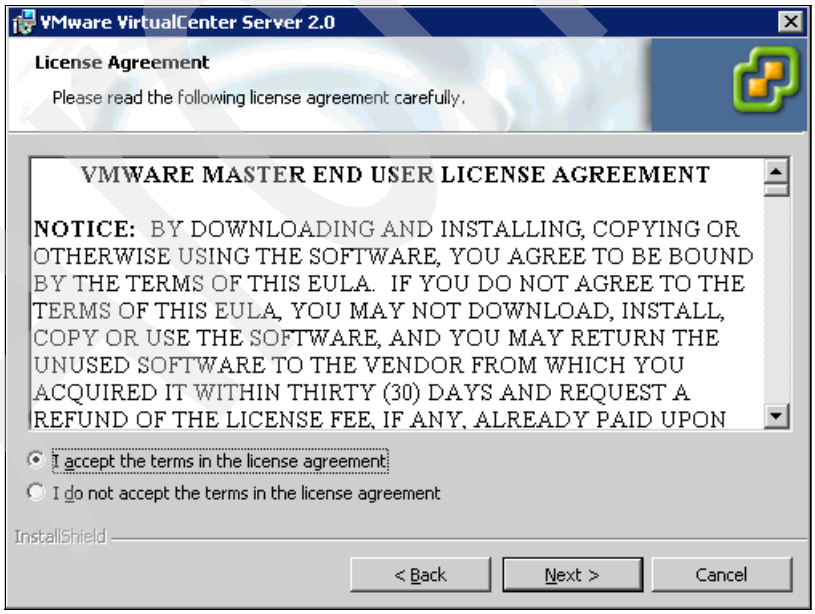

Figure 3-3 VMware VirtualCenter Installer License Agreement window

6. Type the user name and company name and click **Next**, as shown in Figure 3-4.

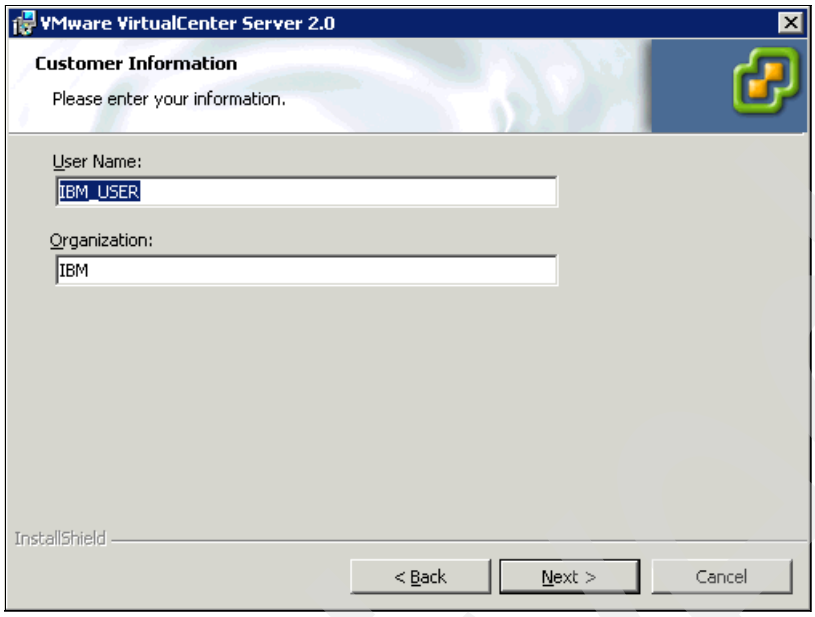

Figure 3-4 VMware VirtualCenter Installer Customer Information window

7. The Destination Folder window is shown in Figure 3-5. The default destination folder can be accepted or you can navigate to the desired install folder by clicking **Change**. When the desired folder has been selected, click **Next**.

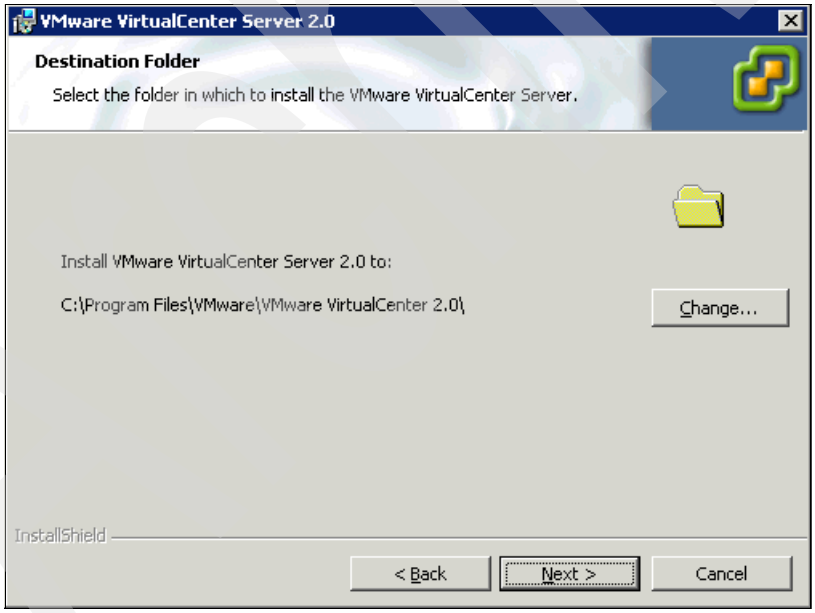

Figure 3-5 VMware VirtualCenter Installer Destination Folder window

8. In Figure 3-6, you indicate what type of install you want to do. In most cases, a Typical install will be the appropriate choice. If you need control over all the details of the install, the Custom option can be selected. After you have selected the setup type, click **Next**.

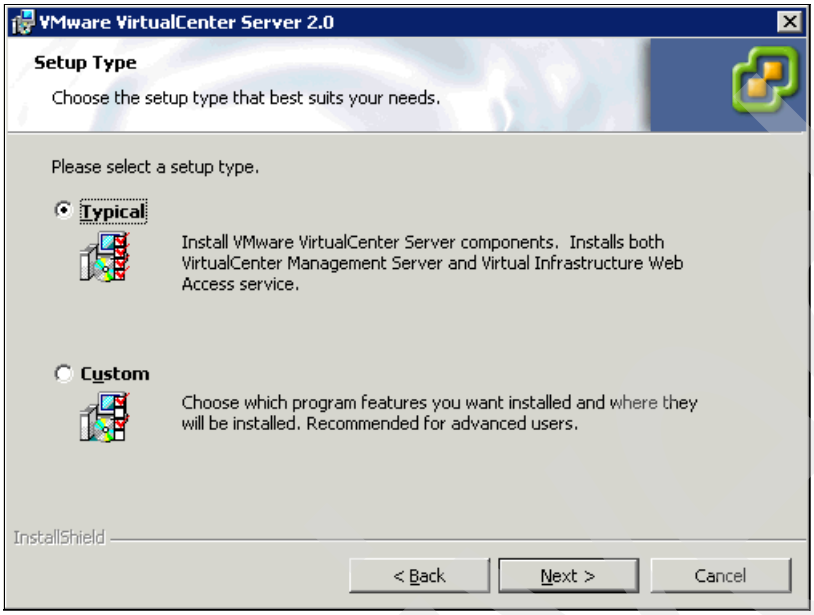

Figure 3-6 VMware VirtualCenter Installer Setup Type window

9. As shown in Figure 3-7, you must select **Use an existing database server** for your production environment. This database should be the one that you configured in 3.1.1, “Configuring the VirtualCenter database” on page 16.

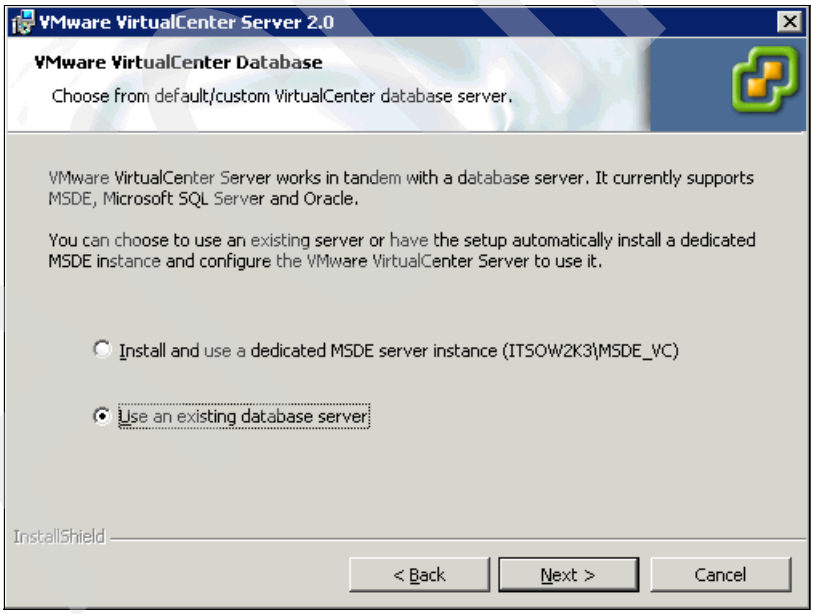

Figure 3-7 VirtualCenter Installer Database window

Note: You should only use the MSDE option if you are installing for test or demonstration purposes.

The database setup steps that follow assume that an existing database will be used. Click **Next** when a selection has been made.

10. Type the appropriate information into the window shown in Figure 3-8:

    a. Type the data source name for the database.

    b. Type the user name and password for the data source name. With some database and Windows OS version combinations, the user name and password might not be required. Click **Next**.

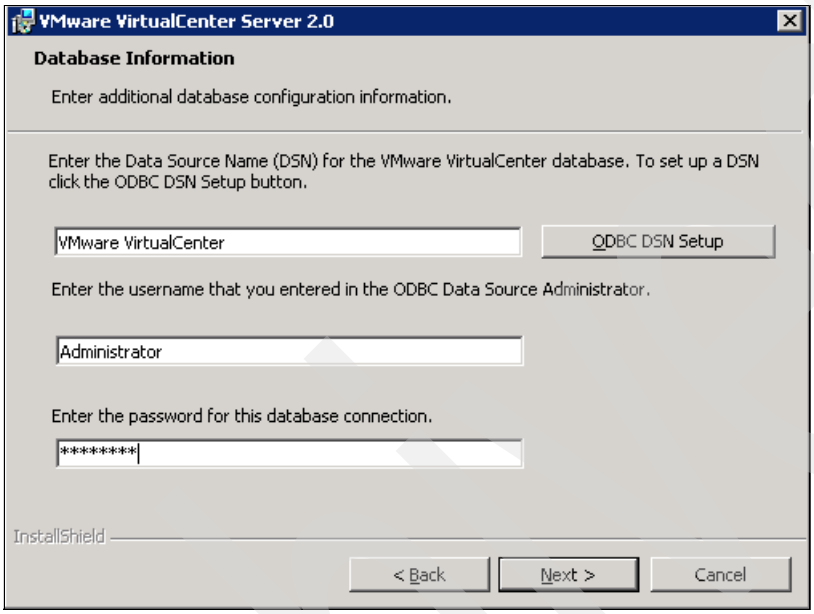

Figure 3-8 VirtualCenter Installer Database Information window

11. Figure 3-9 presents you with a choice as to how you want to set up your license server. The steps following assume that the license server will be installed on the same server as VirtualCenter, which is the recommended location.

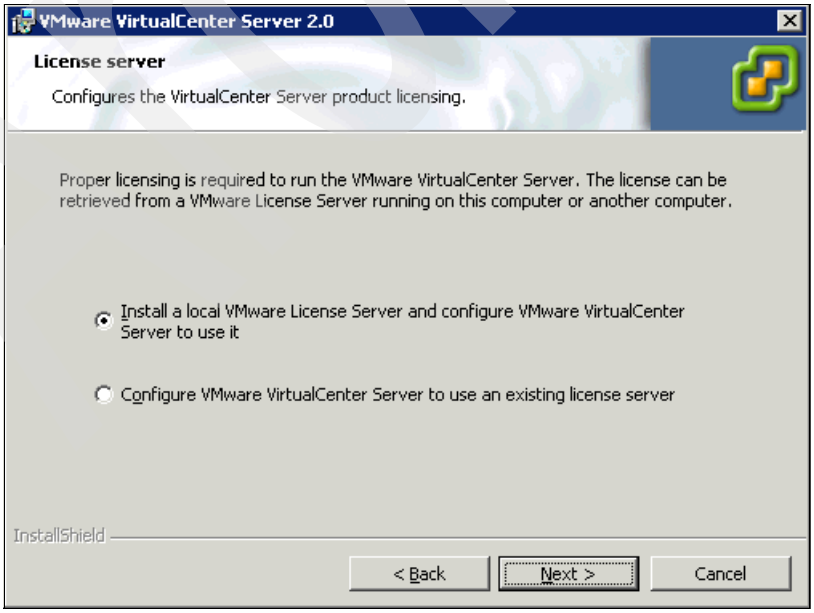

Figure 3-9 VirtualCenter Installer License Server Location window

Note: For information about how to configure VirtualCenter for a license server on a separate server, refer to the *VMware Installation and Upgrade Guide*. The license server must have been installed prior to starting the VirtualCenter installation.

To continue with the license server installed with VirtualCenter, select **Install a local license server and configure VMware VirtualCenter Server to use it** and click **Next**.

12. On the window shown in Figure 3-10, type the path for the license file that was described earlier in 3.1.2, “Setting up the license server” on page 16. You can also use the **Browse** button to navigate to this file. Click **Next** to select this license file.

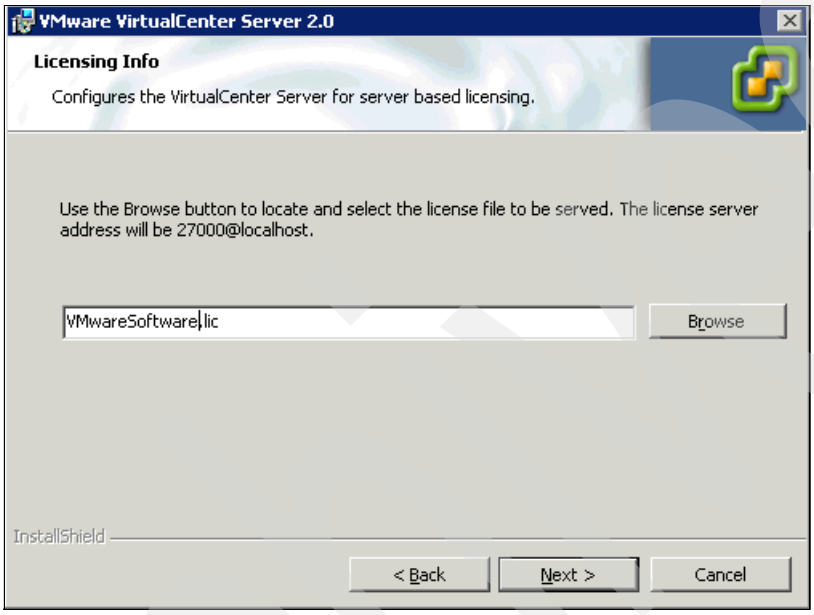

Figure 3-10 VirtualCenter Installer License Information window

Note: If you should need to add additional licenses at a later time, you will need to add the new license file to the directory structure on the license sever machine. The default directory on the license server is C:\Program Files\VMware\VMware License Server\Licenses. You can add the new license file to this directory and restart the license server using the license server tools on the Windows license server host. This will pick up the additional licenses.

13. The next window, shown in Figure 3-11, is used to set up the VMware Software Development Kit (SDK). We recommend that the default settings are accepted unless you have a specific reason to change them. So, in this case, just click **Next** to continue.

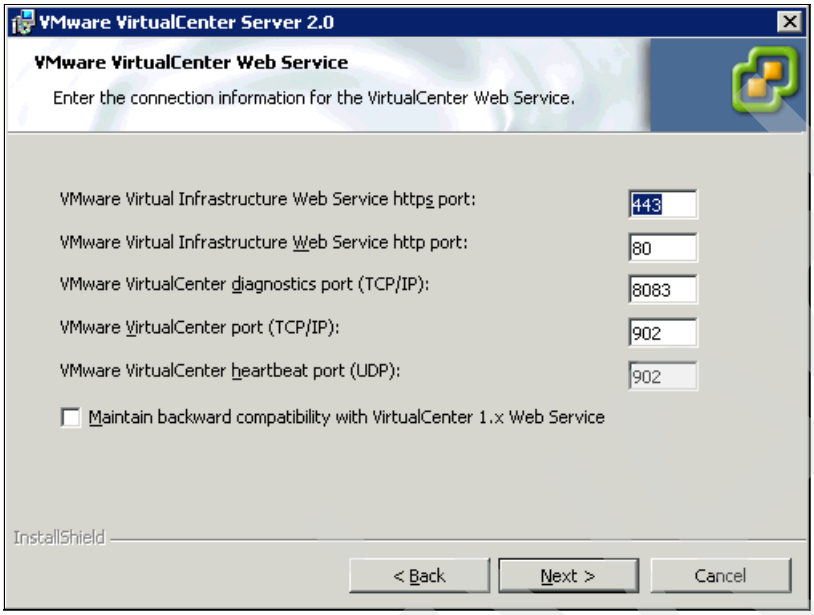

Figure 3-11 VirtualCenter Installer SDK Web Service window

14. The next window configures the VirtualCenter Web server, which provides a subset of the VirtualCenter functionality through a Web browser interface. As shown in Figure 3-12, this is provided by the Apache Tomcat service. You must specify the TCP/IP port on which Apache Tomcat will communicate. In most cases, the default will work. There are also check boxes for whether you want to start the service each time that Windows starts on this server and to start the service on completion of the install. We recommend that you click both check boxes, as shown in Figure 3-12, to start the Web server now and on each startup, so it is available for use. Click **Next** when the desired selections have been made.

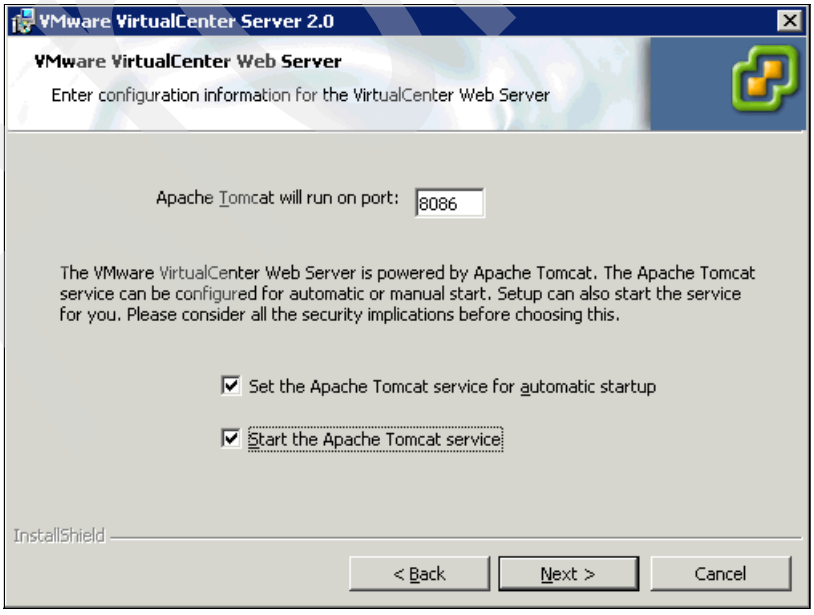

Figure 3-12 VirtualCenter Installer Web Server window

15. The window shown in Figure 3-13 is your last chance to redo any of the selections made in the previous windows. Click **Back** on this and any other windows to back through the install process. When you are ready to proceed with the install, click **Install**.

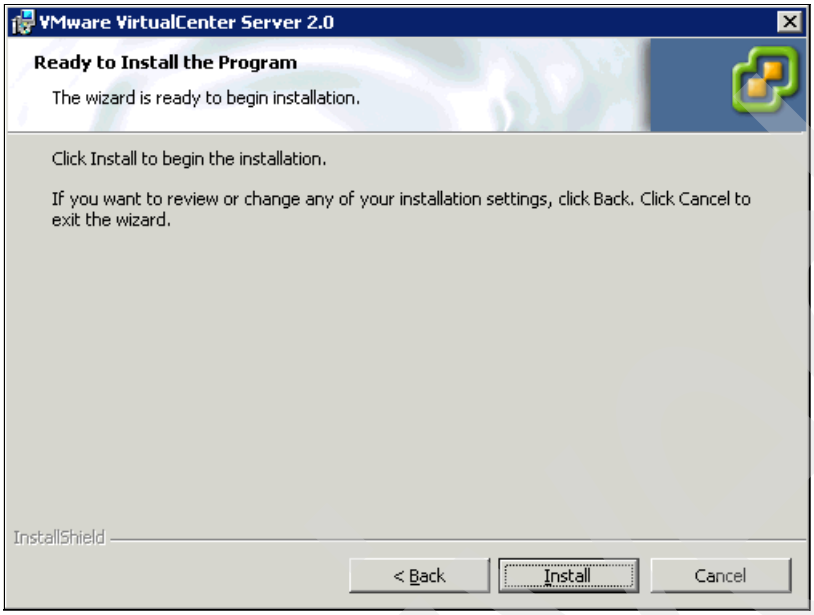

Figure 3-13 VirtualCenter Installer Ready to Install window

16. A progress window similar to the one shown in Figure 3-14 will appear, and continue to update until the install completes.

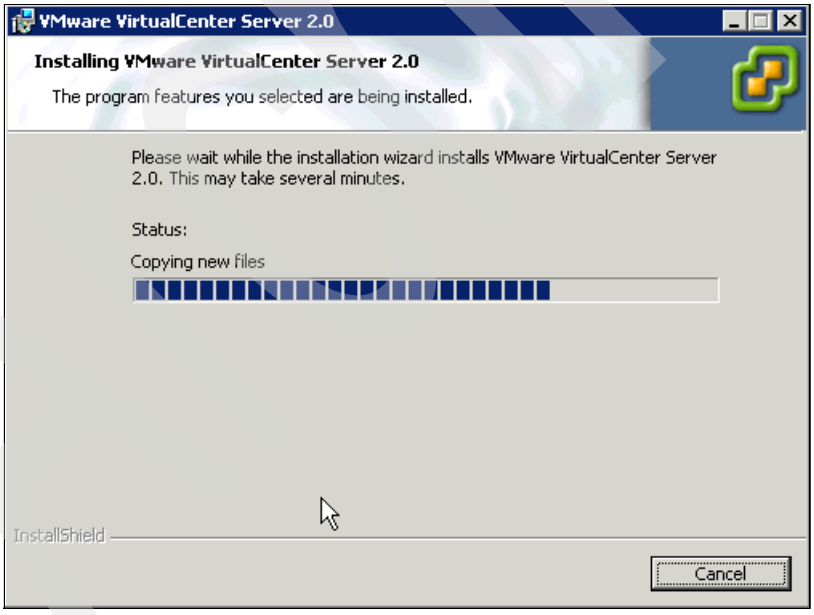

Figure 3-14 VirtualCenter Installer Progress window

17. When the install completes, the window shown in Figure 3-15 is displayed. Click **Finish** to end the installer.

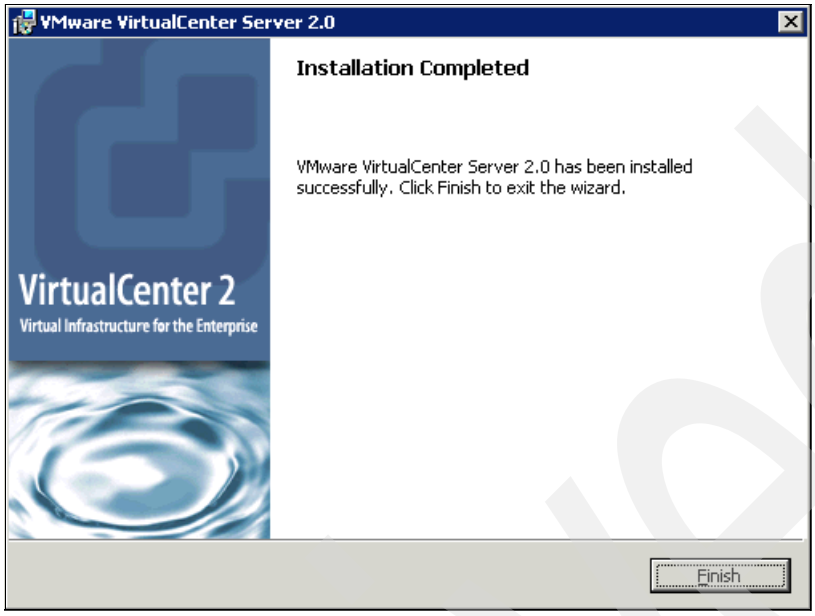

Figure 3-15 VirtualCenter Installer Completion window

3.2 VMware Infrastructure Client installation

VMware Infrastructure Client (VI Client) is the primary interface to VirtualCenter Server and also to ESX Servers individually. The Web Access interface, which is installed with both VIrtualCenter and ESX Server provides limited functionality. VI Client is required to perform the advanced features (VMotion, HA, and DRS).

VI Client can be installed from either the VirtualCenter Server CD or by downloading from an installed VirtualCenter Server or ESX Server host. VI Client can be installed on virtually any Windows machine with connectivity to the VirtualCenter Server or ESX Server hosts that it will connect to.

3.2.1 VMware Infrastructure Client install from CD

To start the install using the VirtualCenter Server CD:

1. Sign on to the Windows host server with administrator authority and insert the VirtualCenter Server installation CD. Wait for the VirtualCenter Installer window (as shown in Figure 3-16) to appear. If the window does not appear, navigate to the CD contents and double-click the autorun.exe icon.

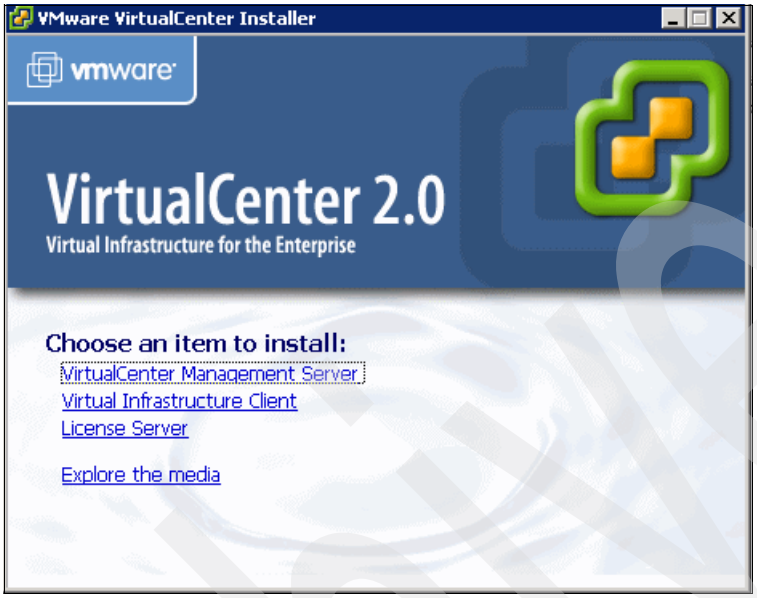

Figure 3-16 VirtualCenter Installer window

2. Click **Virtual Infrastructure Client** to begin the installation.

3.2.2 VMware Infrastructure Client install from download

To download and start the install from a VirtualCenter Server or ESX Server host:

1. Sign on to the Windows host server with administrator authority and point a Web browser to the host name or IP address of the installed VirtualCenter Server or ESX Server host.

2. A window similar to Figure 3-17 will appear. (This is actually the VirtualCenter version. The ESX Server version will look similar.) Click **Download the VMware Infrastructure Client**. The download will start. Save the file to a Windows hard drive as VMware-viclient.exe.

Figure 3-17 VirtualCenter Web Access initial window

3. When the download has completed, navigate to the VMware-viclient.exe file and double-click it to start the install.

3.2.3 Completing the VMware Infrastructure Client installation

The VMware Infrastructure Client installation proceeds the same from this point on for both install methods.

1. The VI Client installer at this point will prompt to install Microsoft .NET Framework 1.1 on the Windows machine if it is not already installed. If this prompt appears, click **Yes** to continue.
2. On the Welcome window (Figure 3-18), click **Next** to begin installing the VMware Infrastructure Client.

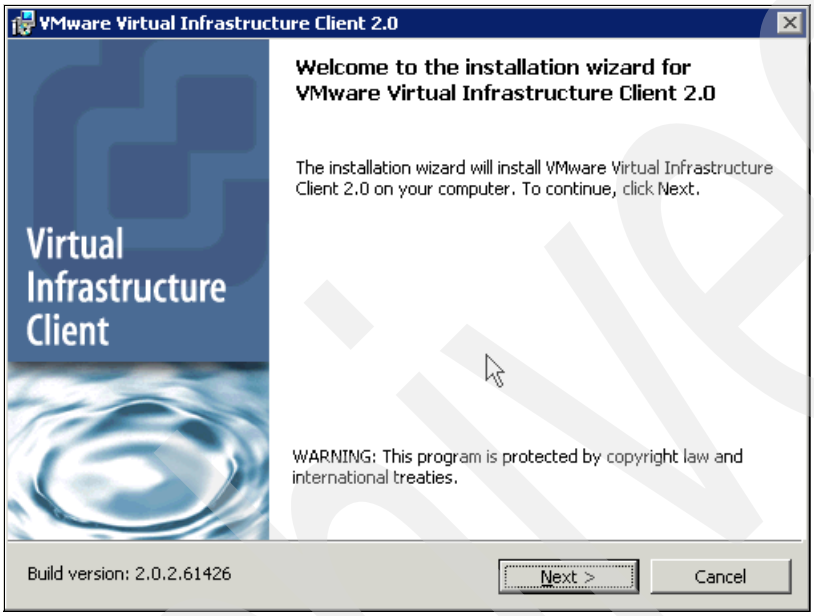

Figure 3-18 VI Client Installer Welcome window

3. Figure 3-19 displays the VMware end user license agreement. After you have read the agreement, select **I accept the terms in the license agreement** and click **Next**.

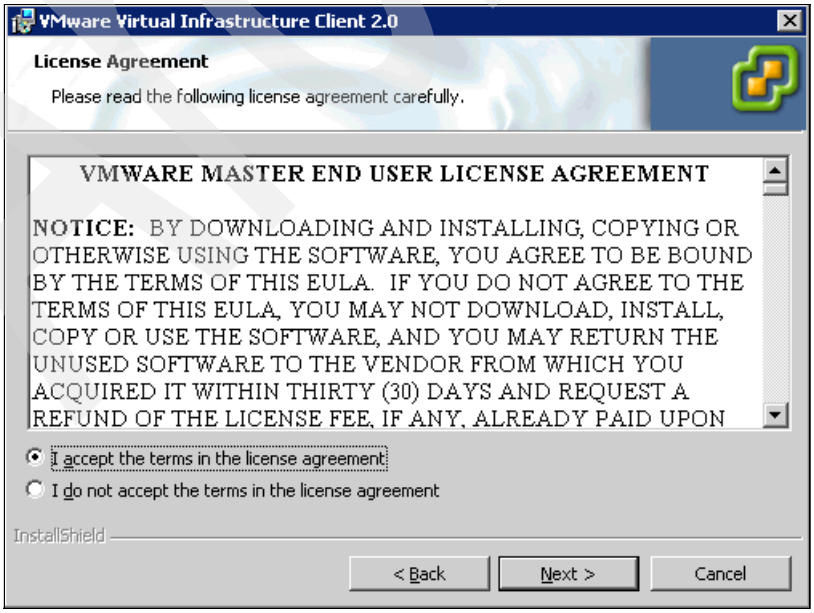

Figure 3-19 VI Client Installer License Agreement window

4. On the Customer Information window (shown in Figure 3-20) type your name and company name and click **Next**.

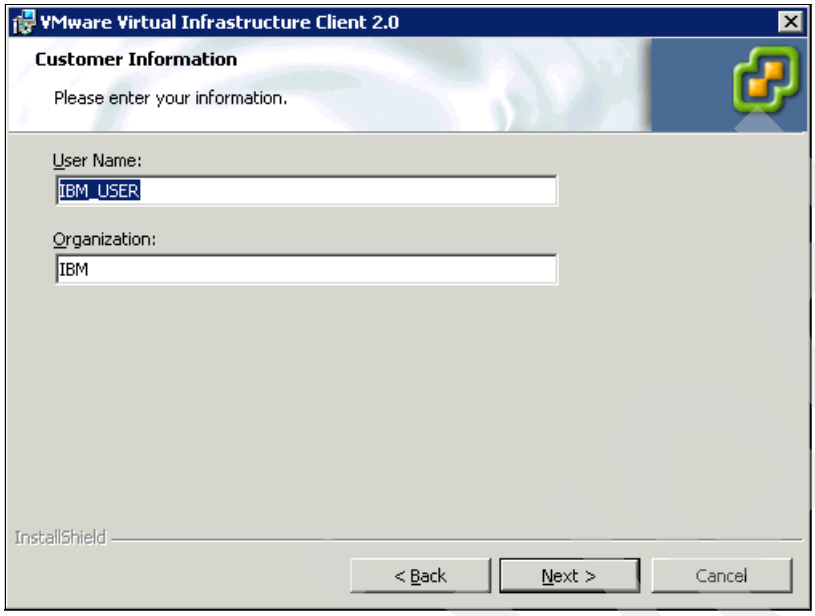

Figure 3-20 VI Client Installer Customer Information window

5. The Destination Folder window is shown in Figure 3-21. The default destination folder can be accepted or you can navigate to the desired install folder by clicking **Change**. When the desired folder has been selected, click **Next**.

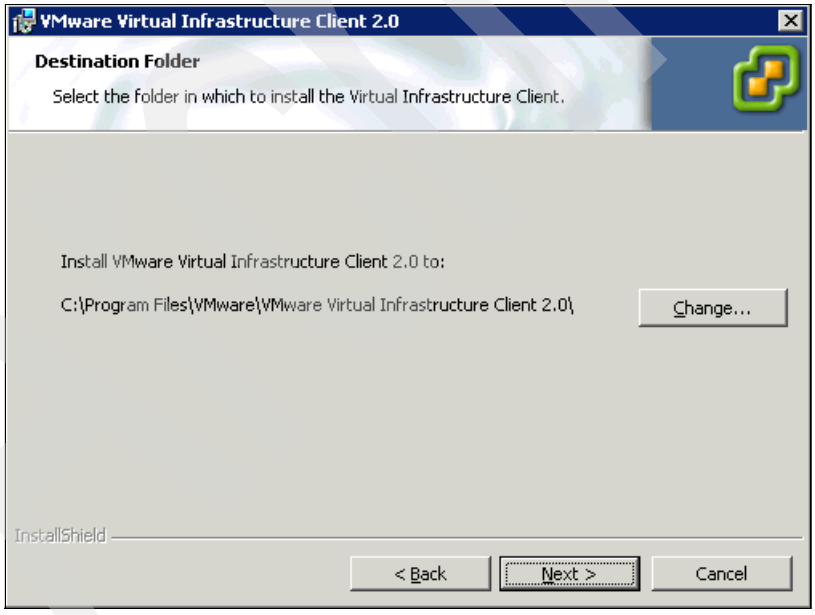

Figure 3-21 VI Client Installer Destination Folder window

6. The window shown in Figure 3-22 is your last chance to redo any of the selections made in the previous windows. Click **Back** on this and any other windows to back up through the install process. When you are ready to proceed with the install, click **Install**.

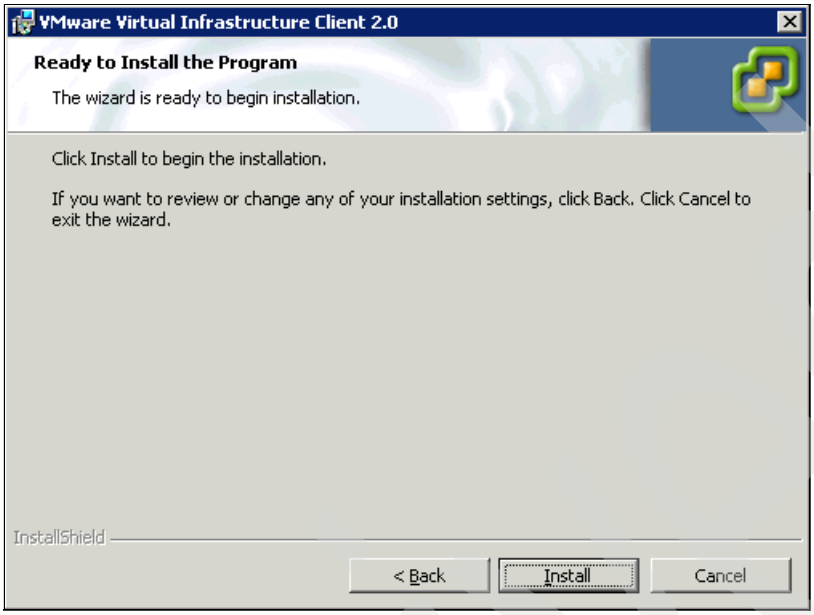

Figure 3-22 VI Client Installer Ready to Install window

7. A progress window similar to the one shown in Figure 3-23 appears, and continues to update until the install completes.

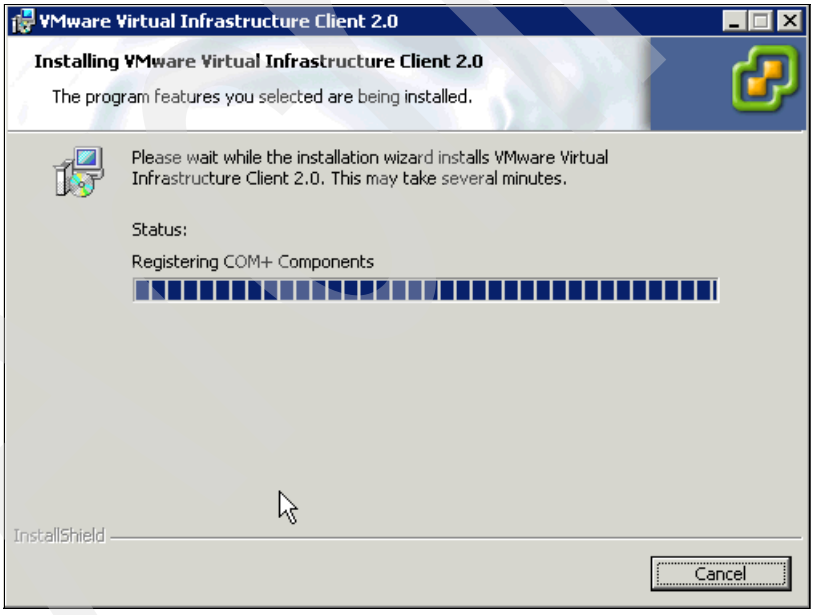

Figure 3-23 VI Client Installer Progress window

8. When the install completes, the window shown in Figure 3-24 is displayed. Click **Finish** to end the installer.

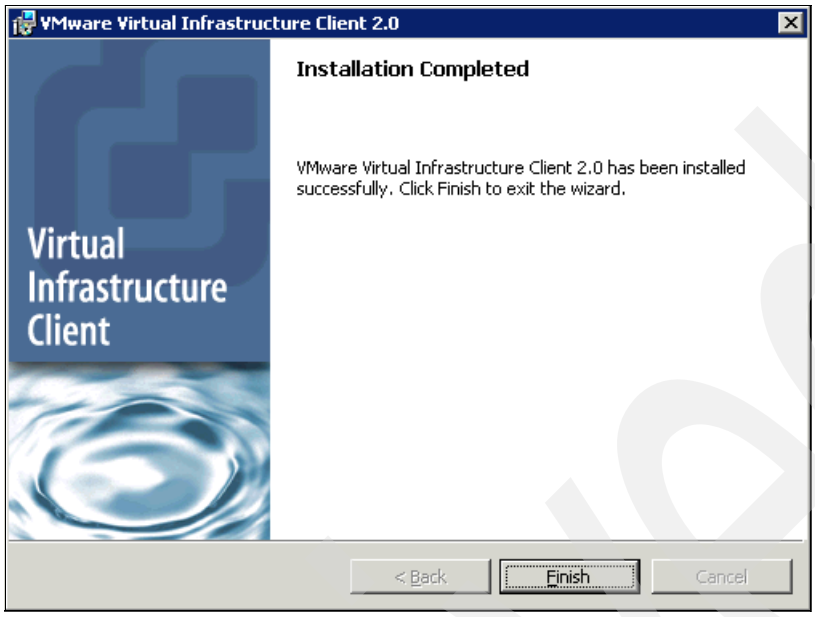

Figure 3-24 Virtual Infrastructure Client installation completion message

3.3 VMware ESX Server installation

The VMware ESX Server is installed on all blade servers and System x servers desired to be ESX Servers. This server hardware must meet the requirements specified in 2.1.1, “Hardware prerequisites” on page 8.

The hardware is assumed to be properly set up for attachment to System i through iSCSI prior to starting the installation steps that follow. Follow the steps on the iSCSI readme first Web page at:

`http://www.ibm.com/systems/i/advantages/integratedserver/ptfs.html/iscsi/readme`

This procedure picks up from *Start the installation from the i5/OS console* step under the *Operating system installation* section of the readme. It is assumed that all steps prior to this one have been completed. This includes the physical installation of all required hardware and software to support the basic iSCSI connection.

Note: The i5/OS objects that support the iSCSI connection must be created prior to starting the ESX Server installation. This includes creating the required Network Server Host Adapter descriptions (NWSH) for the iSCSI HBAs in the System i. It also includes creating the remote system configuration objects describing the x86 hardware, service processor configuration objects that describe the service processor connection in the x86 hardware and Connection Security configuration objects.

In addition, be sure to connect the network adapter that you plan to use for the ESX service console to the network before beginning the install, so the adapter can be correctly configured by the installation process.

Note: The windows and installation steps that follow are based on VMware ESX Server 3.0.2. This section describes the steps to set up a single server as a VMware ESX Server host. To set up a multiple-server environment, simply repeat the steps for each server that you plan to install.

3.3.1 Install media options

The install media for VMware ESX Server is dowloadable or available on CD from VMware. Prior to starting the install, the install media should be inserted into the optical drive of the BladeCenter or System x. On a BladeCenter, be sure to assign the media tray to the blade server to which you are installing.

You can use the remote control capability of the Advanced Management Module in a BladeCenter or the Remote Supervisor Adapter II in a System x along with the downloaded CD image to avoid the necessity of physically accessing the server's optical drive. You must have the CD image accessible to the computer that you connect to the Remote Supervisor Adapter II or Advanced Management Module (these are referred to as the service processor hardware). The steps to do this are:

1. Point your Web browser to the host name or IP address of the service processor hardware (Figure 3-25).

Note: This should be the same host name or address that you set in the service processor network server configuration i5/OS object that you should have configured previously. You can also obtain this information from the i*SCSI Network Planning Worksheets*, items XSP2 and XSP4, respectively.

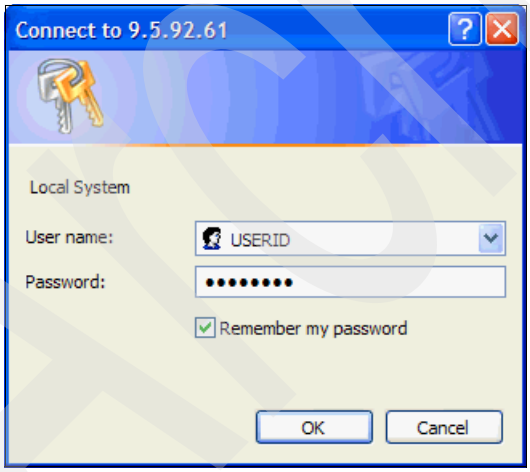

Figure 3-25 Sign on to management module Web browser

2. Type the user name and password for the service processor hardware (Figure 3-26).

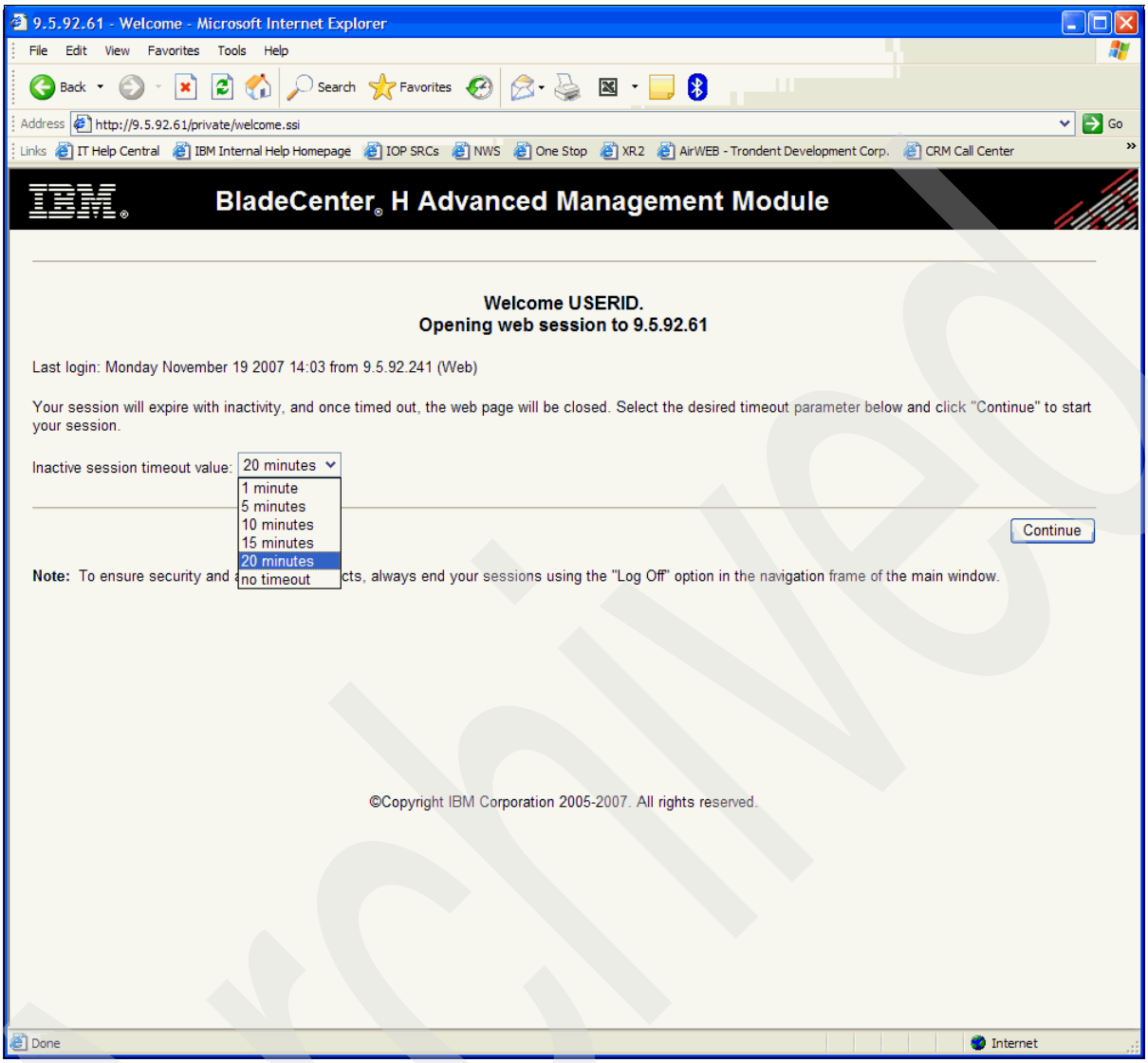

Figure 3-26 Web browser select time-out

3. Select a time-out value for this session on the pull-down (Figure 3-27).

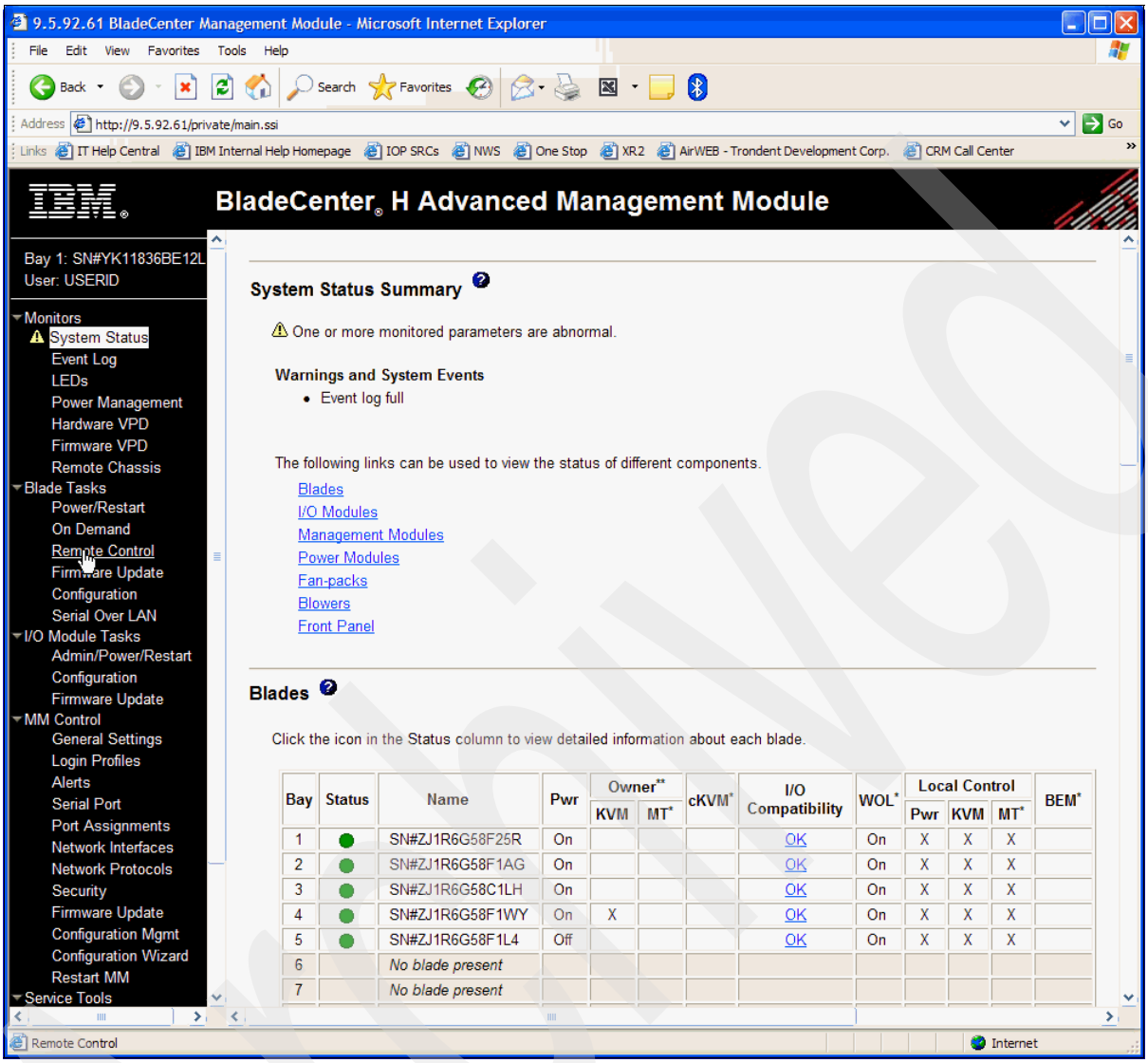

Figure 3-27 Web browser main menu

4. Click **Remote Control** under the Blade Tasks category for BladeCenter (or **Tasks** for System x) in the navigation pane on the far left of the window (Figure 3-28).

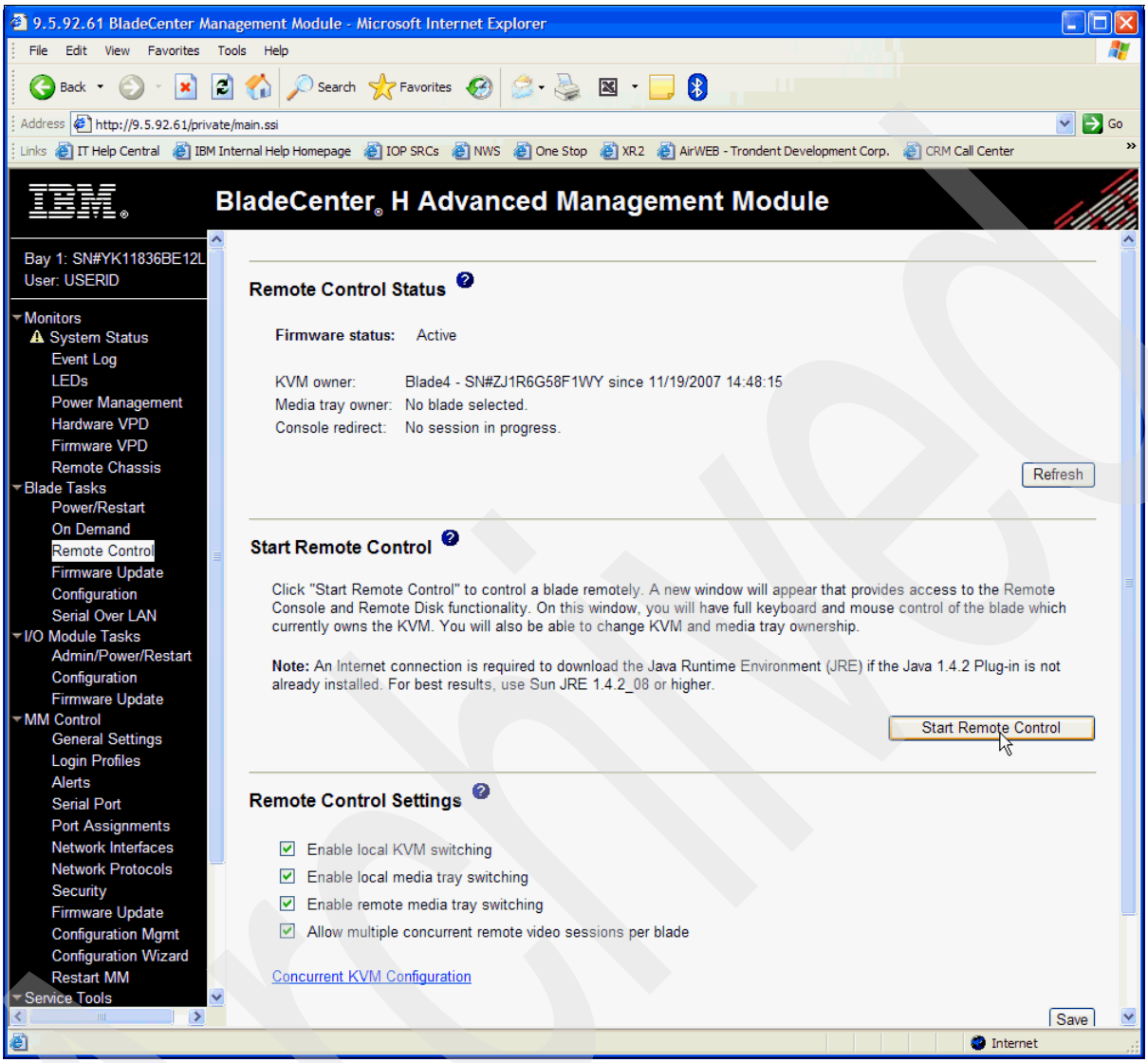

Figure 3-28 Web browser start remote control

5. Click **Start Remote Control** (or **Start Remote Control in single-user mode**).

6. A new Web browser window now opens (Figure 3-29).

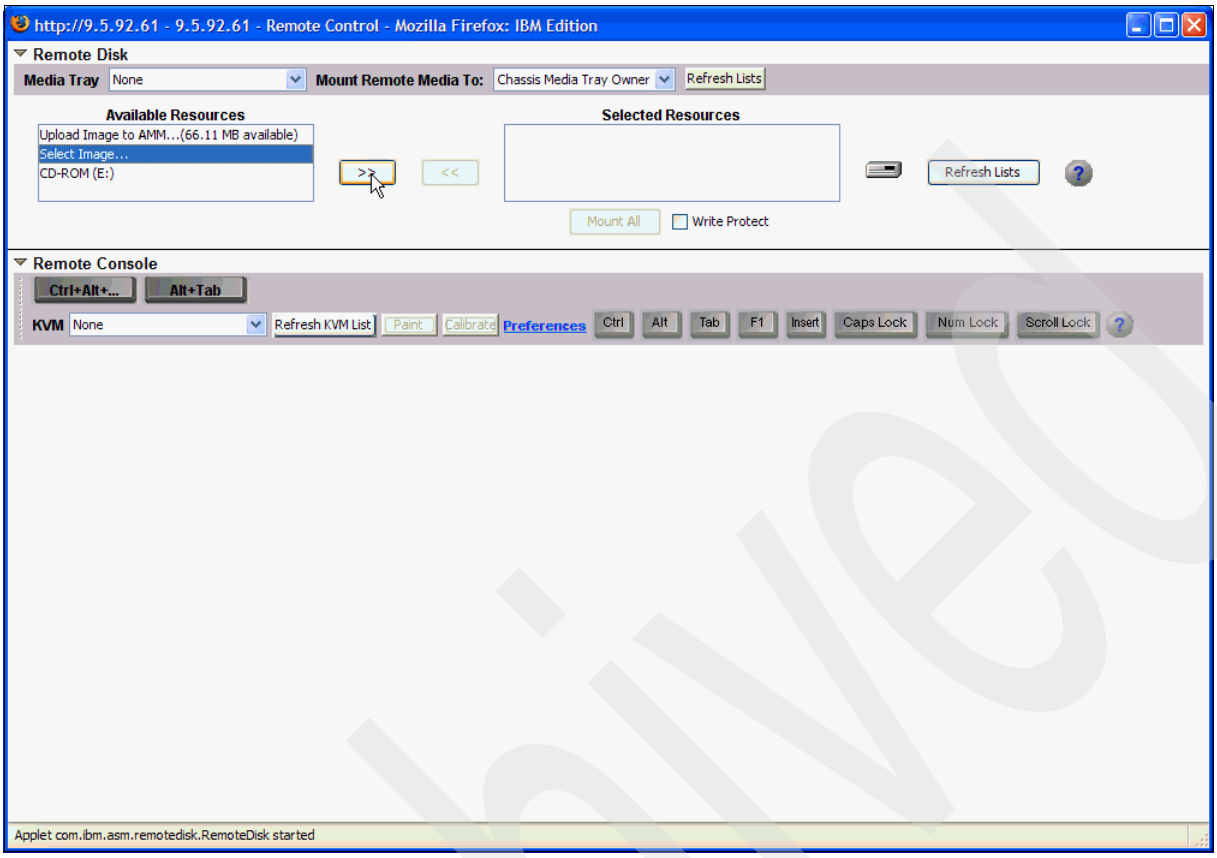

Figure 3-29 Remote control select image

7. Highlight **Select image...** (or **Select file...**) in the upper part of the window and click the **>>** button. This displays an open file dialog window (Figure 3-30).

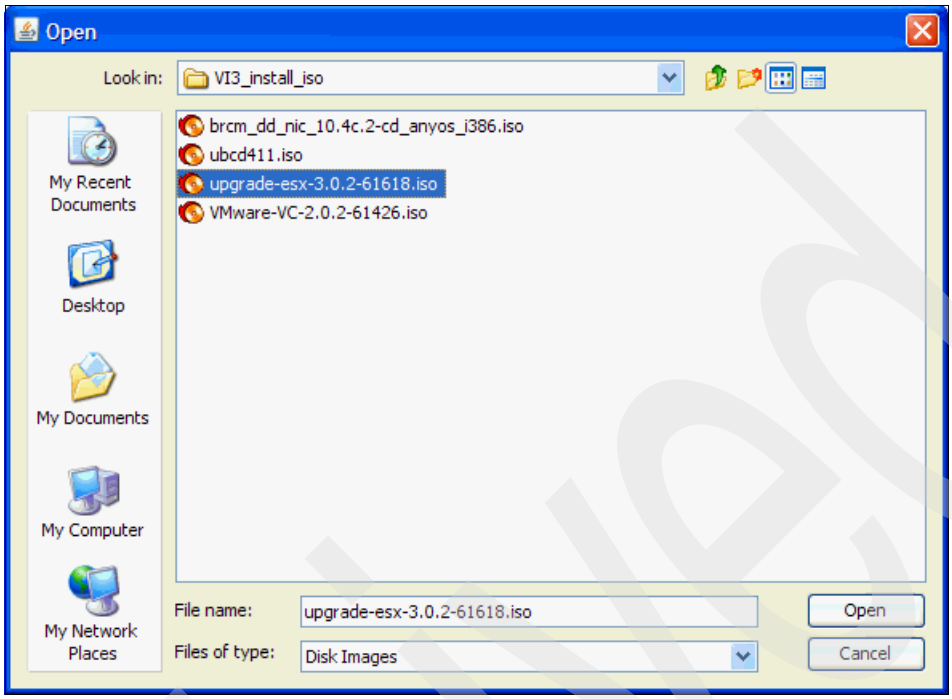

Figure 3-30 Open file dialog window

8. Navigate to the VMware ESX Server install media image and click the **Open** button (Figure 3-31).

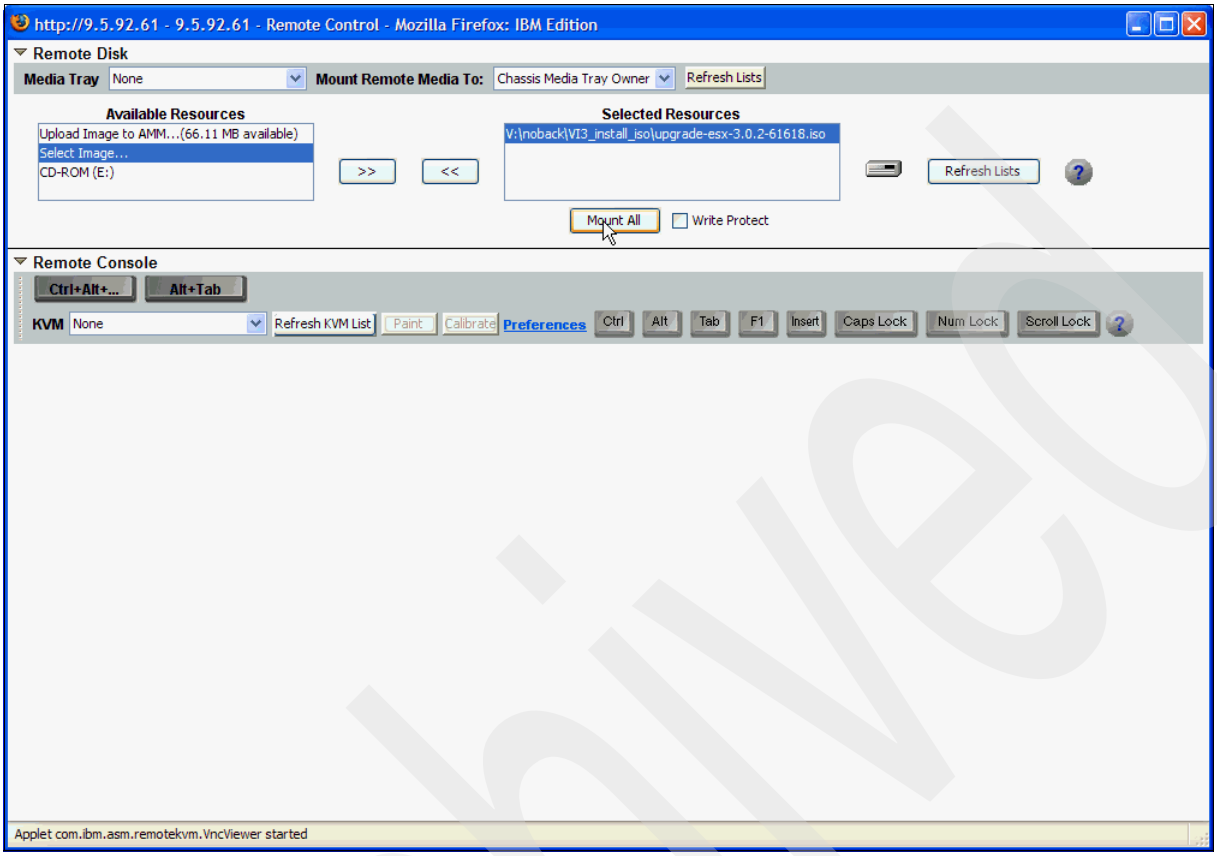

Figure 3-31 Remote control mount drive

9. Highlight the file name in the box near the center of the upper portion of the window and click the **Mount Drive** button. On a BladeCenter, make sure that the media tray is assigned to the blade that you are working with. Use the **Media Tray** pull-down to do this. The image is now mounted and ready for the installation process.

> **Note:** The lower portion of the window shown above can be used as a console for the x86 hardware. For a BladeCenter, you would have to select the blade server to display using the pull-down for KVM. Click in the console display to enter keystrokes into the console. Press Alt to break the keyboard away from console input.

3.3.2 VMware ESX Server software installation steps

To install:

1. On an i5/OS command line type the following:

```
INSLNXSVR NWSD(nwsdname) LNXSVRDST(*ESX3) RSTDEVRSC(*ALL) STGPTH(nwshname)
VRTETHPTH((*VRTETHPTH nwshname)) RMTNWSCFG(rmtsysname) SPNWSCCFG(srvprcname)
CNNNWSCFG(cnnsecname) IPSECERULE(*NONE)
```

See Table 3-1.

Table 3-1 INSLNXSVR command variable definitions

Variable	Description
nwsdname	The name of the network server description being created
nwshname	The NWSH object corresponding to the System i HBA
rmtsysname	The remote system configuration object describing the x86 host server
srvprcname	The service processor configuration object describing the service processor in the host server
cnnsecname	The connection security configuration object created for this server

Note: The RSTDEVRSC parameter setting of *ALL restricts the use of the System i removable media devices. We recommend this since use of the devices with ESX is not supported.

Note: The SVRSTGSIZE parameter allows you to set a size for the two virtual disks i5/OS will create as part of the installation process: the install source drive, in the ESX environment, /dev/sdb; and the system drive or /dev/sda. This parameter was not specified above, which accepts the default of letting i5/OS calculate the storage required. This currently yields a 1 GB install source drive and a 15 GB system drive. We recommend that these defaults are accepted.

2. When the storage spaces for the ESX Server have been created, i5/OS prompts us, as shown in Figure 3-32.

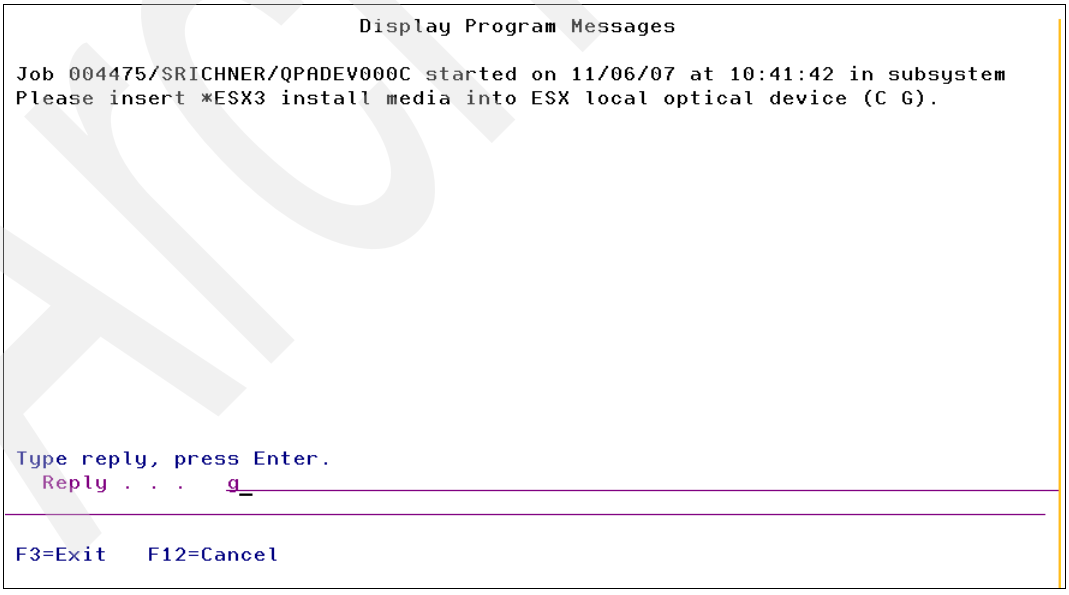

Figure 3-32 INSLNXSVR program message

Note: At this point, the ESX installation media or installation image must be mounted on the blade or System x server.

Type `g` and press Enter. The install will continue on the ESX Server console.

3. The install type selection window shown in Figure 3-33 appears. A text mode install can be started by typing `esx text` and pressing Enter. The install method documented here is the graphical install, which can be started by just pressing enter or doing nothing and letting the window time out.

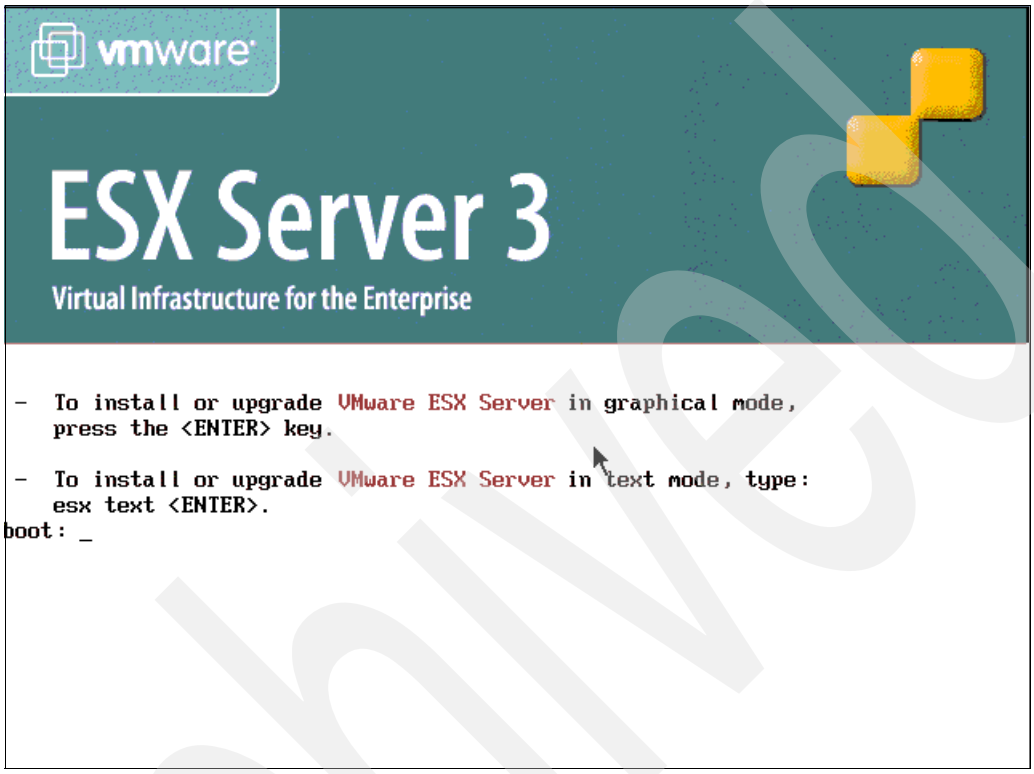

Figure 3-33 VMware ESX Server installer initial window

4. The media test window shown in Figure 3-34 is displayed next. You can check your media for errors by tabbing to the Test button and pressing Enter. The media test can be bypassed by tabbing to Skip and pressing Enter.

Figure 3-34 VMware ESX Server media test window

5. Click **Next** on the Installer welcome window shown in Figure 3-35 to start the install process.

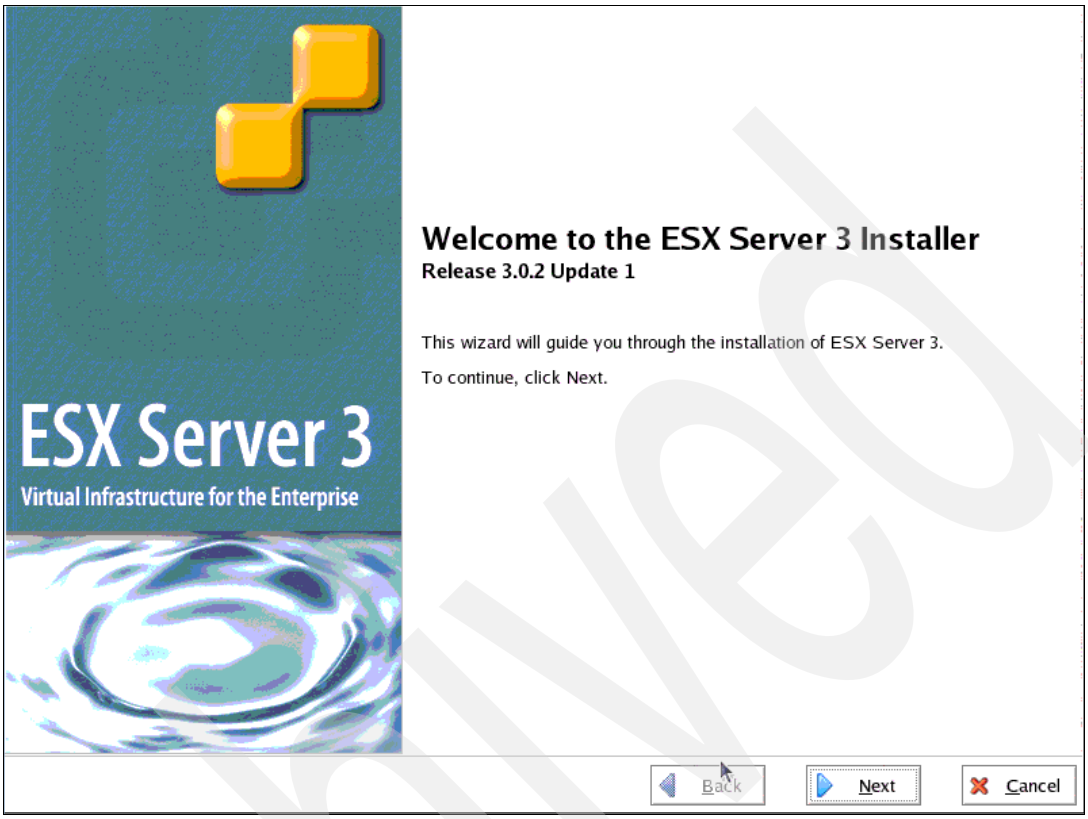

Figure 3-35 VMware ESX Server installer welcome window

6. Select the keyboard type (Figure 3-36) and click **Next**.

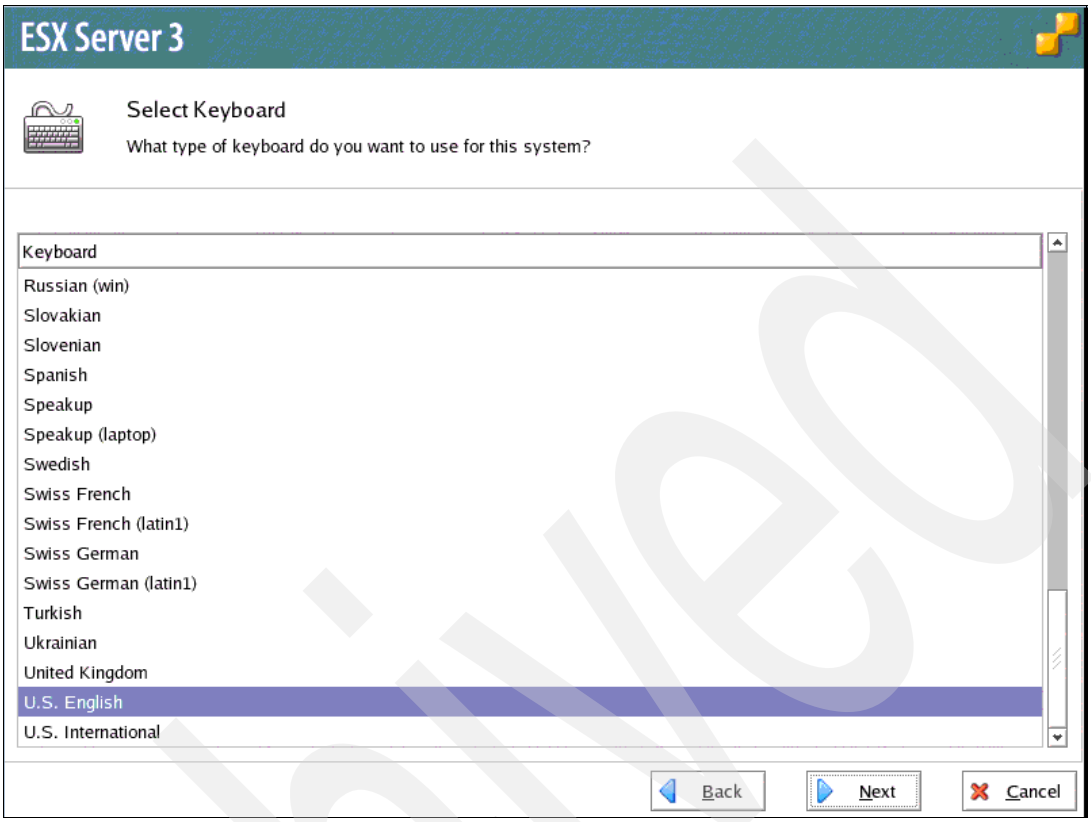

Figure 3-36 VMware ESX Server installer select keyboard window

7. The installer attempts to detect the mouse, and the detected type will be highlighted as shown in Figure 3-37. Verify that this is correct and select the correct type if not. Click **Next** to continue.

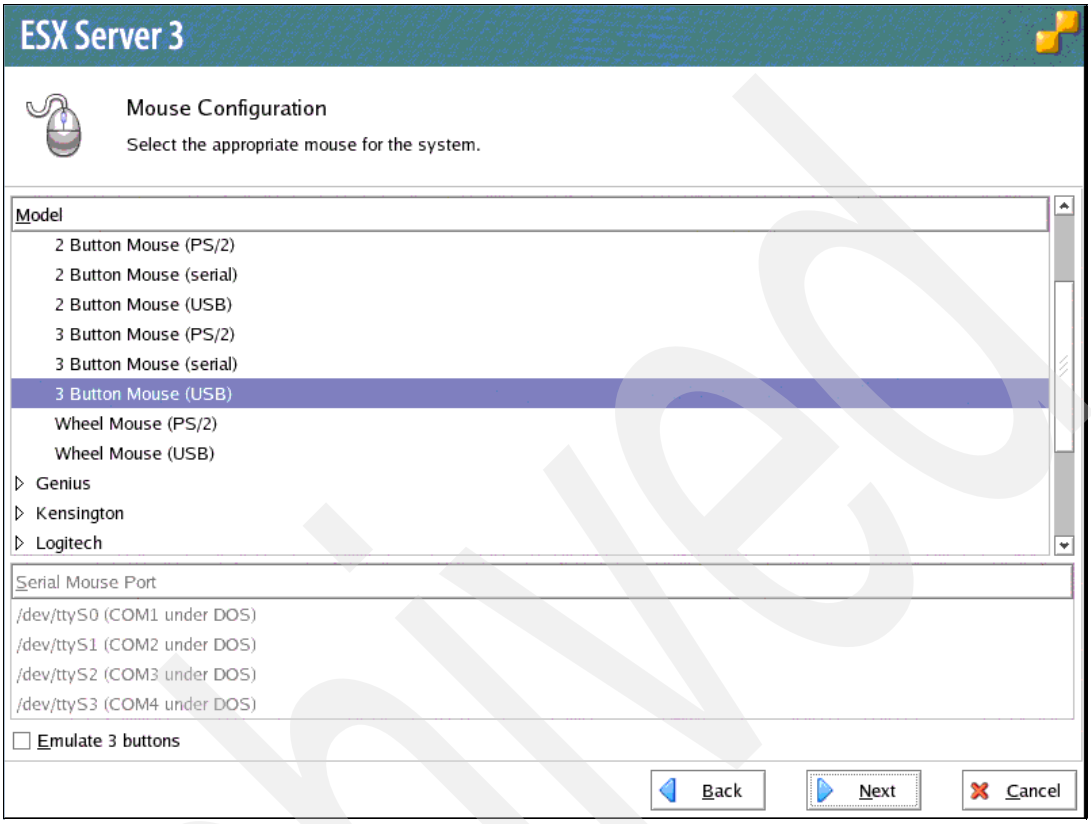

Figure 3-37 VMware ESX Server installer mouse configuration window

8. Figure 3-38 displays the VMware end user license agreement. After you have read the agreement, select **I accept the terms in the license agreement** and click **Next**.

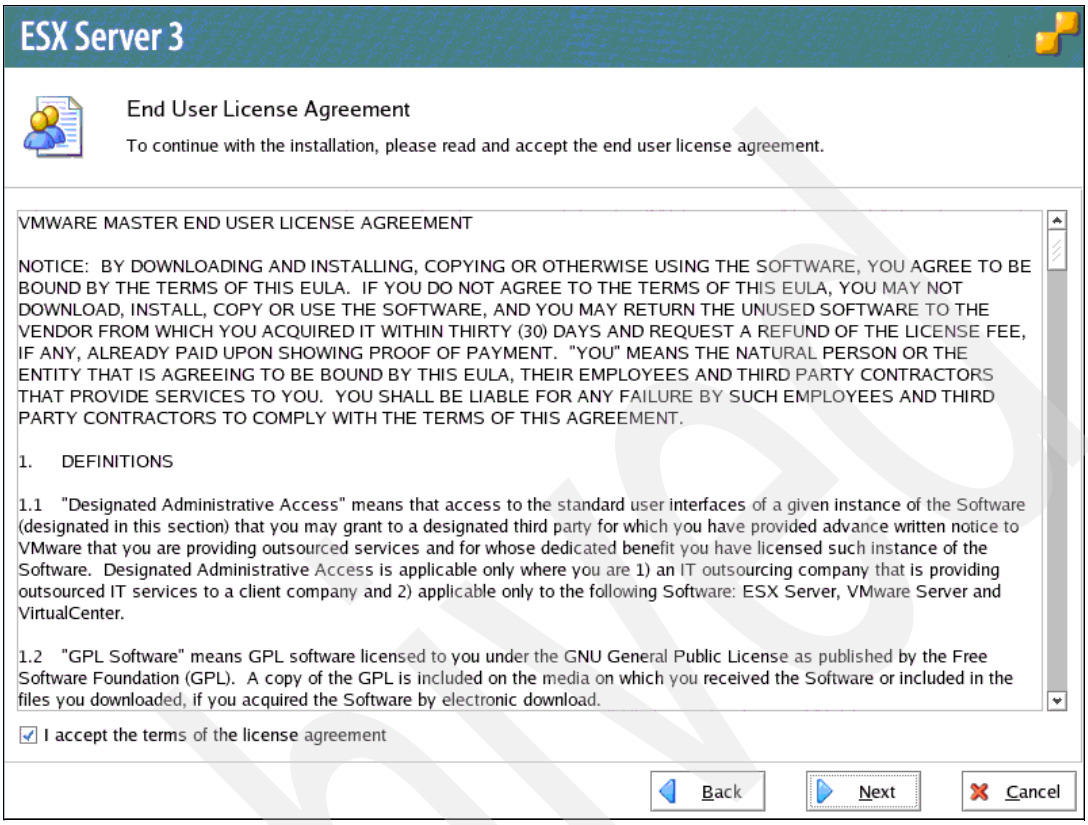

Figure 3-38 VMware ESX Server installer end user license agreement window

9. Verify that the Partitoning Options window (Figure 3-39) has **Recommended** selected. Also, make sure that the sda disk is selected as the install drive. Click **Next**.

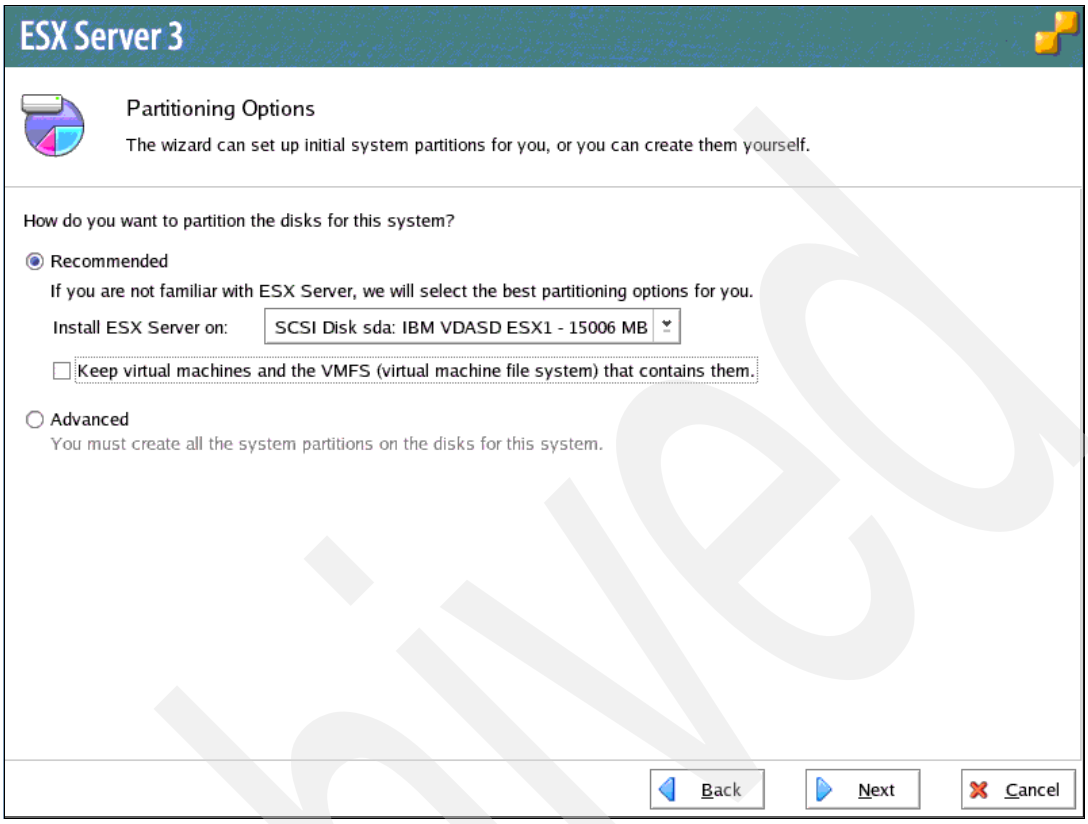

Figure 3-39 VMware ESX Server installer partitioning options window

Note: Be sure not to modify the partition on the /dev/sdb drive or the server might not boot.

10. The partitioning warning shown in Figure 3-40 is displayed. Click **Yes**.

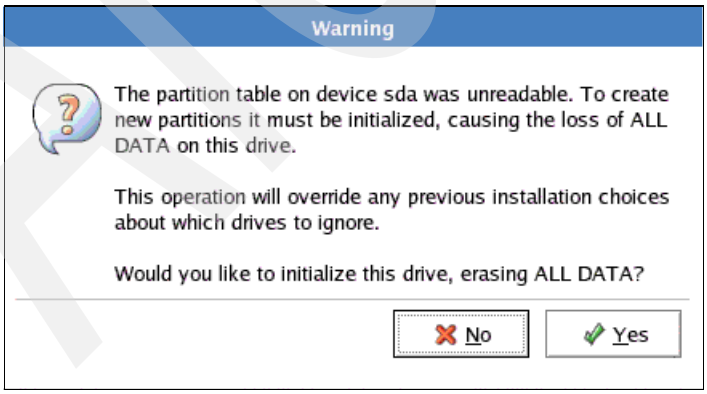

Figure 3-40 Partitioning warning dialog box

11. Review the partitioning summary, as shown in Figure 3-41. Click **Next**.

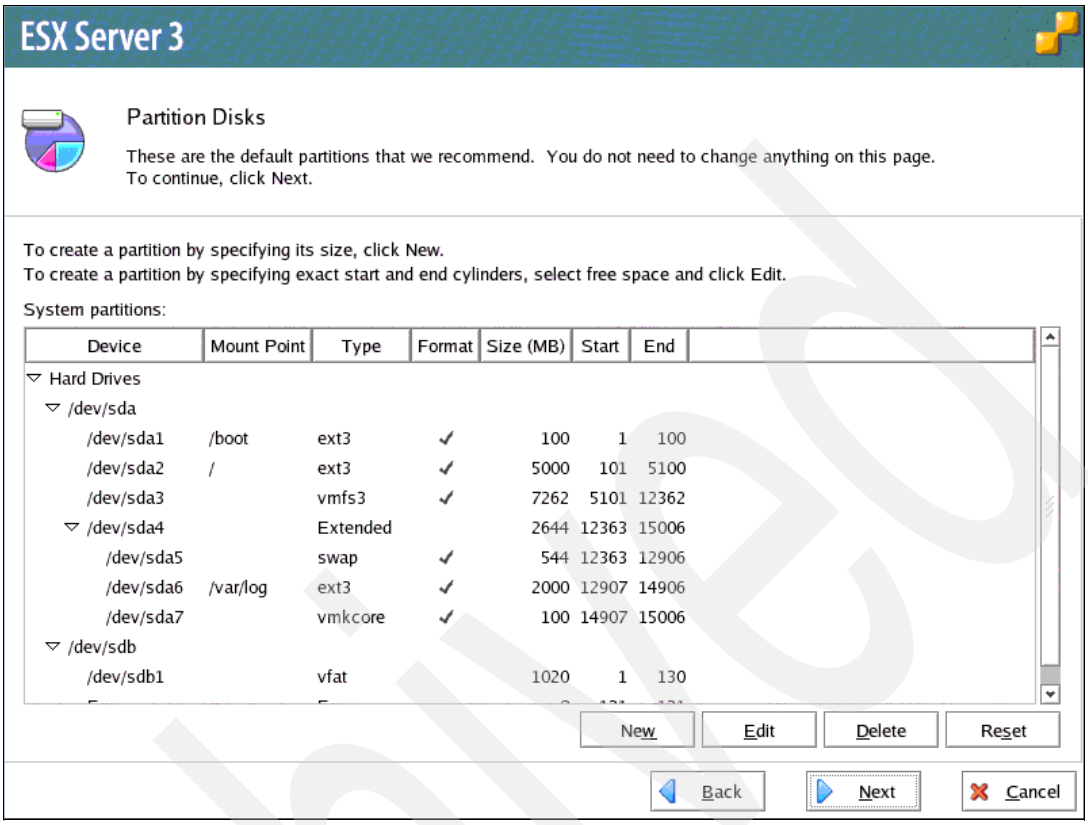

Figure 3-41 VMware ESX Server installer partitioning summary window

12. You should not alter any of the advanced options shown in Figure 3-42, so click **Next** to continue.

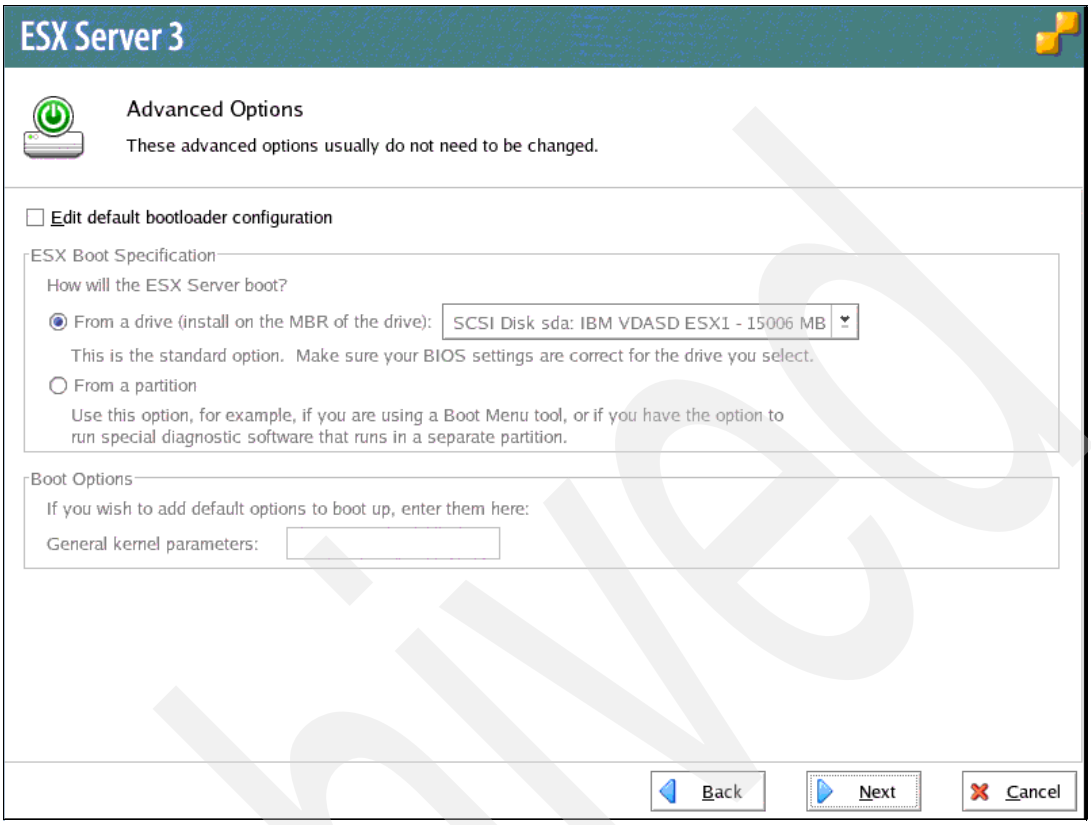

Figure 3-42 VMware ESX Server installer advanced options window

13. The networking options are configured in Figure 3-43.
    a. Select the network adapter to use in the Device pull-down.
    b. Select the **Use the following network information** button to set a static address.
    c. Enter the assigned IP address for the ESX service console.
    d. Enter the subnet mask.
    e. Enter the gateway address.
    f. Enter the primary DNS address.
    g. Enter the secondary DNS address.
    h. Enter the fully qualified host name.
    i. Leave the VLAN ID field blank.
    j. Uncheck the **Create a default network for virtual machines** box. The virtual machine network will be configured later on a different network adapter. Click **Next**.

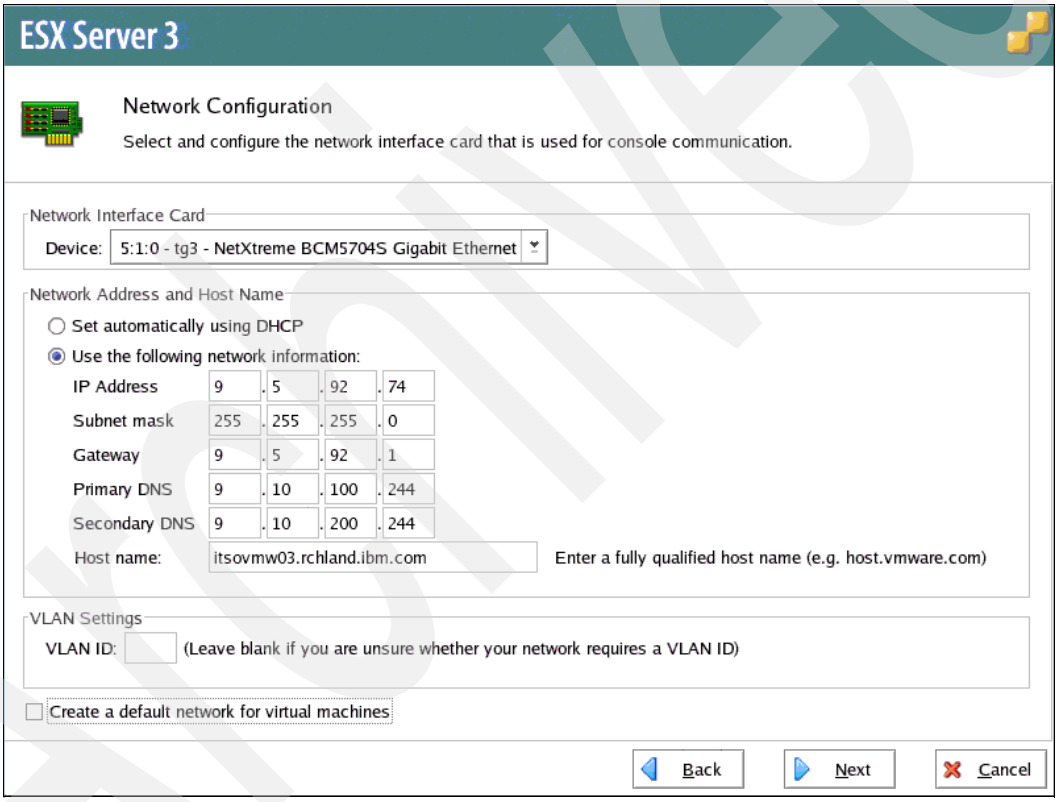

Figure 3-43 VMware ESX Server installer network configuration window

14. The time zone can be selected in one of three ways:

    a. Using the Map tab (Figure 3-44), click a point on the map. The Selected time zone field displays the time zone that you selected. Select **System clock uses UTC** if appropriate. Click **Next**.

Figure 3-44 VMware ESX Server installer map time zone selection window

b. Using the Location tab (Figure 3-45), move up and down in the list of locations using the arrow keys until the correct location is selected. Select **System clock uses UTC** if appropriate. Click **Next**.

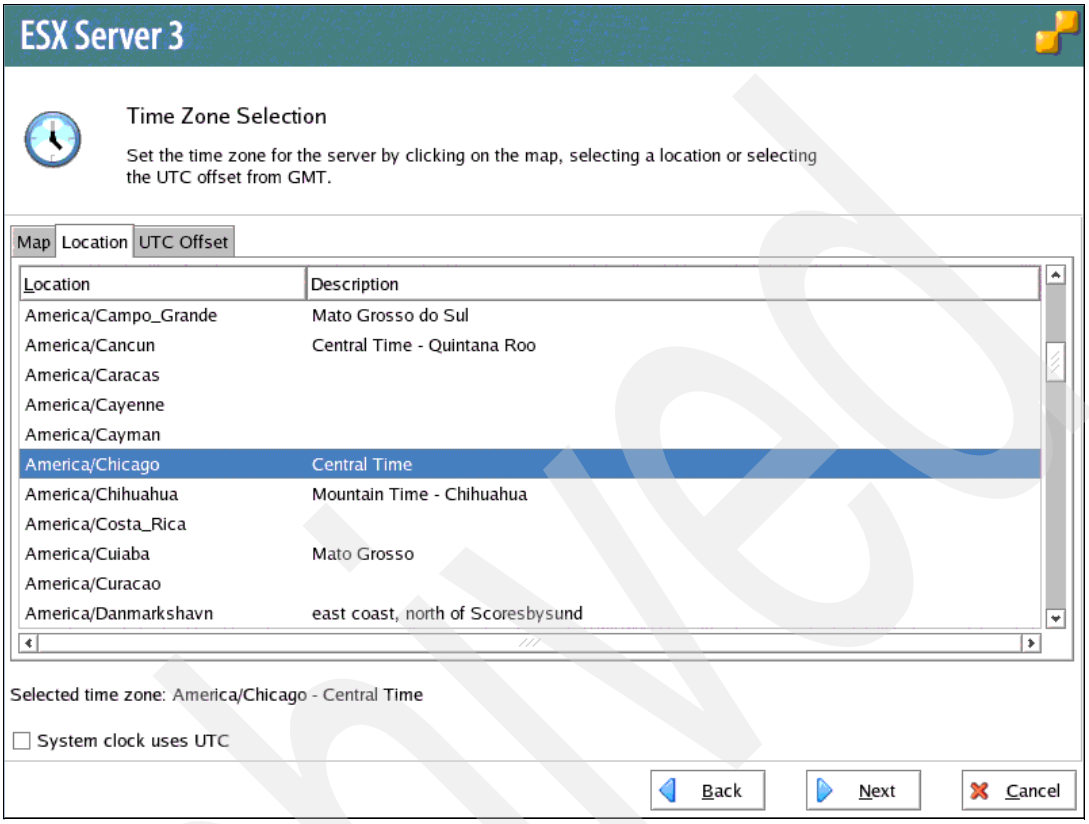

Figure 3-45 VMware ESX Server installer location time zone selection window

c. Using the UTC Offset tab (Figure 3-46), move up and down in the list using the arrow keys until the correct UTC offset is selected. Select **System clock uses UTC** if appropriate. Click **Next**.

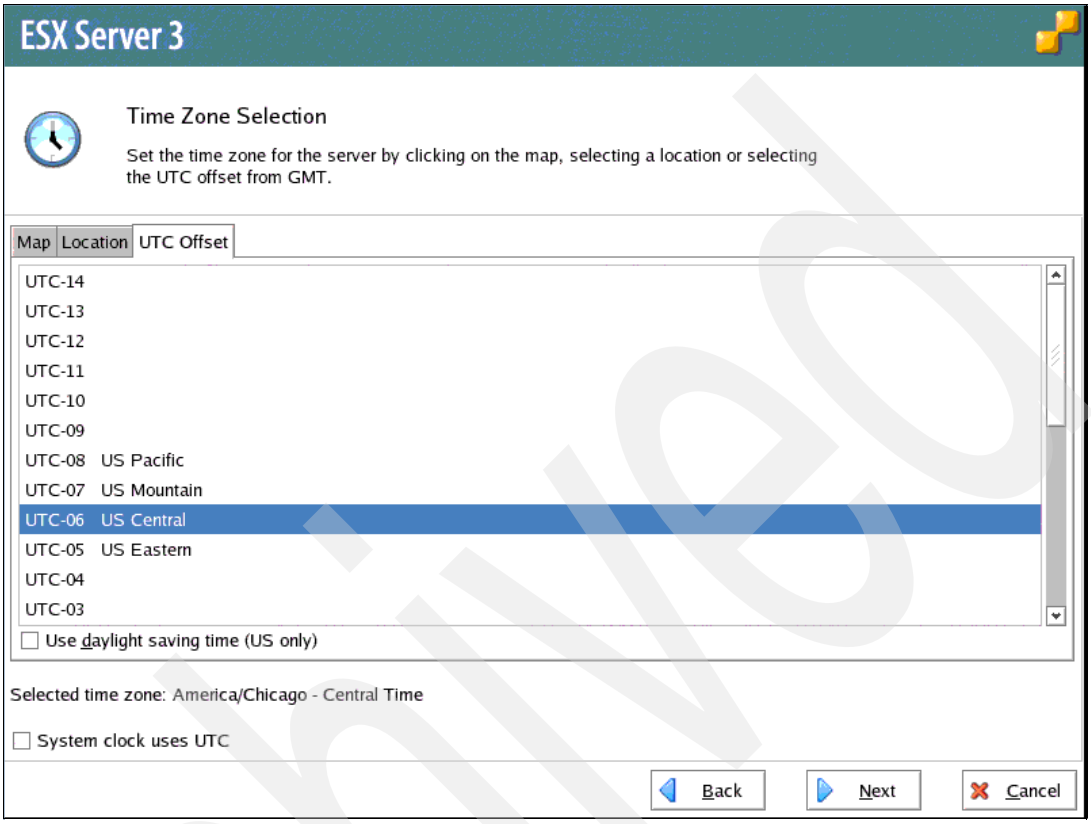

Figure 3-46 VMware ESX Server installer UTC offset time zone selection window

15. Enter the desired root password (Figure 3-47) and confirm it by entering it again. Be sure to keep track of the password that you enter. Click **Next**.

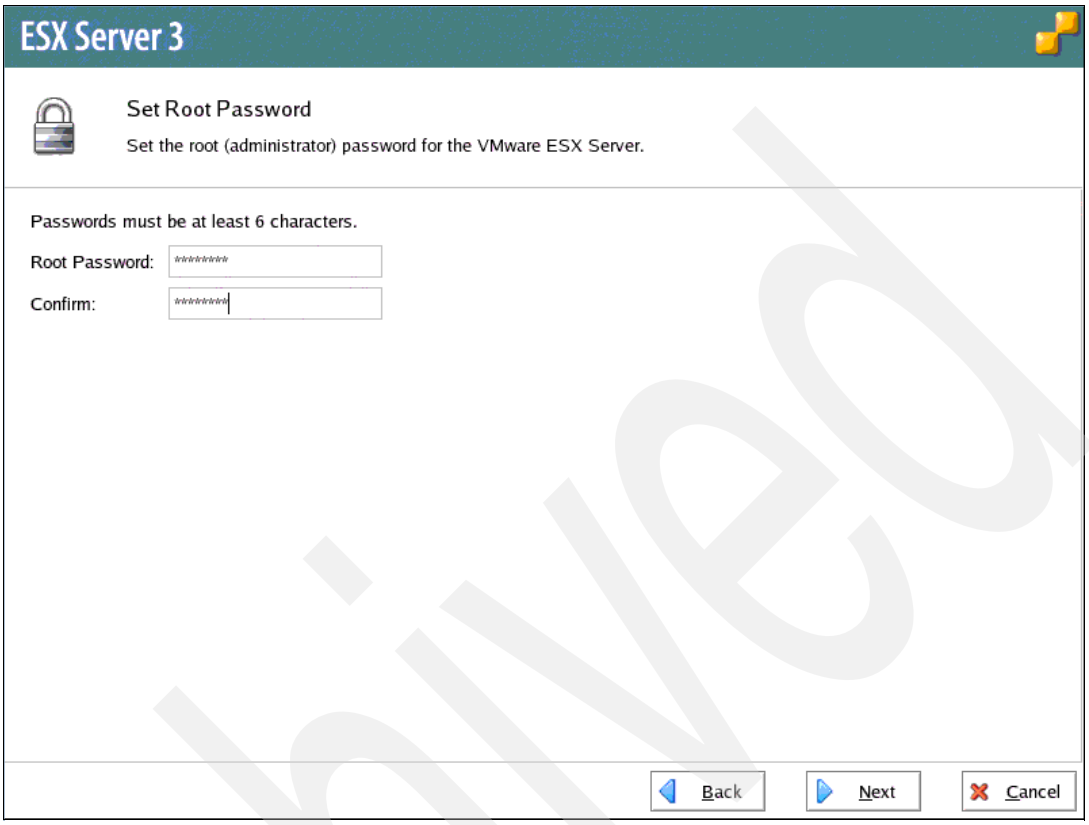

Figure 3-47 VMware ESX Server installer set root password window

16. The window shown in Figure 3-48 is your last chance to redo any of the selections made in the previous windows. Click **Back** on this window and any other windows to back through the install process. When you are ready to proceed with the install, click **Next**.

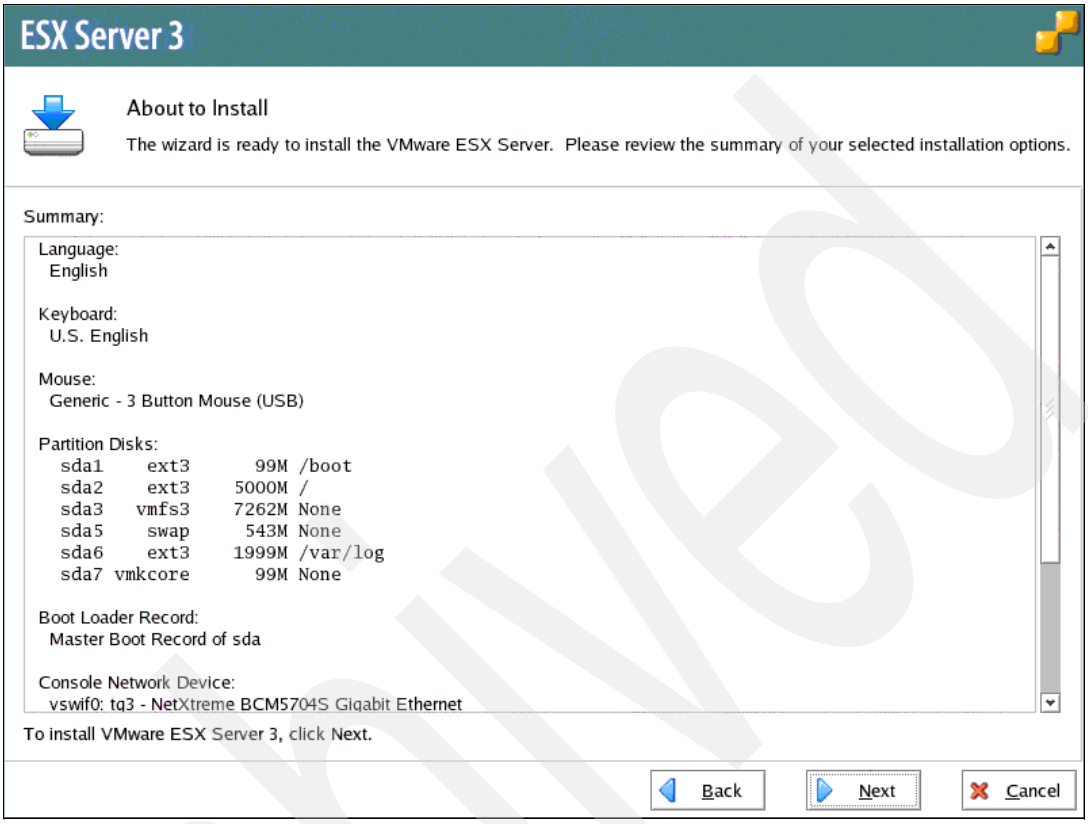

Figure 3-48 VMware ESX Server installer about to install window

17. A progress window similar to the one shown in Figure 3-49 appears, and continues to update until the install completes.

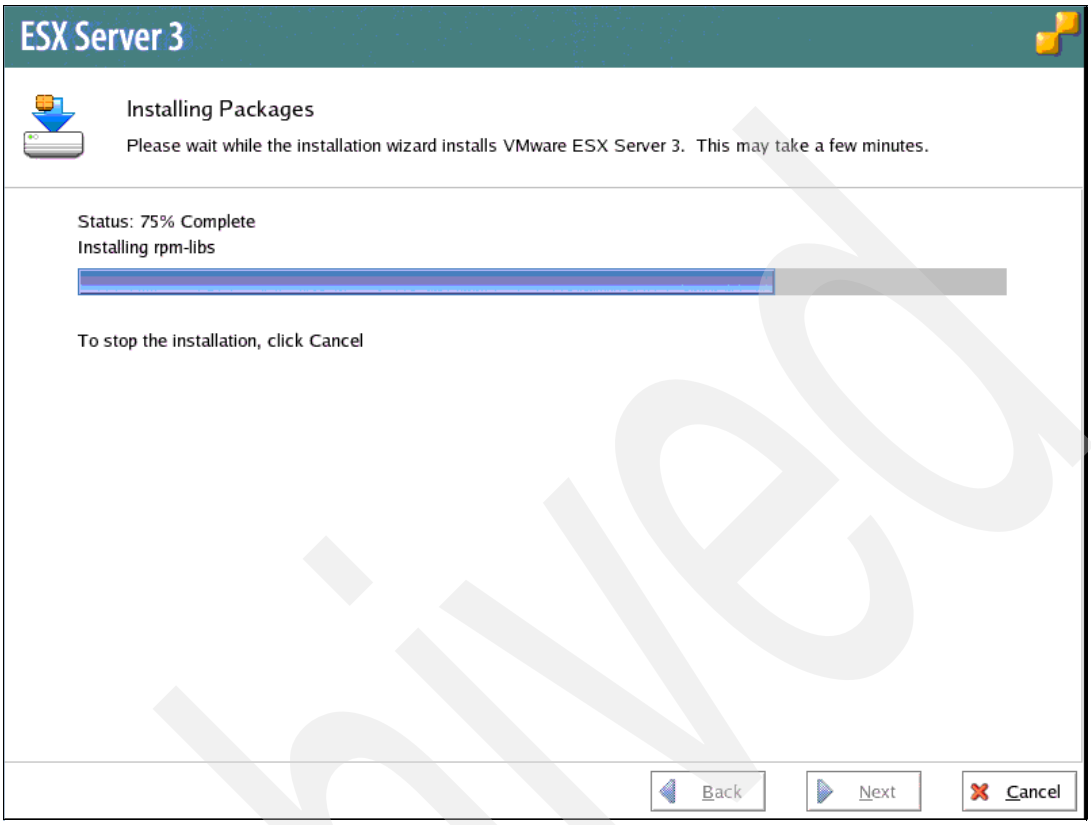

Figure 3-49 VMware ESX Server installer progress window

18. The window shown in Figure 3-50 is displayed when the install completes. Note the ESX service console address displayed on this window. Click **Finish** to complete the install and start rebooting the server.

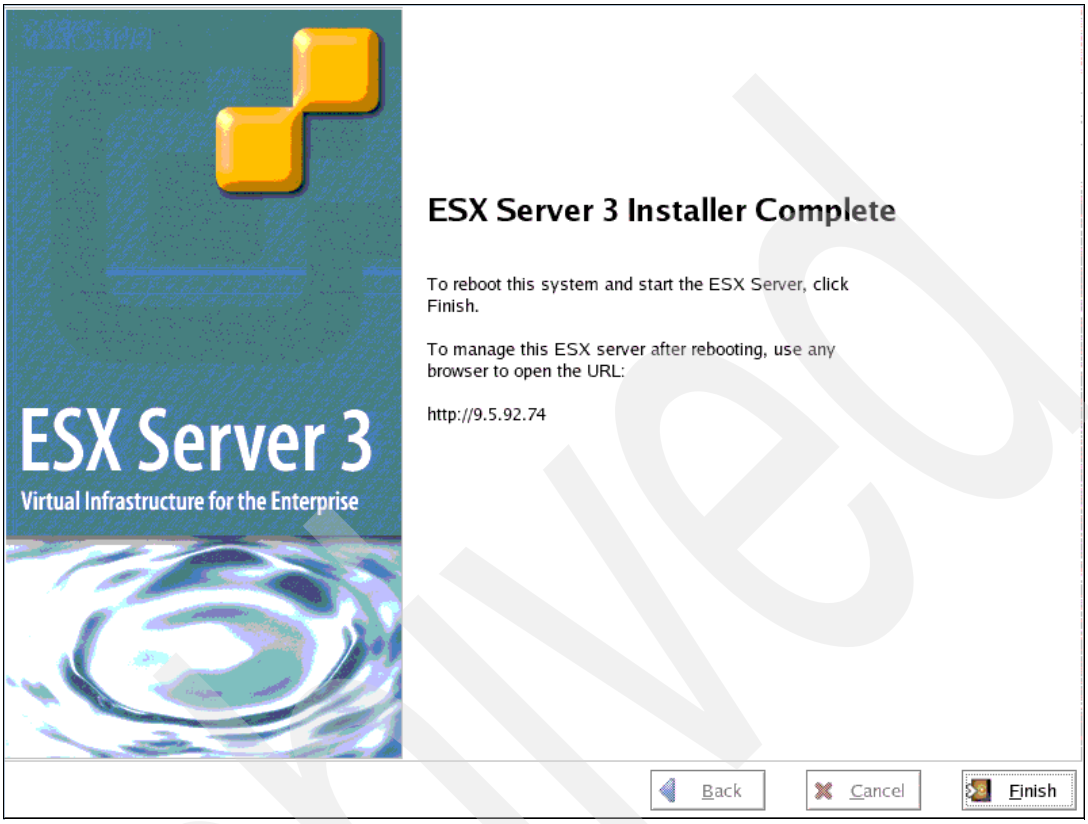

Figure 3-50 VMware ESX Server installer completion window

3.3.3 Post-installation required actions

A post-install utility is provided that must be run before the installation is complete. This utility enables the ESX Server to properly shut down when the Network Server Description (NWSD) is shut down. This does not include shutting down any running virtual machines at the time of the NWSD shutdown, so you must manually shut down any active virtual machines before shutting down the NWSD. The steps to run the utility are:

1. At the VMware ESX Server service console, press Alt+F1 and sign on as root.
2. Type the following command and press Enter:

   ```
   mkdir /mnt/ibmlsv
   ```

3. Type the following command and press Enter:

   ```
   mount /dev/sdb1 /mnt/ibmlsv
   ```

4. Type the following command and press Enter:

   ```
   /mnt/ibmlsv/install/ibmsetup.sh address
   ```

   @here *address* is the IP address or host name of your System i partition.

5. Press Alt+F11 to return to the service console address window.

3.4 Establishing the virtual infrastructure

After all the individual ESX Server hosts have been installed, you can begin to build the infrastructure necessary to support the advanced features of VMware Infrastructure 3. As mentioned previously, VirtualCenter is a required component when implementing the advanced features.

3.4.1 Building the basic infrastructure

A multiple ESX Server virtual infrastructure is managed by VirtualCenter Server and consists of a number of hierarchical objects:

- A root folder is created by default for every VIrtualCenter Server and is at the top of the hierarchy. Other folders can be created throughout the hierarchy to group objects, if desired. In the infrastructure implemented here, no additional folders will be added.
- A data center, which contains clusters, ESX Servers, and their virtual machines. We will create a single data center in this infrastructure.
- A cluster is required to enable VMware HA and VMware DRS. It is a grouping of ESX Servers and their virtual machines. We will create a single cluster in this infrastructure, under which all the ESX Server hosts previously created will reside.
- A host is the installed ESX Server system. After the basic hierarchy has been established, the hosts will be added in 3.4.2, “Adding the ESX Servers to the infrastructure” on page 63. Virtual machines will be configured when the remainder of the infrastructure is complete.

Begin the process by starting the VMware Infrastructure Client you installed in 3.2, “VMware Infrastructure Client installation” on page 25. On the signon window, the server will be the host name or IP address of the VirtualCenter that you installed in 3.1, “Installing VMware VirtualCenter” on page 16. The user name and password will be a Windows user name and password for the machine on which the VirtualCenter Server was installed.

1. Look at far left pane of the first window, as shown in Figure 3-51. Notice the single root folder named Hosts & Clusters. To create a data center below the root folder, right-click the root folder and select **New Datacenter** on the menu. This will create the data center with the default name of New Datacenter. You should change the name to something more meaningful.

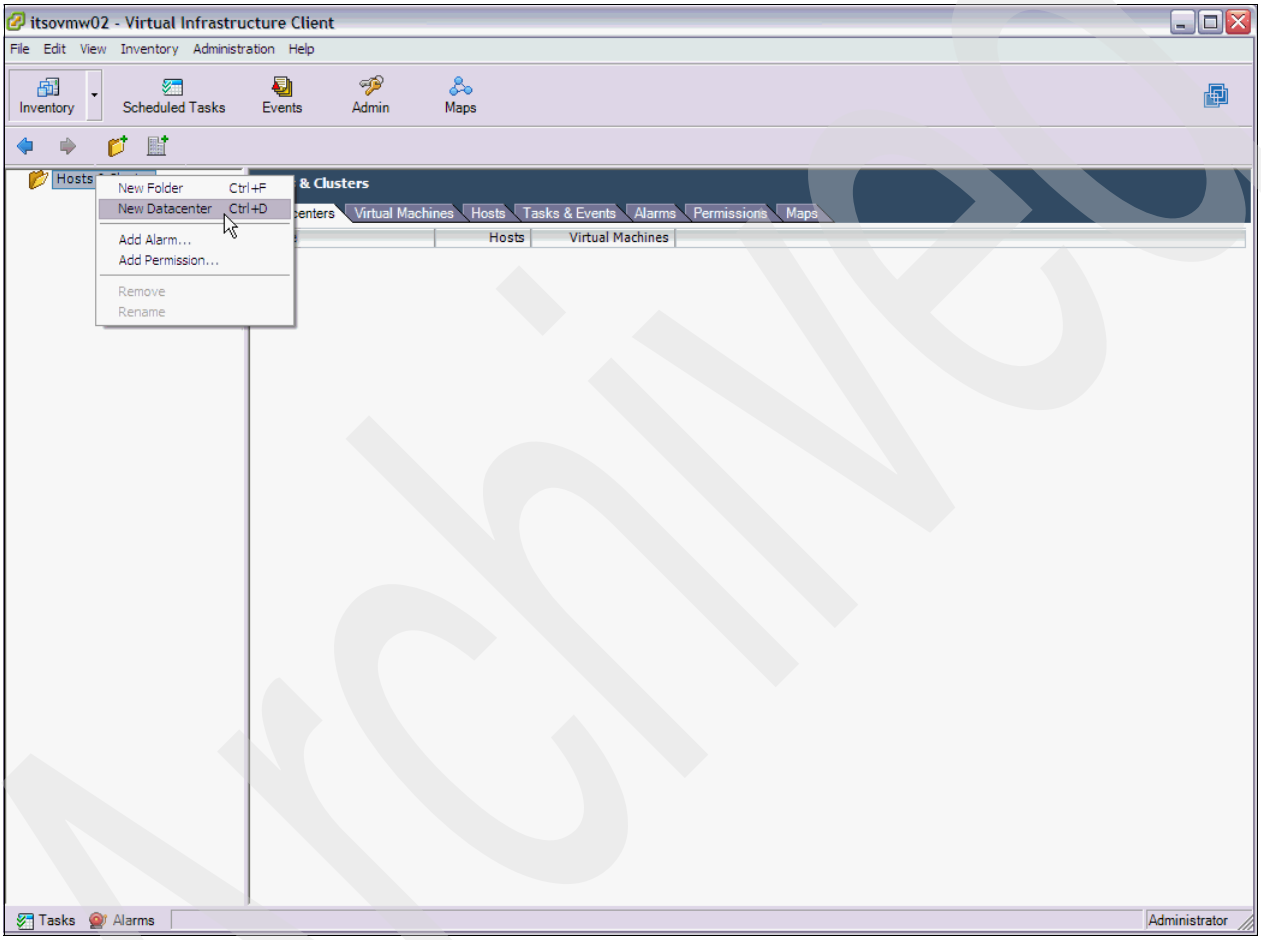

Figure 3-51 Add new data center to inventory

2. Right-click the data center that you just created and select **New Cluster** (Figure 3-52). This starts the new cluster wizard. The settings established with the wizard can also be changed at a later point in time, so the initial settings are not extremely important.

> **Note:** If you are not planning to use either VMware HA or VMware DRS, you do not need to add a cluster.

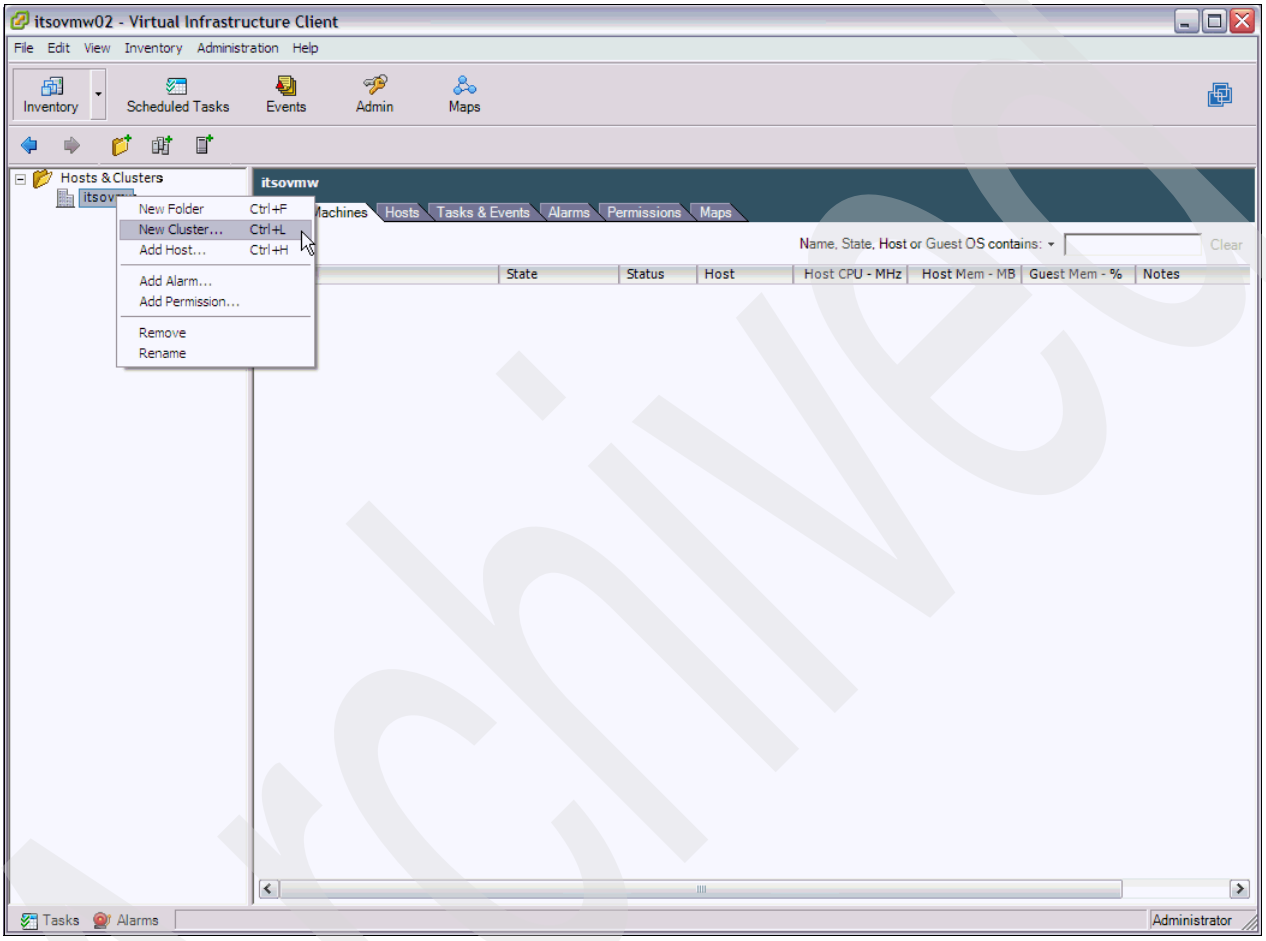

Figure 3-52 Add new cluster to data center

a. Enter a name for the cluster and click the check box for either VMware HA or VMware DRS, or both, to enable the cluster for those features (Figure 3-53). You must select at least one of these features when creating a cluster. Click **Next** to continue.

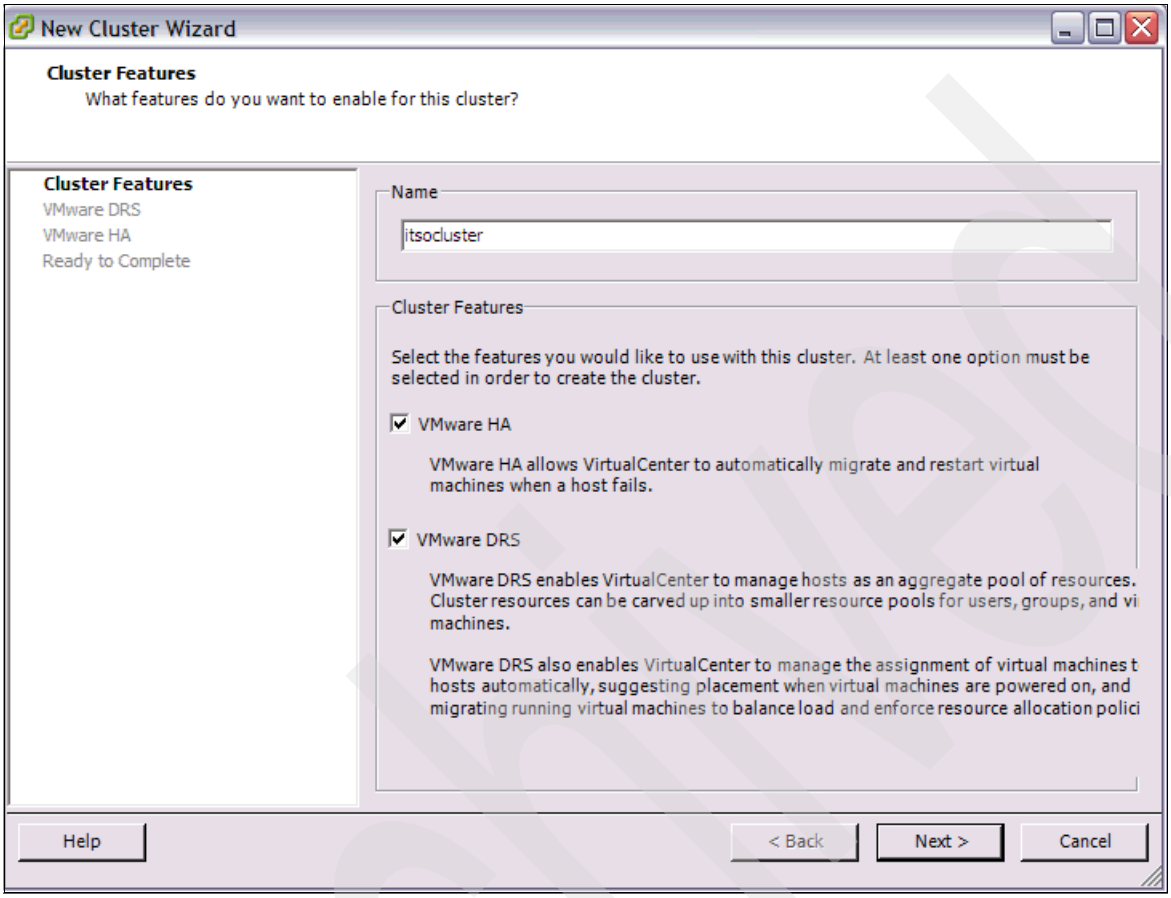

Figure 3-53 New cluster wizard features select window

b. Select the automation level for VMware DRS (Figure 3-54) if you enabled it on the previous window. You can choose between Manual, Partially automated, and Fully automated.

> **Note:** The level of automation you choose should be based on the confidence you have in DRS. We recommend that you begin with Manual or no automation until you have some experience with DRS. At this level, DRS will make recommendations on where to place virtual machines at start up and over time to load balance. You can manually migrate the virtual machines as recommended. When you have confidence in how your DRS environment is working, you can increase the automation level.

The text on the window describes the automation level. If you choose Fully automated, notice that there is also a slider that designates the migration threshold. Click **Next** after you have made your choice.

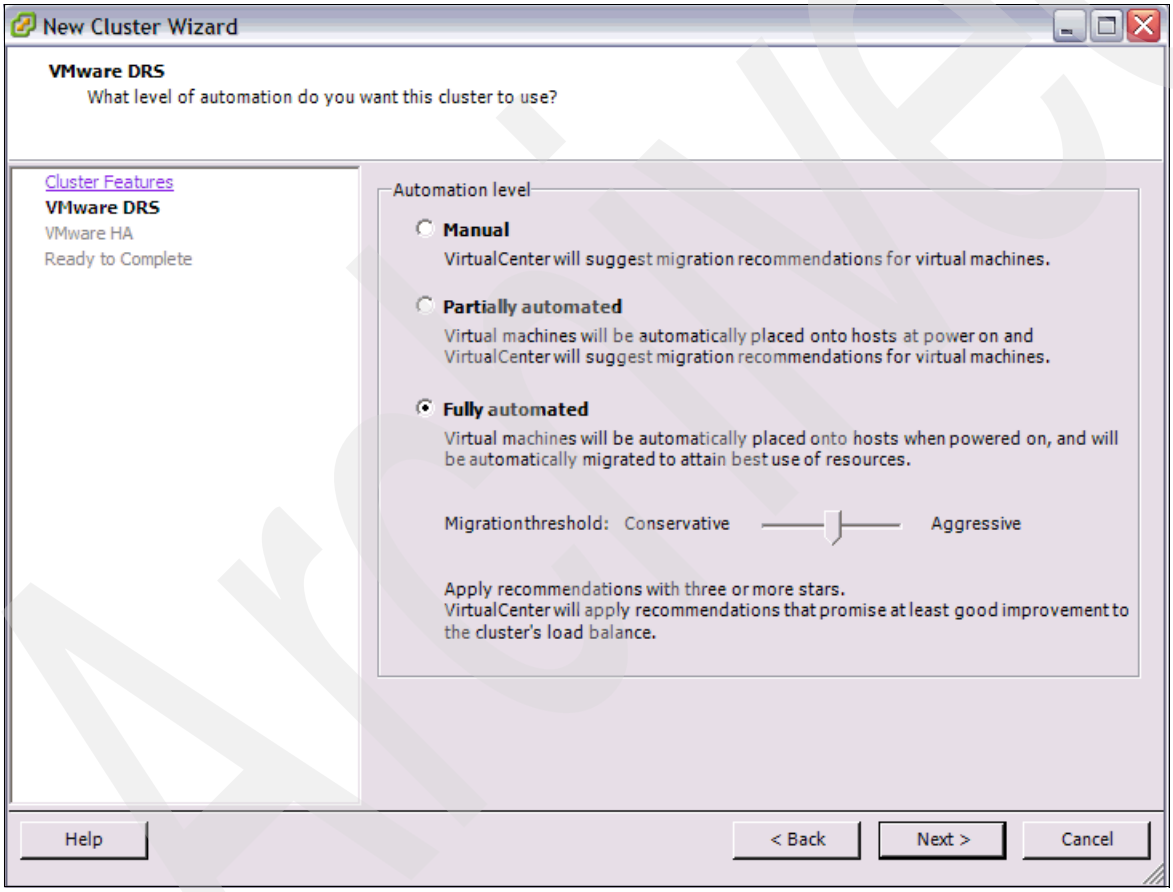

Figure 3-54 New cluster wizard - VMware DRS configure

c. Configure the high availability options as shown in Figure 3-55 if you enabled VMware HA previously. Select the number of host failures the cluster should allow by clicking the up/down arrow next to the number. Also, select an admission control policy.

Note: The Host Failures field above refers to the number of ESX Servers that you want HA to provide failover capacity for. Admission control allows you to set whether a failed ESX Server's virtual machines should be restarted if they fail HA's availability constraints. To begin with, we recommend that you set this for one host failure and select **Do not start virtual machines if they violate availability constraints**. Refer to the VMware document *Resource Management Guide* for an in-depth discussion about HA configuration. The configuration values can be changed later, if you determine that you need a different setting.

Click **Next**.

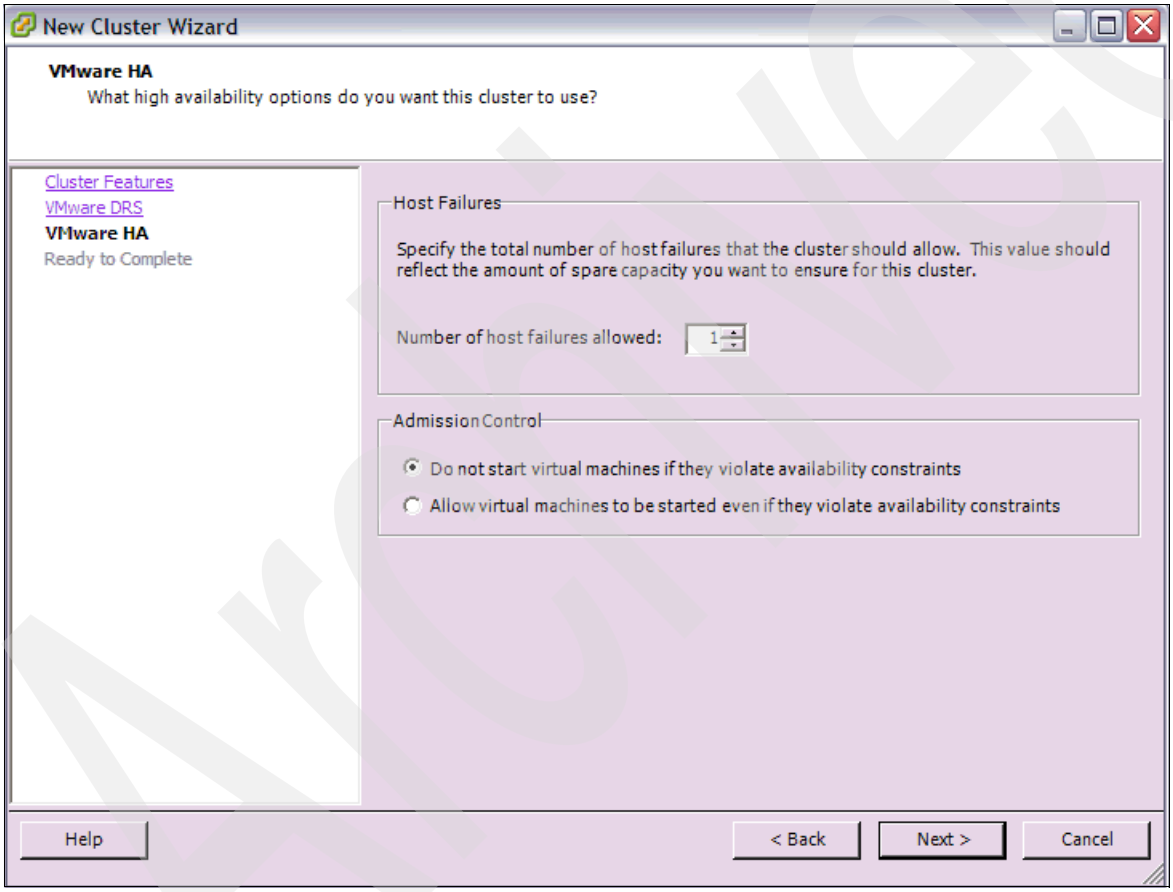

Figure 3-55 New cluster wizard - configure HA

d. Review the configuration option for the enabled features (Figure 3-56). Click **Finish** to complete the wizard. The new cluster will appear under the data center.

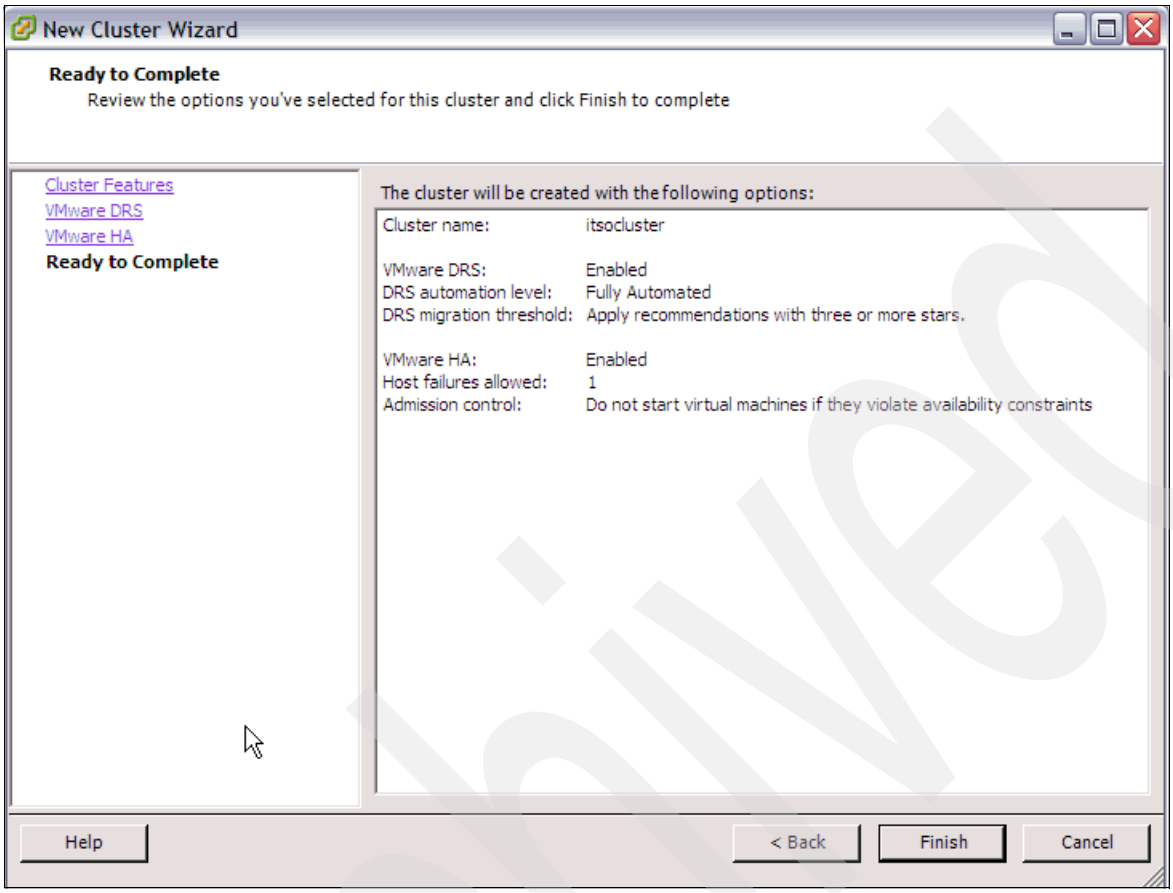

Figure 3-56 New cluster wizard VMware HA configure

The basic infrastructure has now been created.

3.4.2 Adding the ESX Servers to the infrastructure

We now add the ESX Server hosts to the infrastructure. This procedure should be repeated for each ESX Server host that has been installed. The procedure starts from the VMware Infrastructure Client displaying the VirtualCenter inventory window.

1. Right-click the cluster and select **New Host**, as shown in Figure 3-57. This starts the add host wizard.

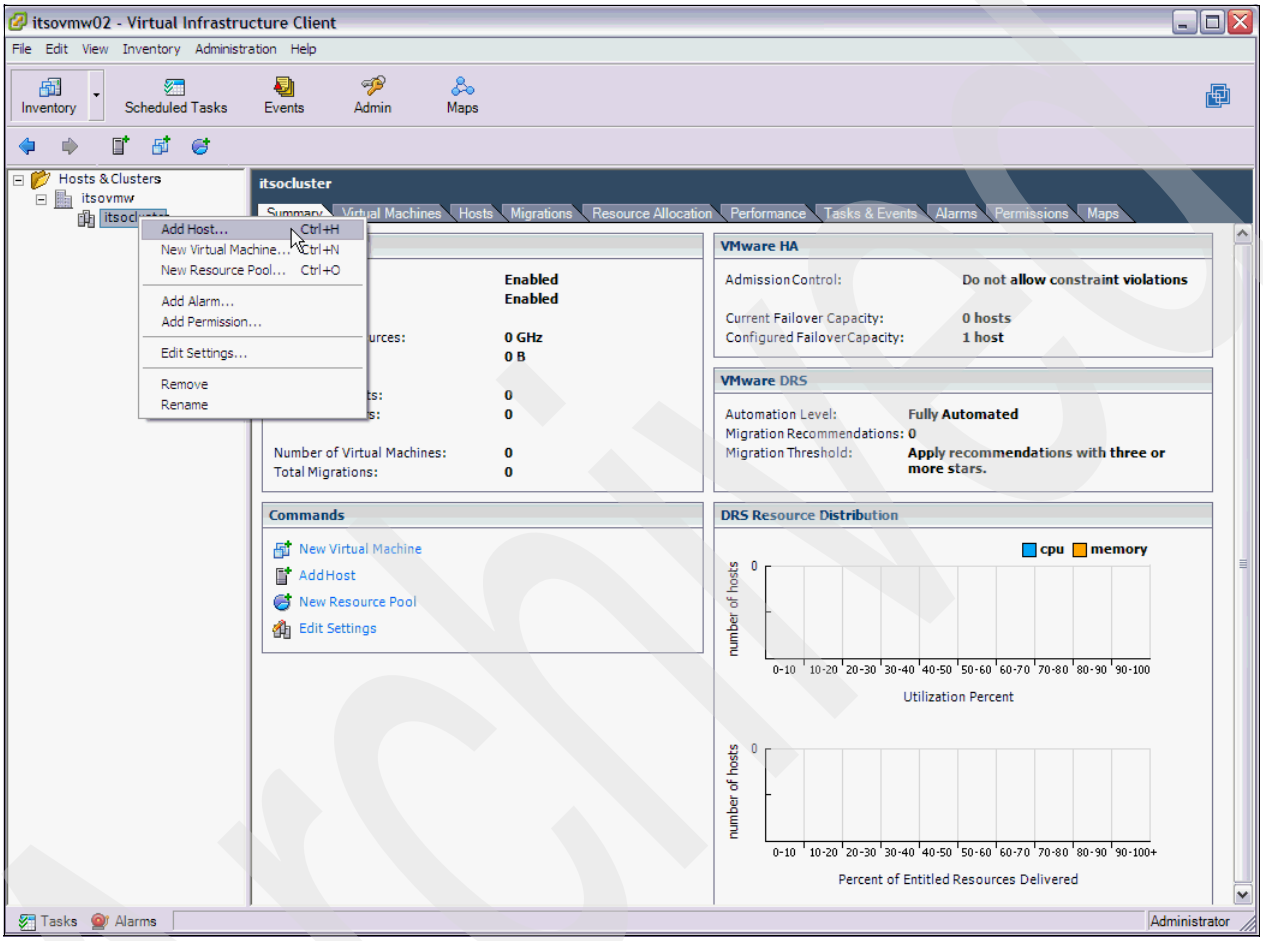

Figure 3-57 VMware Infrastructure Client displaying VirtualCenter inventory

2. Refer to Figure 3-58. Type the host name or IP address assigned to the ESX Server. The host name should be resolvable through the DNS. Also, enter the user name and password for the ESX Server. This would be the root user and password, since it is the only user currently defined for the ESX Server.

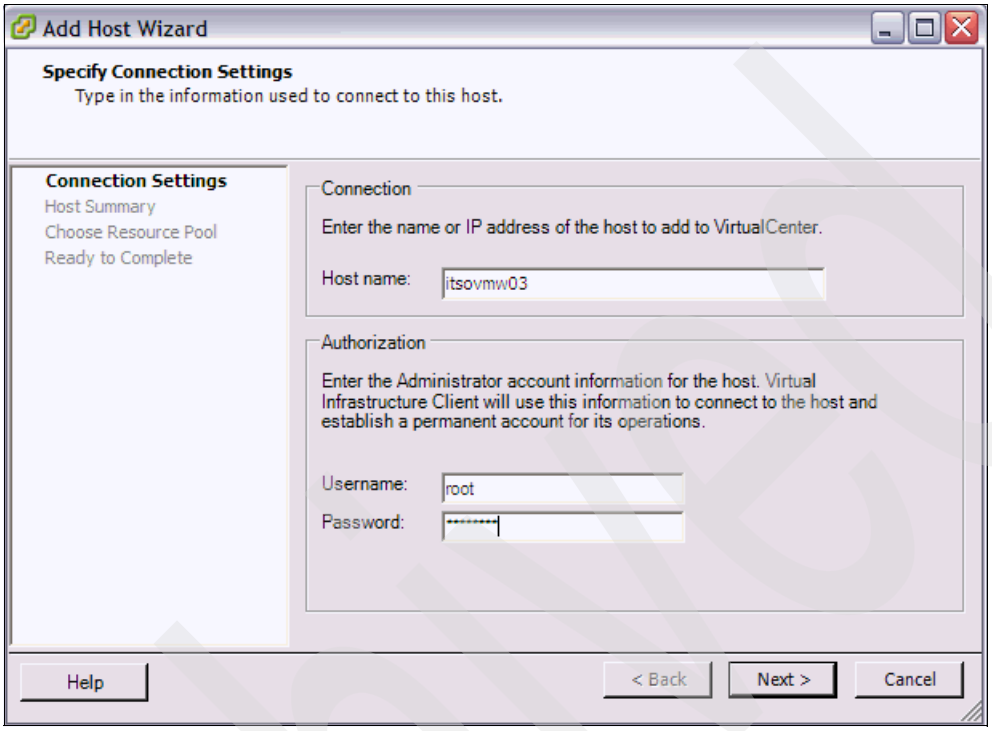

Figure 3-58 Add host wizard connection settings

3. The VirtualCenter Server attempts to contact the host and displays a window with information that it retrieved from the host (Figure 3-59). Review this information to verify that this is the correct host and click **Next** to continue.

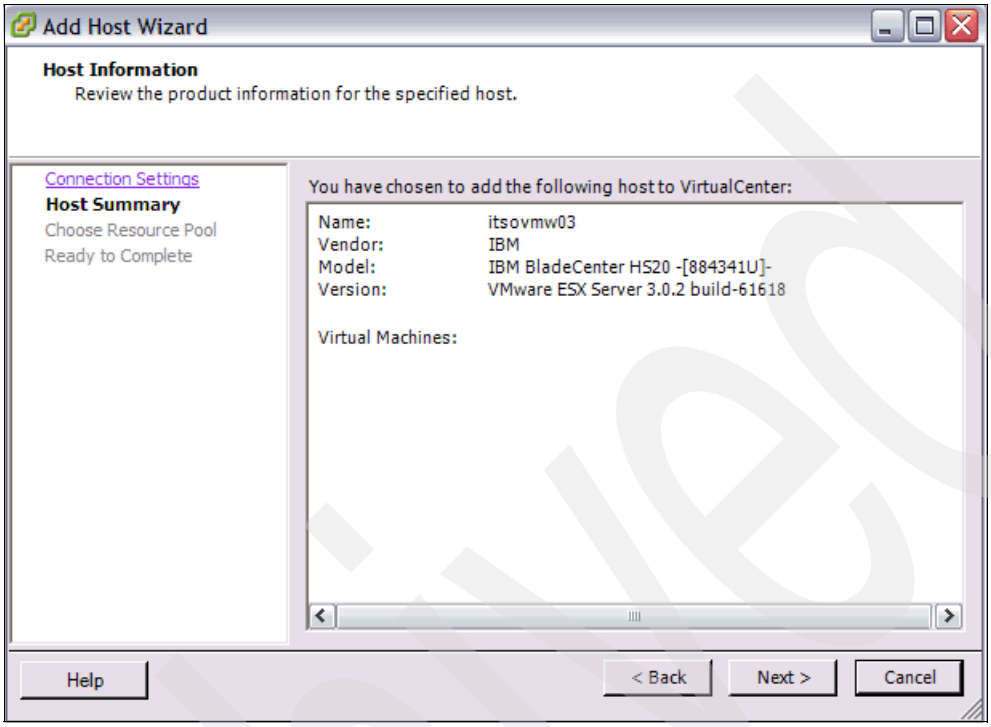

Figure 3-59 Add host wizard host information

4. In the window shown in Figure 3-60, you are presented with the option of where to locate the resources associated with this ESX Server. We will put all the resources in the clusters root pool, so make sure that the option beginning **Put all this host's virtual**... is selected. Click **Next** to continue.

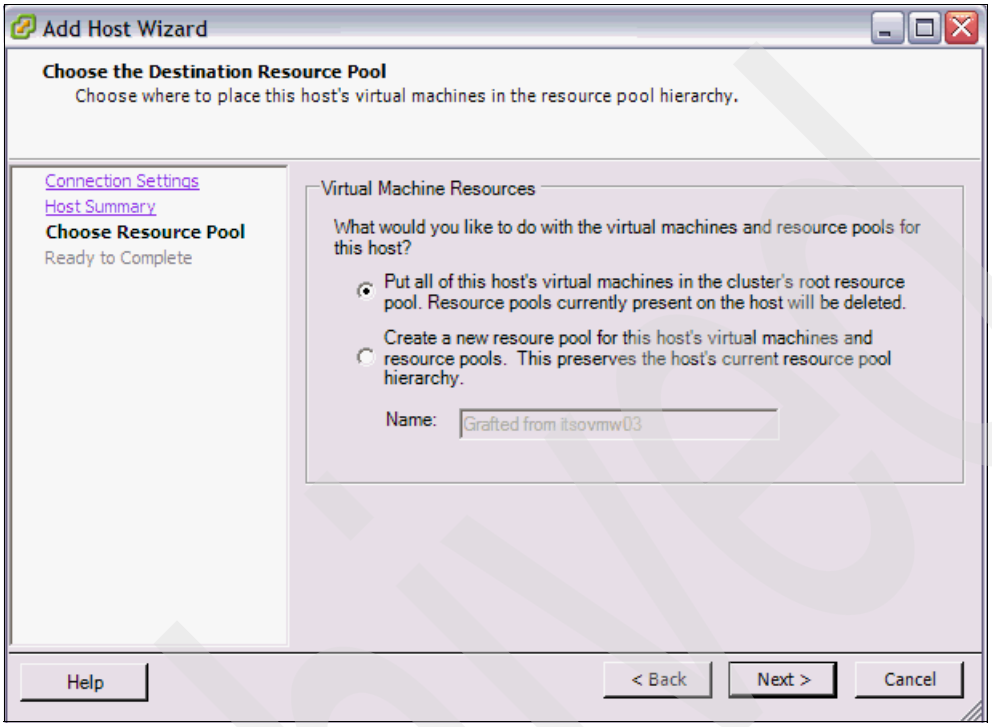

Figure 3-60 Add host wizard resource pool configuration

5. The configuration of the new host is now complete, as shown in Figure 3-61. Review the summary information and click **Finish** to add the host to the cluster.

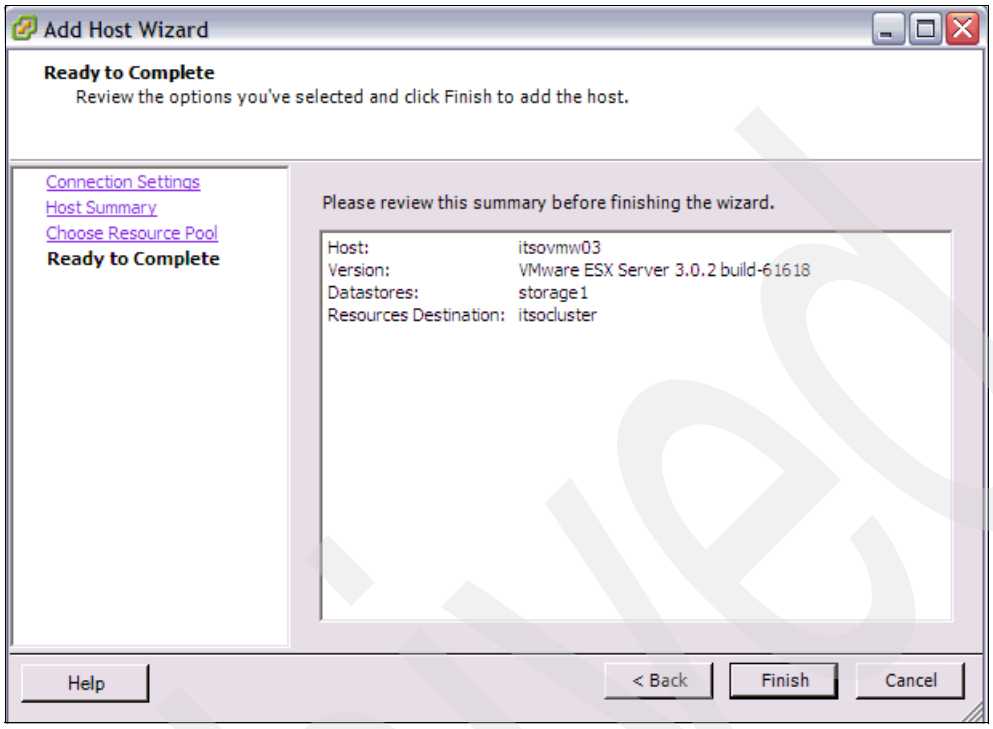

Figure 3-61 Add host wizard ready to complete

6. Figure 3-62 shows the VirtualCenter inventory after the host has been added to the cluster. Notice that a VMware HA configuration error is being reported, since we have not fully configured for HA as yet.

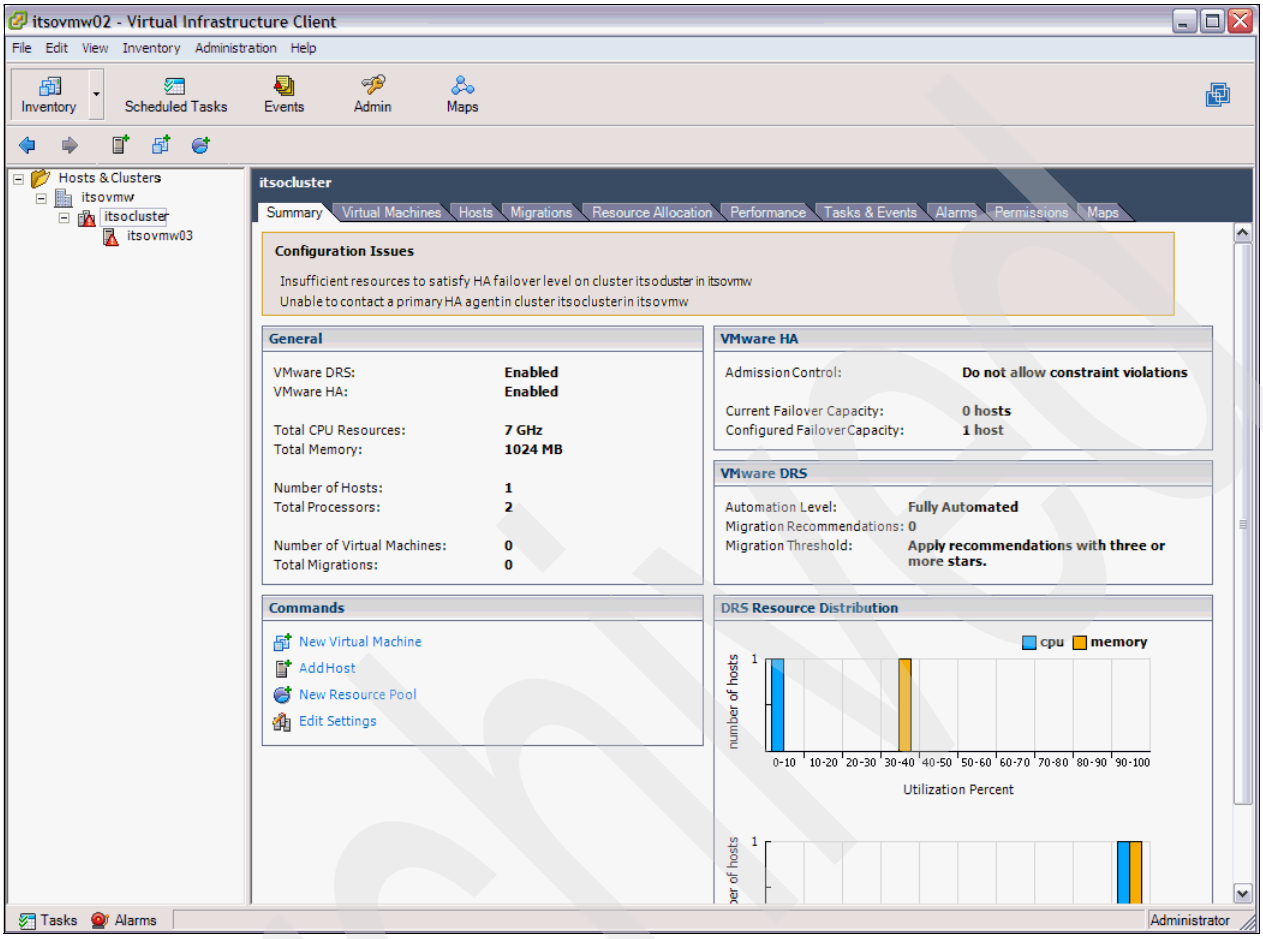

Figure 3-62 VMware Infrastructure Client displaying VirtualCenter inventory post-add

3.4.3 Adding multipath I/O to the ESX Servers for redundancy

Perform the steps in this section if you would like to add storage paths to the ESX Servers. These redundant paths require additional hardware over and above that required for a basic configuration, but provides an additional method of ensuring high availability on the individual ESX Server.

Note: Configuring additional HBAs in the x86 hardware will affect the reconfiguration that you will need to do to activate a hot-spare server. You will need to consider this before adding multipath I/O to your environment.

To achieve complete redundancy, you will need a completely separate path from the x86 hardware back to the System i. This will require at least one additional iSCSI HBA in the System i partition, and at least one additional HBA in the blade server (or System x). This HBA might already be installed if the original HBA used was one port of a dual port adapter, as is the case with a blade server. Also, an additional switch is required. On a BladeCenter, if you are already using a switch in I/O bay 3, you will need a switch in I/O bay 4 for multipath. On System x, a separate external gigabit switch would be required. You will need to cable the

System i HBA and your System x HBA to the external switch. On a BladeCenter, you need to cable the System i HBA to the integrated switch. The blade HBA connection is internal to the BladeCenter.

Note: Refer to the *iSCSI Network Planning Worksheets* that you should have filled out prior to doing the basic iSCSI hardware installation for the parameter values that you will need to configure the additional iSCSI HBAs required for multipath I/O. If the worksheet was not previously completed for the additional hardware, you should do that now.

This procedure assumes that the additional System i HBA already has a corresponding Network Server Host (NWSH) adapter created. Repeat these steps for each ESX Server to which you wish to add multipath. The procedure starts out using System i Navigator:

1. Shut down the integrated server running ESX Server.
   a. Expand **Integrated Server Administration**.
   b. Click **Servers**.
   c. Right-click the server name and select **Shut Down** from the list (Figure 3-63).

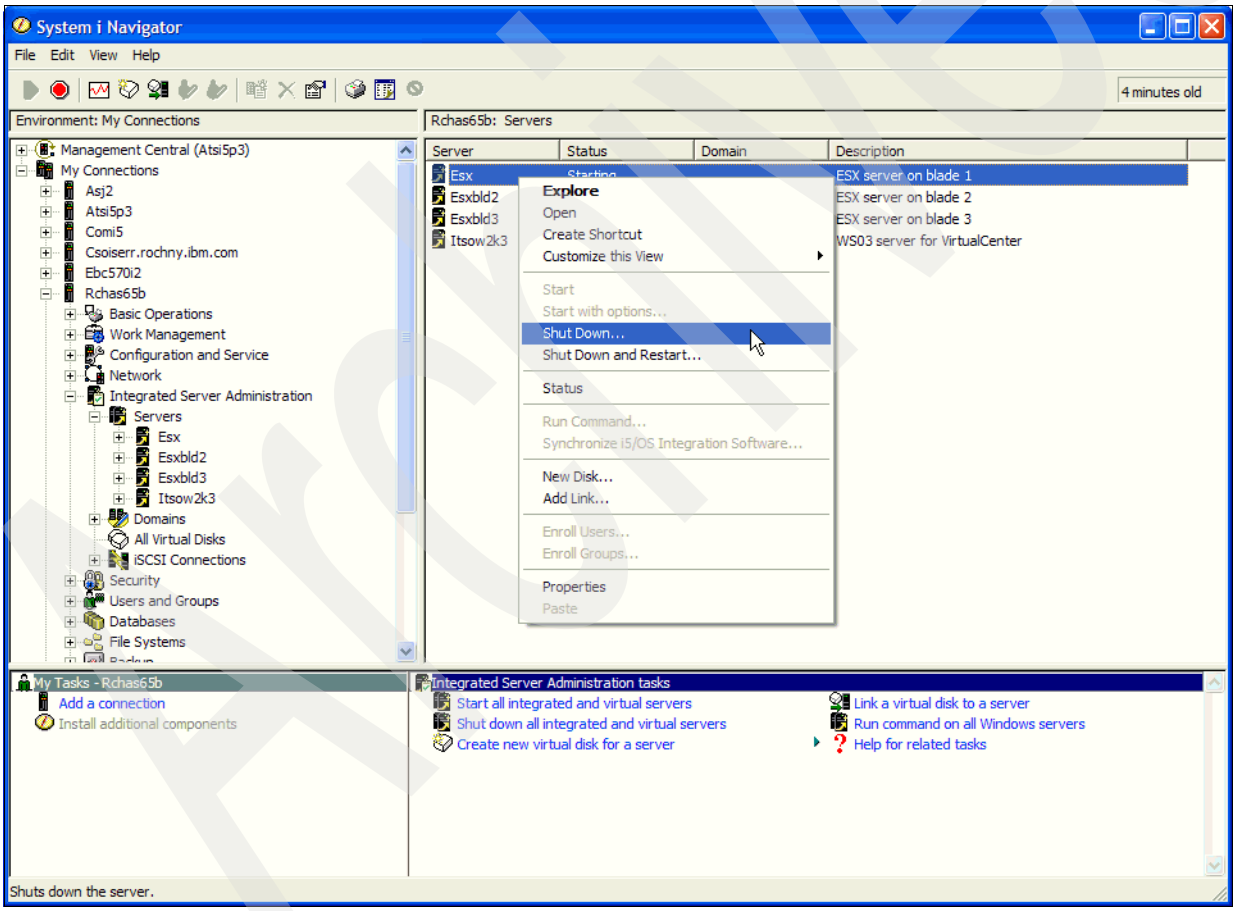

Figure 3-63 System i Navigator showing integrated server shutdown

d. Confirm the shutdown request by clicking the **Shut Down** button, as shown in Figure 3-64.

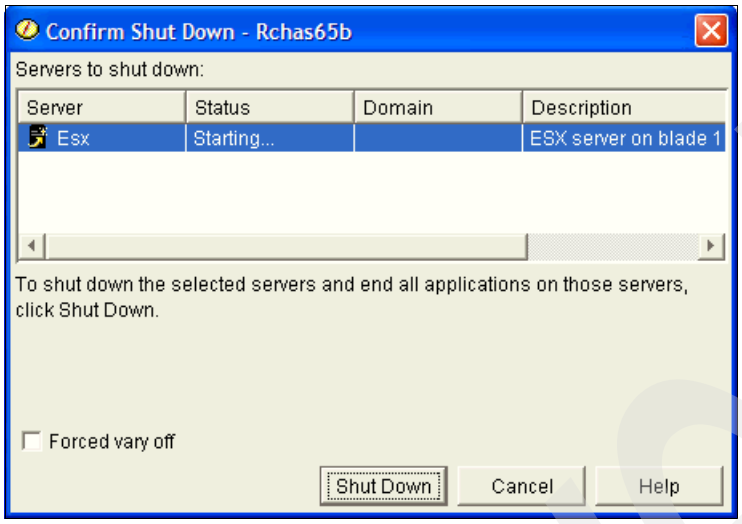

Figure 3-64 Confirm shutdown window

2. Set up the second storage path on the integrated server and create the multi-path group.
   a. Expand **Integrated Server Administration**.
   b. Click **Servers**.

c. Right-click the server name and select **Properties** from the list, as shown in Figure 3-65.

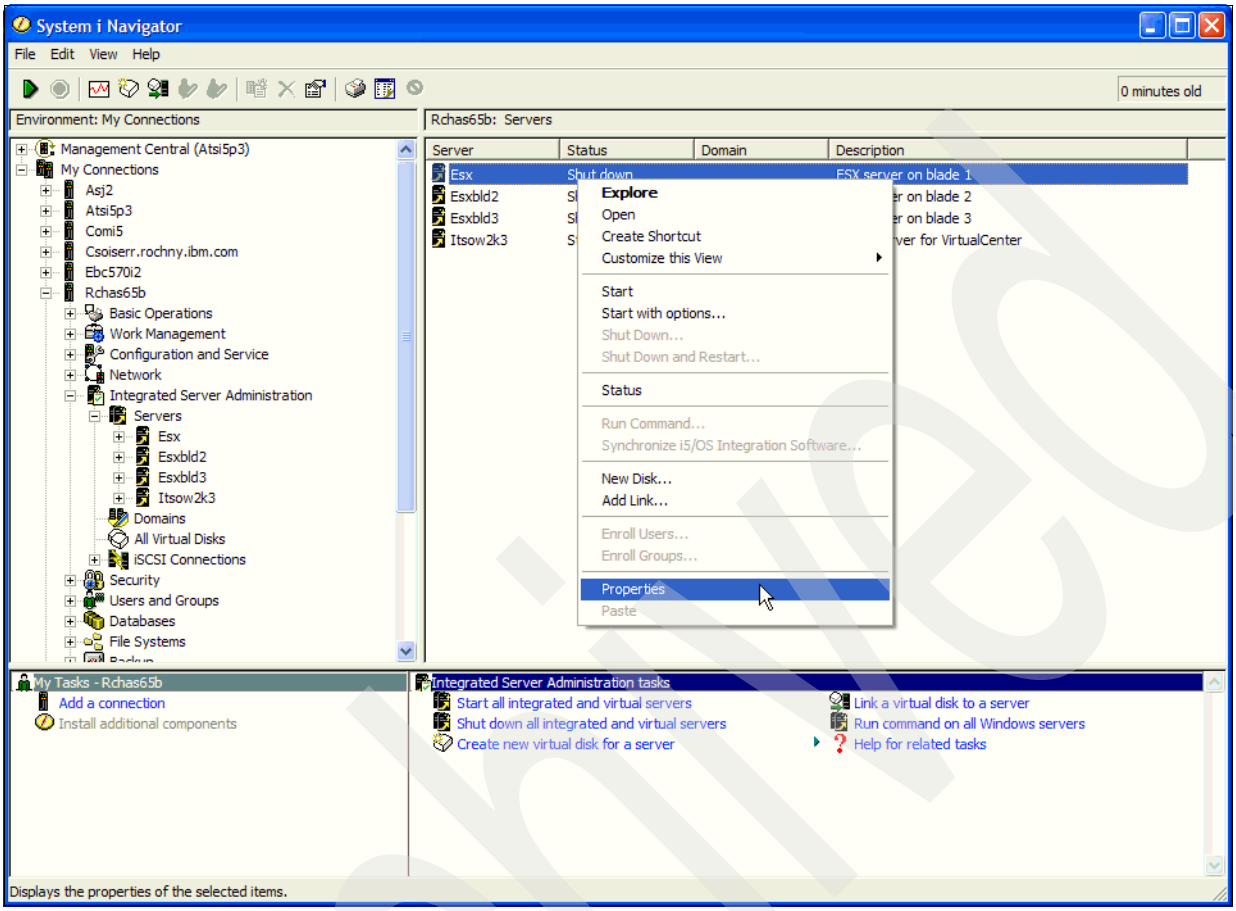

Figure 3-65 System i Navigator integrated server properties selection

d. Click the **Storage Paths** tab.

e. If there are not two storage paths present in the table (shown in Figure 3-66):

i. Click the **Add** button.

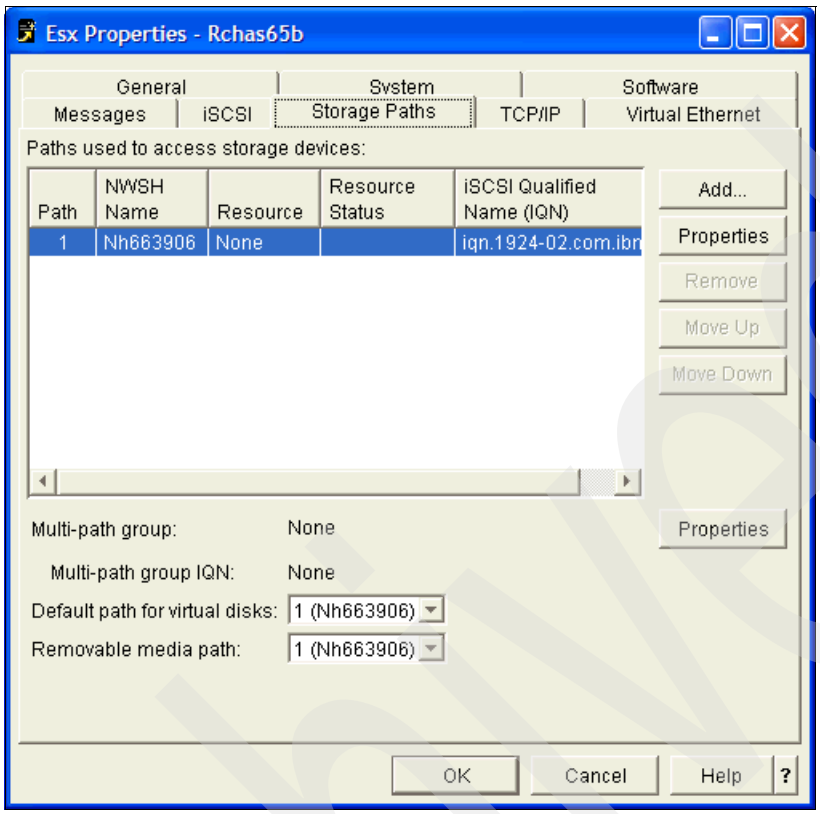

Figure 3-66 Integrated server storage paths window

ii. Select the NWSH to use for the storage path (Figure 3-67). This will be a different one from the one that the already defined storage path uses. Click **OK**.

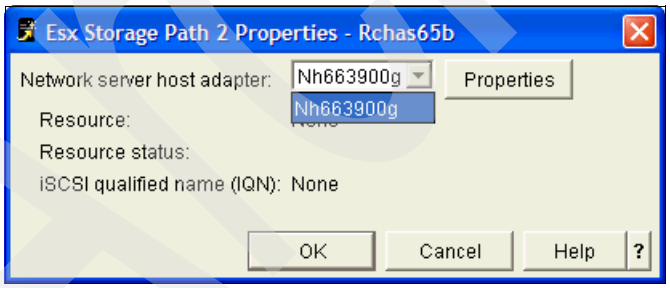

Figure 3-67 Storage path 2 properties

f. Click the **Properties** button for the multi-path group, located below the storage paths table.

g. Select the defined storage paths as members of the multi-path group and click **OK** to create the multipath group (Figure 3-68).

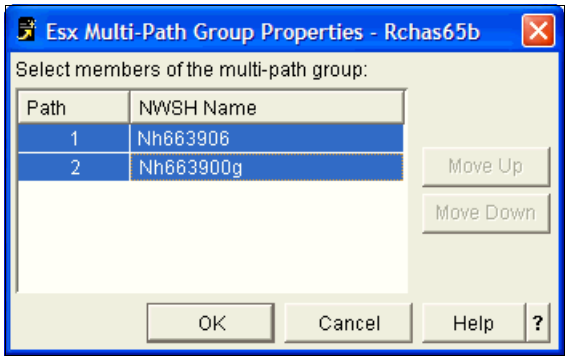

Figure 3-68 Multi-path group properties

h. Select the multi-path group as the default storage path and click **OK** to save the changes (Figure 3-69).

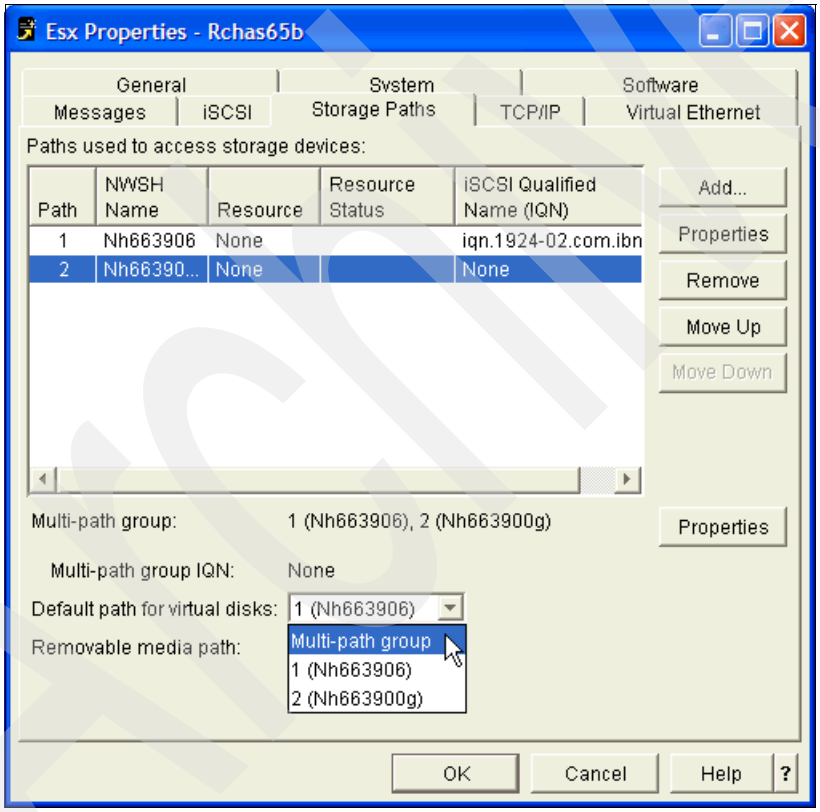

Figure 3-69 Selecting default storage path

3. Verify that the integrated servers disks are all linked through the default path (which is now the multi-path group just created).
   a. Expand the integrated server's name.
   b. Click **Linked Virtual Disks**.

c. Look at the Storage Path column (Figure 3-70). Verify that the path is Default. If not, the disk will need to be unlinked and relinked.

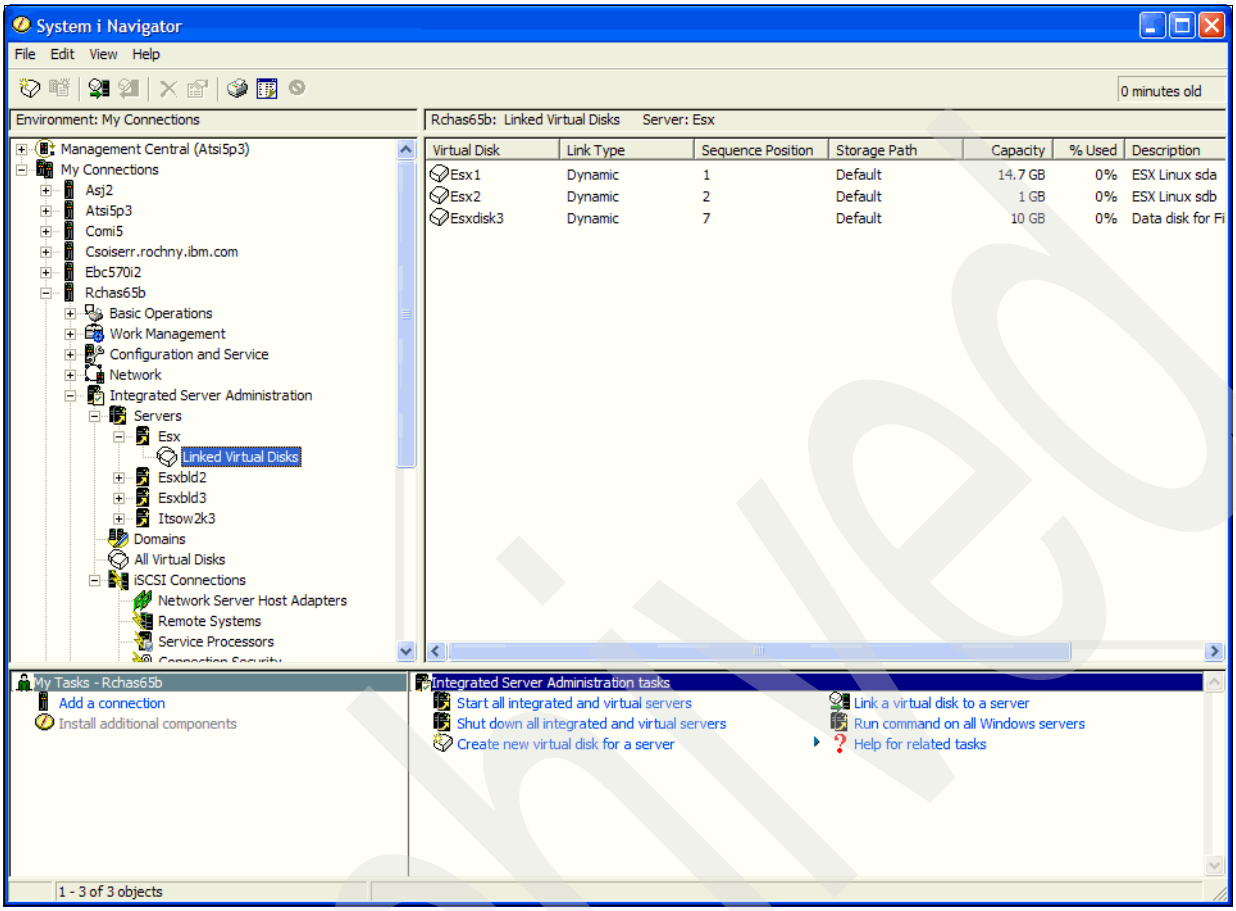

Figure 3-70 Linked disks window

Note: Figure 3-70 shows the remove link/add link procedure being run against a disk with the default path for demonstration purposes only. A disk with the default path would not need to have this procedure performed.

i. Right-click the integrated server and select **Remove Link,** as shown in Figure 3-71.

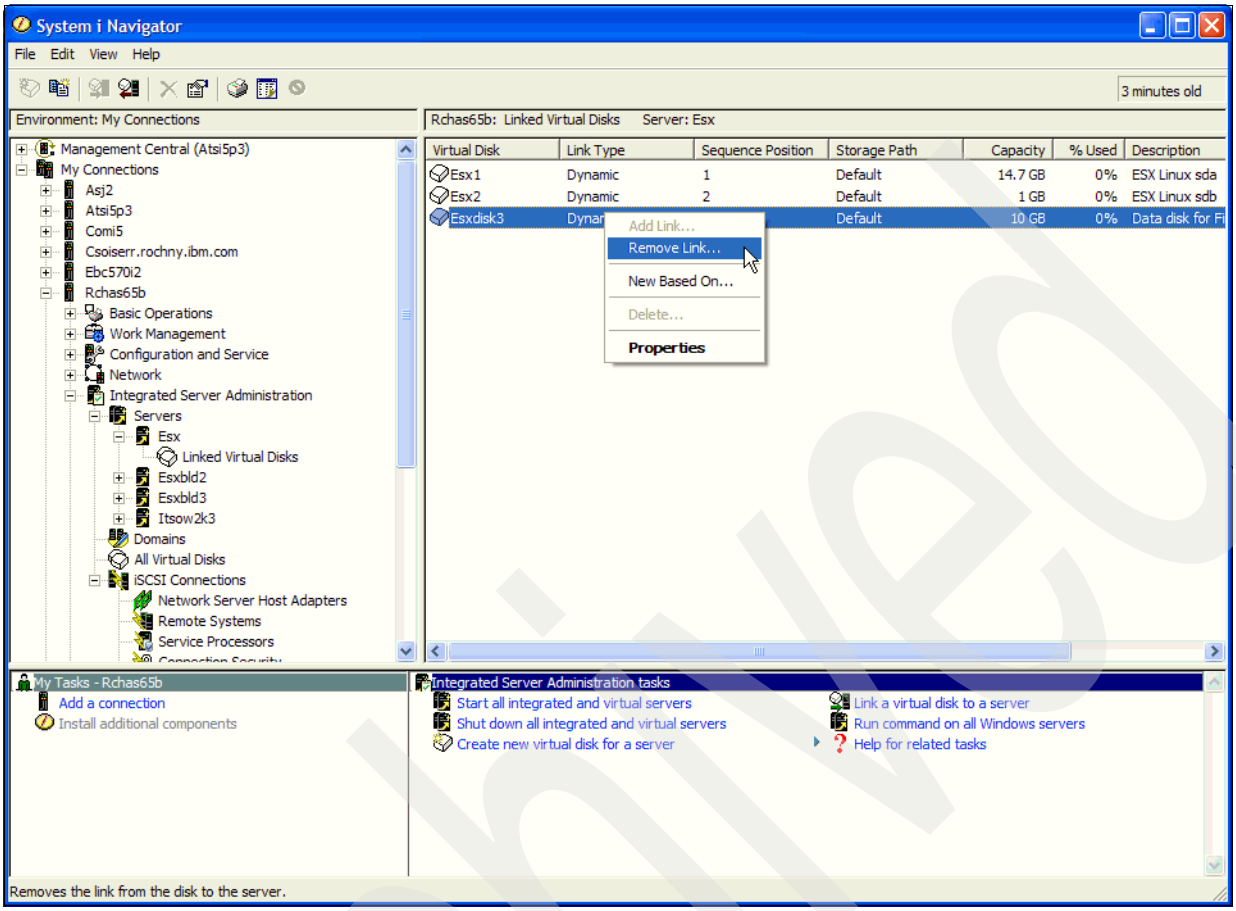

Figure 3-71 Select remove link for a disk

ii. Click **Remove** (Figure 3-72).

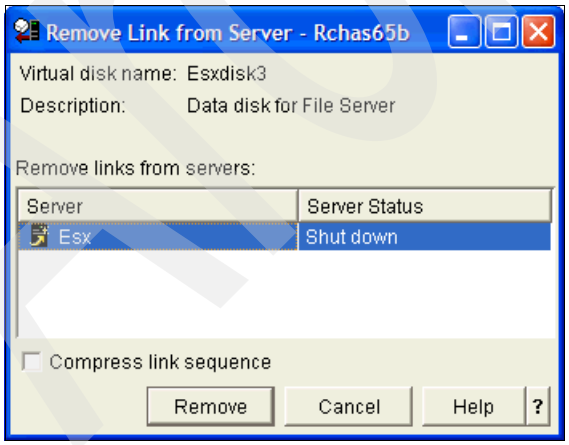

Figure 3-72 Remove link from server dialog box

iii. Click **All Virtual Disks** under Integrated Server Administration.

iv. Right-click the disk and select **Add Link**, as shown in Figure 3-73.

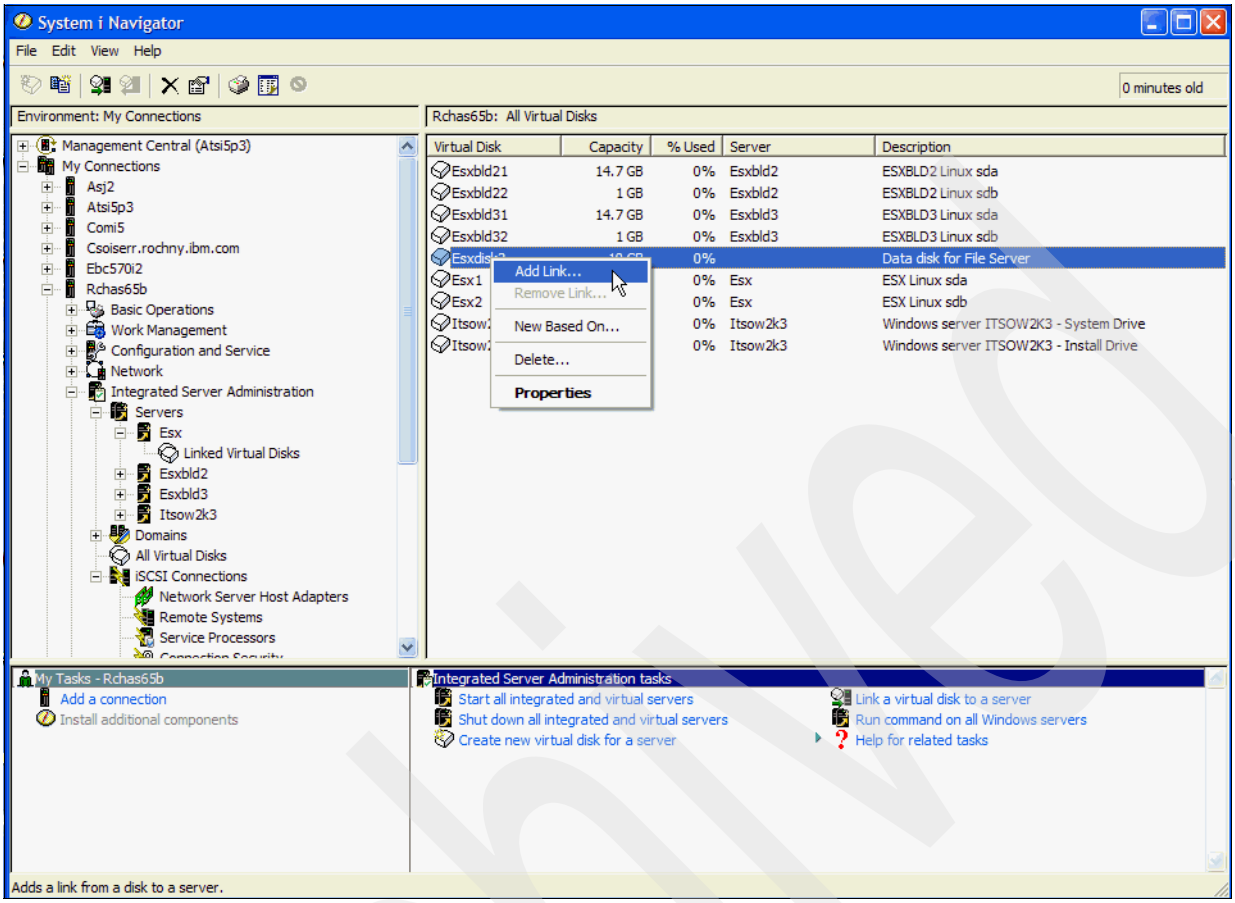

Figure 3-73 Adding a link to a virtual disk

v. Select the Default or Multi-path group storage path, as shown in Figure 3-74.

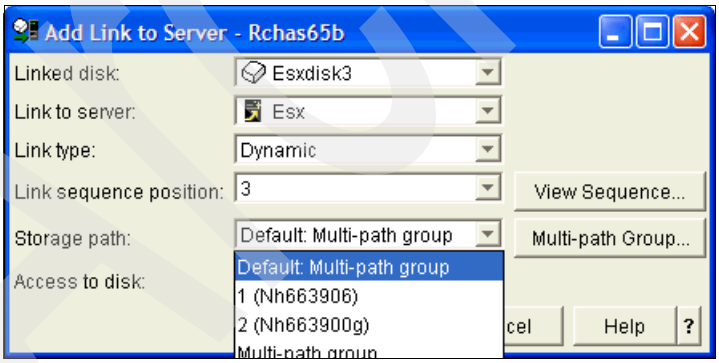

Figure 3-74 Add link properties window

4. Configure the additional iSCSI HBA in the blade server (or System x) in the Remote System configuration object for the ESX Server.

   a. Expand **Integrated Server Administration**. Expand **iSCSI Connections** and click **Remote Systems**. Right-click the remote system configuration object associated with the integrated server (Figure 3-75) and select **Properties**.

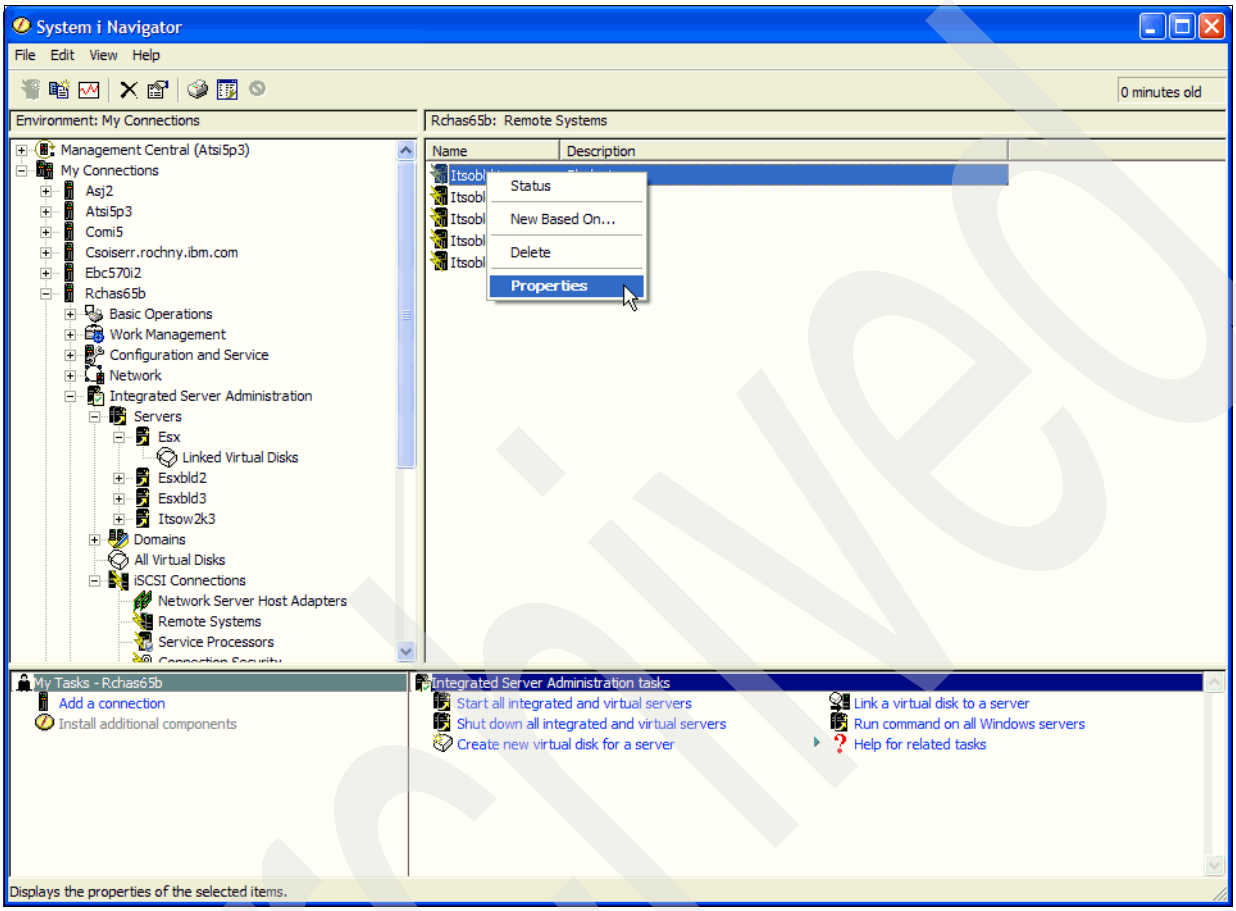

Figure 3-75 Selecting remote system properties

   b. Select the **Remote Interfaces** tab.

c. The remote interfaces are shown in Figure 3-76. If you previously configured the additional interfaces when you configured the first interface, you will see additional interfaces shown on this window. You will need to add an additional interface if only one is shown.

   i. Click the **Add** button.

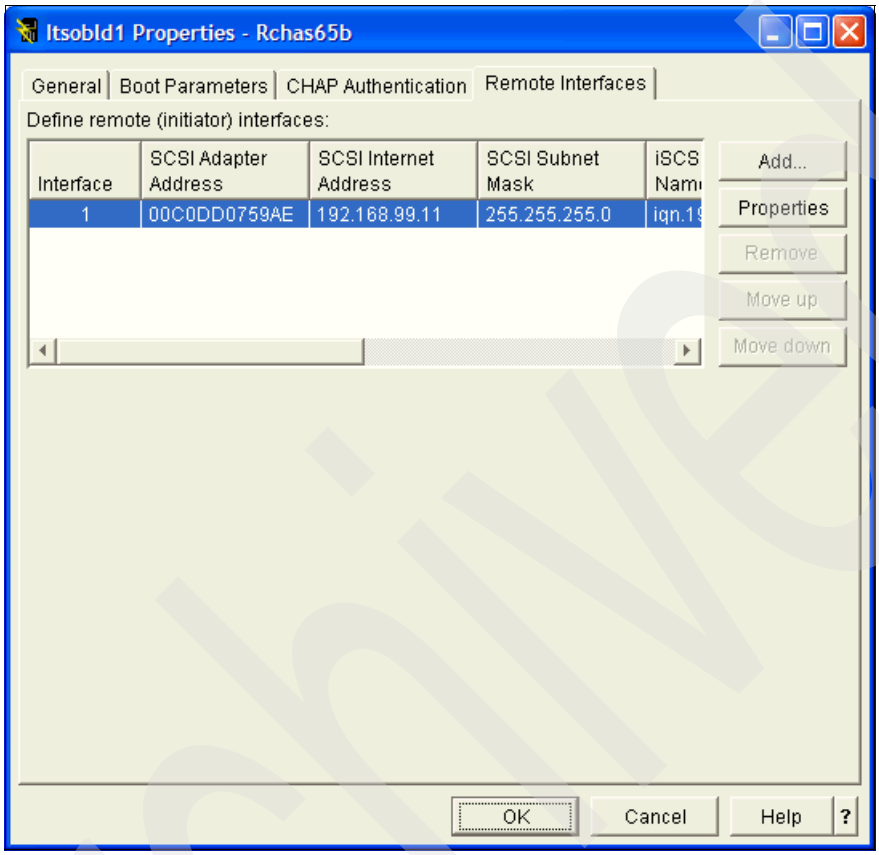

Figure 3-76 Remote system remote interfaces

ii. Refer to Figure 3-77. Enter the MAC address, Internet (IP) address, and subnet mask for both the SCSI (top of window) and the LAN (bottom of window) interfaces. Select **Generate an iSCSI qualified name**.

> **Note:** The values above should be obtained from the iSCSI Network Planning Worksheets that you should have filled out earlier. Refer to the *Plan the iSCSI Network* step of the *iSCSI install read me first* Web site for more information:
>
> http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/readme

Click **OK** when complete.

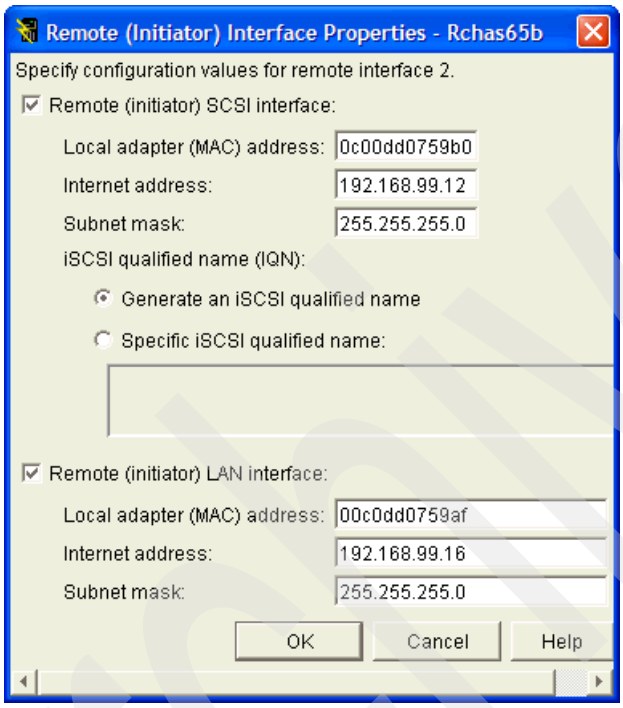

Figure 3-77 Entering the remote interface properties

iii. Figure 3-78 shows the next window displayed. Note that the second interface is now shown. Click **OK**.

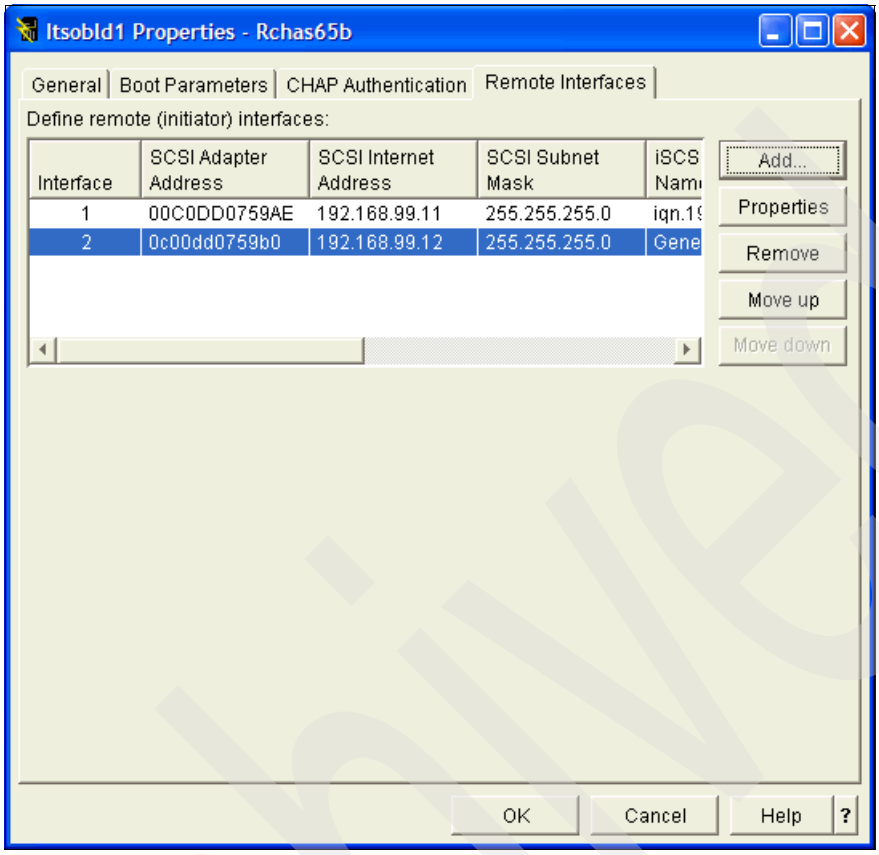

Figure 3-78 Remote interfaces

d. Verify that the remote interface information matches your *iSCSI Network Planning Worksheets*, since you will be using this information when you configure the VMware ESX Server for multipath.

i. Right-click the remote system object name and select **Properties**.

ii. Click the **Remote Interfaces** tab.

iii. Select the first interface (Figure 3-79) and click **Properties**.

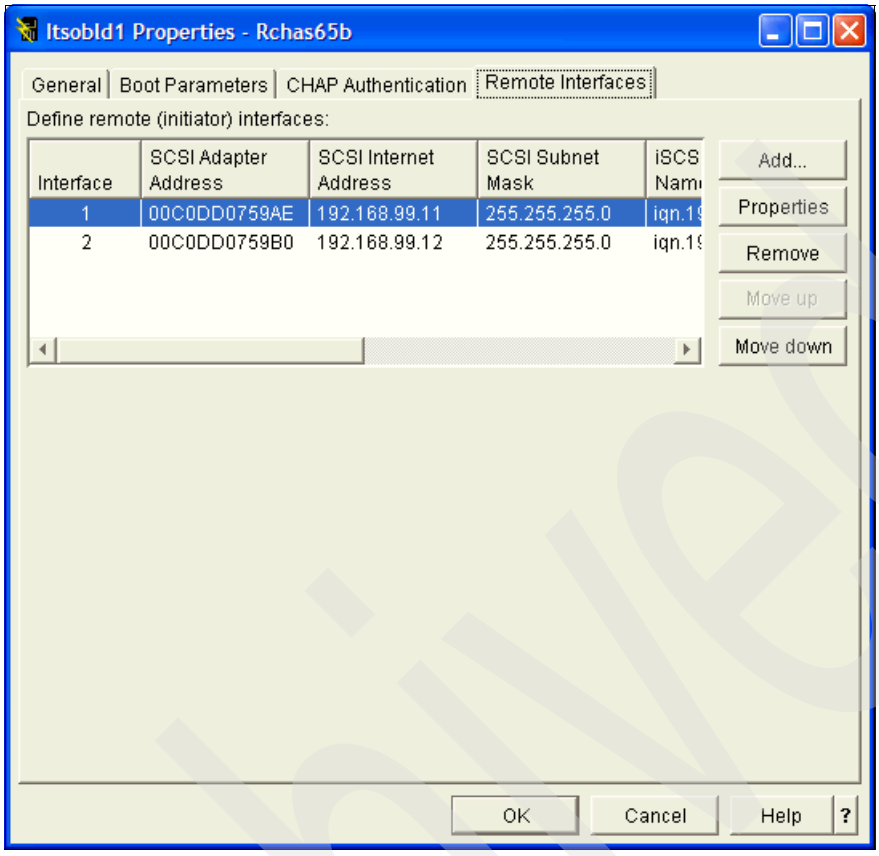

Figure 3-79 Remote interfaces window

iv. Verify the information shown in Figure 3-80 with the *iSCSI Network Planning Worksheets*, items RS12 through RS18. Be sure to record the specific iSCSI qualified name information in item CQ6 in the worksheets, since you probably let i5/OS generate that and have not previously recorded that information in your worksheets. Note that multiple ports on the same iSCSI HBA can have the same specific iSCSI qualified name, even though worksheet item CQ6 might imply that they must be different.

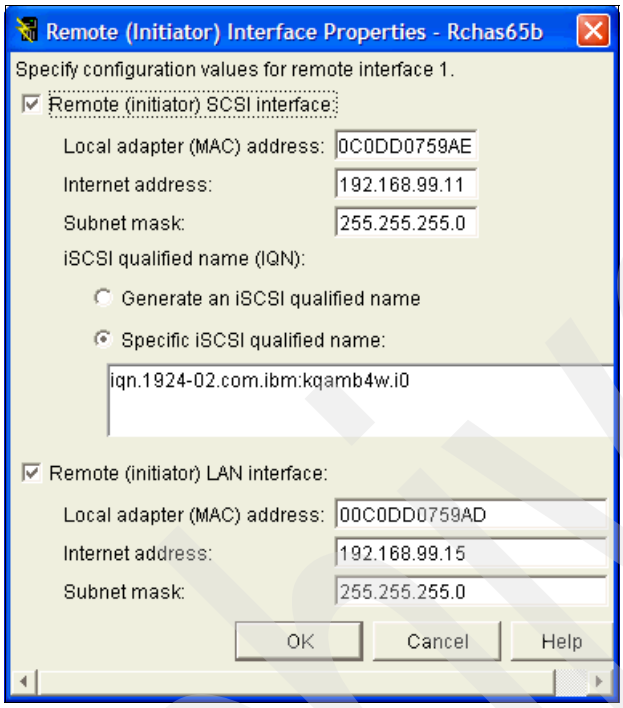

Figure 3-80 Displaying remote system properties

v. Click **Cancel** to return to the remote interfaces window.

vi. Repeat the three prior steps for each defined interface.

5. Right-click the integrated server name, as shown in Figure 3-81, and select **Start** to restart the server.

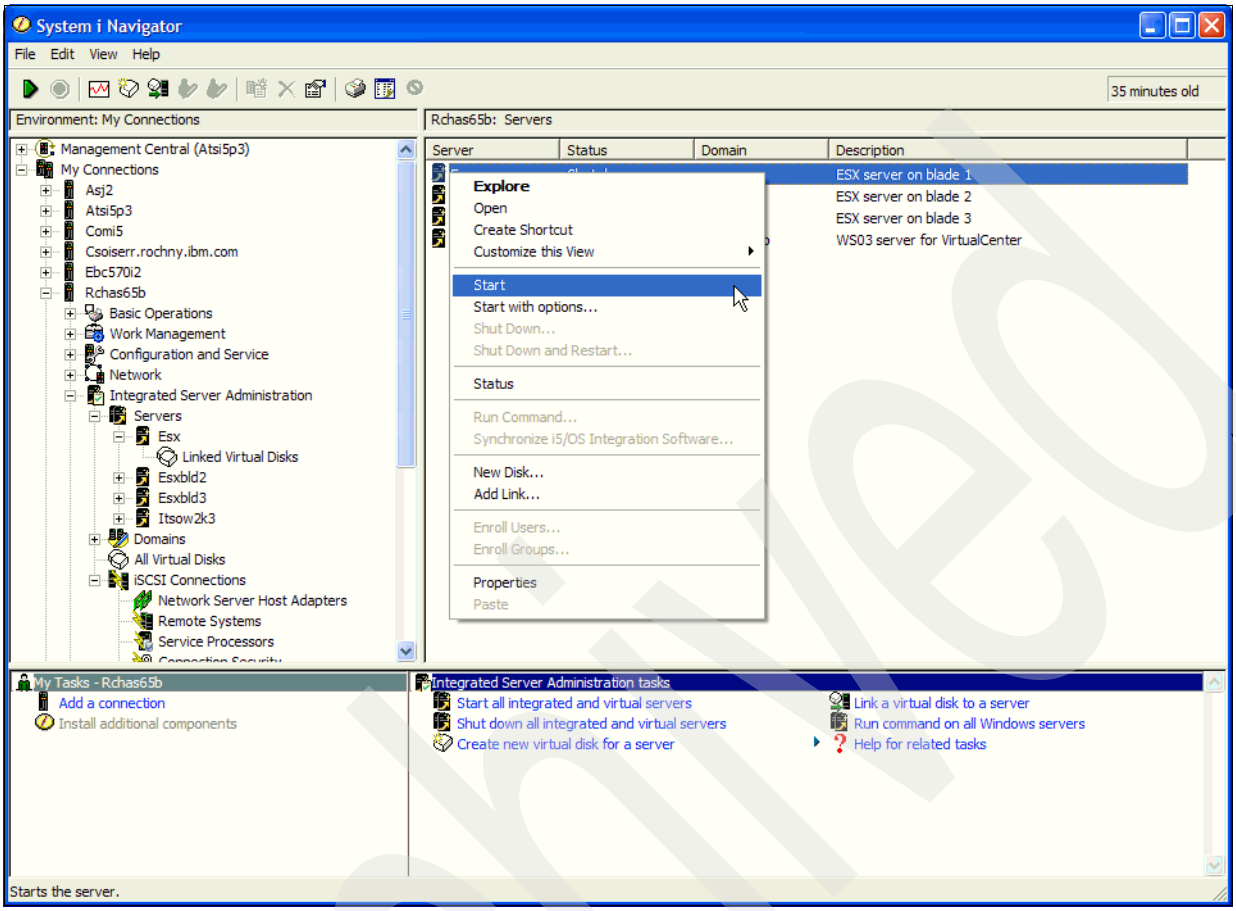

Figure 3-81 Starting the integrated server

The following steps are performed on the VMware Infrastructure Client connected to VirtualCenter Server. From the Inventory window:

1. Expand the root folder (**Hosts & Clusters**). Expand the data center (**itsovmw**). Expand the cluster (**itsocluster**). Select the ESX Server name (Figure 3-82).

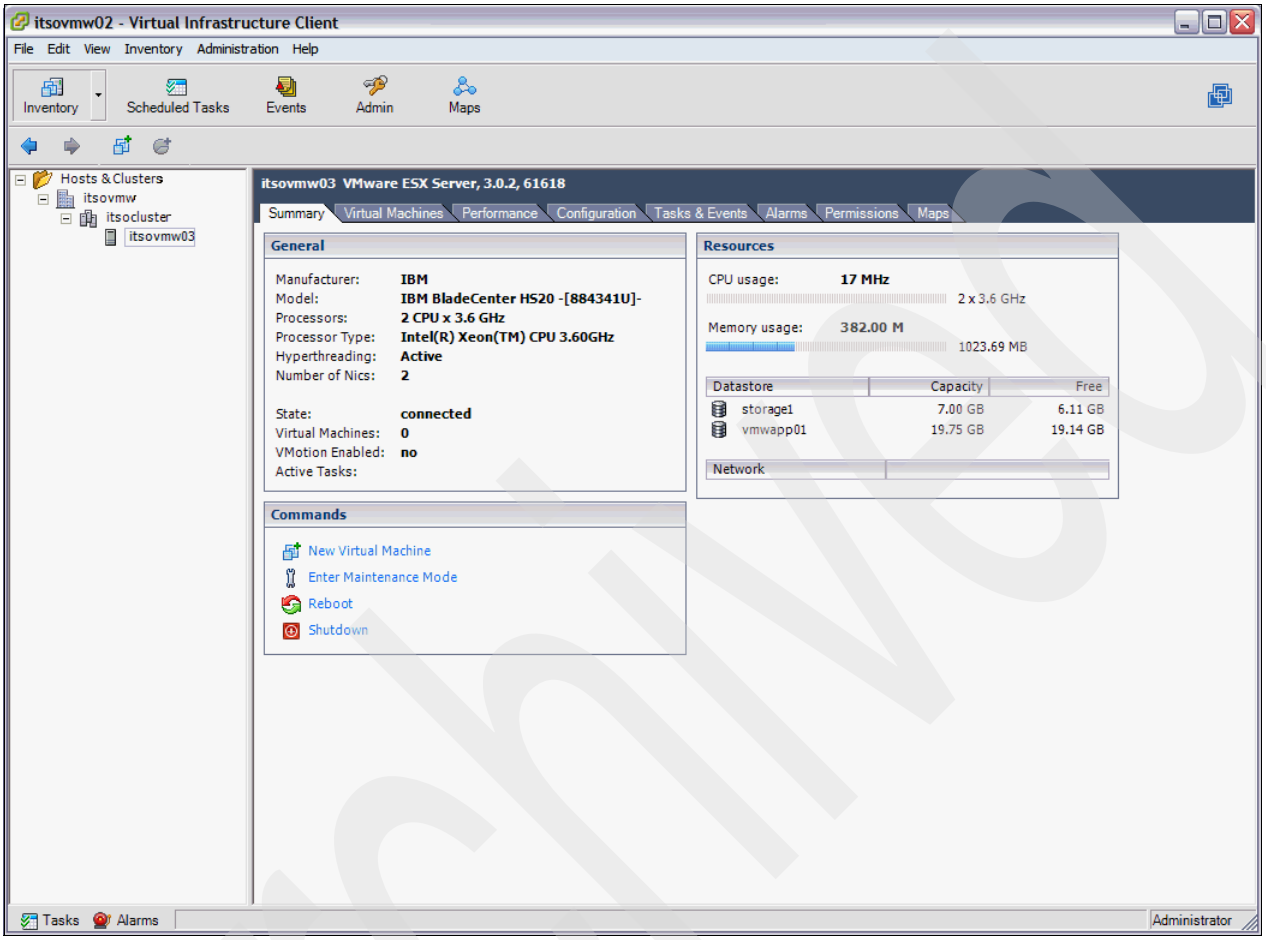

Figure 3-82 VirtualCenter inventory summary window

2. Click the **Configuration** tab (Figure 3-83).

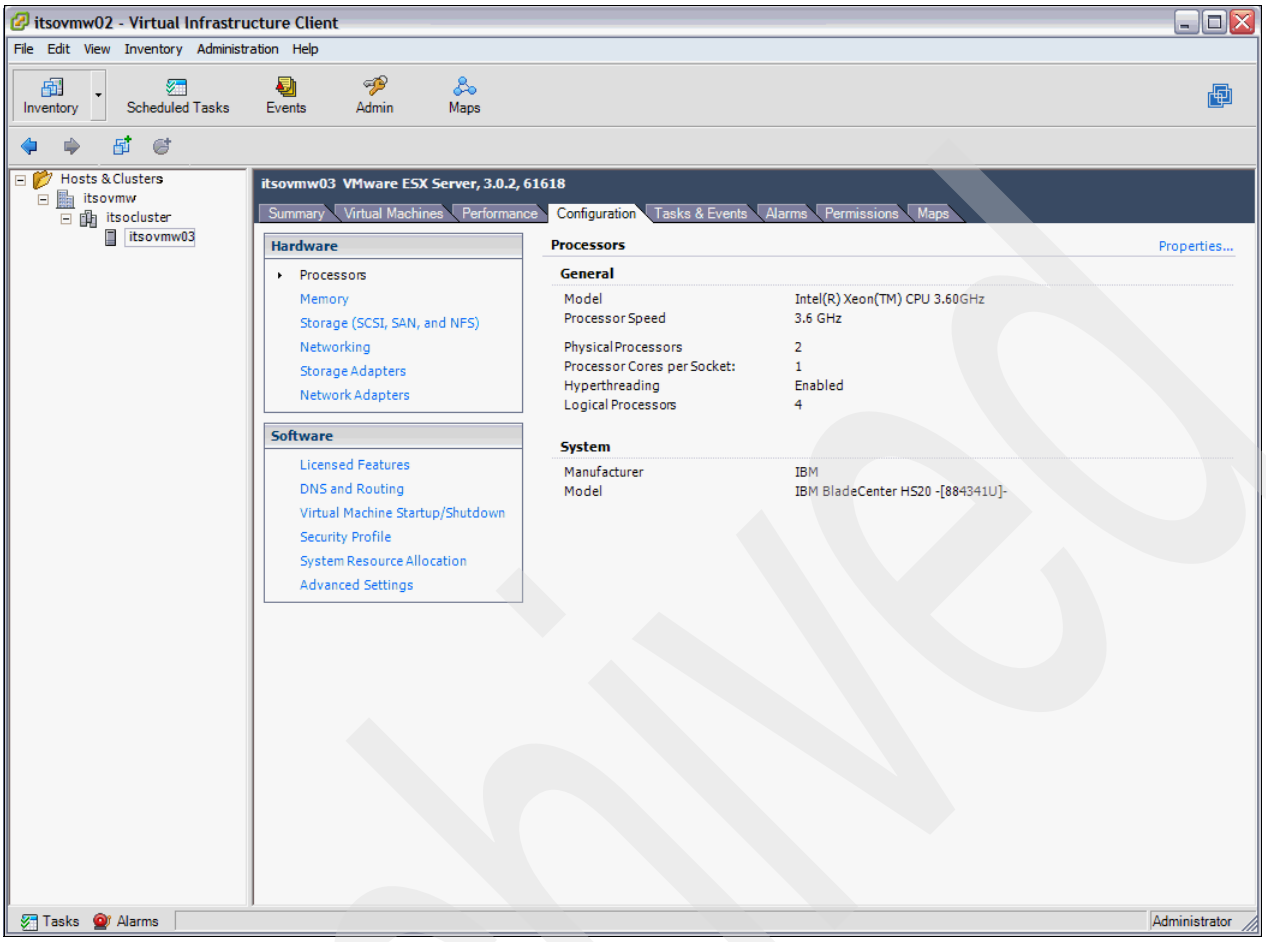

Figure 3-83 VirtualCenter inventory processor configuration window

3. Click **Storage Adapters**.

4. Look for the list of iSCSI adapters in the window shown in Figure 3-84 under the QLA4022 heading. This should show the initiator HBAs present in the x86 server. You will need to configure these adapters so that they match the information in the i5/OS *Remote System Configuration Object Worksheet* from the *iSCSI Network Planning Worksheets*.

   a. Select the initiator adapter to be configured. This will display the adapter details in the lower right quadrant of the window under the Details heading. Click **Properties** (in the upper right corner of the Details display area—circled in Figure 3-84).

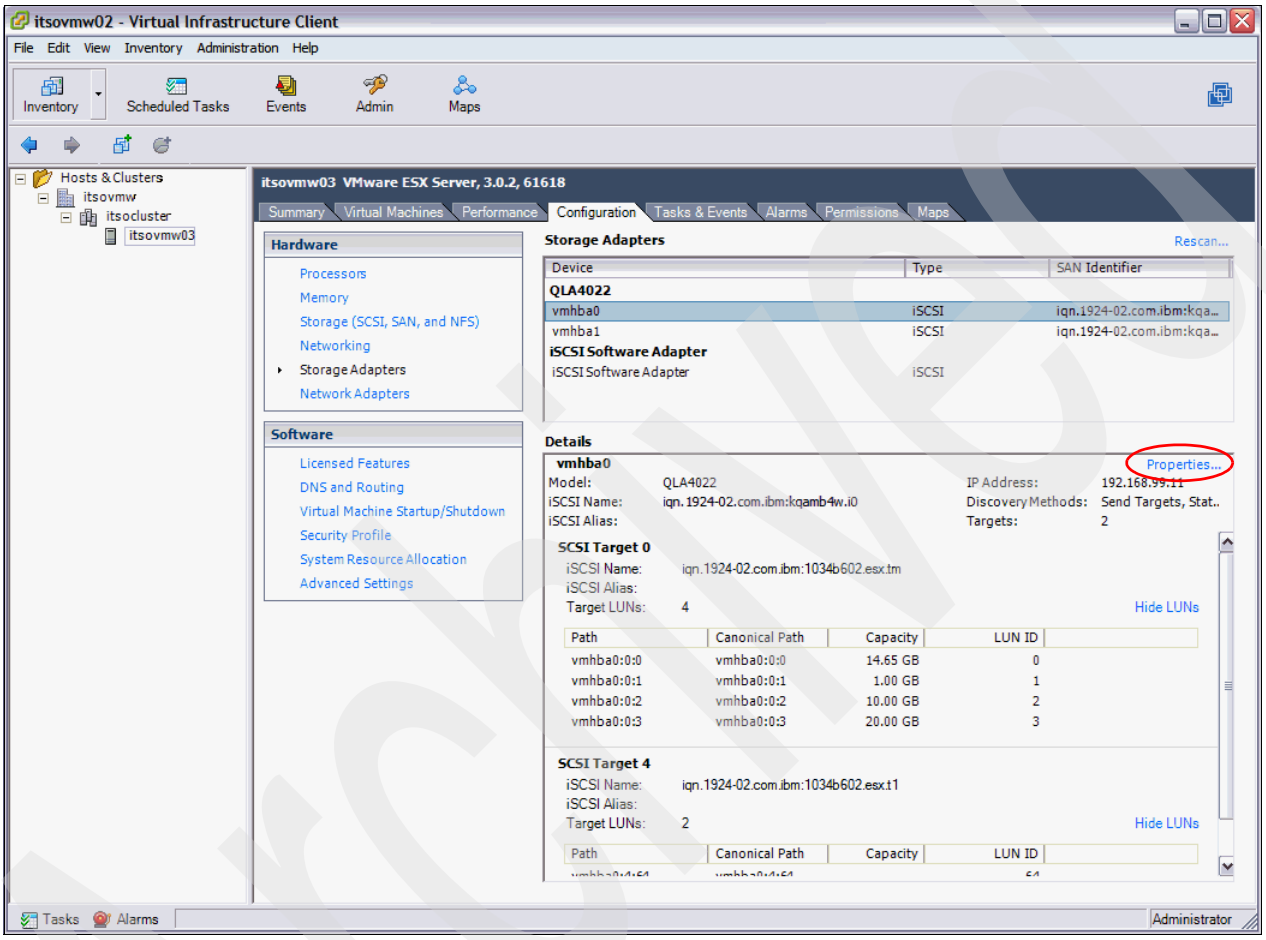

Figure 3-84 VirtualCenter inventory storage adapters configuration window

b. Note the MAC address on the General tab, and match that to one of the MAC addresses from your *iSCSI Network Planning Worksheets* (item RS11). Use the information from the worksheets for that MAC address to fill in the fields on the next window.

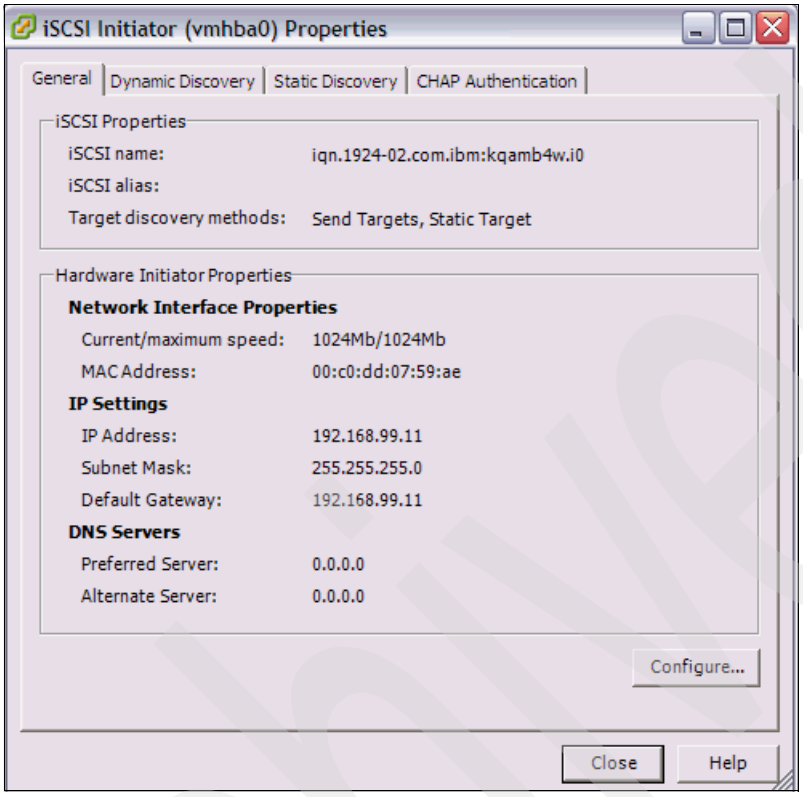

Figure 3-85 General iSCSI HBA properties

c. Click **Configure**.

d. As shown in Figure 3-86, enter the iSCSI name (worksheet item CQ6). Make sure that **Use the following IP settings** is selected and enter the IP address (item RS12) and subnet mask (item RS13). Enter the same value for the default gateway as you did for the IP address, which signifies that there is no gateway. Click **OK** to save the changes.

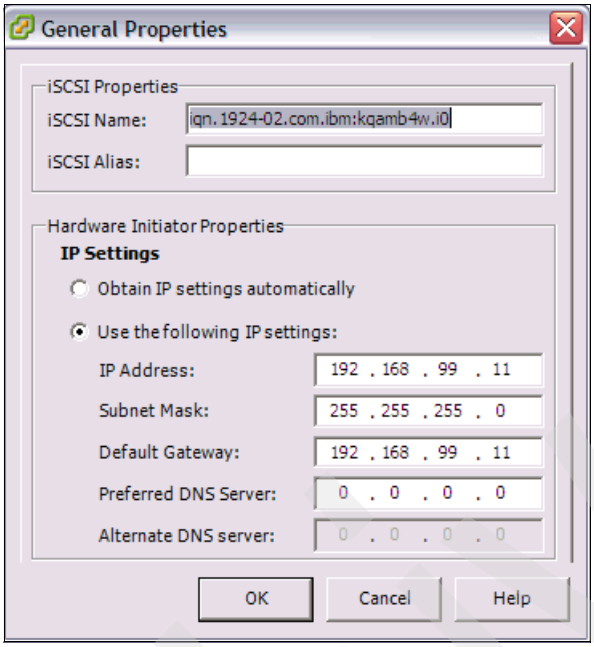

Figure 3-86 Configure general iSCSI HBA properties

e. Select the **Dynamic Discovery** tab.

f. Click **Add** (Figure 3-87).

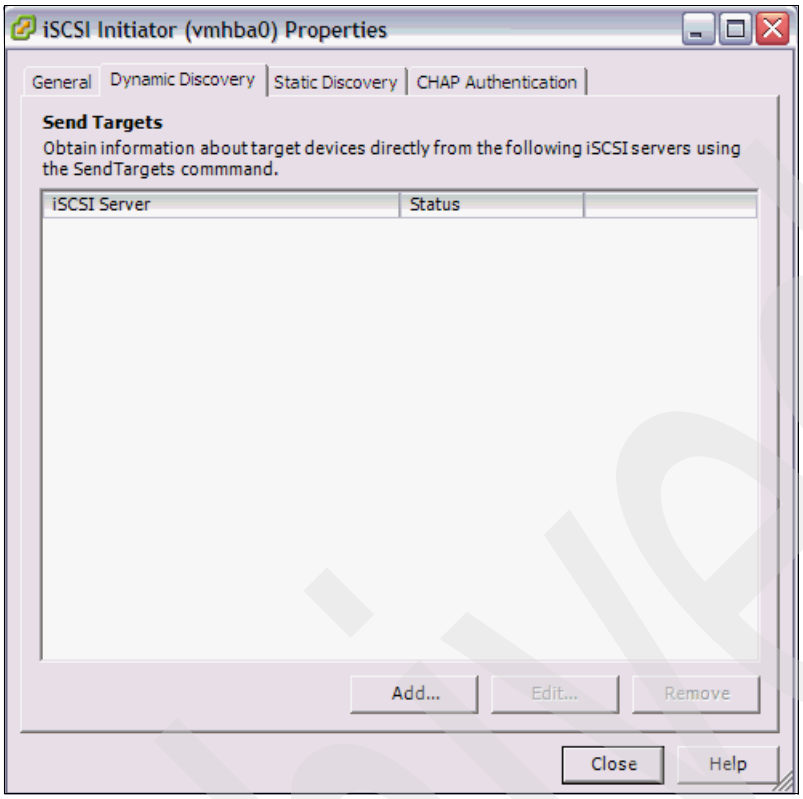

Figure 3-87 iSCSI properties - dynamic discovery

g. Refer to the *iSCSI Network Planning Worksheets* item NH5 for one of the Network Host Adapters in the multipath group. Type this value in the iSCSI Server field, as shown in Figure 3-88. Click **OK** to save the changes.

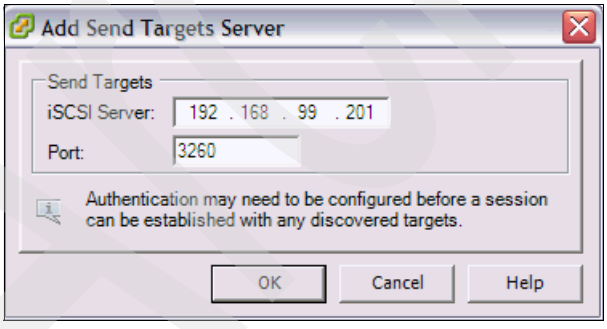

Figure 3-88 Add targets window

h. Repeat the previous two steps until all the IP addresses of all the Network Host Adapters in the multipath group have been added. The window displayed should look something like Figure 3-89 when complete.

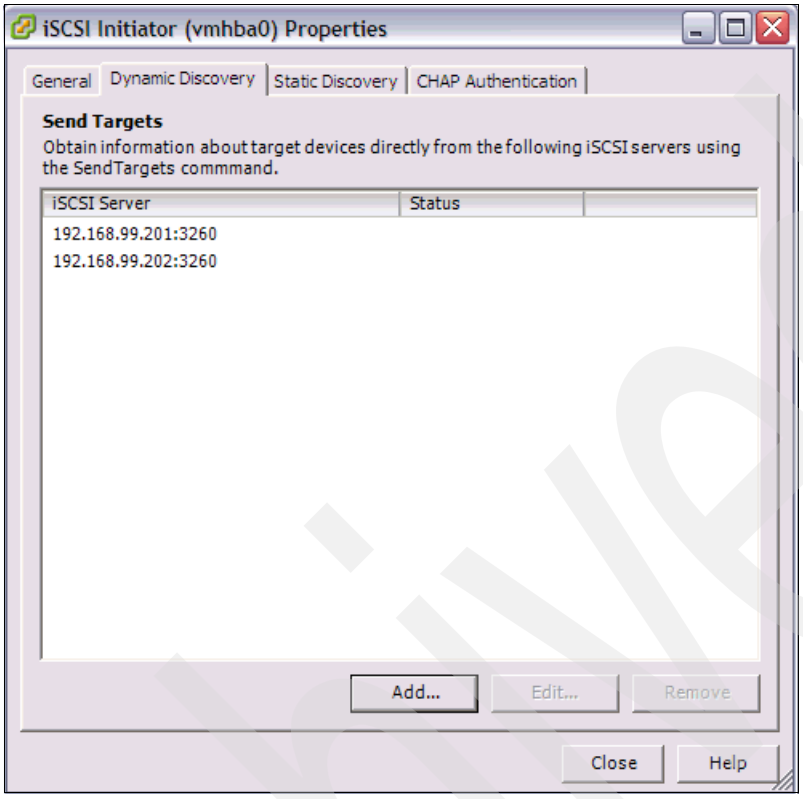

Figure 3-89 iSCSI properties - dynamic discovery

i. Click **Close**.

j. Select the next adapter and repeat the process above until all adapters have been configured.

k. After all adapters are complete, click **Rescan** in the upper-right corner of the Storage Adapters section of the window.

l. Click **OK** (Figure 3-90) on the rescan dialog box. When complete, the rescan should show the LUNs in the lower portion of the window for the newly configured adapter.

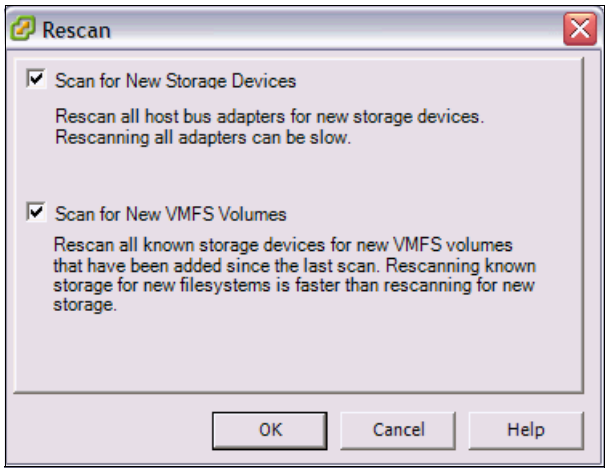

Figure 3-90 Rescan dialog box

5. The ESX Server is now configured for multipath. Repeat the steps in this section for all ESX Servers that you wish to configure.

3.4.4 Setting up the licensing for the virtual infrastructure

The license server was installed and configured previously, at the time of the VirtualCenter install. Now the individual ESX Servers must be set up to use the license server. This procedure is performed using VMware Infrastructure Client connected to the VIrtualCenter Server.

1. Expand the root folder (**Hosts & Clusters**). Expand the data center (**itsovmw**). Expand the cluster (**itsocluster**). Select the ESX Server name. Click the **Configuration** tab.

2. Click **Edit**, located to the far right of License Sources (Figure 3-91).

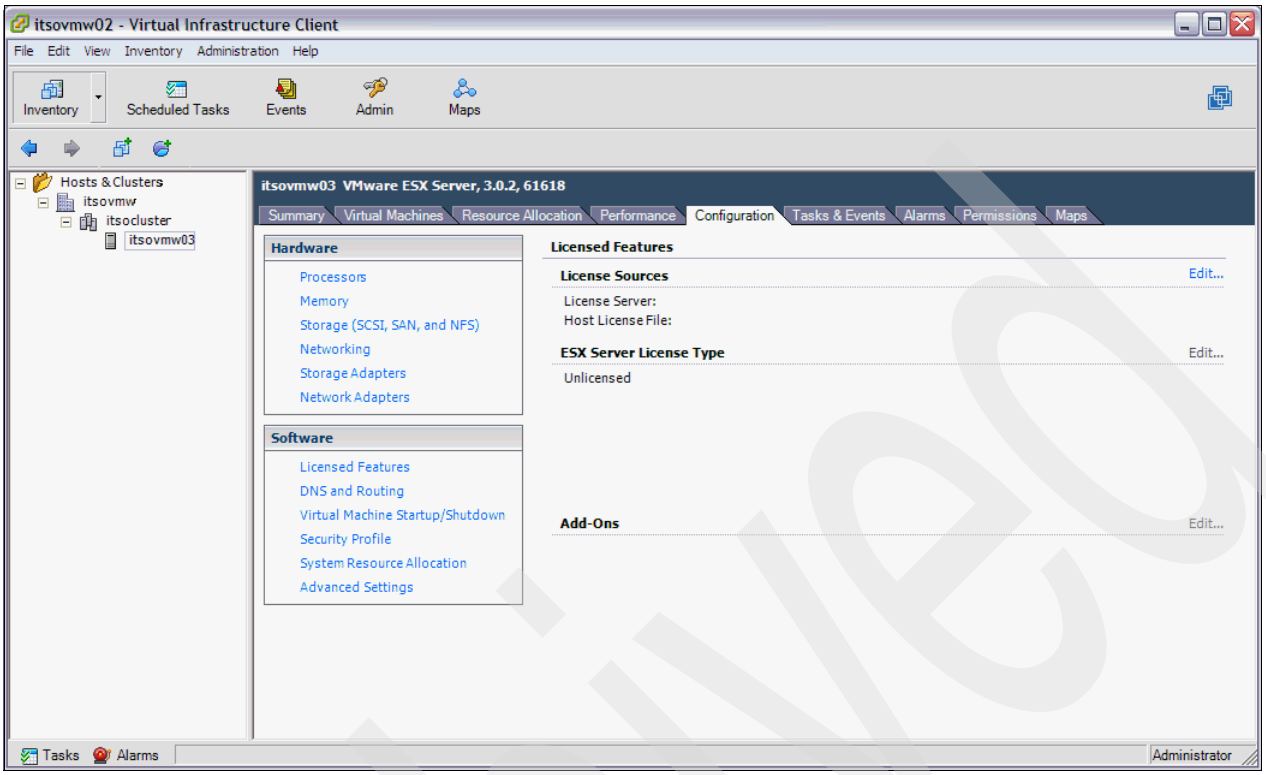

Figure 3-91 Licensed features window

3. Select **Use License Server (recommended)**. Enter the host name of the license server (same as the VirtualCenter Server) in the Address field. Click **OK** (Figure 3-92).

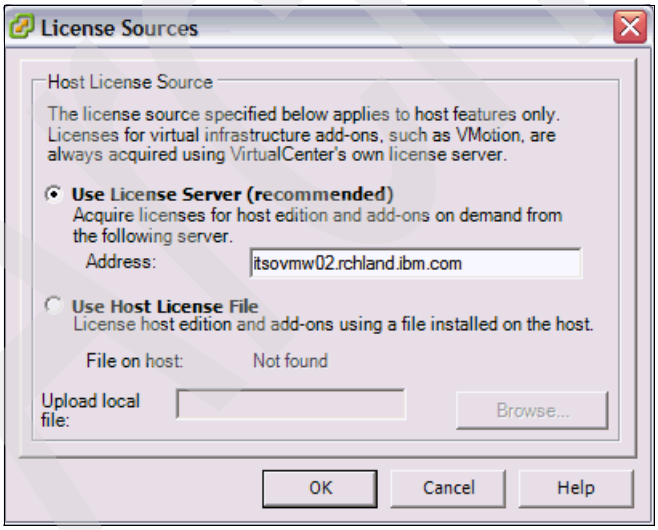

Figure 3-92 Setting up the license sources

4. Click **Edit**—this time the one located to the far right of ESX Server License Type (Figure 3-91).

5. Select **ESX Server Standard**, as shown in Figure 3-93. Click **OK**.

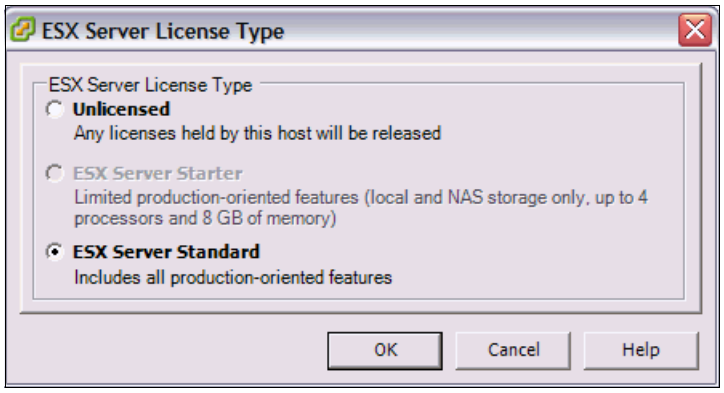

Figure 3-93 Setting the license type

6. Click **Edit**—this time the one located to the far right of Add-Ons (Figure 3-91 on page 92).
7. Click the boxes for features for which you want to enable the license. Click **OK** (Figure 3-94).

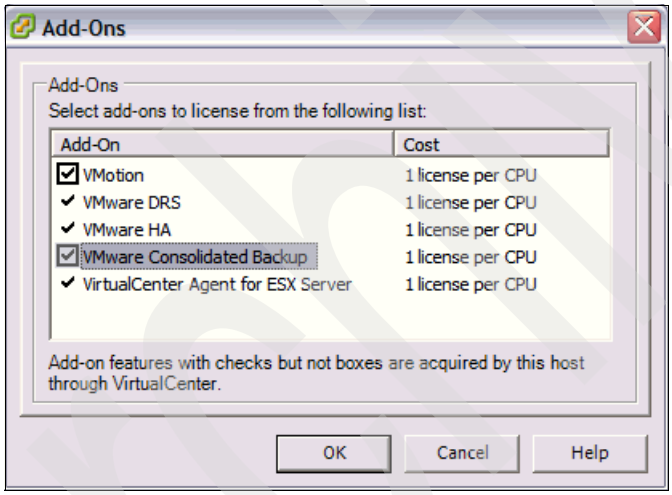

Figure 3-94 Enabling licensing for add-on features

8. The resulting window should look similar to Figure 3-95. Repeat the steps in this section for all of the ESX Servers.

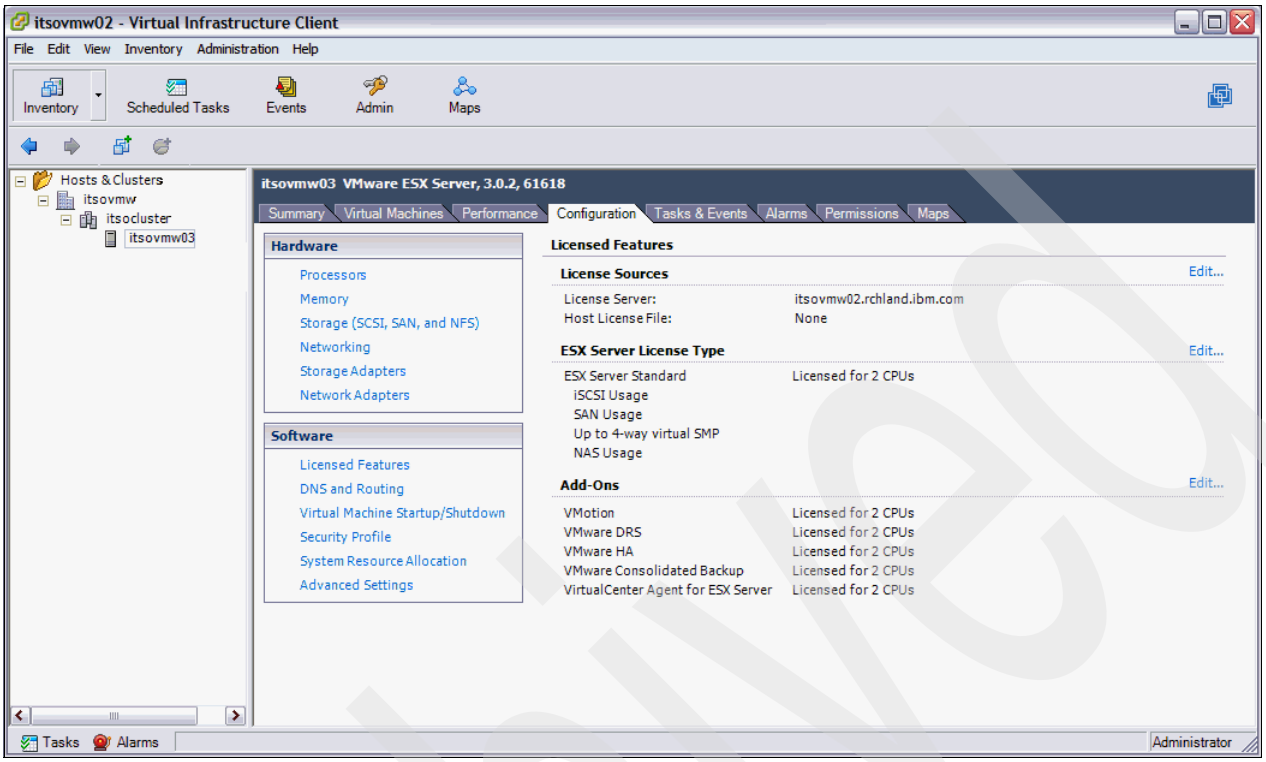

Figure 3-95 Enabling the license

3.4.5 Completing the setup

This completes the virtual infrastructure setup. The chapters that follow present you with information about VMware Infrastructure 3 features and how to configure virtual machines to use them.

4

VMware Infrastructure 3 advanced capabilities with shared storage support of i5/OS

The introduction of shared storage support with i5/OS V6R1 enables us to use the VMware Infrastructure 3 advanced capabilities VMware Vmotion, VMware High Availability (HA), and VMware Distributed Resource Scheduler (DRS) on integrated iSCSI servers.

4.1 Shared storage support from i5/OS

With shared storage support from i5/OS more than one ESX Server running on integrated iSCSI servers in the same i5/OS partition can access the same storage space concurrently. Previously, each iSCSI storage space was dedicated to only one server.

All ESX Servers need shared access to the storage spaces with the virtual machine files. Each ESX host has exclusive access to its system and install storage space. All storage spaces are provided by System i iSCSI integration. Integrated servers do not use any internal storage. Figure 4-1 shows an example storage overview.

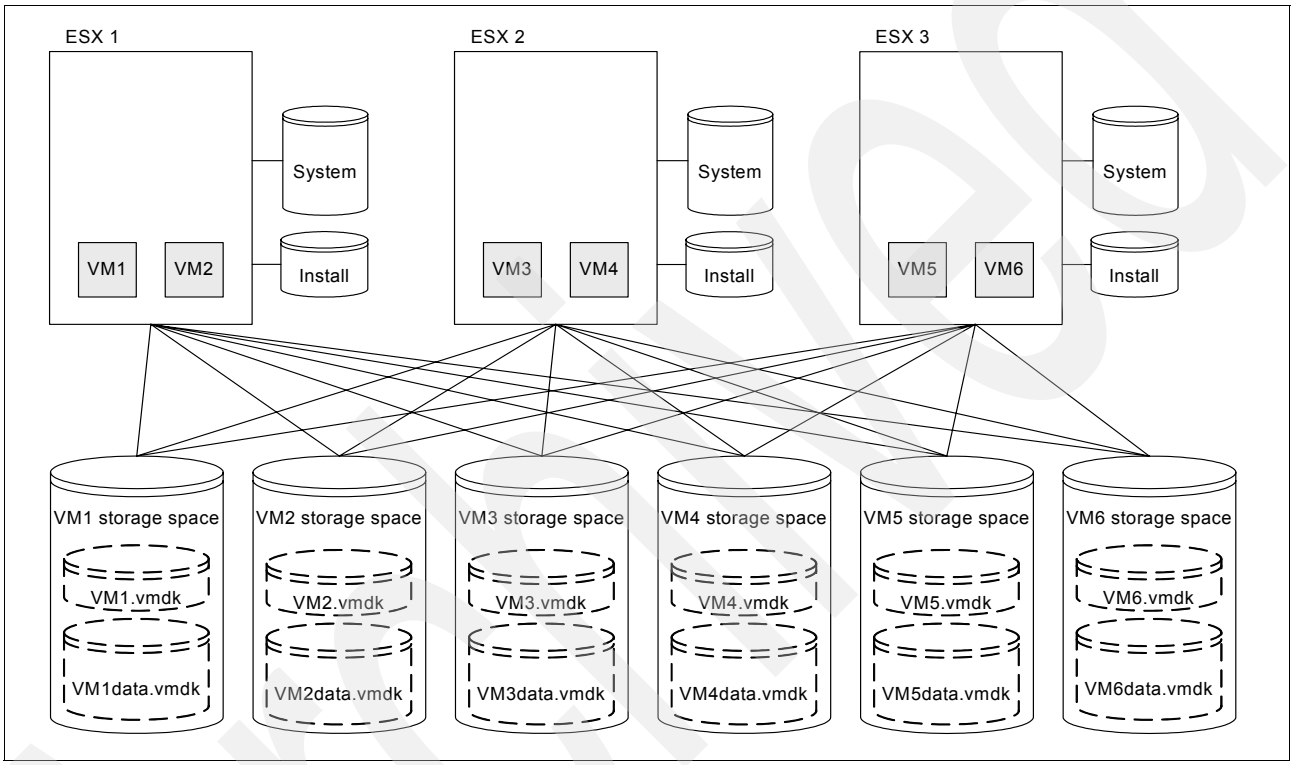

Figure 4-1 Shared storage overview

4.2 VMware VMotion

VMware VMotion enables us to move a virtual machine from one ESX Server to another without service disruption. Using this scalability you can distribute load between ESX Servers, even automatically (see 4.4, “VMware Dynamic Resource Scheduler (DRS)” on page 98). You also can use VMotion to move all running virtual machines from one ESX Server to other ESX Servers before shutting it down for hardware maintenance. Figure 4-2 shows an example of using VMotion to move virtual machines off an ESX Server.

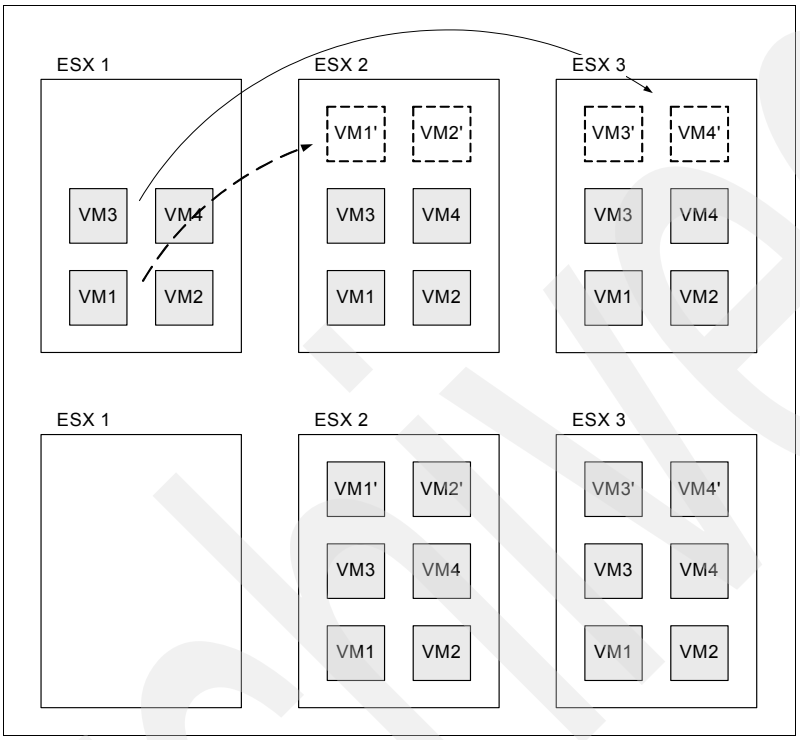

Figure 4-2 Free an ESX Server for maintenance using VMotion

How it works

The VMotion process consists of the following steps:

1. VirtualCenter validates the target ESX Server (for example, resource availability, storage and network configuration).
2. The vmkernel replicates the memory contents over the VMotion network.
3. The CPU state is replicated.
4. The virtual machine is switched over to the target ESX Server.
5. The target ESX Server takes over the MAC and TCP/IP addresses of the virtual machines.
6. The virtual machine is removed from the source ESX Server.

4.3 VMware High Availability (HA)

VMware High Availability automatically restarts virtual machines from broken ESX Servers on other still-running ESX Servers. When you add an ESX Server to an HA enabled cluster the VirtualCenter configures and activates an agent on the server (see 7.7, “Cluster, HA, and DRS” on page 229). After that initial configuration this HA agent runs independent from the

VirtualCenter and continuously checks the availability of the other cluster servers. If it detects a failure, the virtual machines of the broken ESX Server are redistributed to the remaining servers and restarted automatically.

Note: To the virtual machines an HA takeover looks like a hard power-off without shutdown. Some operating systems will restart with a file system check.

VMware HA only detects complete ESX Server failures. Failures of a single virtual machine are not covered.

Configuration and Management of VMware HA is documented in the VMware *Resource Management Guide*, available at:

http://www.vmware.com/support/pubs/vi_pubs.html

Figure 4-3 shows an example of how VMware HA redistributes and restarts virtual machines after an ESX Server failure.

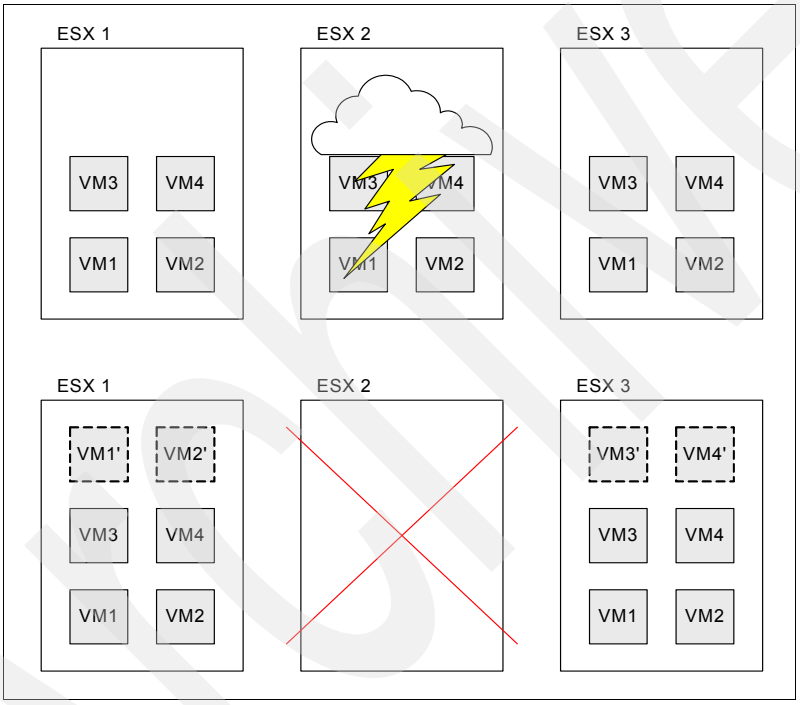

Figure 4-3 Example for VMware high availability

4.4 VMware Dynamic Resource Scheduler (DRS)

With the VMware Dynamic Resource Scheduler a VMware Infrastructure 3 environment can be set up to automatically load distribution using VMotion when starting virtual machines or when workload thresholds are exceeded.

Resources in a VMware Infrastructure 3 environment are managed using relative share values in clusters and resource pools. By default the virtual machines in a resource pool share the available resources evenly. You can adjust the weighting of different VMs by changing the default share values for CPU and memory usage.

You can find an in-depth explanation of resource pool configuration and management in the VMware *Resource Management Guide.*

In the Figure 4-4 the size of the virtual machine boxes represents the resource usage of the VMs. In the initial distribution all VMs use the same amount of resources. When the resource usage of VM1 on ESX 1 grows, DRS redistributes the load by moving VM2 to ESX 2.

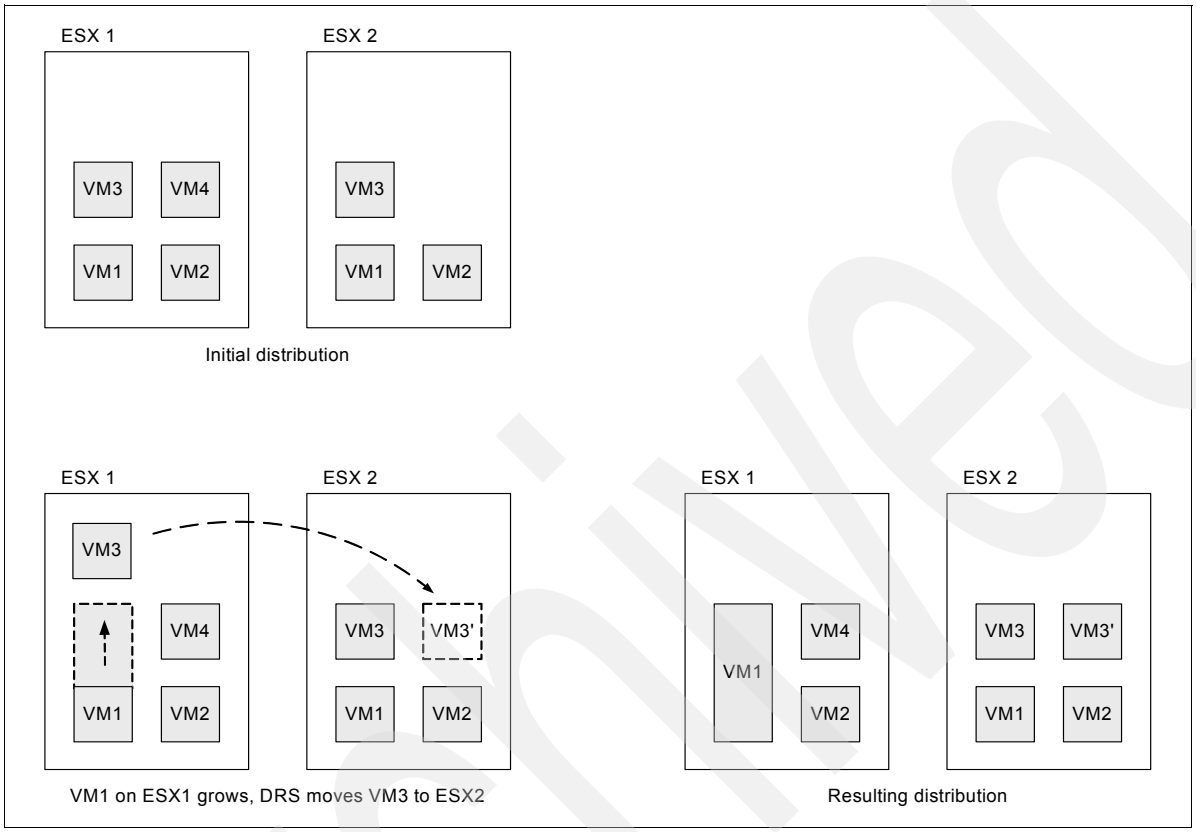

Figure 4-4 DRS resource redistribution example

4.5 VMware Consolidated Backup (VCB)

VMware Consolidated Backup provides a way to offload backup/restore tasks to a backup proxy server. With VCB you can use a single dedicated Windows iSCSI integrated server to enable file level backup for all Windows virtual machines in your VMware Infrastructure 3 on System i integration with BladeCenter and System x. The VCB proxy accesses the Windows file system of the virtual machine directly on the storage space without using any network or CPU resources on the ESX Servers.

With the VCB proxy you can use System i integration file level backup to back up files from your Windows virtual machines even when the VMs are not running.

To enable shared access from the VCB proxy server to the virtual machine storage spaces you need additional iSCSI configuration (see 5.3.1, “Using VCB server for Windows VM” on page 105).

Figure 4-5 shows an example of how you can access Windows virtual machines files from i5/OS using VCB.

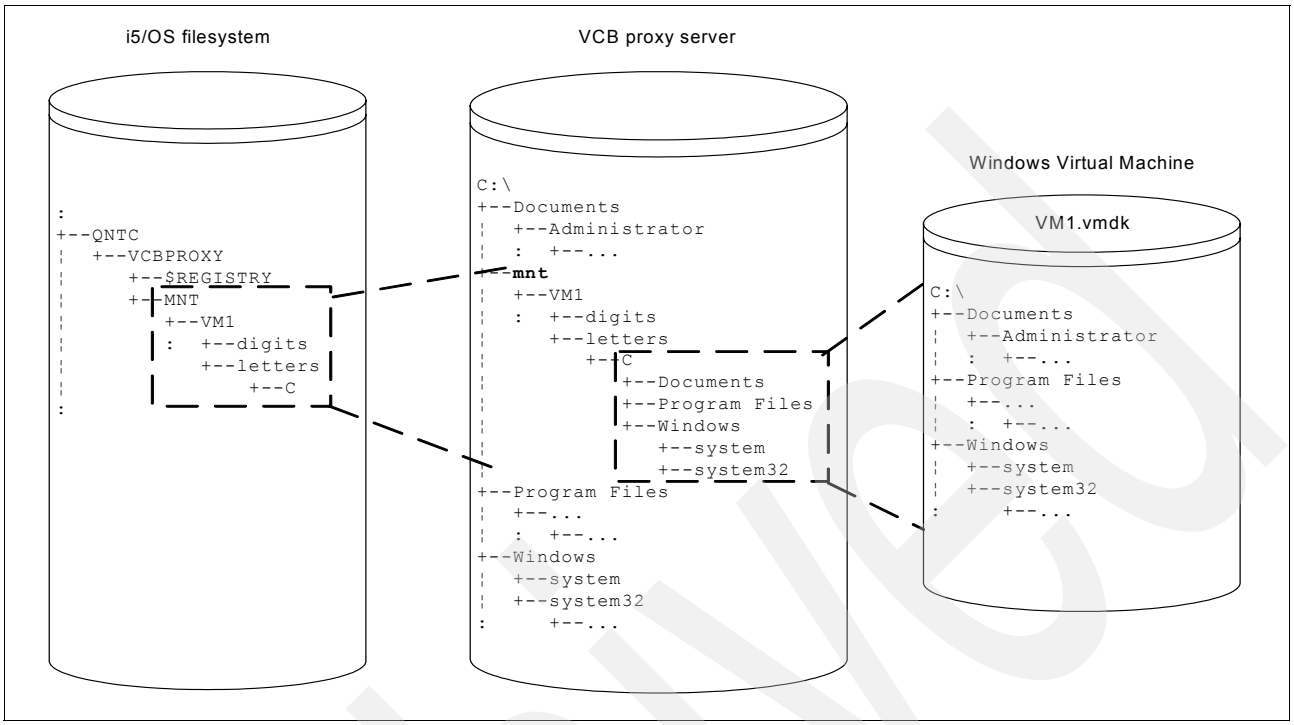

Figure 4-5 VCB access structure example

5

Backup and recovery

This chapter discusses the backup and recovery perspectives of running VMware VI3 on BladeCenter and System x Integrated with System i.

5.1 VI3 infrastructure backup and recovery

In this chapter we discuss new capabilities and differences in capabilities between iSCSI attached Windows and VMFS (Linux) storage spaces, along with the additional capabilities enabled with VMware Infrastructure 3

5.2 Virtual Machine backup and recovery

In this section we discuss the available options to back up a VMware virtual machine. The objects that are necessary for a complete backup of a integrated environment are:

- The network server description (NWSD)
- The network server host adapter (NWSH)
- The service processor network server configuration (NWSCFG type SRVPRC)
- The remote system network server configuration (NWSCFG type RMTSYS)
- The connection security network server configuration (NWSCFG type CNNSEC)
- The storage spaces associated with the ESX integrated server
- The storage spaces associated with each virtual machine

5.2.1 Saving storage space

The saving of storage spaces has not been changed, with the exception of now having the ability to save a storage space snapshot. The cleanest approach to saving the storage space still would be to shut down the iSCSI server or virtual machine, run your backup job, then start the server.

If you followed our recommendation in 2.3.2, “System i storage sizing” on page 13, of having one storage space per virtual machine, you can perform a backup of each virtual machine by saving a single storage space.

5.2.2 Snapshot

New in V6R1M0, you can now save a storage space snapshot. While the save is happening, i5/OS saves the changes made to a storage space in a temporary file, which can be up to 25% of the original size of the storage space. However, no quiescing is being performed.

To enable this function, there is a new option in the SAVACTOPT parameter within the SAV command, *NWSSTG. This option enables you to save a storage space linked to an active iSCSI server.

1. To utilize this feature within BRMS, open **System i Navigator** → **System** → **Backup, Recovery, and Media Services** → **Backup Control Group** (Figure 5-1).

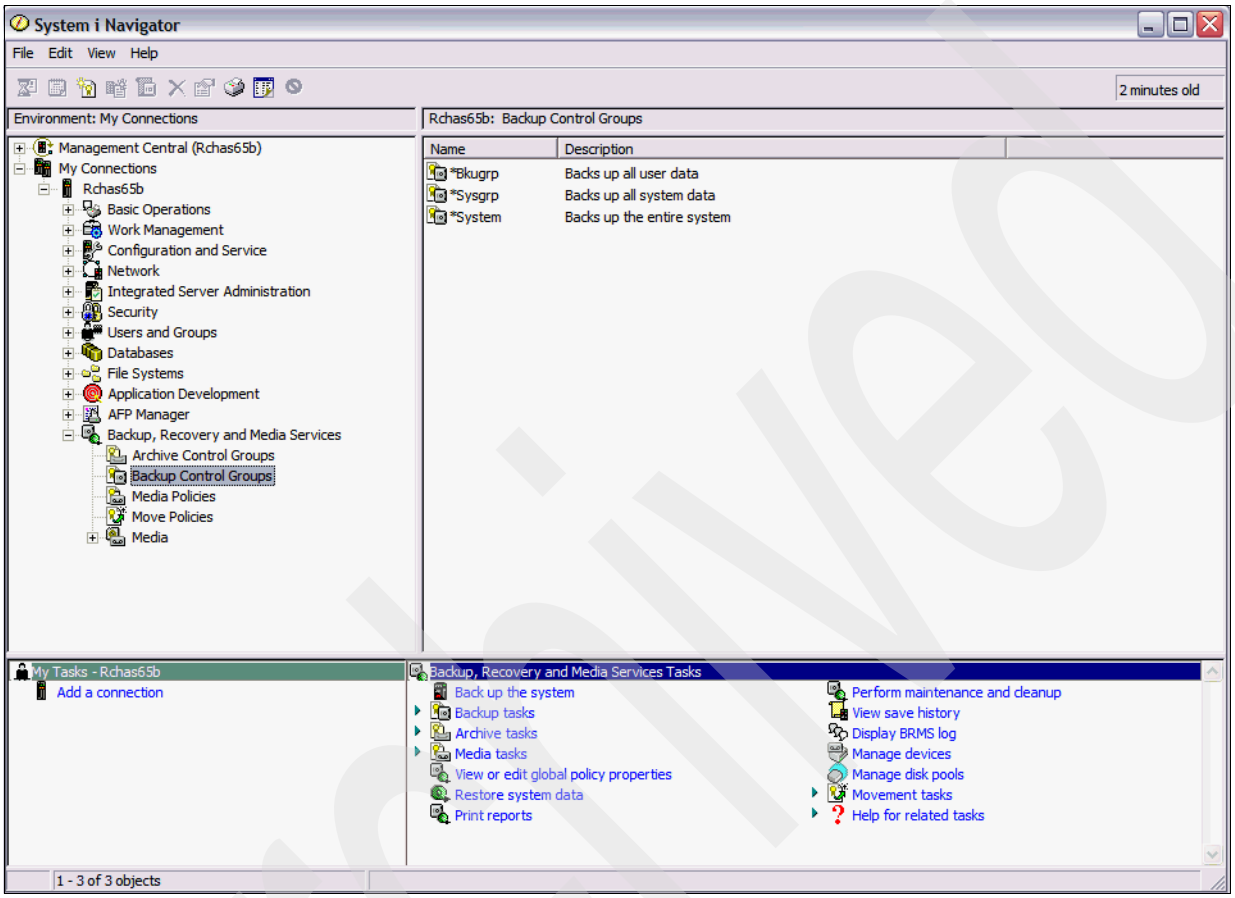

Figure 5-1 Snapshot™ setting steps (1 of 4)

2. Within each of your backup control groups, you will need to enable the Save While Active function. Click the **Where** tab, then select **All Directory Data** and click **Edit** (Figure 5-2).

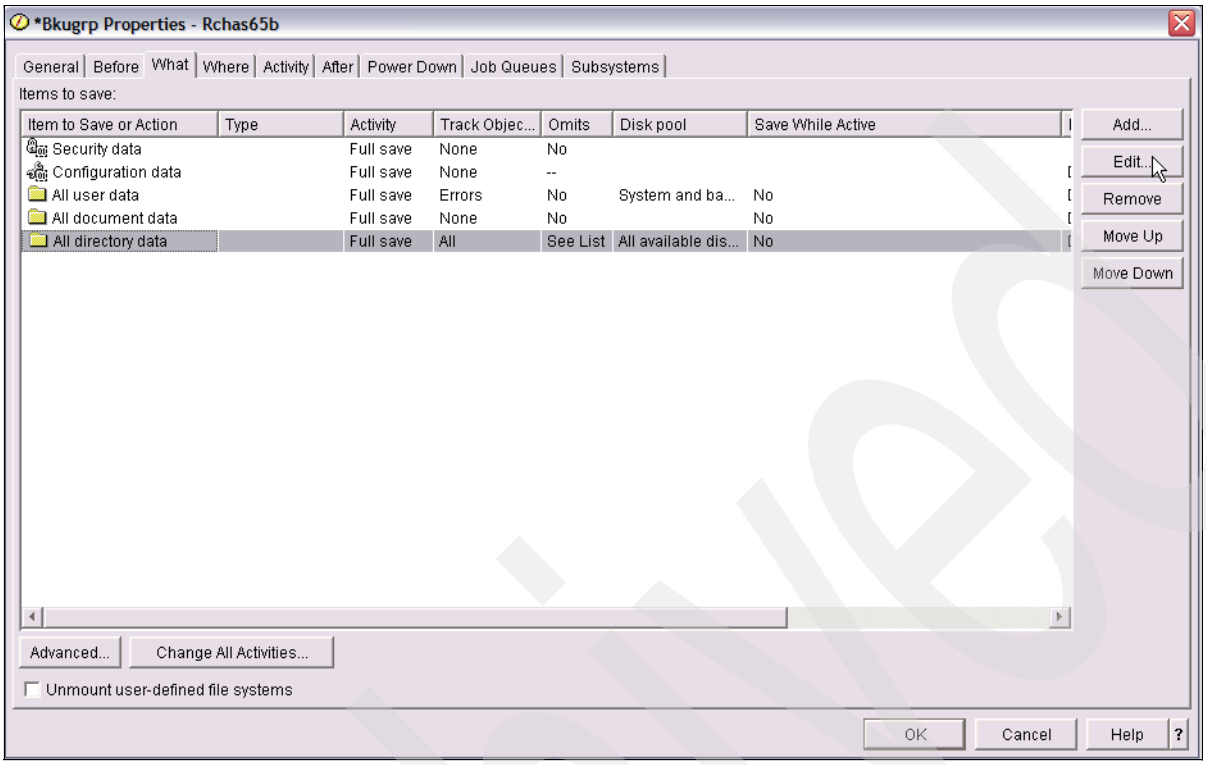

Figure 5-2 Snapshot setting steps (2 of 4)

3. On the Edit pop-up window, click the pull-down menu for Save While Active and select the appropriate setting (Figure 5-3).

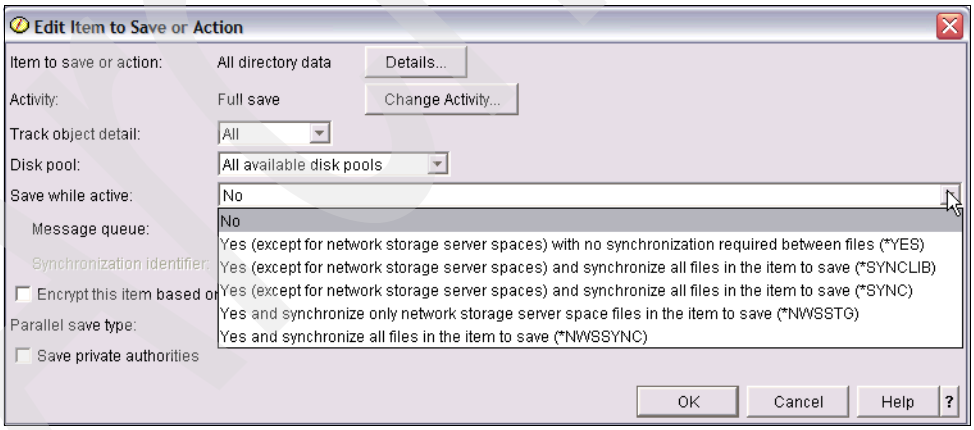

Figure 5-3 Snapshot setting steps (3 of 4)

4. On the Before tab, make sure to clear the Shutdown integrated servers option (Figure 5-4). We no longer need to shut down the iSCSI servers if the Save while active function will be utilized.

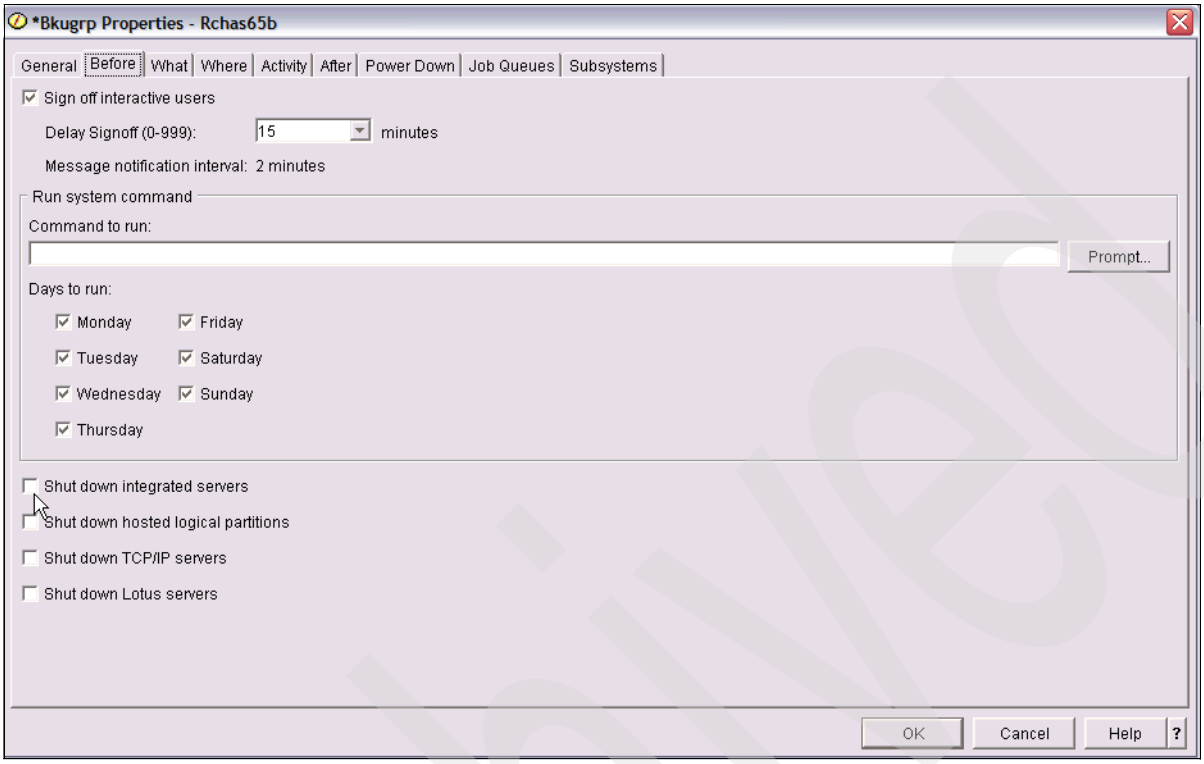

Figure 5-4 Snapshot setting steps (4 of 4)

Note: This new function is enabled only for iSCSI attached servers. Additionally, this backup will not give you a *crash consistent* backup of the ESX Server.

5.3 VM Guest OS file level backup

In this section we discuss backing up a virtual machine guest OS at a file level. There are two options. The first option is to use the VCB server, which can only be used for Windows OS. The second option is another backup solution running on the virtual machine. This could be used for either Windows or Linux guest OS.

5.3.1 Using VCB server for Windows VM

The VCB server runs on a native Windows server, which you would put on a iSCSI attached blade or System x server. This server is intended to take the workload off of the production servers when performing a backup. This involves accessing the virtual server storage space and taking snapshots to perform a backup. To enable this functionality, you will need to adjust some settings on the setup of the remote systems in the iSCSI environment.

For instructions on installing VCB, refer to the *Virtual Machine Bakcup Guide*, found at:

`http://www.vmware.com/support/pubs/vi_pubs.html`

Note: This *requires* two HBA initiator ports on your System x or Blade, and the second port must be configured in the remote system. We recommend that the system be powered up after installing and configuring the second port prior to performing the following steps. This will ease the setup, as the second HBA initiator port will have the necessary information in persistent storage. To perform these steps, both the Windows Server and the ESX Server must be shut down.

Note: This procedure does not work with CHAP. Make sure in your Windows System x or Blade QLogic® Fast!UTIL that CHAP is not enabled.

1. You need to obtain information about the remote system for the Windows server on which the VCB is running. To get this information, open **System i Navigator** → **System i** → **Integrated Server Administration** → **iSCSI Connections** → **Remote Systems** (Figure 5-5).

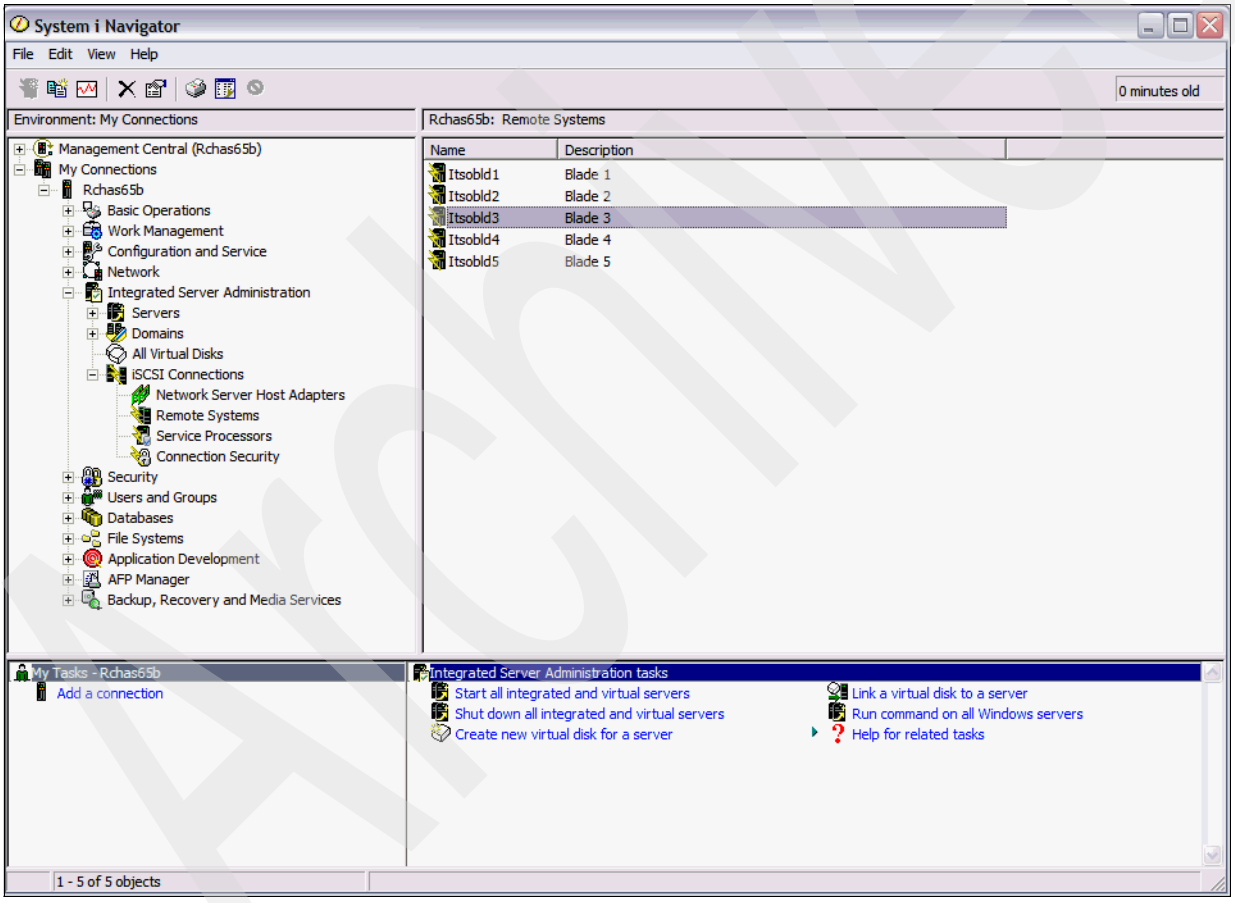

Figure 5-5 Obtaining information about the remote system

2. Right-click the remote system for the Windows server running the VCB and select **Properties** (Figure 5-6).

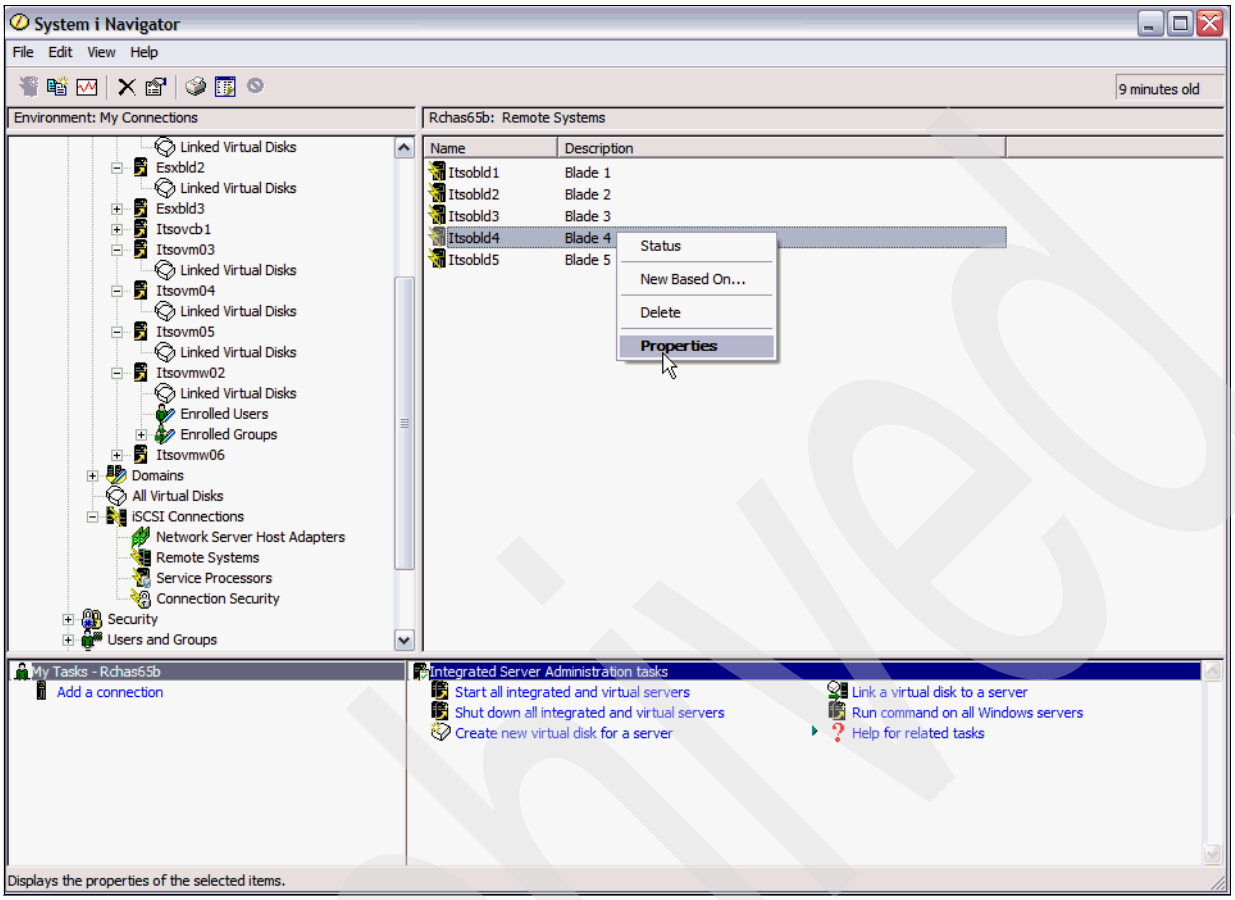

Figure 5-6 Selecting properties of the remote system

3. On the Properties window, click the **Remote Interfaces** tab (Figure 5-7).

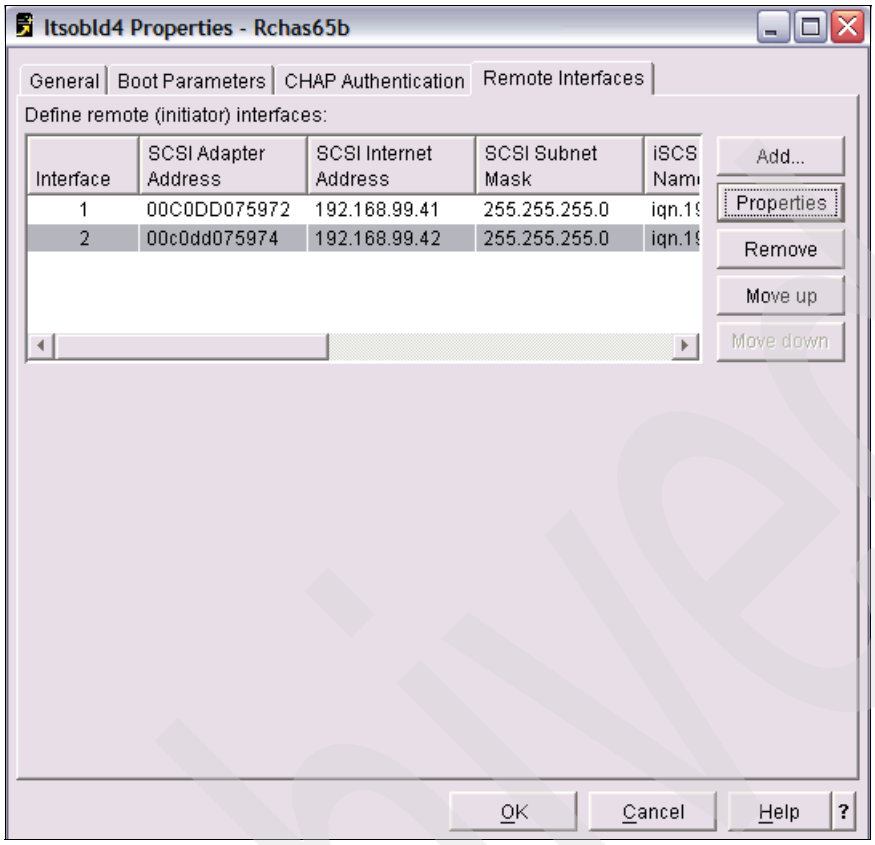

Figure 5-7 Remote System properties

4. Select **Interface 2**, then click **Properties** (Figure 5-8).

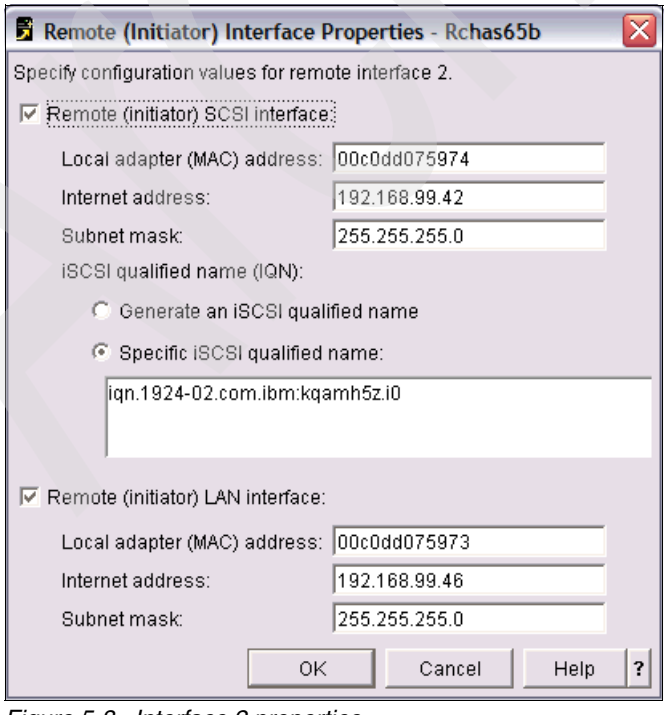

Figure 5-8 Interface 2 properties

5. Record the information from the Remote (Initiator) Interface → Properties. You will need to enter this information as Interface 3 on your ESX Server Remote System. When recorded, click **OK**.
6. You now need to remove the Interface 2 from the Remote Interfaces tab of the Remote System properties for your Windows/VCB server (Figure 5-9).

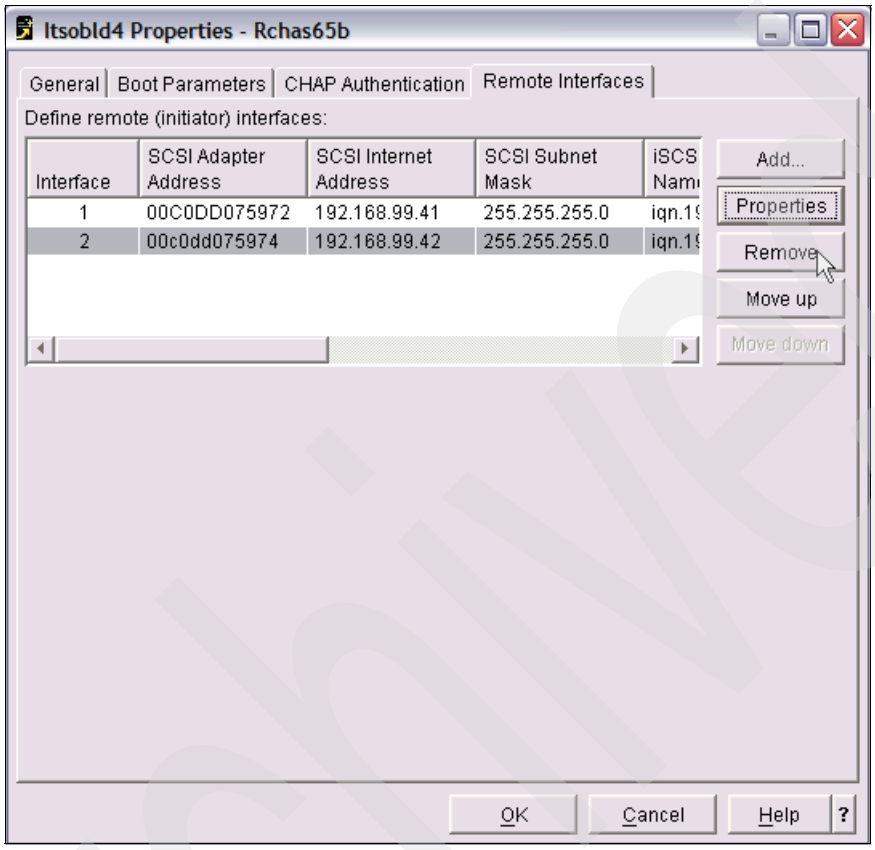

Figure 5-9 Remove Interface 2

7. After clicking **Remove**, you should only see one interface listed. Click **OK**.

8. Right-click the Remote System for your ESX Server that has access to the virtual machine storage spaces that will be backed up, and select **Properties** (Figure 5-10).

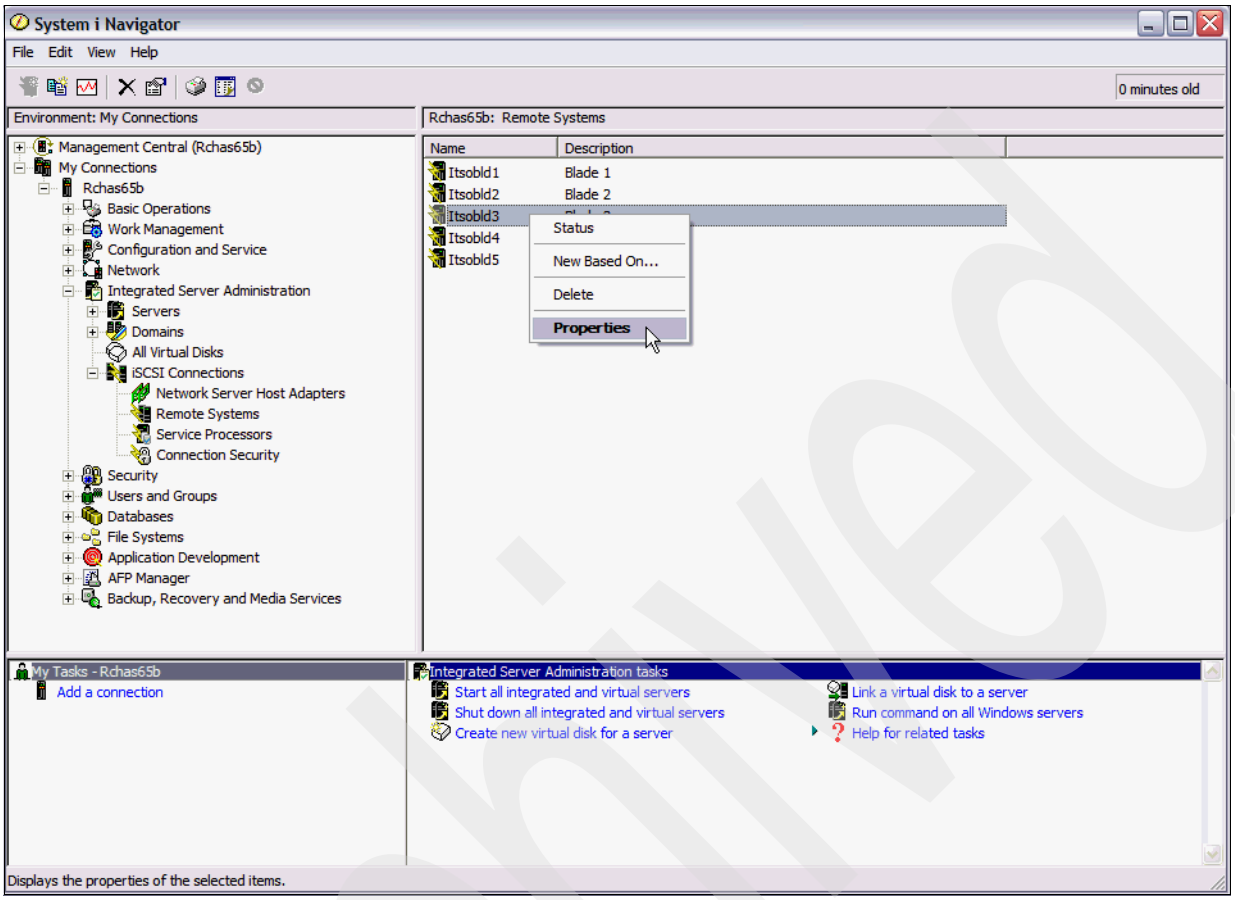

Figure 5-10 Selecting properties of the Remote System to be backed up

9. On the Properties window, select the Remote Interfaces tab. Here you will add the interface information obtained in step 5 on page 109 (Figure 5-11).

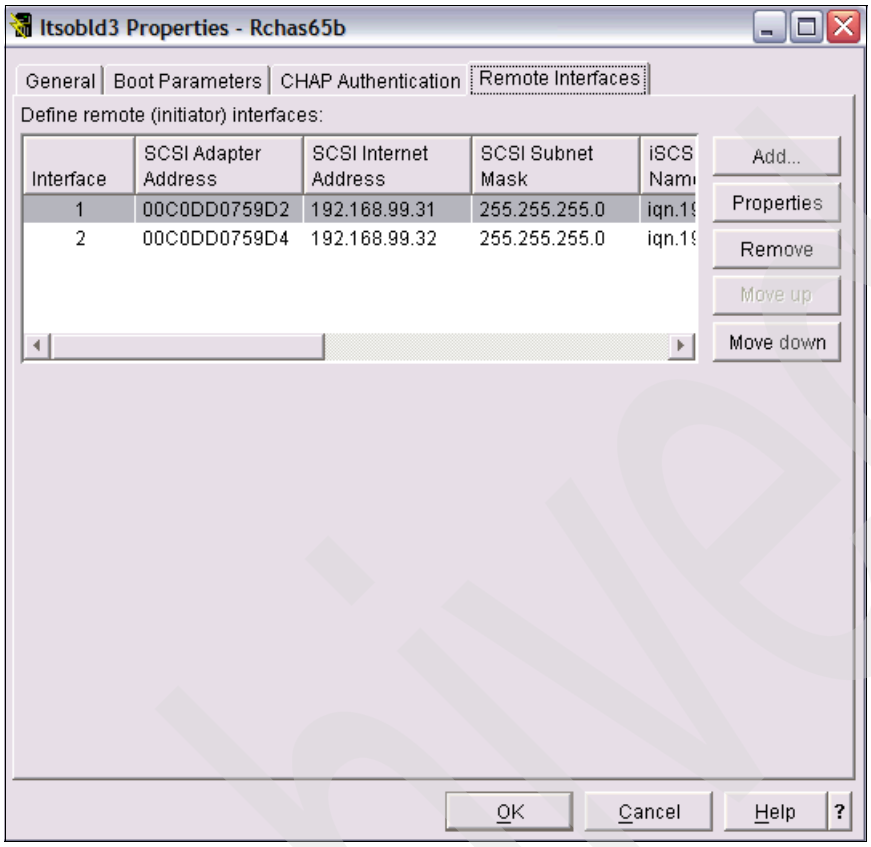

Figure 5-11 Selecting Remote Interface tab

10. Click **Add**, then enter the information obtained in step 5 on page 109 and click **OK** (Figure 5-12).

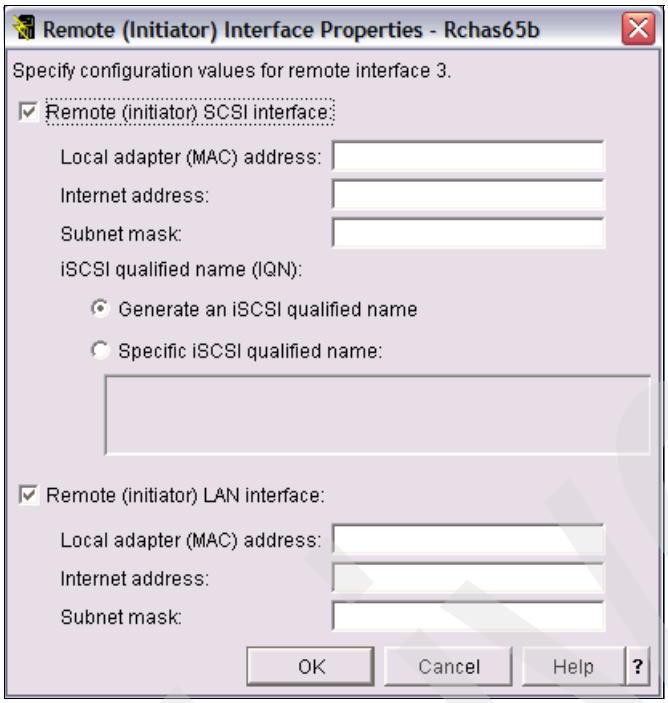

Figure 5-12 Adding interface information

11. You should now have three interfaces on your Remote Interfaces tab. Click **OK** (Figure 5-13).

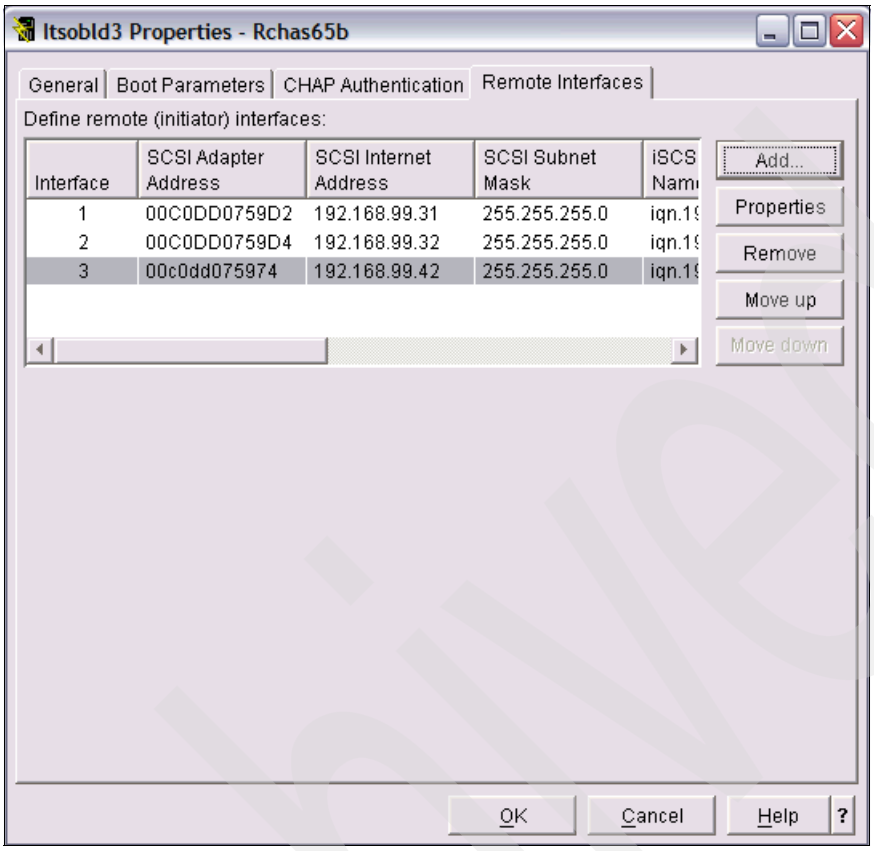

Figure 5-13 Remote Interface information added

12. Obtain information from the NWSH that will be used for communication. Click **Network Server Host Adapters** (Figure 5-14).

> **Note:** Select the NWSH that is utilized for the storage path on the virtual machine storage spaces that will be backed up with the VCB.

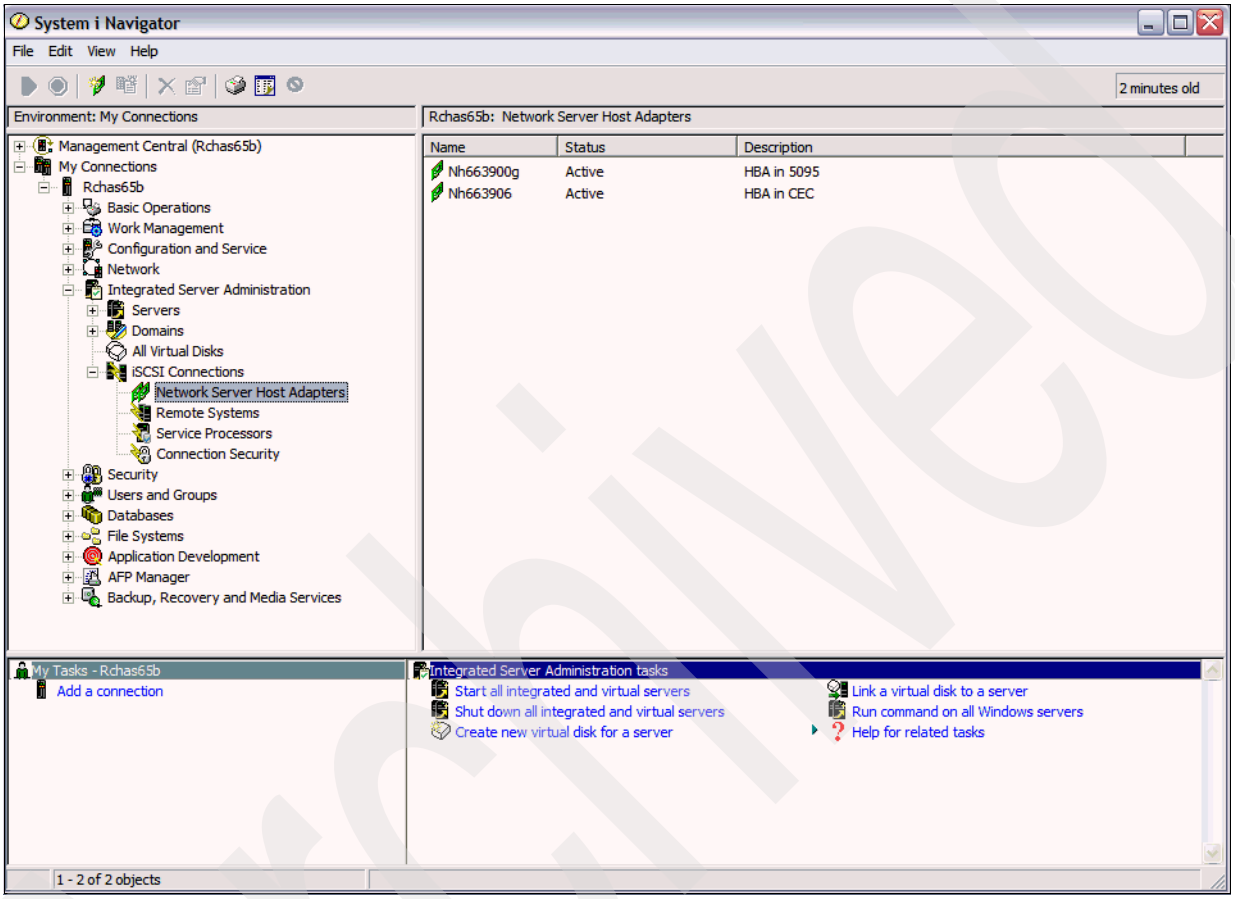

Figure 5-14 NWSH

13. Select the NWSH that you want to use by right-clicking and selecting **Properties** (Figure 5-15).

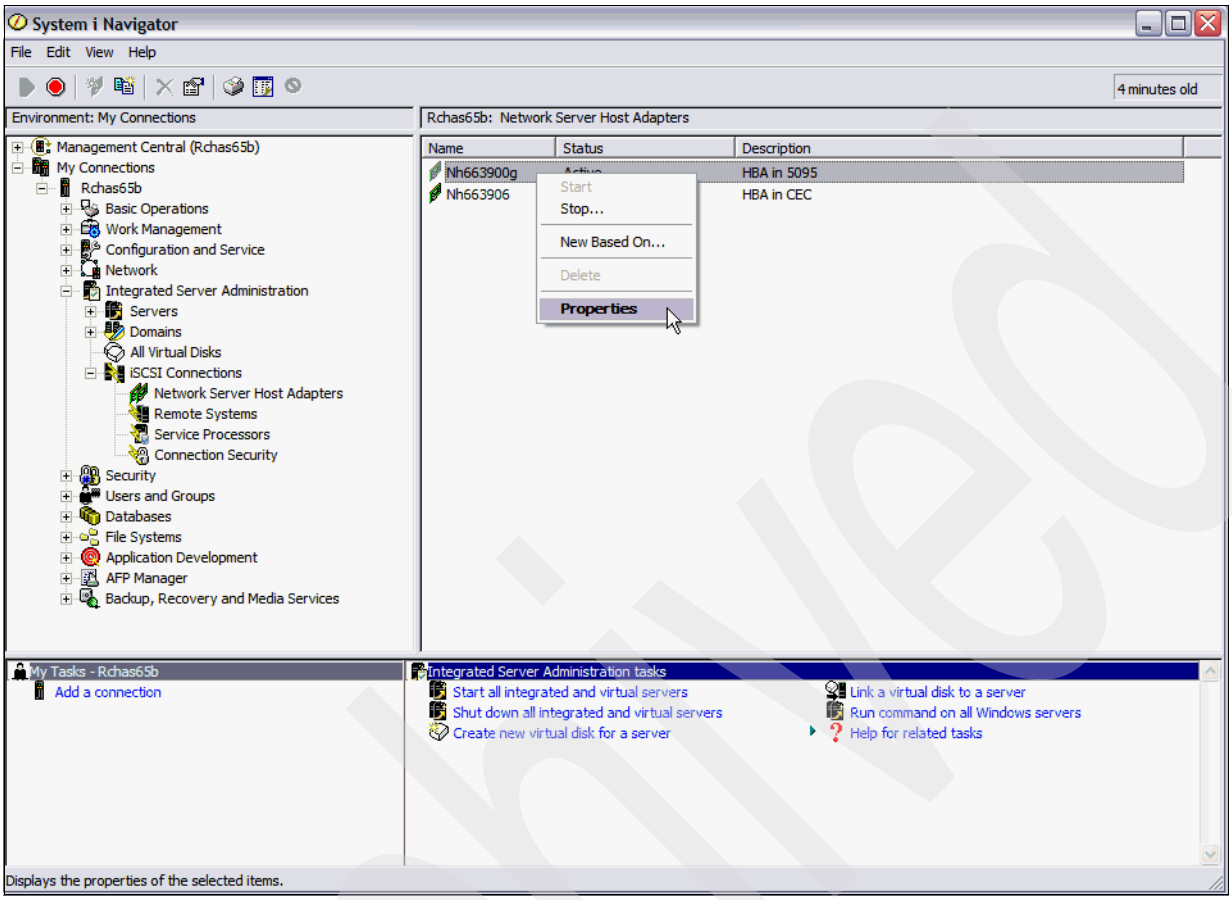

Figure 5-15 Select NWSH

14. On the Properties window, click the **Local (Target) Interface** tab and record the local (target) SCSI interface Internet address. Click **OK** (Figure 5-16).

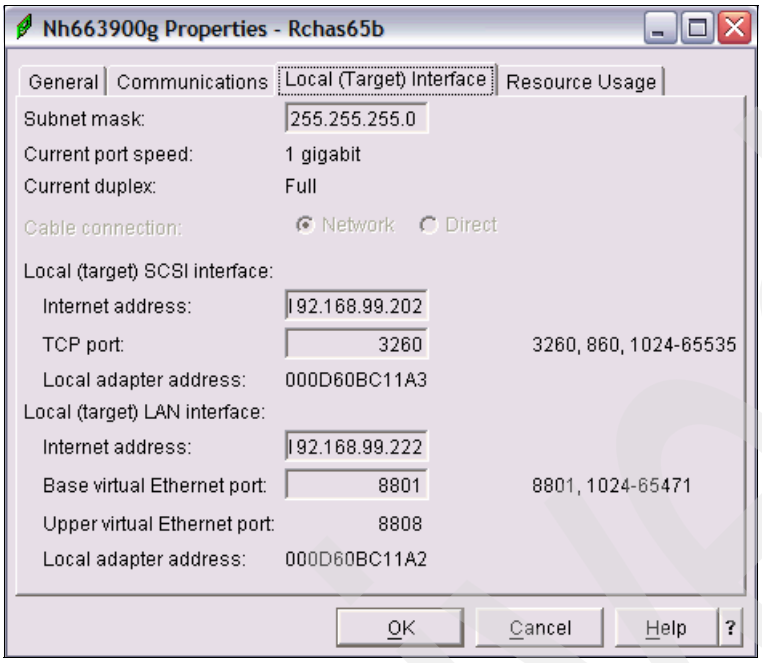

Figure 5-16 Local Interface information added.

15. In System i Navigator, click **Servers**. This should give you a list of your integrated servers. Right-click your ESX Server and select **Properties** (Figure 5-17).

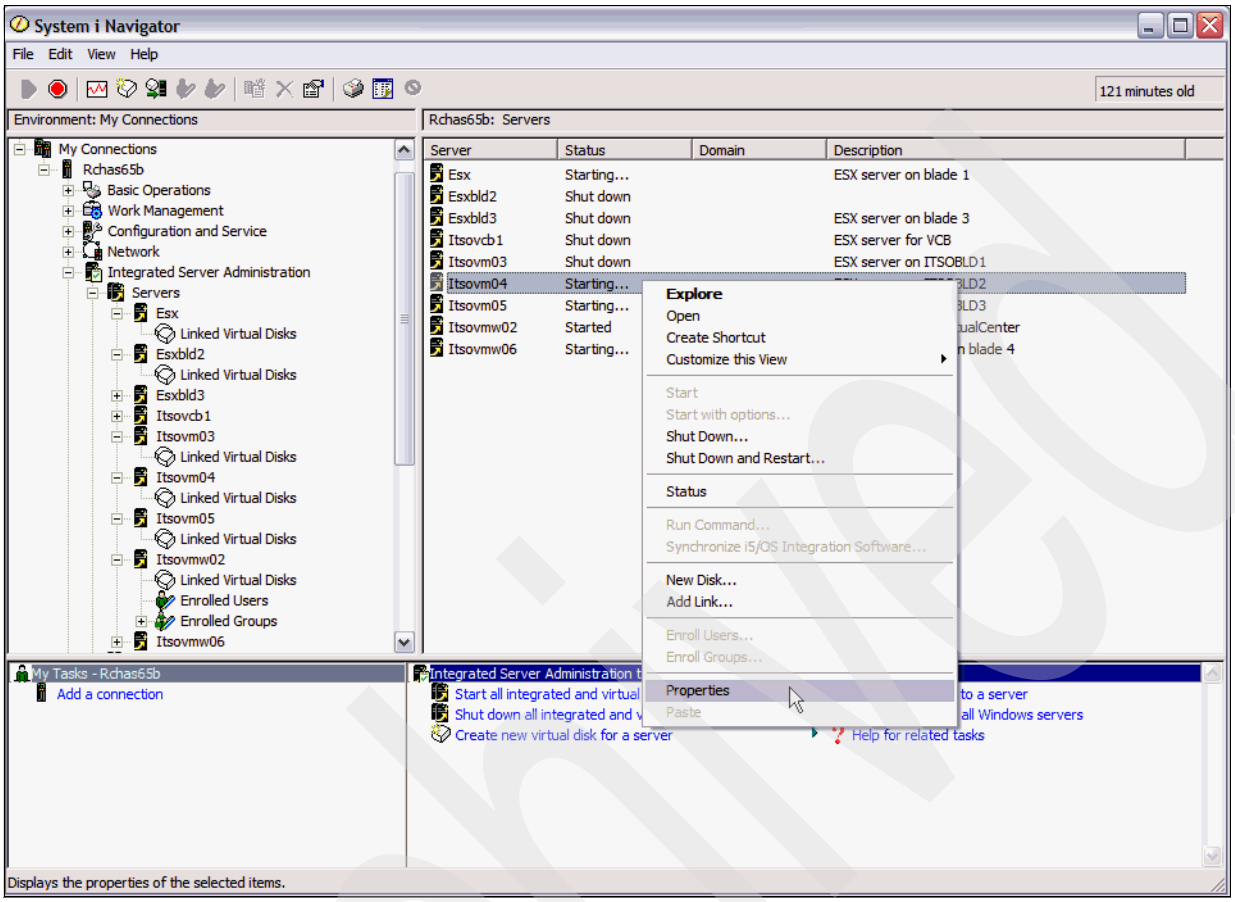

Figure 5-17 ESX iSCSI server

16. On the server properties window, select the **Storage Paths** tab (Figure 5-18).

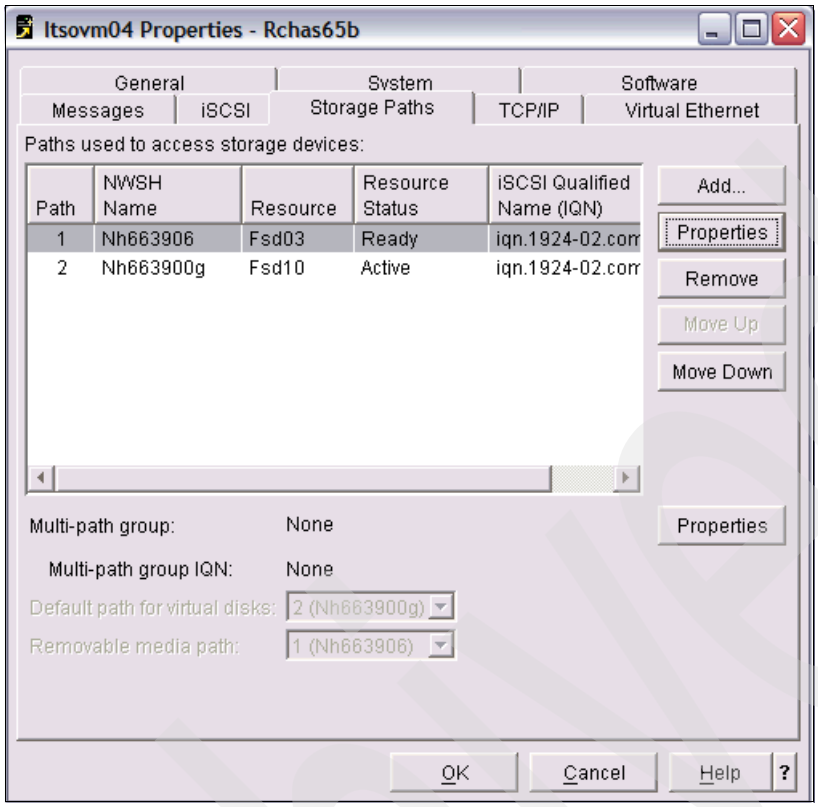

Figure 5-18 Storage Paths

17. Select the NWSH that you obtained information about in step 15 on page 117 and click **Properties** (Figure 5-19).

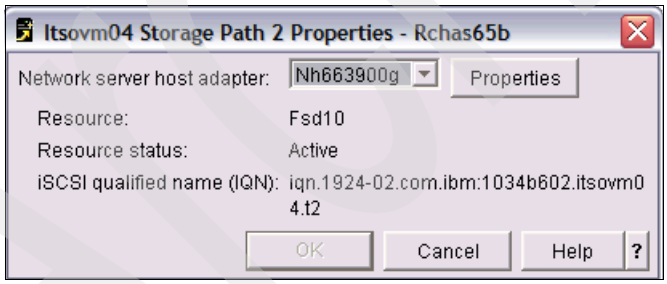

Figure 5-19 Selecting NWSH to add information

18. Record the iSCSI qualified name (IQN). You will need to enter this information, along with the information obtained in step 15 on page 117, into Fast!UTIL for the System x or BladeCenter HBA.
19. Click **Cancel**. Click **OK**.
20. Now you need to get into Fast!UTIL. If your system is powered down, power on. If it is powered on, shut down and restart the system.

21. When prompted in the server console, press Ctrl+Q to enter Fast!UTIL (Figure 5-20).

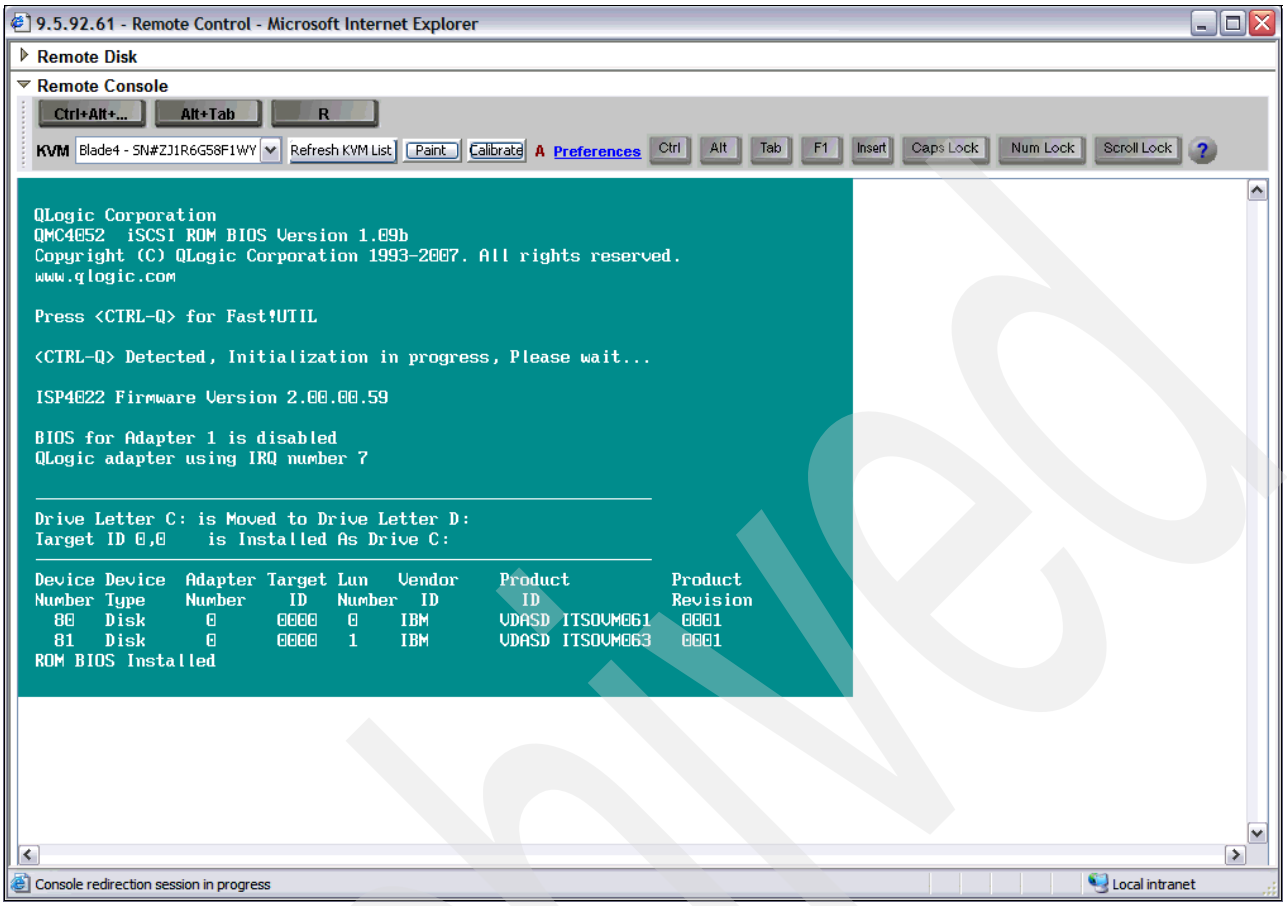

Figure 5-20 Fast!UTIL prompt

22. When you are in Fast!UTIL, select the second HBA and press Enter (Figure 5-21).

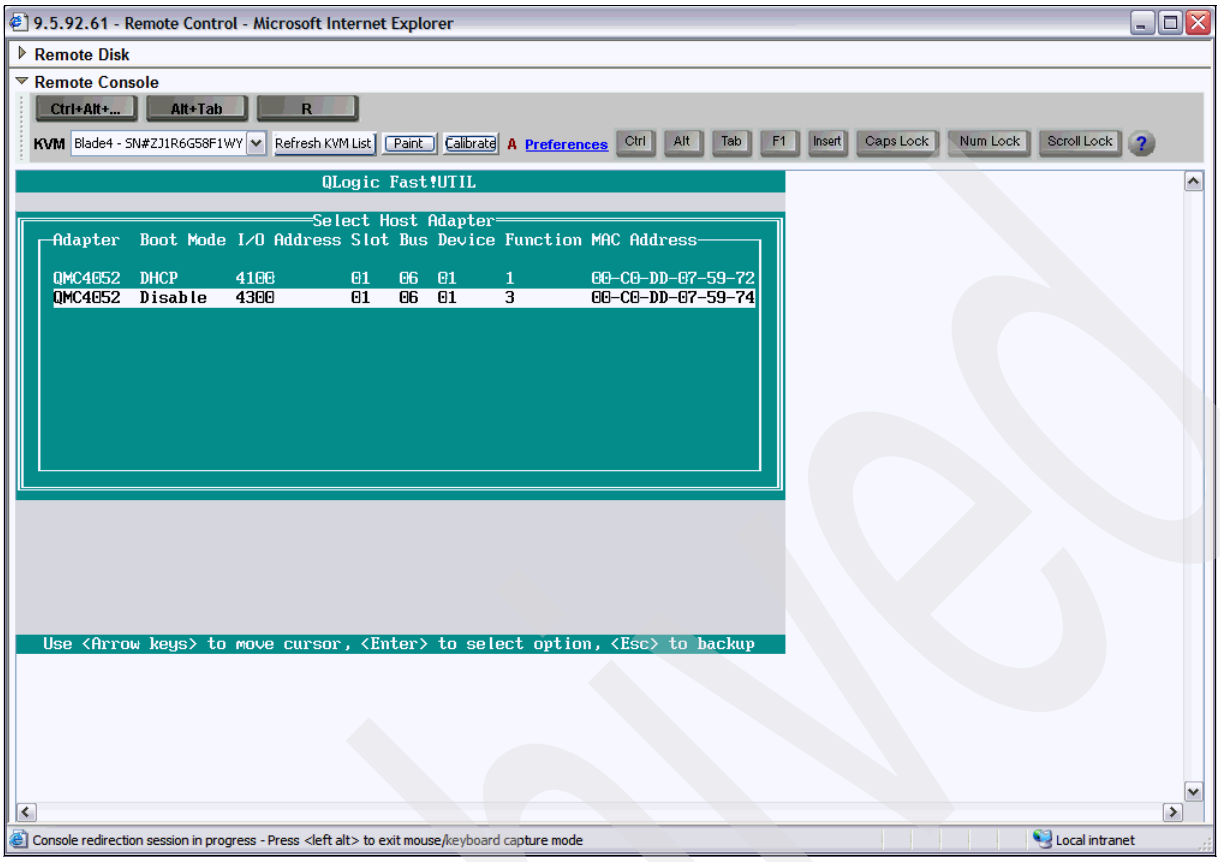

Figure 5-21 Select HBA

23. Select **Configuration Settings** (Figure 5-22).

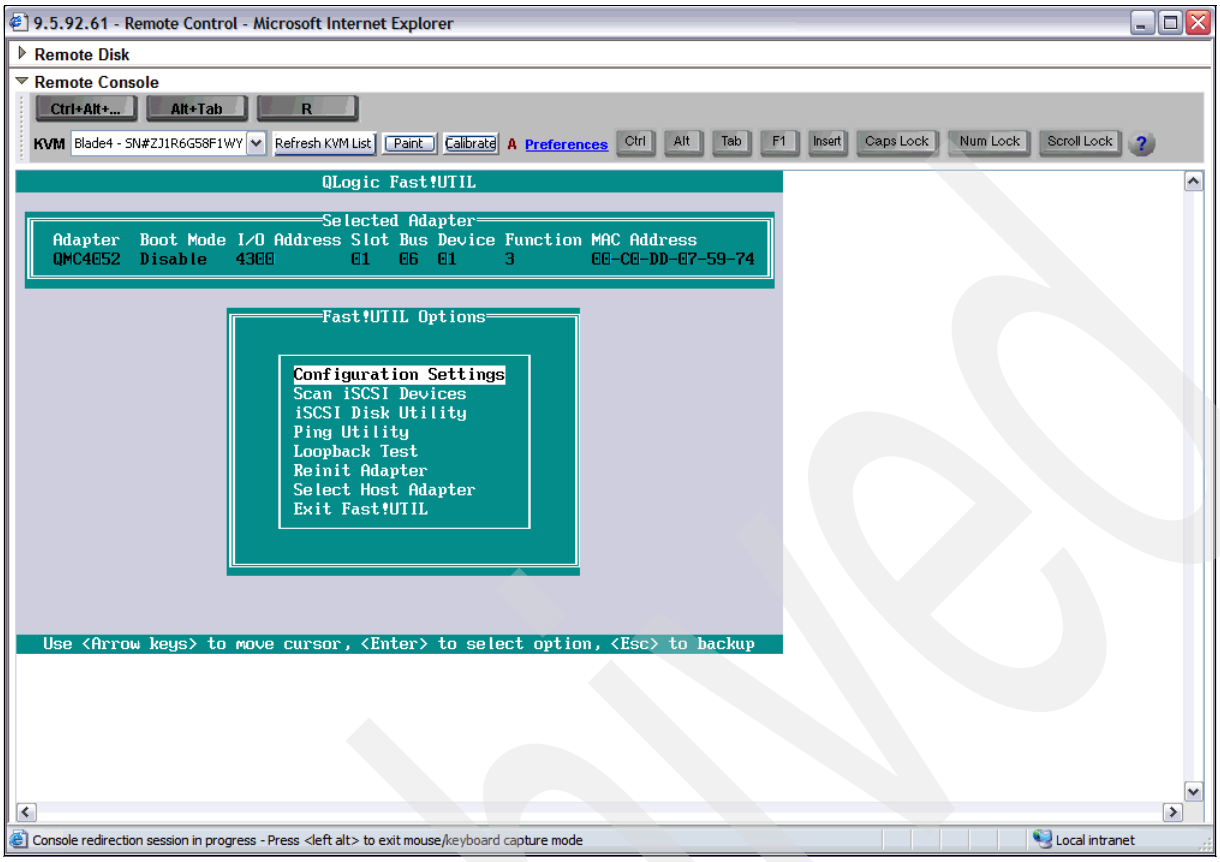

Figure 5-22 Select Configuration Settings

24. Select i**SCSI Boot Settings** (Figure 5-23).

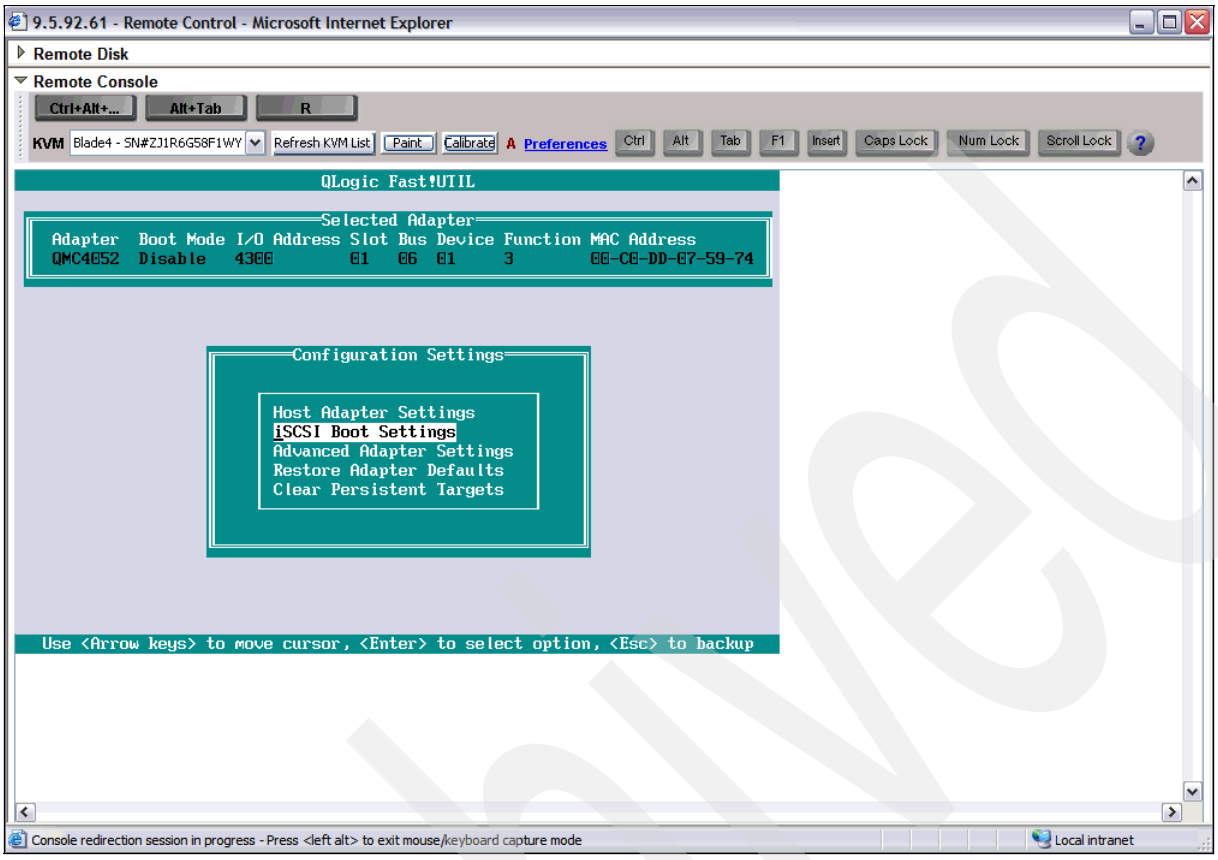

Figure 5-23 Select iSCSI Boot Settings

25. Select **Primary Boot Device Settings** (Figure 5-24).

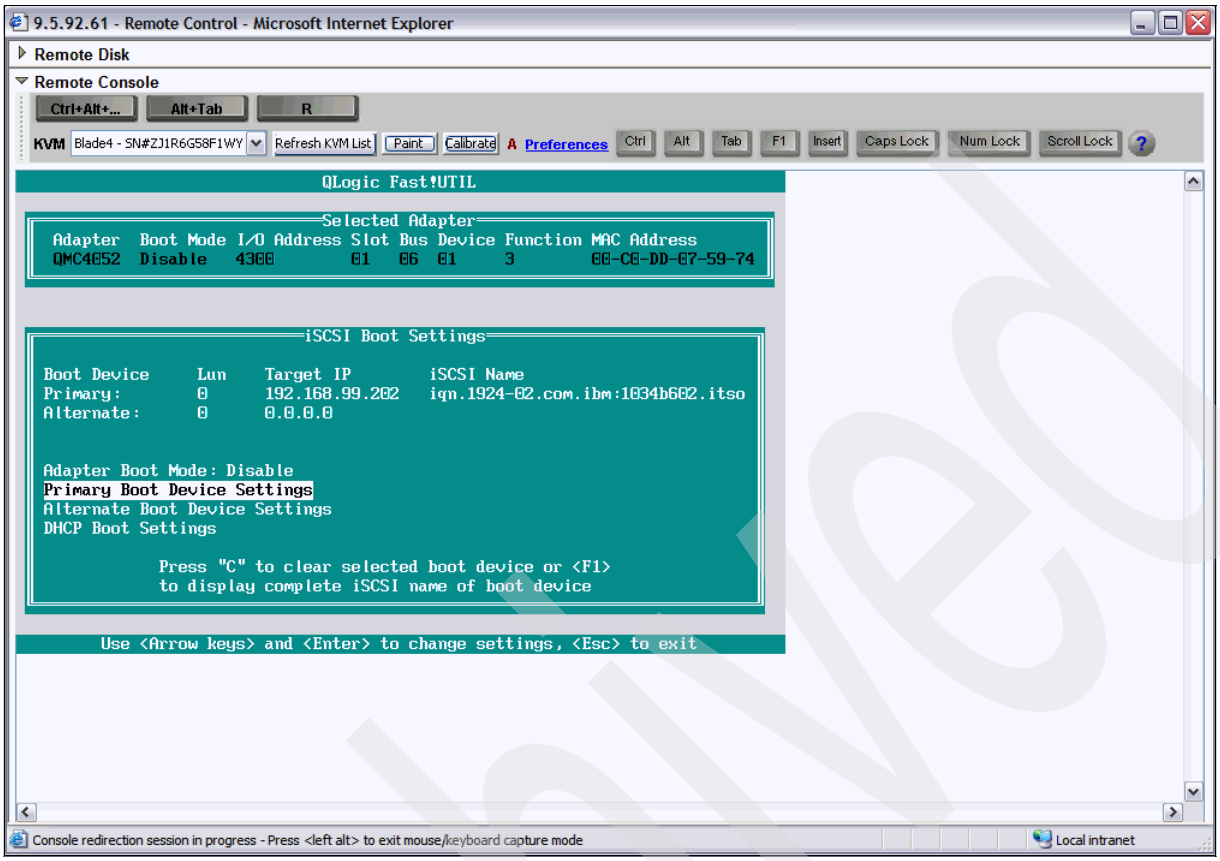

Figure 5-24 Select Primary Boot Device Settings

26. Select **Target IP** and enter the IP address obtained in step 15 on page 117 (Figure 5-25).

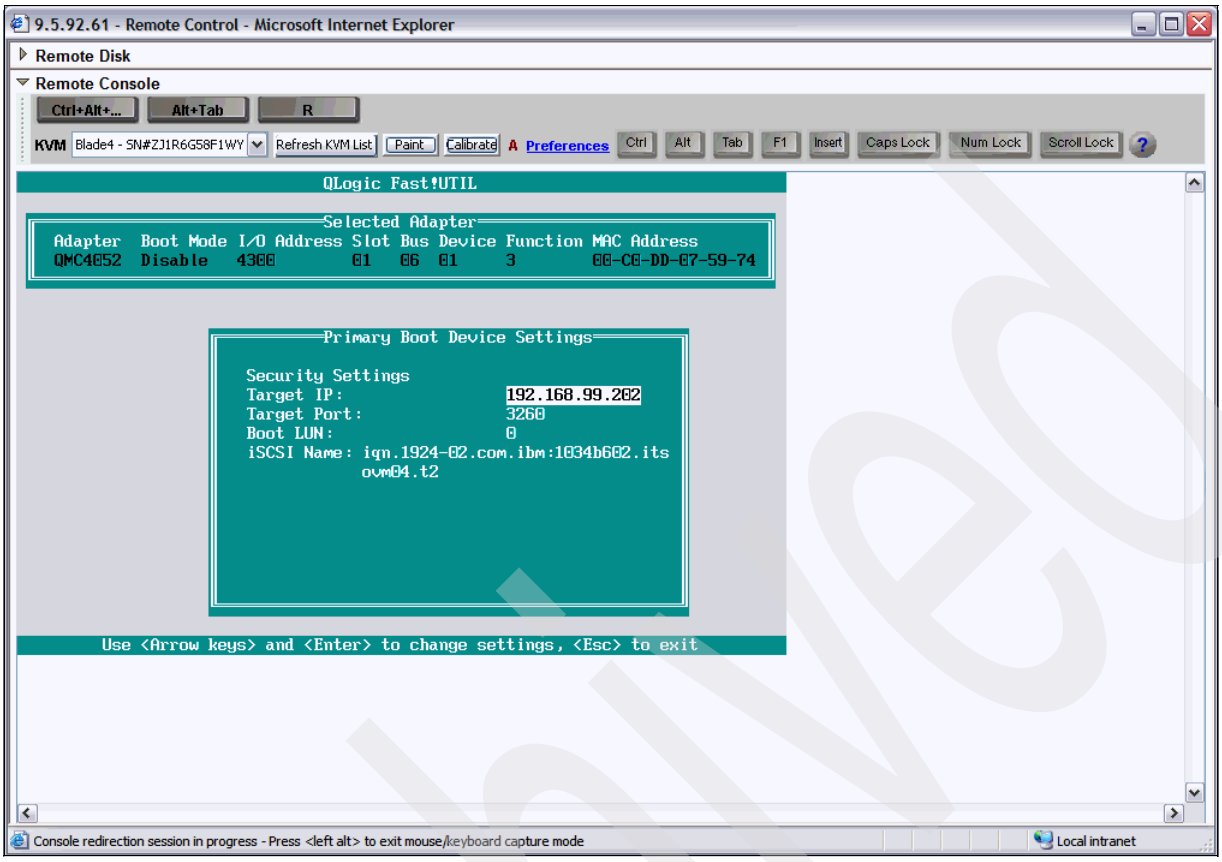

Figure 5-25 IP Settings

27. Select **iSCSI name** and enter iqn information obtained in step 18 on page 118 (Figure 5-26).

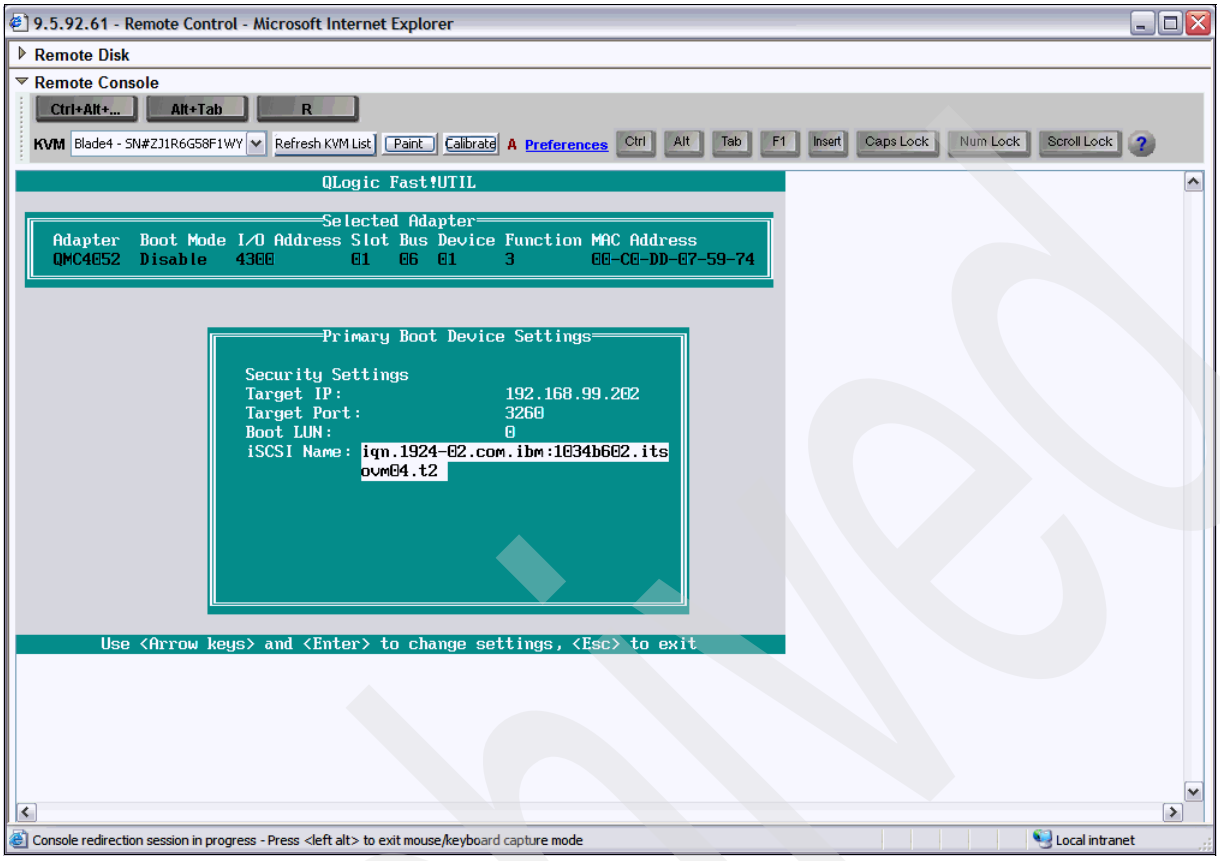

Figure 5-26 iSCSI name

28. Exit from Fast!UTIL and save changes.
29. You can now reboot your system. This should start your system into Windows. When the system is up and running, log on to the system with administrator authority.

30. When logged in to the system (we used remote desktop), you need to right-click **My Computer** and select **Manage** (Figure 5-27).

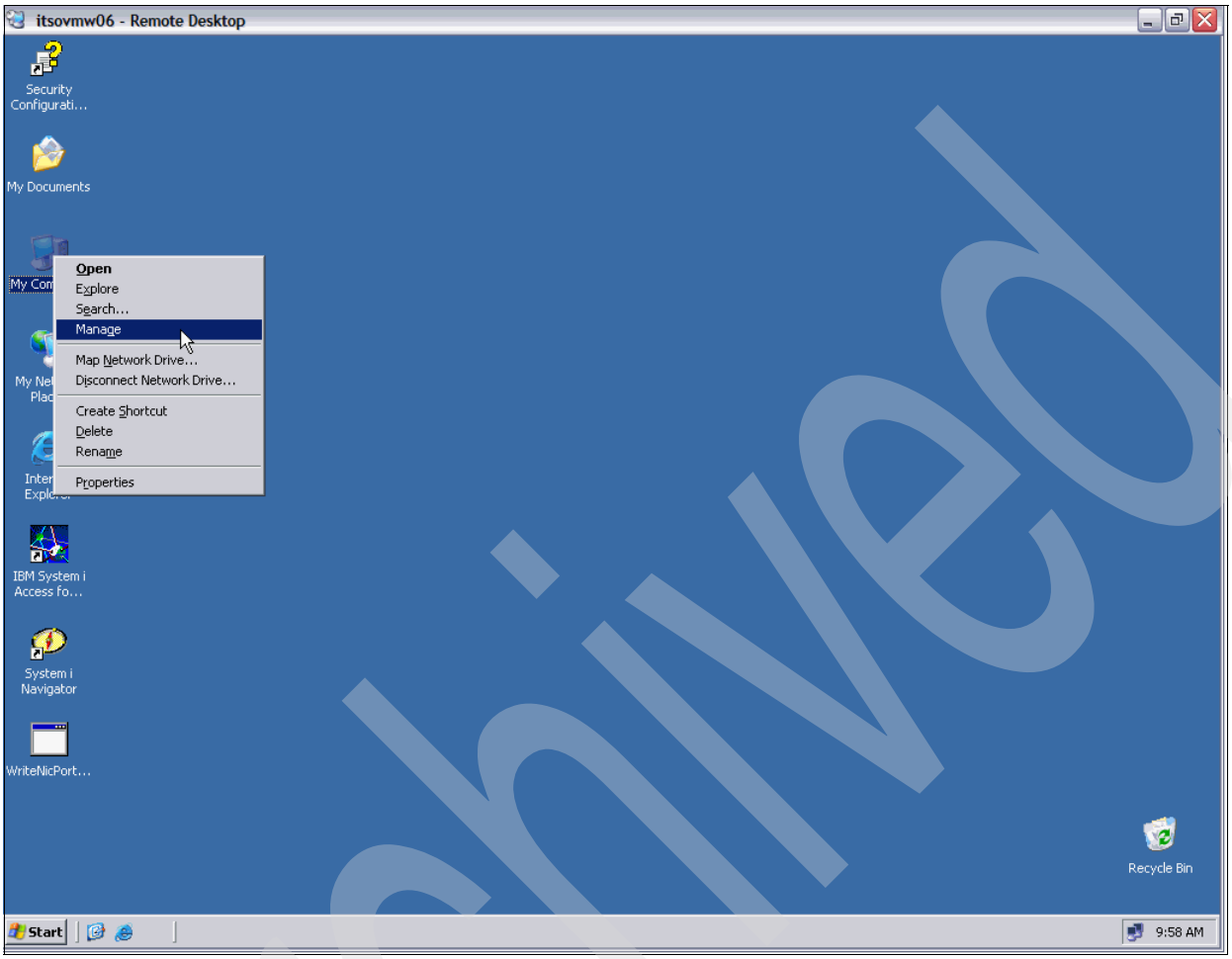

Figure 5-27 My Computer

31. In Computer Management, select **Disk Management** (Figure 5-28).

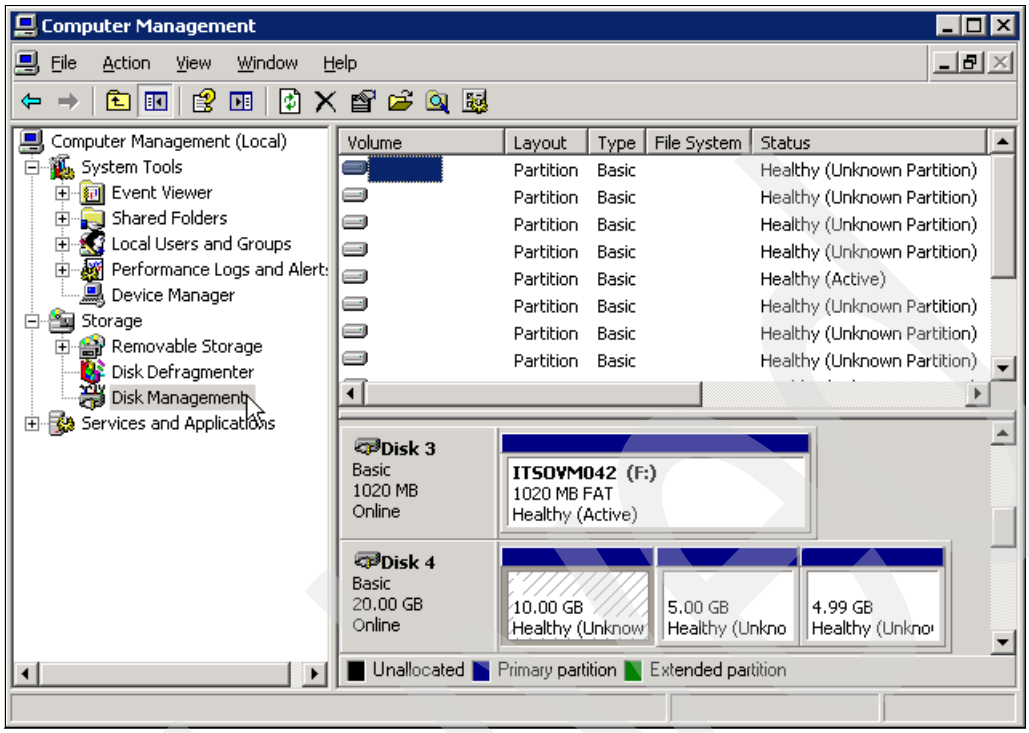

Figure 5-28 Disk management

32. Here you should see all of the storage spaces that are utilizing the NWSH selected in step 15 on page 117 for their storage path. If you do not see any additional drives other than the Windows drives for this server, you might need to select **Action** → **Rescan Drives** (Figure 5-29).

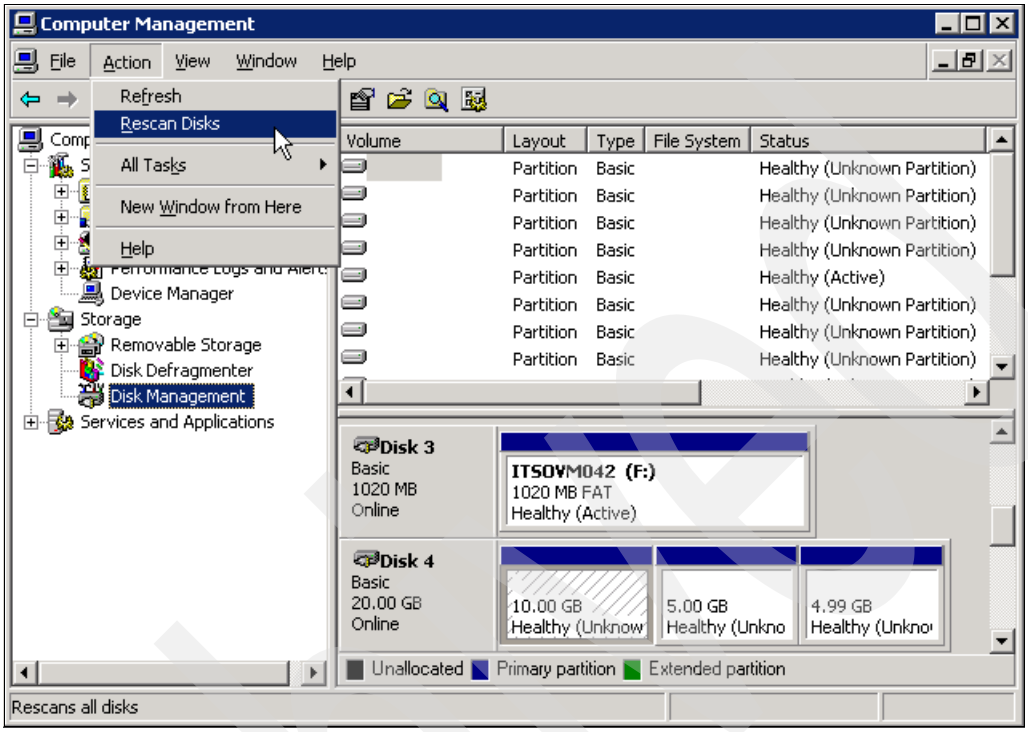

Figure 5-29 Rescan drives

33. The drives for the virtual machines should be listed as Healthy (Unknown Partition). To determine which disk is for which machine, right-click the disk and select **Properties** (Figure 5-30).

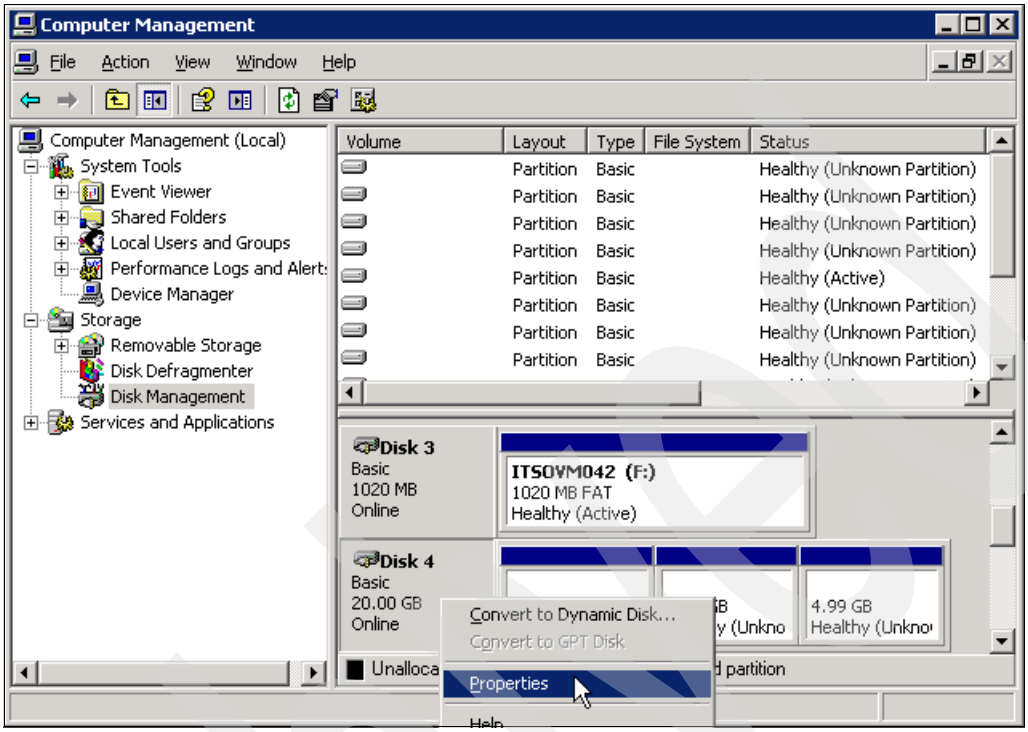

Figure 5-30 Select disk properties

34. On the disk properties window, this will list the volume name. This volume name should contain the disk name used when the disk was created in System i Navigator (Figure 5-31).

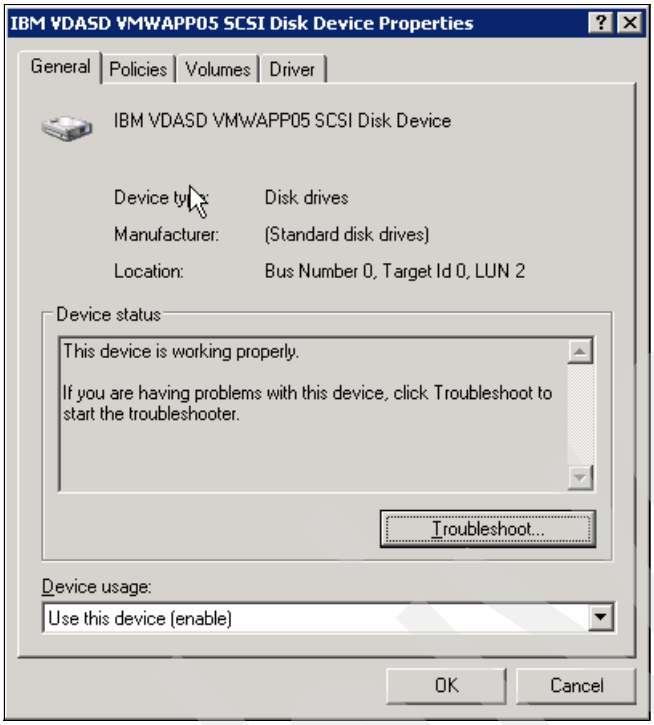

Figure 5-31 Disk device properties

35. After you have ensured that the storage spaces are showing up in disk management, you can use the VCB mount instructions to mount the virtual machine disk drive in preparation for backup.

36. You should now create a directory C:\mnt on the Windows server containing the VCB proxy. This will be used to mount the virtual machine storage spaces, which will allow you to perform a file level backup of the virtual machine. When you have created this directory, you must create a share for this directory in order for i5/OS to see it through the /QNTC integrated file system directory.

37. You now need to mount the virtual machine storage spaces. We used the vcbmounter.exe script and created a mount.bat file to perform our mount. We used *%1* as a variable, which would be the name of the virtual machine (Example 5-1). This would mount the drive for the virtual machine and create a directory in C:\mnt with the virtual machine name. You could create a .bat file that has a line for each server that you would like to mount and execute that batch file to perform a mount of all of your virtual machines for backup. For details on using the vcbmounter.exe, refer to Virtual Machine Backup, found at:

    http://www.vmware.com/support/pubs/vi_pubs.html

Example 5-1 mount.bat

```
vcbmounter.exe -h itsovmw02 -u administrator -p itso4all -a name:%1 -r
c:\mnt\%1 -t file
```

38. After you have executed the mount.bat, you should see a directory C:\MNT*%1* (Figure 5-32).

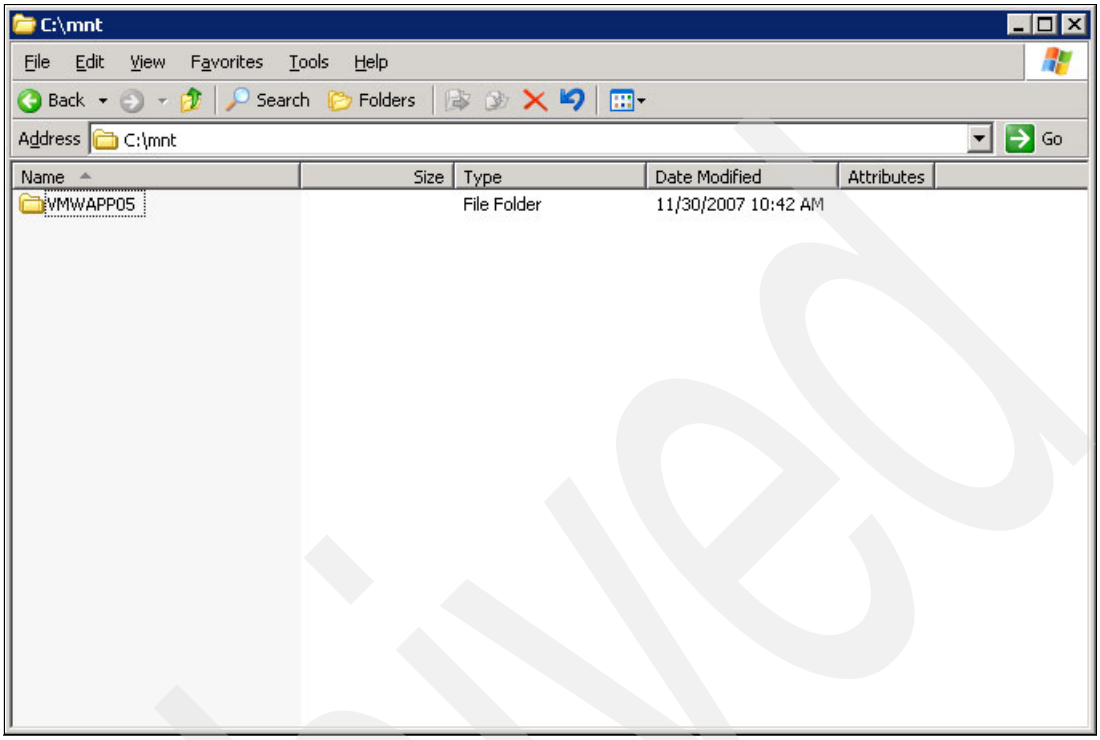

Figure 5-32 Virtual machine mounted directory

39. Within this directory, you will see two subdirectories: digits and letters. Both subdirectories are identical. You will want to refer to the letter subdirectory. Within this subdirectory, you should see any drive letters associated with this virtual machine (Figure 5-33).

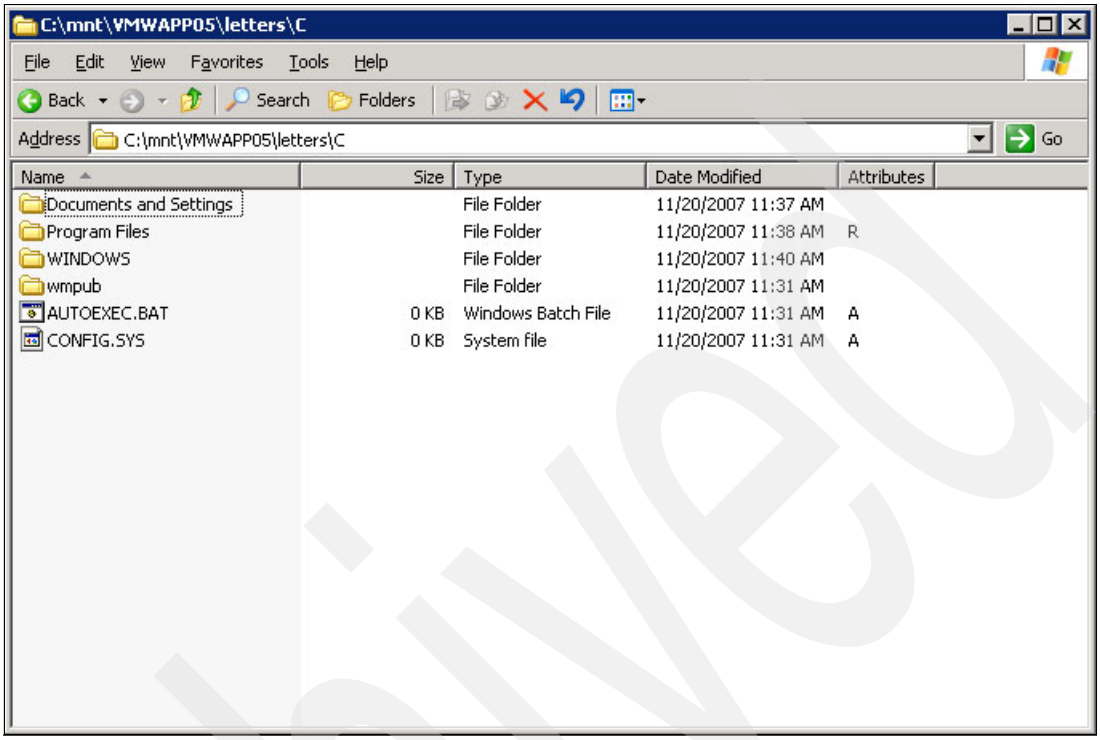

Figure 5-33 Virtual machine C drive

40. You should now be able to see this directory structure from i5/OS, through /QNTC in the integrated file system (Figure 5-34).

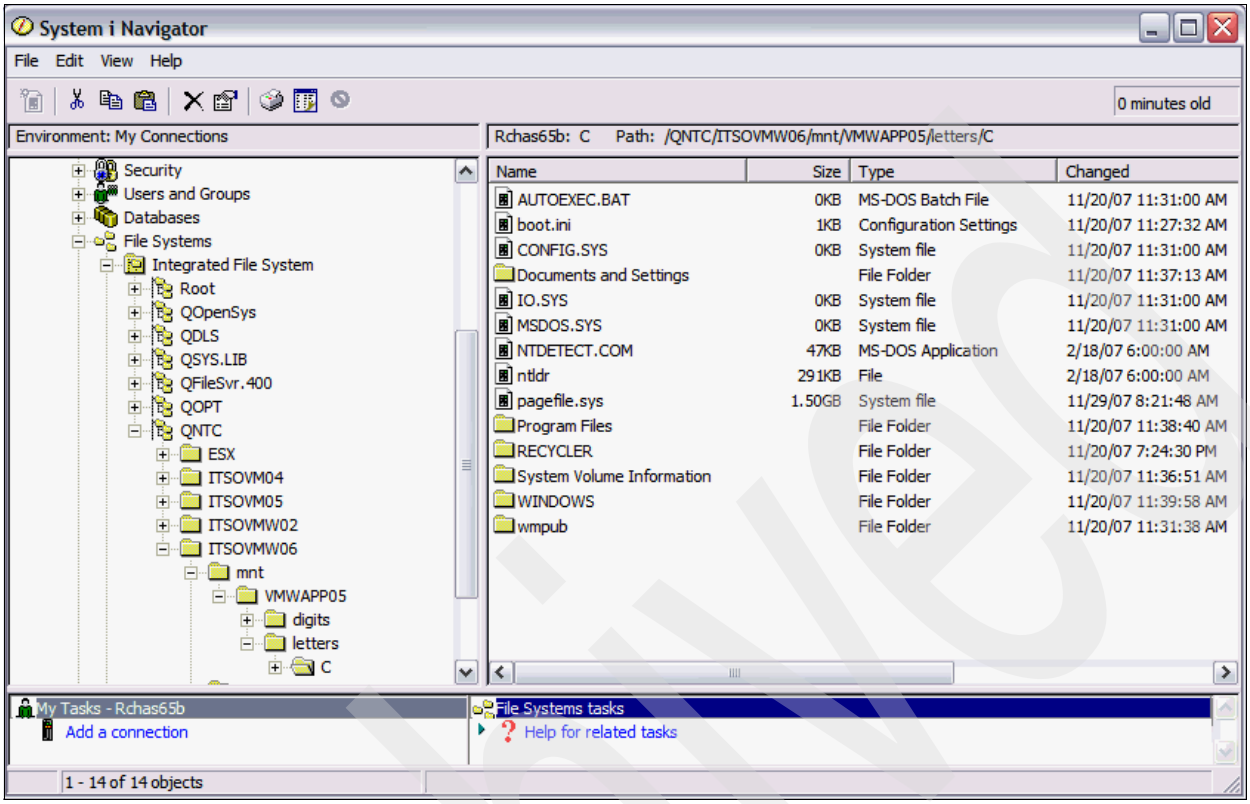

Figure 5-34 Mounted virtual machine directory

41. With this storage space mounted, you can now perform a file level backup of this virtual machine. In our example, we performed the save to a save file on the System i (Figure 5-35).

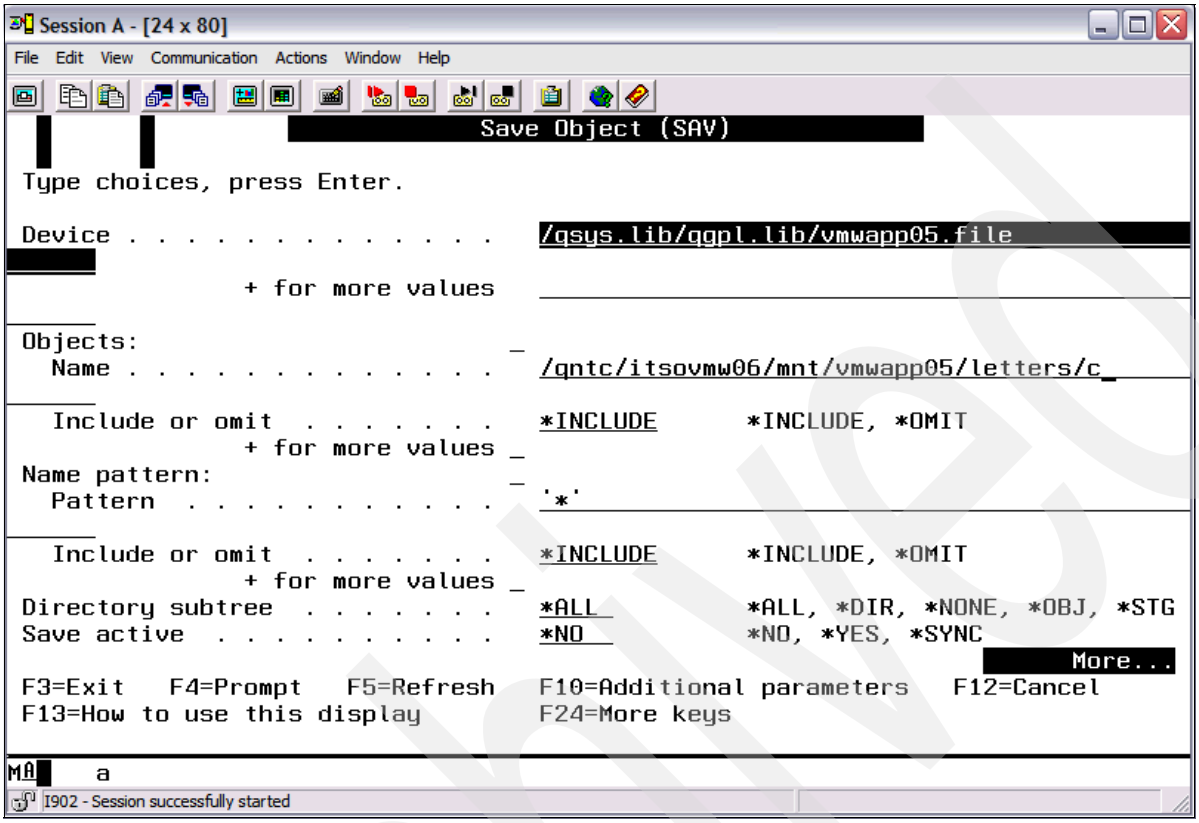

Figure 5-35 Save command

42. If the command completes successfully, you will get a message at the bottom of the window telling you how many objects were saved.

43. After you have saved your virtual machine storage spaces, you must unmount the drives. To do this, we used the vcbmounter.exe command and created an unmount.bat file. This unmounts the virtual machine drive and allows the virtual machine to resume as normal (Example 5-2).

Example 5-2 unmount.bat

```
vcbmounter.exe -h itsovmw02 -u administrator -p itso4all -U c:\mnt\%1
```

44. After performing the unmount, you should see your mounted directory removed from the C:\mnt directory (Figure 5-36).

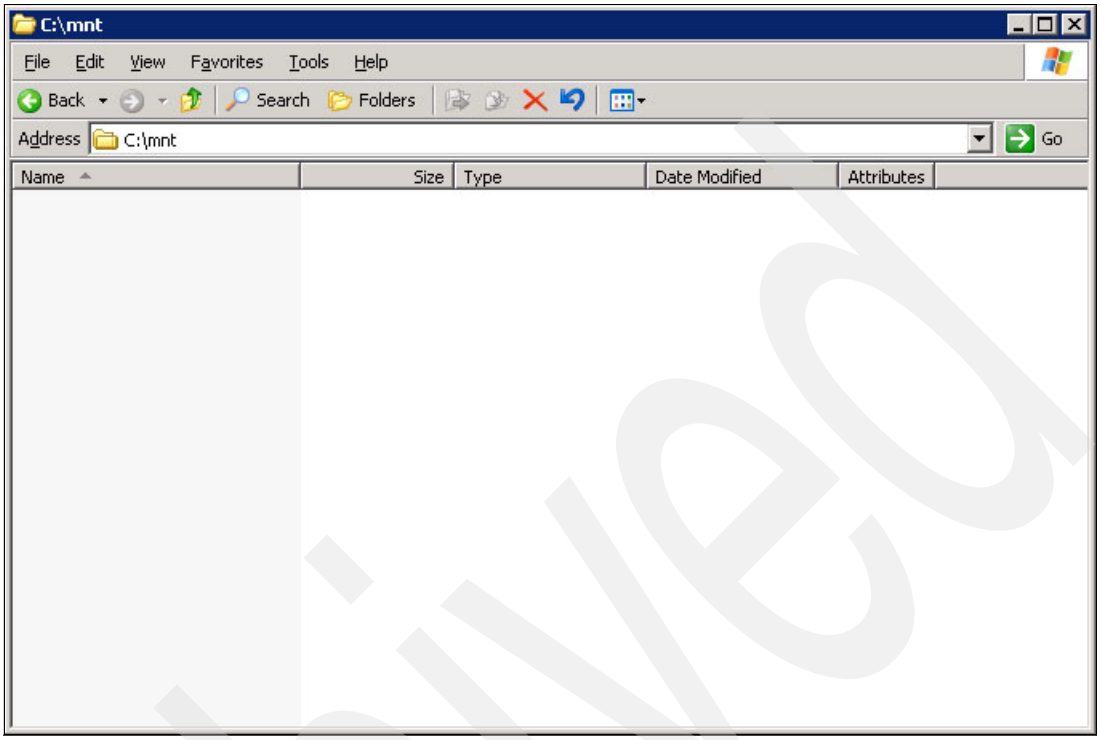

Figure 5-36 Unmounted directory

You have successfully performed a file level backup of the virtual machine through i5/OS, utilizing the VCB proxy.

5.3.2 Using other backup solutions

To achieve a file level backup, this would involve some sort of agent within the virtual machine, such as TSM. There are many generally available products that could fit this solution. For complete details, refer to Virtual Machine Backup, found at:

`http://www.vmware.com/support/pubs/vi_pubs.html`

5.4 VMware Infrastructure 3 recovery

This section discusses the topic of recovering VMware Infrastructure 3.

5.4.1 Storage space recovery

If you follow the recommendations in 2.3.2, “System i storage sizing” on page 13, then recovery of a storage space for an individual virtual machine will be easily accomplished. By having a separate storage space for each virtual machine, you would be able to recover a single virtual machine with the restoring of a single storage space.

To restore a storage space, you need to create a NWSSTG space to restore the storage space into. Use the RST command and specify in the Objects field ‘/QFPNWSSTG/*stgspc*’

and ‘dev/QASP*nn*/*stgspc*.UDFS’, where *stgspc* is the name of the network server storage space and *nn* is the number of the disk pool.

5.4.2 Virtual machine file level restore

To do this:

1. To ease the restoring of individual files from a virtual machine, we recommend creating a Restore folder on your VCB proxy server and making it a shared folder. This allows you to restore the file from the save media into the /QNTC directory. You will then be able to move the restored file to the virtual machine (Figure 5-37).

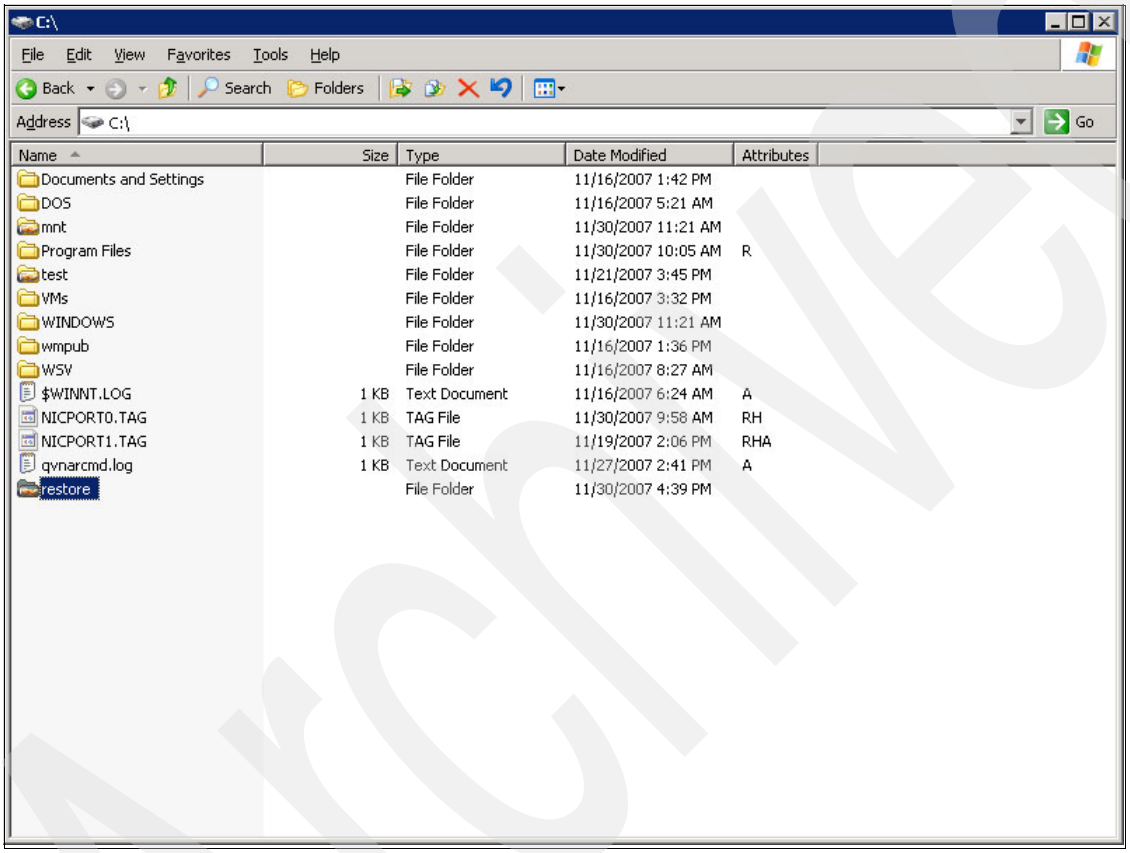

Figure 5-37 Restore share

2. After you have the shared restore folder created, you can restore the files from your save media into the shared folder (Example 5-3).

Example 5-3 Restoring files from save media

```
===> RST DEV('/qsys.lib/qgpl.lib/vmwapp05.file')
OBJ(('/qntc/itsovmw06/mnt/vmwapp05/letters/C/boot.ini' *INCLUDE
'/qntc/itsovmw06/mnt/vmwapp05/letters/c/boot.ini')) CRTPRNDIR(*YES)
ALWOBJDIF(*ALL)
```

3. When the file is restored, you can add the shared restore folder to your virtual machine and copy the restored file to the virtual machine.

6

Managing integrated ESX Server

Administering a VMware VI3 environment based on System i integrated servers requires the use of both VMware and i5/OS techniques. Some i5/OS configuration objects such as NWSDs and storage spaces are involved when the user wants to start and stop the Integrated ESX Servers. These i5/OS objects have to be carefully handled when an integrated ESX Server or a virtual machine needs to be removed from the system.

This chapter explains the integrated infrastructure management using the System i interfaces (System i Navigator and the i5/OS command line), the VMware Virtual Infrastructure Client, and the service processor Web interface:

- Advanced Management Module (AMM) for Blade
- Remote Supervisor Adapter II (RSA II) for System x

6.1 Getting ready for ESX Server management

This section discusses getting ready for EST sever management.

6.1.1 Introduction to service processor for i5/OS users

The service processor on System x and BladeCenter is a separate processor that is used to control power to the device and perform management and diagnostic functions. There are three types of processors available:

- Base Management Controller (BMC) is used to control some System x servers. We do not recommend managing a System x server using BMC. BMC does not have a Web server interface.
- Remote Supervisor Adapter II (RSA II) is the processor that is required for many System x servers. We recommend installing RSA II on all the Integrated System x servers.
- Advanced Management Module (AMM) is the management processor for the BladeCenter as a whole. Thus, from the perspective of the System i configuration, all 14 blades in the chassis have the same service processor.

Both RSA II and AMM have a built-in Ethernet adapter. The RSA II or AMM can be connected to the System i over the 1 Gb iSCSI LAN, but are usually connected to a separate Ethernet LAN.

To set up the RSA II or AMM module you can connect a PC or mobile computer client to their network interface using a crossed Ethernet cable. If the Ethernet adapter on your PC or mobile computer is capable of 1 Gb line speed, you can use either a crossed or straight cable.

The default IP address for an RSAII or AMM service processor is 192.168.70.125 and the subnet mask is 255.255.255.0.

Connecting to Advanced Management Module or RSA II Web interface

To connect to the service processor Web interface (AMM or RSA II):

1. Set the IP address on your Windows workstation to something in the same subnet as the service processor default IP address of 192.168.70.125, such as 192.168.70.124, and set the subnet mask to 255.255.255.0.
2. Open a Web browser. In the address or URL field, type the IP address `192.168.70.125`. The Connect to window opens.
3. Enter the user name and password. The service processor has a default user name of USERID and password of PASSW0RD (where 0 is a zero, not the letter O).
4. Select a time-out value on the next window and click **Continue**.

Note: If you have problems trying to connect to a service processor Web interface (AMM or RSA II), consider the following:

- A software firewall active on your client can cause problems. Stop the firewall and retry.
- An RSA II adapter is usually configured by default to look for an address from a DHCP server before activating the fixed address 192.168.70.125. If no DHCP server is available, follow these steps to enable the fixed IP mode:
  a. Boot the System x server and press F1 on the console to enter the setup mode.
  b. Drill down the menus **Configuration** → **Advanced Configuration** → **Remote Supervisor Adapter II**.
  c. Set the fixed IP mode.
  d. If you want to connect your server's RSAII to an existing network, assign a new IP address. Otherwise, leave the default 192.168.70.125.
  e. Exit from the setup menu and save the new configuration.

The service processor Web interface provides a management menu with many options.

You can manage the service processor's configuration and firmware update, and manage the status of the System x server or each of the blade servers. Figure 6-1 shows the Advanced Management Module of a BladeCenter.

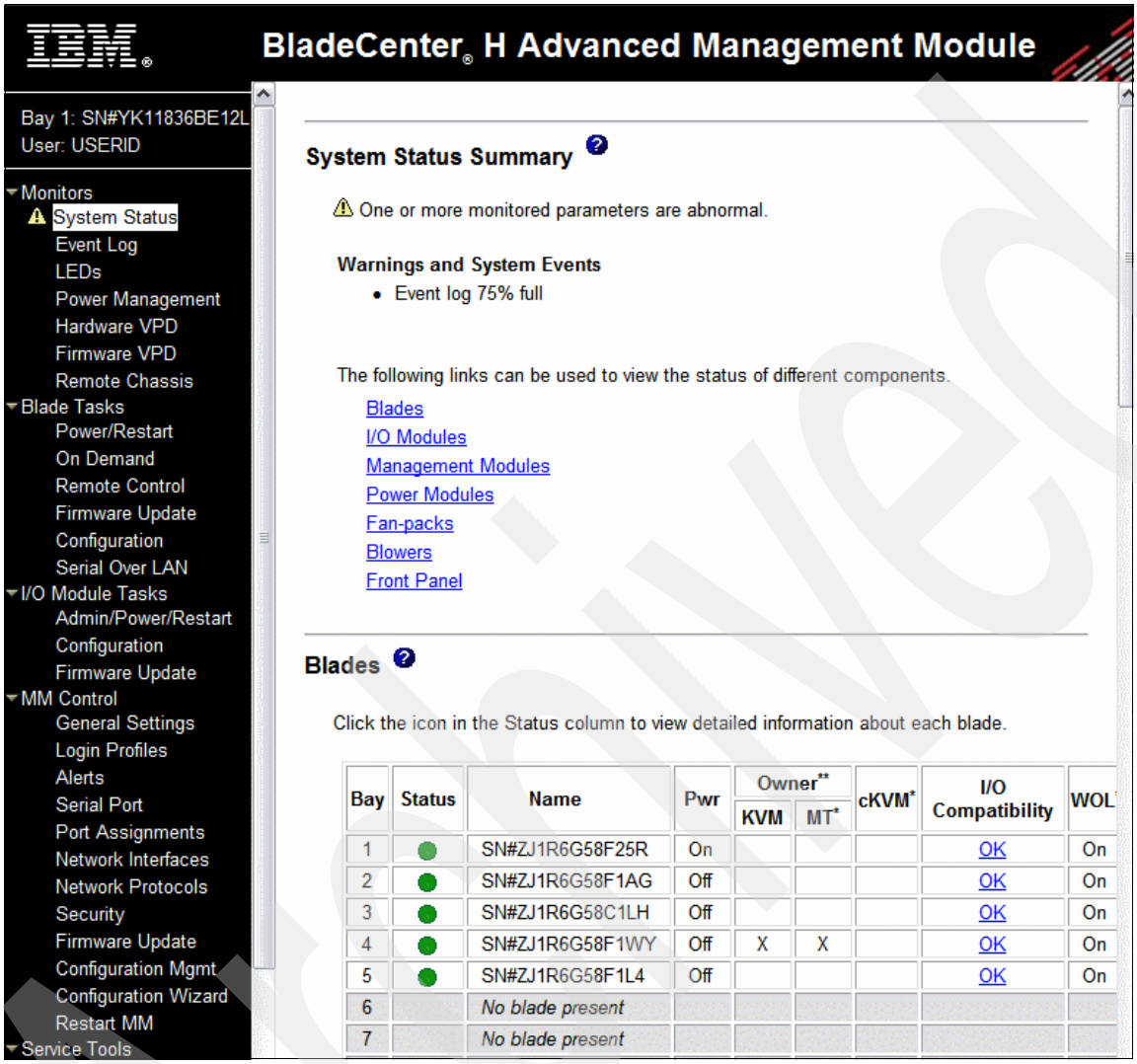

Figure 6-1 Service processor Web interface (BladeCenter Advanced Management Module)

Start and stop a server using the service processor Web interface

Note: You should only use the service processor Web interface to power on or power off an ESX Server if it is in a shut down or varied off state. Performing these operations with the server in any other state can have unpredictable results. This method will not start or shut down the integrated ESX Server itself. It will just power on or power off the server hardware. This is intended to be used for maintenance of the server hardware only.

To start or stop a System x server using the RSAII Web interface:

1. Expand the **Tasks** menu.
2. Click **Power/Restart**.
3. On the right pane, click **Power On / Off Server Immediately**.
4. Click **OK** on the confirmation window.

To start or stop a blade server using the Advanced Management Module:

1. Expand the Blade Tasks menu.
2. Click **Power/Restart**.
3. Check the box next to the blade that you want to manage.
4. Click **Power On / Off Blade**.
5. Click **OK** on the confirmation window.

Figure 6-2 shows a blade server ready to be started using the Advanced Management Module Web interface.

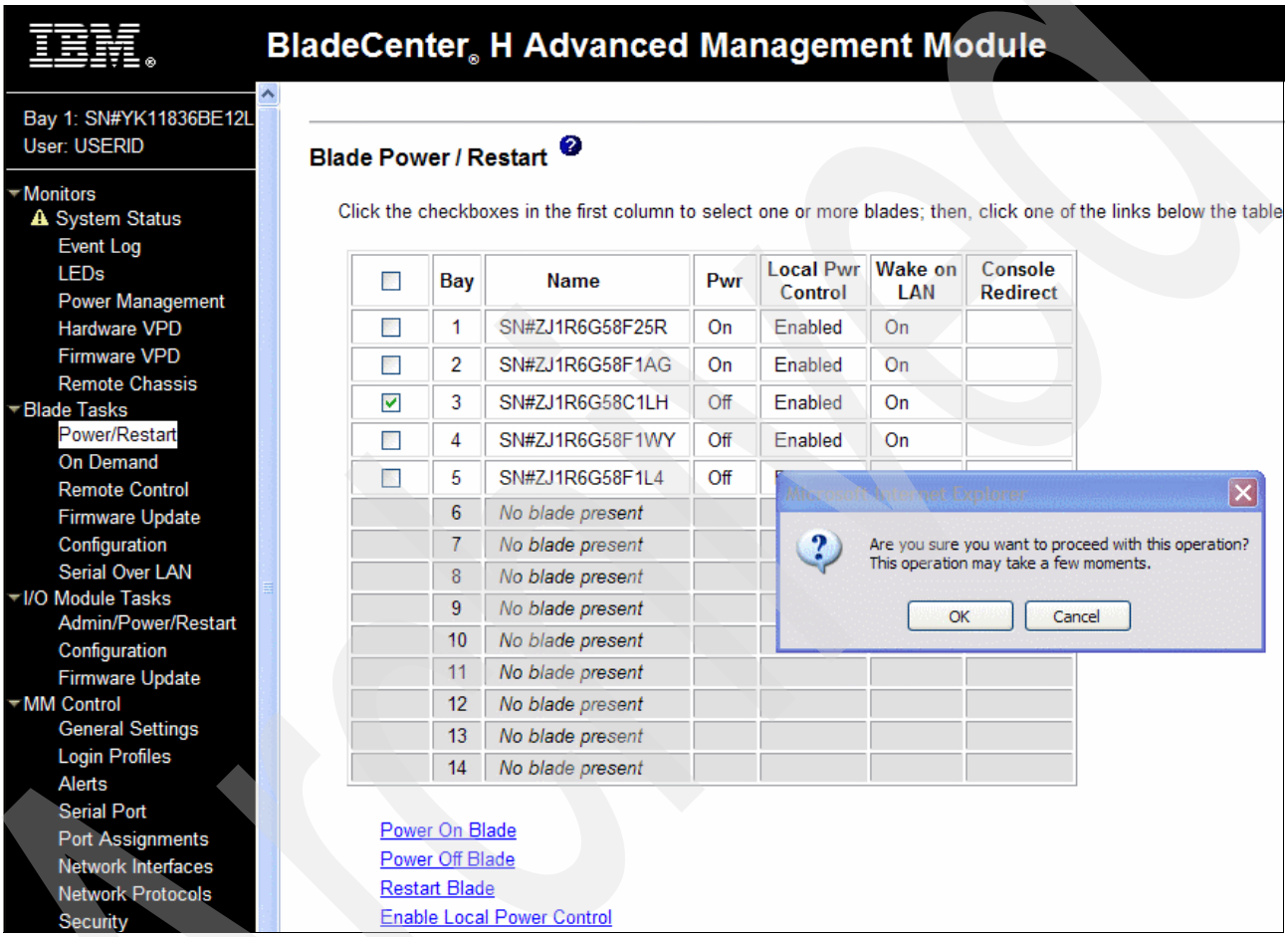

Figure 6-2 Blade power management

Enter the ESX Server Console using the remote control Web interface

Remote control is a feature of the AMM and RSA II Web interface. Remote control allows you to enter the managed system's console from a Web browser, replacing a physically attached monitor, mouse, and keyboard. You need a Java™-enabled Web browser in order to start the Remote Console feature.

On a System x or blade server running VMware ESX, remote control allows you to access the ESX operating system console. It does not give access to the Virtual Machines running on the ESX Server.

To start a console window on the RSAII Web interface:

1. Expand the **Tasks** menu.
2. Click **Remote Control**.
3. On the right pane, click **Start Remote Control in Single User Mode**.

   A window opens where you can access the System x console, manage the CD-ROM drive, and mount ISO images.

To start a Console window on the AMM Web interface:

1. Expand the **Blade Tasks** menu.
2. Click **Remote Control**.
3. On the right pane, click **Start Remote Control**.
4. The Remote Control window opens. Pull down the KVM menu to select the blade that you want to manage.

Figure 6-3 shows the Remote Control window of an Advanced Management Module.

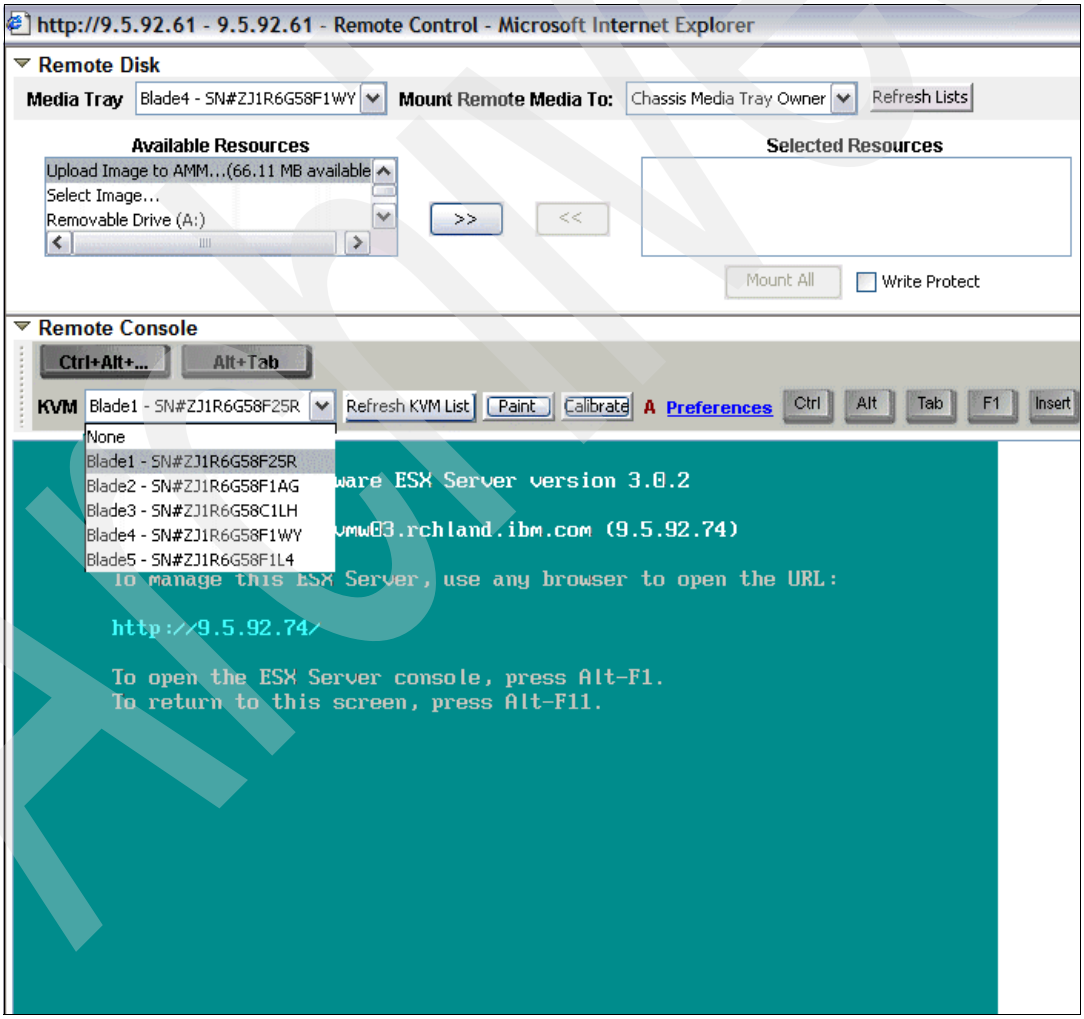

Figure 6-3 Remote Control window

Click the Console window in order to enter commands. Press Alt to exit the console.

Service processor event log

The service processor (AMM or RSA II) provides an event log viewer where you can read errors and messages about the server's hardware environment.

To access the server's event log (both for RSAII and AMM service processor):

1. Expand the **Monitors** menu.
2. Click **Event Log**.
3. The event log is displayed in the right pane.
4. You can clear the event log by clicking the **Clear Log** button on the bottom of the window. Save the log to a text file before clearing it.

Figure 6-4 shows the event log of an Advanced Management Module.

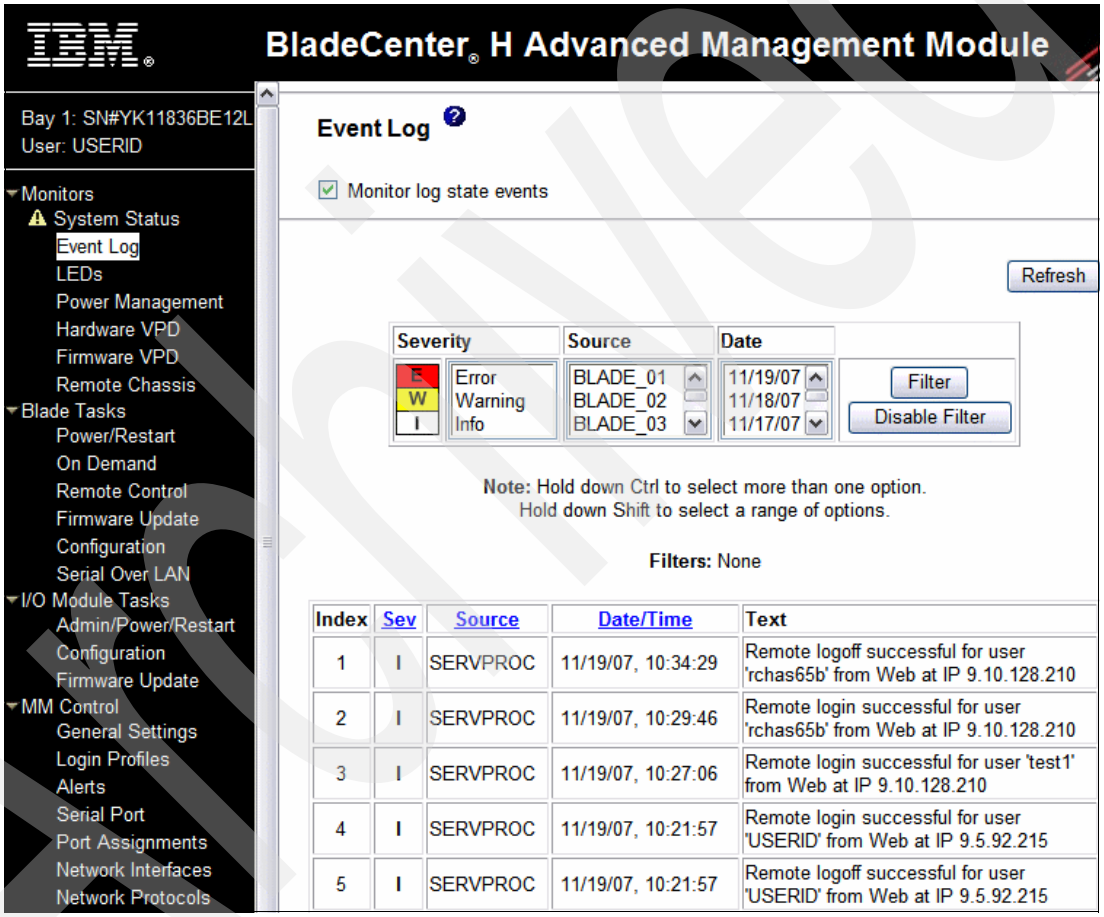

Figure 6-4 BladeCenter event log

6.1.2 Starting IBM Director

Before trying to start an Integrated ESX Server you should verify that IBM Director is active. IBM Director can be started using either System i Navigator or the Qshell interface

Starting IBM Director using the System i Navigator interface

To do this:

1. Open System i Navigator and drill down the following menus: **YourSystem** → **Network** → **Servers**, then click **User-Defined**.
2. You can now see the status of the director server. Right-click it to start IBM Director if it is not already started (Figure 6-5).

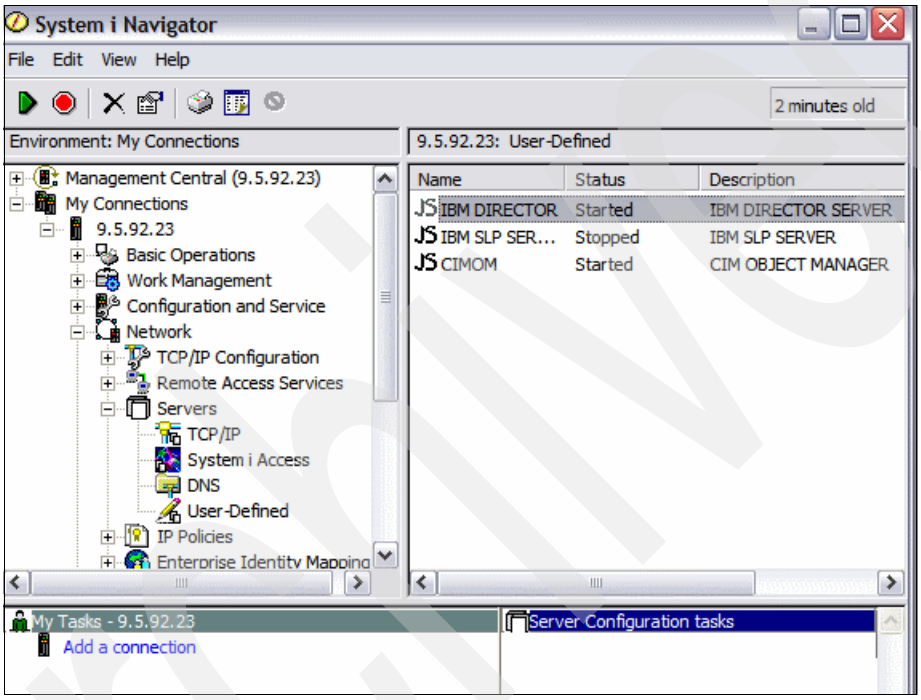

Figure 6-5 IBM Director status

Starting IBM Director using the i5/OS Qshell interface

To do this:

1. Start the Qshell interface by entering the **qsh** command on the System i command line.
2. On the Qshell command line enter the command (Example 6-1):

```
/QIBM/ProdData/Director/bin/twgstat
```

Example 6-1 IBM Director status in Qshell

```
QSH Command Entry
$
 > /qibm/proddata/director/bin/twgstat
   Active
   $
===> /qibm/proddata/director/bin/twgstat
F3=Exit  F6=Print F9=Retrieve F12=Disconnect
 F13=Clear F17=Top  F18=Bottom  F21=CL command entry
```

3. If IBM Director is not active, enter the command:

   ```
   /QIBM/ProdData/Director/bin/twgstart
   ```

4. If IBM Director fails to start, look at the QCPMGTSVR joblog on System i, as a first troubleshooting action. Use the following command:

   ```
   WRKJOB QCPMGTSVR
   ```

Starting IBM Director at IPL

To configure IBM Director to automatically start when TCP/IP is started at IPL, use System i Navigator to perform the following steps (Figure 6-6):

1. Expand your server.
2. Expand **Network** → **Servers**, and click **User-Defined**.
3. On the right pane, right-click **IBM DIRECTOR** and select **Properties**.
4. Select the **Start when TCP/IP is started** option. Click **OK**.

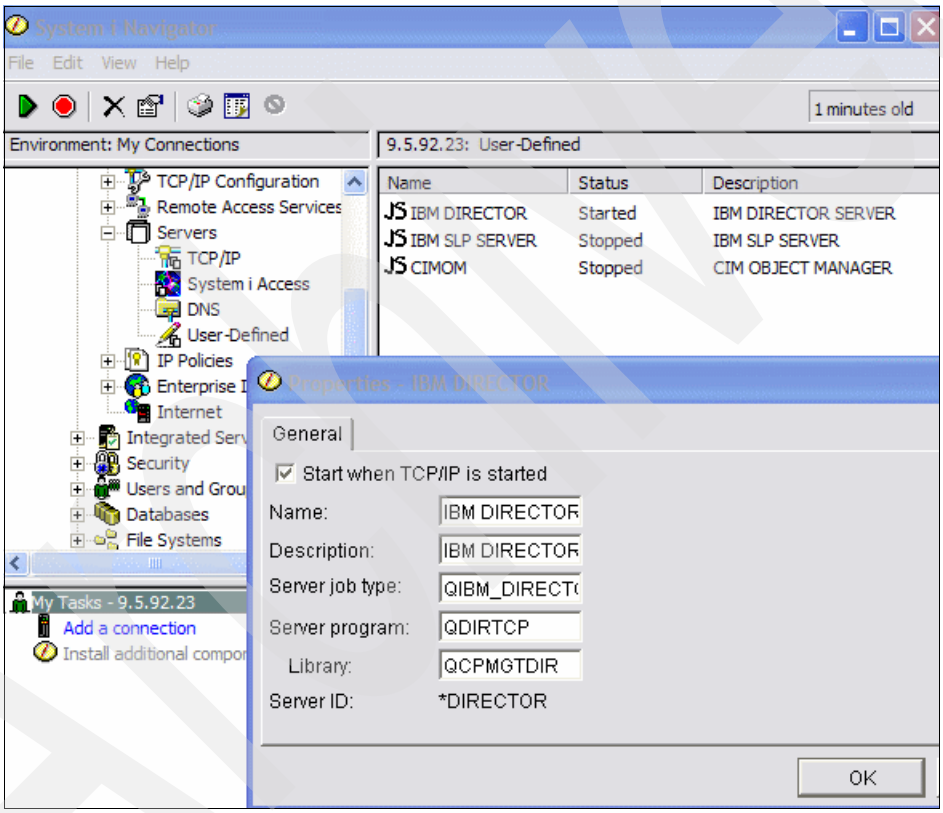

Figure 6-6 IBM Director autostart

6.2 Starting an Integrated ESX Server

An Integrated ESX Server can be started in several ways:

- System i Navigator interface
- System i command line (also known as *green screen*)
- Hardware power on (Power button or service processor Web interface)

As explained in “Start and stop a server using the service processor Web interface” on page 140, we do not recommend handling the ESX Server status using the hardware interface. Use System i Navigator or the command line to start and stop an ESX Server.

6.2.1 Starting an Integrated ESX Server using System i Navigator

The best option for handling the status of an Integrated ESX Server is the System i Navigator interface. The Navigator GUI interface gives a complete view of the integrated environment and allows you to handle all of the options quickly.

To start a server using System i Navigator, execute the following steps (Figure 6-7):

1. Expand the **Servers** section under Integrated Servers Administration.
2. Right-click the server’s name.
3. Click **Start**, or click **Start with Options**.

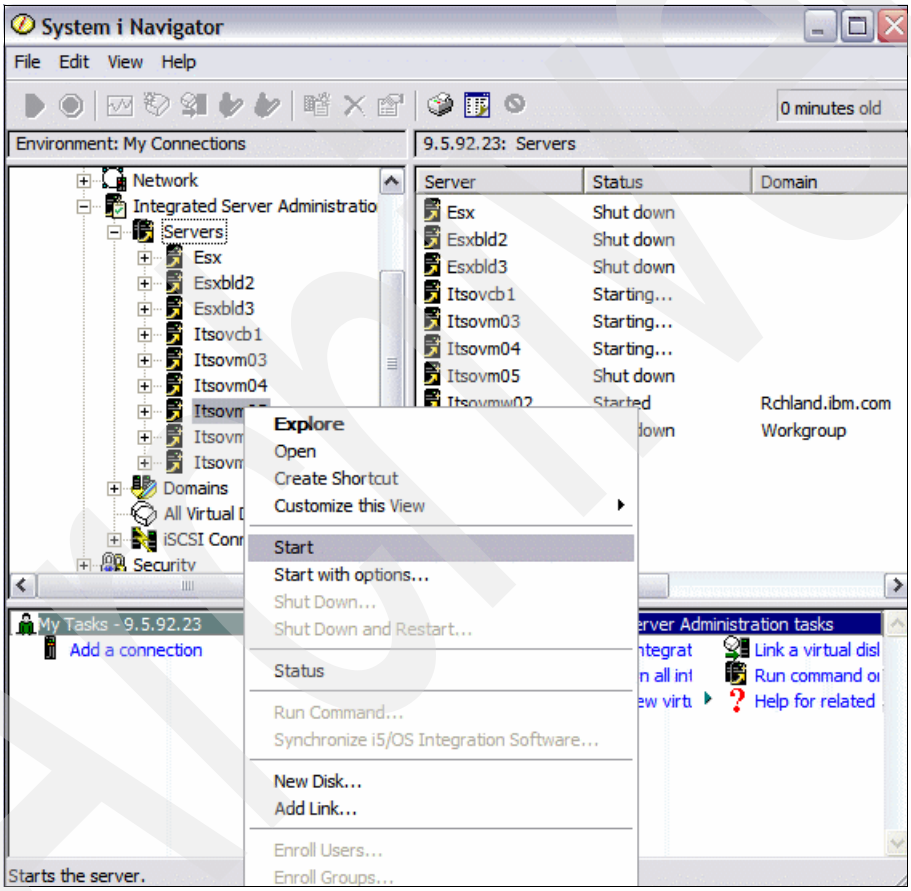

Figure 6-7 Starting a server using System i Navigator

Start with Options provides you with the following options (Figure 6-8):

- Regenerate Path Certificates: Leave the box unchecked.
- Reset remote system: By checking this option the associated System x or blade will be powered off completely before the requested power on. Ensure that the physical server is not in use by another NWSD before entering this parameter.

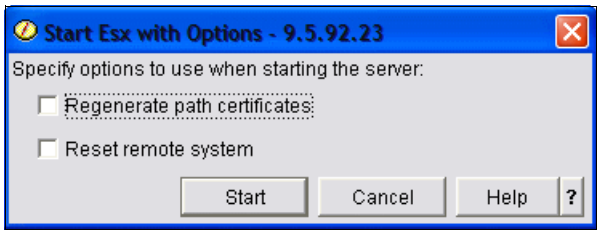

Figure 6-8 Start server with options

6.2.2 Starting an Integrated ESX Server using CL commands

An Integrated ESX Server is linked to an i5/OS NWSD object (network server description). You can use the i5/OS command-line interface, as known as green screen, to start the server.

1. On the i5/OS command line, type the command WRKCFGSTS *NWS and press Enter.
2. Choose the server that you want to power on.
3. Select option 1 (Vary on) and press Enter.

Note: If the physical server (System x or Blade) is not powered off, an error message is issued. To force the activation when the physical server is already powered on you need to reset the server as follows:

1. Select option 1 (Vary on) and press PF4.
2. Press PF9.
3. Set the Reset system parameter to *YES.
4. Press Enter.

Ensure that the physical server is not in use by another NWSD before setting the reset system parameter.

Figure 6-9 shows the reset system parameter set to *YES during the server activation.

```
 Vary Configuration (VRYCFG)

 Type choices, press Enter.

 Configuration object . . . . . > ITSOVM05      Name, generic*, *ANYNW...
 Type . . . . . > *NWS          *NWS, *NWI, *LIN, *CTL...
 Status . . . . . > *ON          *ON, *OFF, *RESET...
 Vary on wait . . . . . .   *CFGOBJ       *CFGOBJ, *NOWAIT, 15-180
(sec)
 Submit multiple jobs . . . . . .   *NO           *NO, *YES
 Job description  . . . . . .   QBATCH        Name
   Library  . . . . . .     *LIBL       Name, *LIBL
 Generate path certificate  . . .   *NO           *NO, *YES
 Reset system . . . . . .   *YES          *NO, *YES

                                                                      Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

Figure 6-9 Starting an Integrated server using i5/OS command line

6.2.3 Starting an Integrated ESX Server during System i IPL

To start an Integrated ESX Server during System i IPL you can set the autostart parameter on the IP interface of the Virtual Ethernet point-to-point line attached to the NWSD.

Setting autostart with System i Navigator

To do this:

1. Open System i Navigator (Figure 6-10).
2. Expand the menu **Network** → **TCP/IP Configuration** → **IPv4**.
3. Click **Interfaces**.
4. Right-click the interface named ***yournwsd*PP**, then click **Properties**.
5. Select the **Advanced** tab.
6. Check the box **Start Interface when TCP/IP is started**.

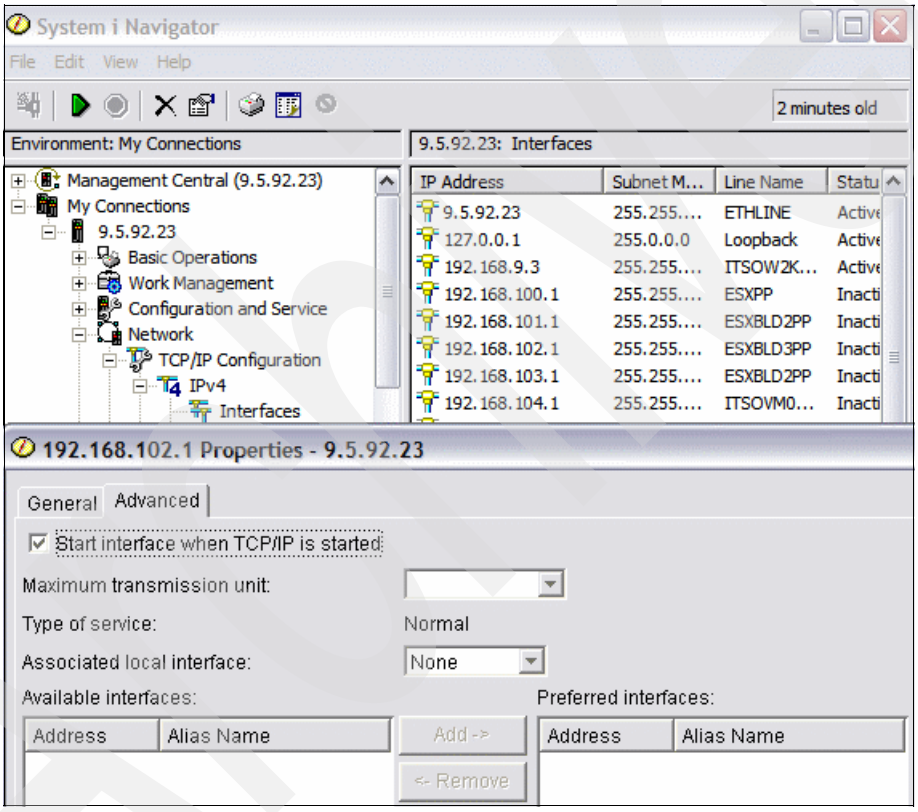

Figure 6-10 Setting a TCP/IP interface for autostart

Setting Autostart using the CFGTCP CL command

To do this:

1. Retrieve the NWSD's point to point line address using the NETSTAT *IFC command (Figure 6-11).

```
 Work with TCP/IP Interface Status
                                                                System:   RCHAS65
 Type options, press Enter.
   5=Display details   8=Display associated routes   9=Start   10=End
   12=Work with configuration status   14=Display multicast groups

      Internet         Network             Line      Interface
 Opt  Address          Address          Description  Status
      9.5.92.23        9.5.92.0         ETHLINE      Active
      127.0.0.1        127.0.0.0        *LOOPBACK    Active
      192.168.9.1      192.168.9.0      ITSOW2K3PP   Inactive
      192.168.9.3      192.168.9.0      ITSOW2K3PP   Active
      192.168.100.1    192.168.100.0    ESXPP        Inactive
      192.168.101.1    192.168.101.0    ESXBLD2PP    Inactive
      192.168.102.1    192.168.102.0    ESXBLD3PP    Inactive

Bottom
 F3=Exit   F9=Command line   F11=Display line information    F12=Cancel
 F13=Sort by column          F20=Work with IPv6 interfaces   F24=More keys
```

*Figure 6-11 NETSTAT *IFC menu*

2. Change the autostart parameter to *YES using the CHGTCPIFC command:

```
CHGTCPIFC INTNETADR('192.168.101.1') AUTOSTART(*YES)
```

Note: For the integrated server autostart function to work properly, IBM Director Server must also be configured to autostart. Refer to section 5.2.2 in *Implementing Integrated Windows Server through iSCSI to System i5,* SG24-7230, for information about how to do this.

6.3 Stopping an integrated ESX Server

The need can arise for powering down an integrated ESX Server. For example, hardware maintenance has to be performed, as does adding or replacing I/O adapters or memory modules.

when you need to power down the system i itself, remember to plan a shutdown of all your virtual machines and integrated ESX Servers in advance.

Before stopping an Integrated ESX Server, all of its virtual machines must be shut down, or moved while active to other servers using the VMotion function. See 7.6, "VMotion" on page 224.

When no virtual machines are active on the ESX Server, place the server in maintenance mode before stopping it. When the server is in maintenance mode, neither a user nor the automatic DRS function are allowed to migrate any active virtual machines to it. This way you

can safely power down the ESX Server. See 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.

Note: Take extreme care before shutting down an NWSD object using the command line or using System i Navigator. Different from a Integrated Windows or Linux server, these interfaces do not give you any evidence of the virtual servers running on top of the infrastructure.

6.3.1 Place an integrated ESX Server in maintenance mode before stopping it

To do this:

1. Start VI3 Virtual Client on your workstation and open a session to Virtual Center. To install and manage Virtual Client see 3.2, “VMware Infrastructure Client installation” on page 25.
2. Click the **Inventory** button on the Toolbar.
3. Select **Hosts and Clusters** from the drop-down menu.
4. Find the ESX host that you want to power off and expand the list of its virtual machines.
5. Right-click each active virtual machine and select **Migrate**. Using VMotion, move all of the active virtual machines to other servers in the cluster. Shut down the virtual machines that you do not need to stay active.
6. Right-click the ESX Server that you want to shut down and select **Maintenance Mode**. This way the DRS feature will not try to move any virtual machine back to the server (Figure 6-12).

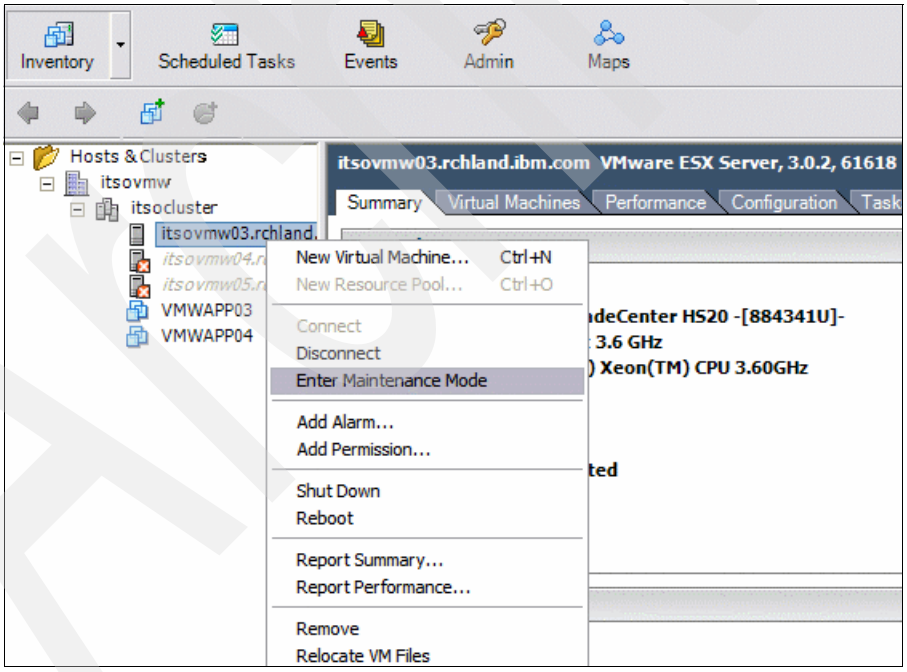

Figure 6-12 Entering Maintenance Mode

7. Although the ESX Server can now be shut down using the Virtual Client interface, we recommend using System i Navigator to put the ESX Server in vary off status. See 6.3.2, “Stopping an Integrated ESX Server using System i Navigator” on page 152.

6.3.2 Stopping an Integrated ESX Server using System i Navigator

Verify that no virtual machines are active on the server that you are going to shut down. Put the ESX Server in Maintenance Mode using the VI3 Virtual Client interface, as explained in 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.

To stop a server using System i Navigator, right-click the related icon under **Integrated Servers Administration** → **Servers** and click **Shut Down** (Figure 6-13).

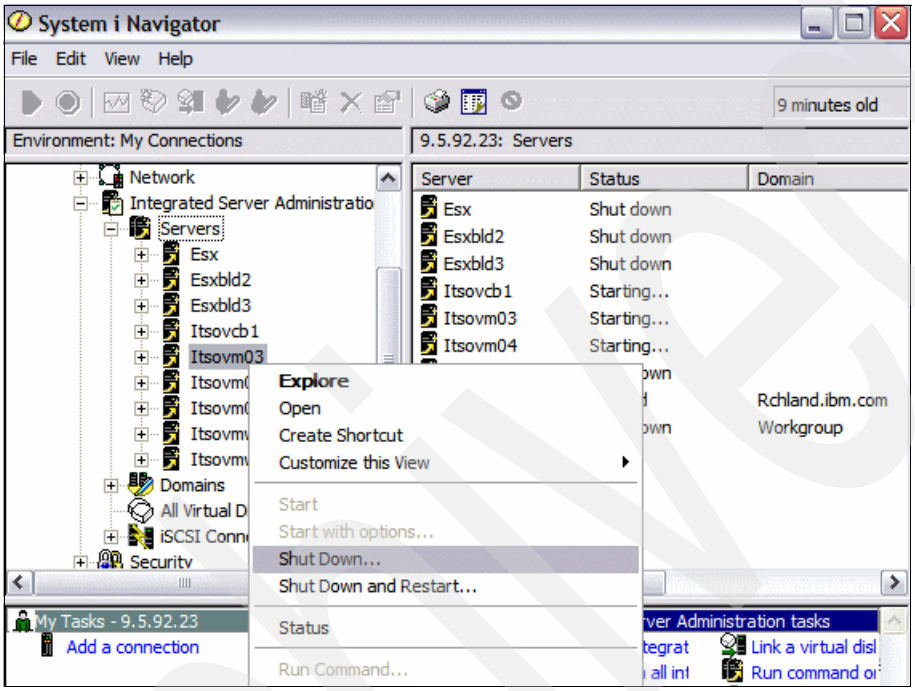

Figure 6-13 ESX Server shutdown using System i Navigator

The shutdown time-out default value is 15 minutes. If you need to modify this parameter follow these steps:

1. On System i Navigator, expand **Integrated Systems Administration** → **Servers**.
2. Right-click the ESX Server and select **Properties**.
3. Select the **System** tab.
4. Click the **Advanced** button.
5. Modify the Hardware shut down timeout parameter.

Figure 6-14 illustrate these steps.

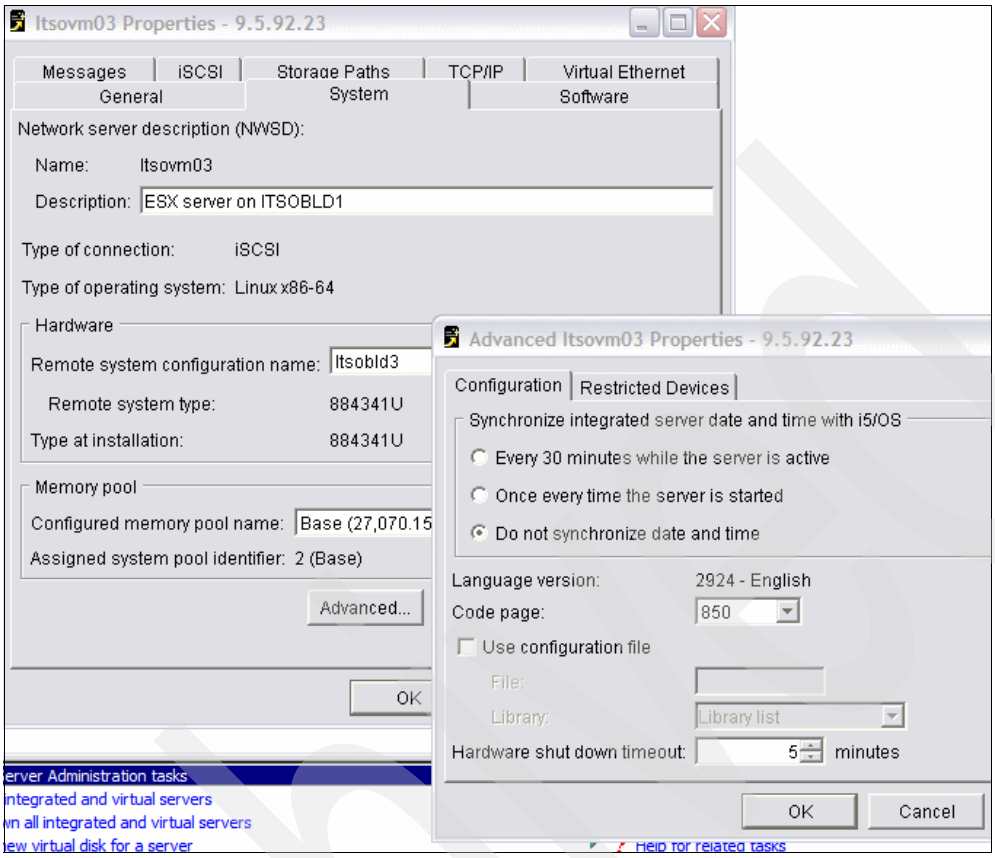

Figure 6-14 Setting the hardware shut down timeout

6.3.3 Stopping an integrated ESX Server using the System i command line

An active Integrated ESX Server can be stopped using the VRYCFG command on the System i command line, or by entering option 2 next to its NWSD configuration object.

Verify that no virtual machines are active on the server that you are going to shut down. Put the ESX Server in maintenance mode using the VI3 Virtual Client interface, as explained in 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.

To shut down a server using the System i green screen:

1. On the System i command line, type the command WRKCFGSTS *NWS.
2. Choose the server that you want to shut down.
3. Enter option 2 (Vary off). Press Enter.

6.3.4 Stopping an integrated ESX Server using VI3 Virtual Client

Verify that no virtual machines are active on the ESX Server that you are going to shut down. Put the ESX Server in maintenance mode using the VI3 Virtual Client interface, as explained in 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.

To shut down a server using the VI3 Virtual Client interface, execute the following steps:

1. Start the VI3 Virtual Client on your workstation.
2. Connect to the VirtualCenter.
3. Click the **Inventory** button.
4. Select the ESX Server that you want to shut down.
5. Right-click and select **Shut Down**.

Figure 6-15 illustrates these steps.

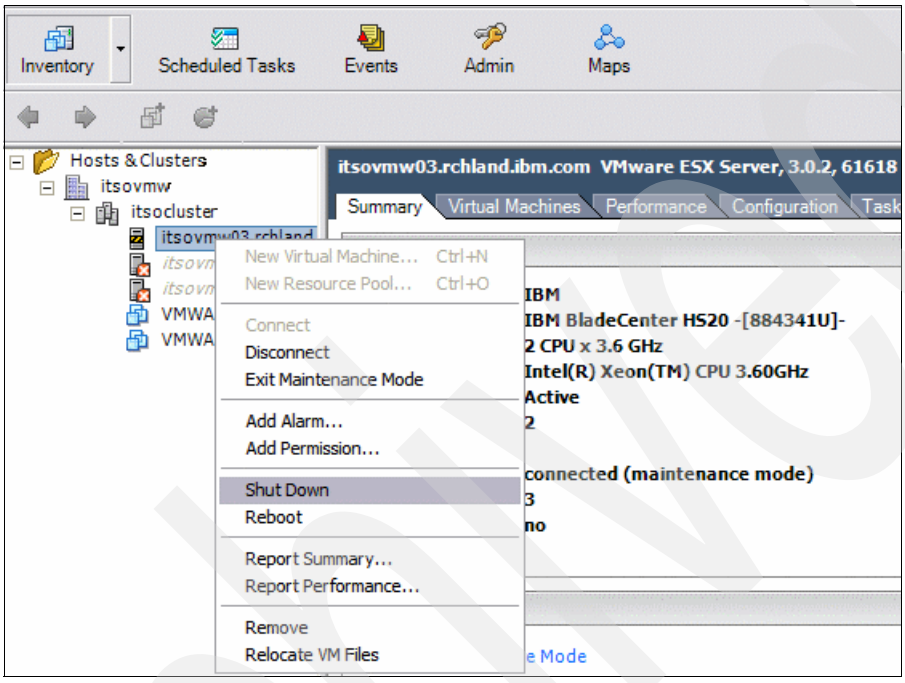

Figure 6-15 Shutting down an ESX Server using VI3 Virtual Client

6.3.5 Stopping an integrated ESX Server using the ESX OS console

With the help of an SSH client, the VMware Service Console can be accessed, and commands entered. We strongly recommend handling the status of an Integrated ESX Server using the virtual center or the System i interfaces.

The service console is based on a modified Red Hat Linux distribution. Thus, common Linux commands can be executed to stop the system:

- **`shutdown -h now`**
- **`poweroff`**
- **`reboot`** (The system will restart after a complete power off.)

6.4 Deleting an integrated ESX Server

To remove an Integrated ESX Server from your infrastructure:

1. Put the ESX Server in maintenance mode, as explained in 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.
2. Open a System i command-line session.

3. Ensure that the server that you are going to delete is in varied off status. See 6.3.3, “Stopping an integrated ESX Server using the System i command line” on page 153.
4. Enter the command DLTLNXSVR NWSD(*YourServerName*), as shown in Figure 6-16.

```
Work with Configuration Status                RCHAS65
                                                          11/19/07  11:28:17
Position to  . . . . .               Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status                ------------Job--------------
     ESX              VARIED OFF
       ESXPP          VARIED OFF
         ESXPPNET     VARIED OFF
           ESXPPTCP   VARIED OFF



                                                                      Bottom
Parameters or command
===> DLTLNXSVR NWSD(ESX)
F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys

Ending of ESXPP in progress.                                           +
```

Figure 6-16 Deleting an integrated ESX Server

The DLTLNXSVR command deletes all of the server’s objects:

- NWSD
- Line description
- TCP/IP controller description
- TCP/IP device description
- Virtual Ethernet TCP/IP interface
- Server storage spaces

The virtual machine storage spaces are not affected by the DLTLNXSVR command.

7

Virtual Machine administration

After you have created and configured the Integrated VI3 Infrastructure, you can add the Virtual Machines.

According to the official VMware documentation, a Virtual Machine is “a tightly isolated software container that can run its own operating systems and applications as though it were a physical computer. A virtual machine behaves similar to a physical computer and contains its own virtual (that is, software-based) CPU, RAM, hard disk and network interface card (NIC).

The isolation, or encapsulation, means that all of the components of a Virtual Machine consist in a single set of files, placed in a storage container.

In our Integrated VI3 Infrastructure the container is represented by a storage space, created by i5/OS and formatted by the VMware Operating System.

Although it would be possible to host more than one Virtual Machine in a single storage space, we strongly recommend creating a dedicated storage space for each Virtual Machine, in order to keep the environment consistent and easy to manage, and to allow reliable backup and restore operations.

In this chapter we explain how to create the storage space for a new Virtual Machine, create the Virtual Machine itself, and enlarge the storage when the guest operating system (OS) requires additional disk space. Then we talk about handling the Virtual Machines using the enhanced VMware feature: VMotion.

In this chapter, we use the term *data store* to indicate a VMFS3 formatted disk space inside a storage space.

7.1 Creating new storage spaces for Virtual Machines

Three operating systems are involved when you add disk space to an Integrated VMware VI3 Infrastructure in order to create a Virtual Machine.

Their interfaces have to be used in the following sequence to complete the storage creation:

1. IBM i5/OS: We use System i Navigator or a command line for its interface.
2. VMware VI3: We use Virtual Center 2 for its interface.
3. The guest OS: It is on the Virtual Machine and they are usually Windows or Linux.

Each OS creates and formats the disk space using its own file system, and makes it available to the next level, up to the applications running on the guest OS.

Note: Install and use System i Navigator *V6R1* to handle the Integrated VMware servers. Older versions are not able to display and manage some key features, such as the Access to Disk Drive - Shared parameter.

The new storage spaces can be created using either CL commands or System i Navigator. You do not need to shut down the ESX Server in order to link a new storage space. Since a storage space is dedicated to a single Virtual Machine, use the same name for both objects. All of the storage spaces will be located in the integrated file system directory /QFPNWSSTG.

7.1.1 Create a new storage space using System i Navigator

To do this:

1. Expand **YourSystem** → **Integrated Servers Administration** → **Servers**.
2. Right-click the server that you want to add the disk to and select **New Disk** (Figure 7-1).

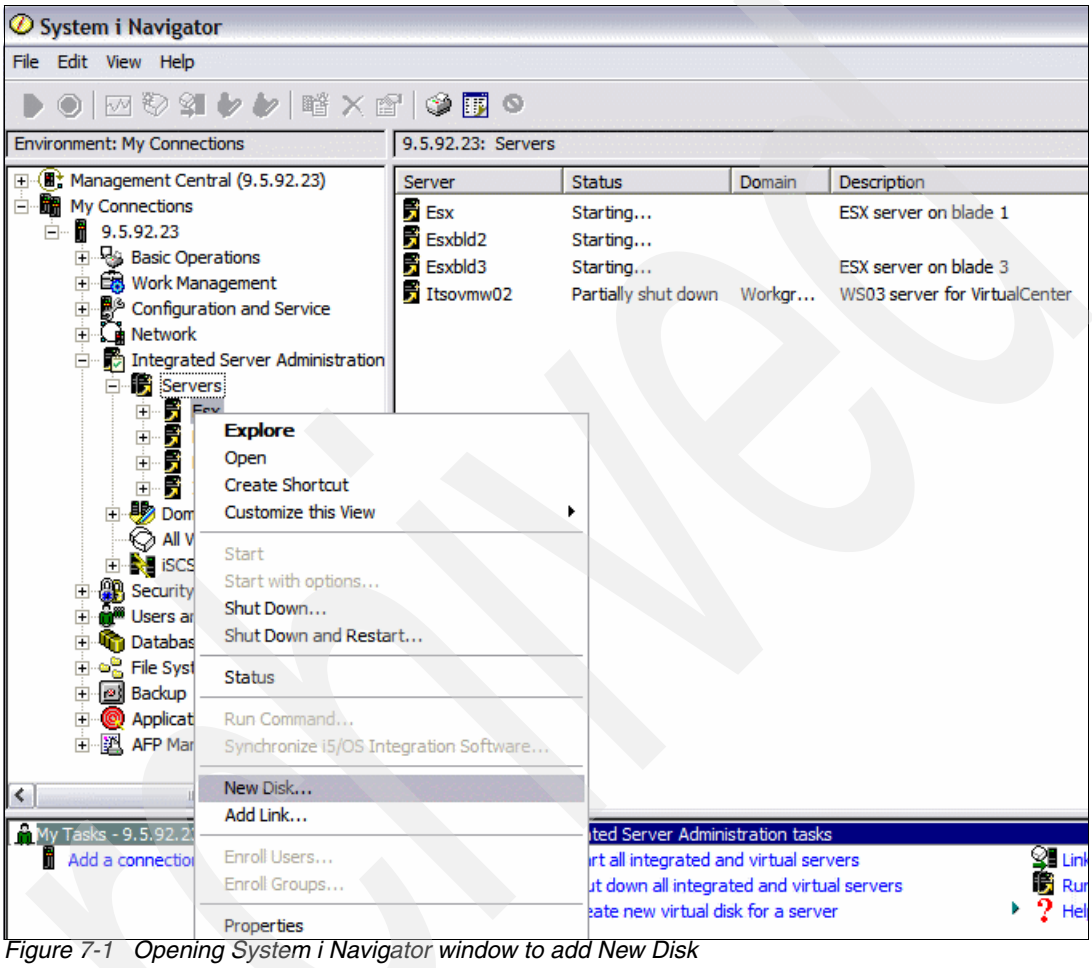

Figure 7-1 Opening System i Navigator window to add New Disk

3. A new window named New Disk opens, where you can select the following values (Figure 7-2 on page 160):
   - Disk Drive Name: Choose a name for the new storage space, usually the same as the Virtual Machine's name in which it is going to be created.
   - Description: Write a meaningful description for the new drive.
   - Initialize disk with data from another disk: Leave unchecked.
   - Capacity: Select a size between 1200 MB and 1,000 GB. This is the disk space required for your new Virtual Machine. Do not use up all of the available disk space. See 2.3.2, "System i storage sizing" on page 13.
   - Disk Pool: Both the system ASP and user ASPs are allowed.
   - Planned File System: Leave the default NTFS. ESX will format it later as VMFS3.
   - Advanced Data Offset: To determine the appropriate value, refer to 7.1.5, "Creating a VMFS data store in a storage space with partition alignment" on page 166.

- Link Disk to a Server: Select the name of your Integrated ESX Server.
- Link Type: Leave the default as dynamic.
- Link Sequence Position: Leave the default as selected by the system.
- Storage path: Leave the default.
- Access to disk drive: Select **Shared-Update**.

Click **OK** to stat the creation of the storage space.

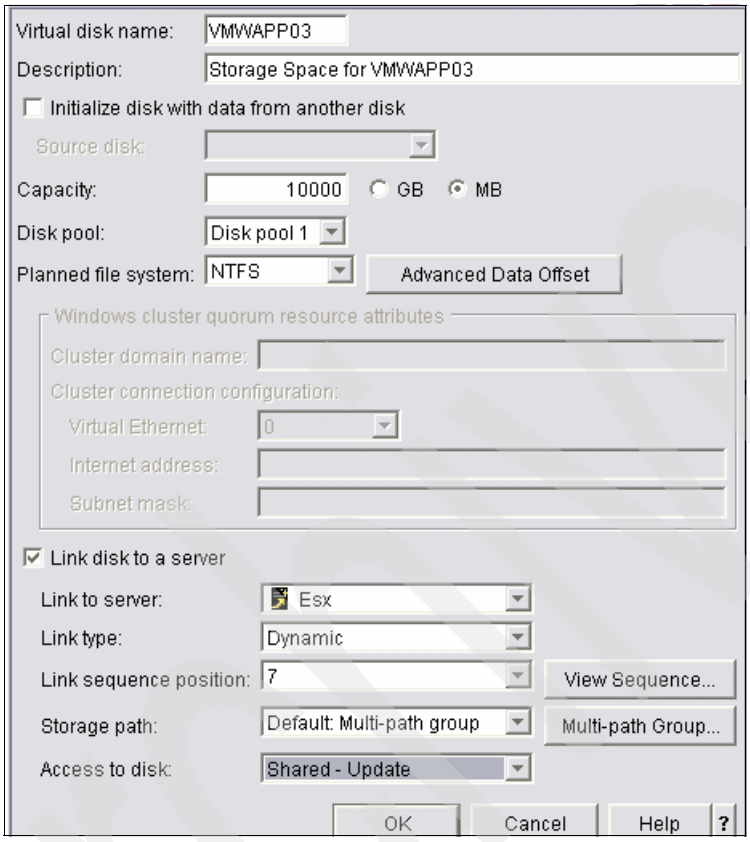

Figure 7-2 New disk parameters

The work in progress graphic window opens (Figure 7-3).

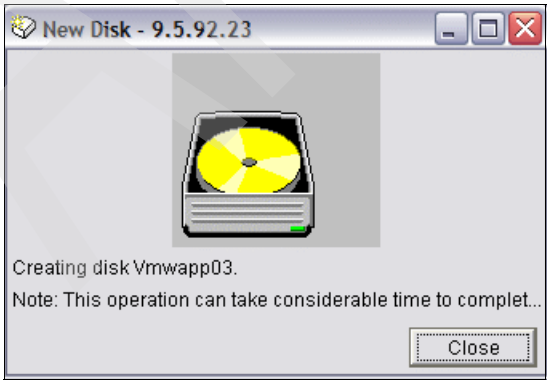

Figure 7-3 Creating the new disk

A completion message is then issued (Figure 7-4).

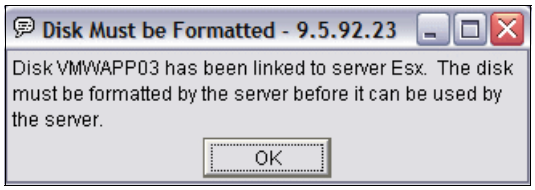

Figure 7-4 New disk creation completion message

The new storage space is now available to the server and ready to be handled using the VMware VI3 interface. Proceed with 7.1.3, “Storage adapter rescan using Virtual Center” on page 162.

7.1.2 Create a new storage space using i5/OS command line

To add a new storage space to an existing Integrated ESX Server:

1. Create the new storage space using the CRTNWSSTG command:

   ```
   CRTNWSSTG NWSSTG(StorageSpaceName) NWSSIZE(xxxxx) OFFSET(offsetvalue)
   ```

   Where:

   – *xxxxx* is the size in megabytes.

   – *offsetvalue* is the offset needed to align the partition. To determine the offest value, refer to 7.1.5, “Creating a VMFS data store in a storage space with partition alignment” on page 166.

Note: Remember the following points:

- The minimum disk size is 1.2 GB in order to create a VMFS3 file system.
- The maximum disk size is 1,000 GB (approximately, 1 TB).
- Leave the default value *NTFS on the FORMAT parameter. The actual VMFS3 file system will be created later by the ESX operating system.
- You can place the new storage space on the system ASP, on a user ASP, or on an iASP.

The disk creation progress is shown in Figure 7-5.

```
Work with Network Server Descriptions
                                                              System:   RCHAS65
Type options, press Enter.
  1=Create   2=Change   3=Copy   4=Delete   5=Display   6=Print
  9=Retrieve Source...

        Network
Opt     Server       Text

        ESX          ESX Server on blade 1
        ESXBLD2
        ESXBLD3      ESX Server on blade 3
        ITSOVM01     itsovm01 NWSD
        ITSOVM04     itsovm04 NWSD
        ITSOVM05     itsovm05 NWSD
        ITSOW2K3     WS03 server for VirtualCenter



                                                                      Bottom
Parameters or command
===> CRTNWSSTG NWSSTG(VMWAPP02) NWSSIZE(10000)
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F17=Position to
F23=More options      F24=More keys
Creating NWS storage space VMAPP02: 640 of 10001 megabytes complete.
```

Figure 7-5 Creating a new storage space

After the completion, the system issues the message:

```
Network server storage space VMWAPP02 created.
```

2. Link the new storage space to the ESX Server using the ADDNWSSTGL command:

```
ADDNWSSTGL NWSSTG(VMWAPP02) NWSD(ESX) DYNAMIC(*YES) ACCESS(*SHRUPD)
STGPTHNBR(*MLTPTHGRP)
```

The following message appears:

```
Network server storage space link added
```

Note: Remember the following points:

- Set the ACCESS parameter to *SHRUPD in order to allow all of the servers in the cluster to access the storage space for VMotion.
- On the STGPTHNBR parameter, leave the *MLTPTHGRP default to give access to the storage space from both of the iSCSI HBA adapters installed on System i.

7.1.3 Storage adapter rescan using Virtual Center

After assigning the new storage space to the Integrated server, the VMware ESX operating system needs to rescan the storage adapters.

To do so, use the VMware VI3 Client to access the Virtual Center interface, and execute the following steps (Figure 7-6):

1. On the left pane, expand **Hosts & Clusters**, then click your ESX Server's name.
2. On the right pane, select the **Configuration** tab.
3. Click **Storage Adapters**.
4. Under Storage Adapters in the right pane, select the first iSCSI adapter that gives access to the storage.
5. In the Details section, take note of the pre-existing targets.
6. Click the **Rescan** button in the upper right corner (Figure 7-6).

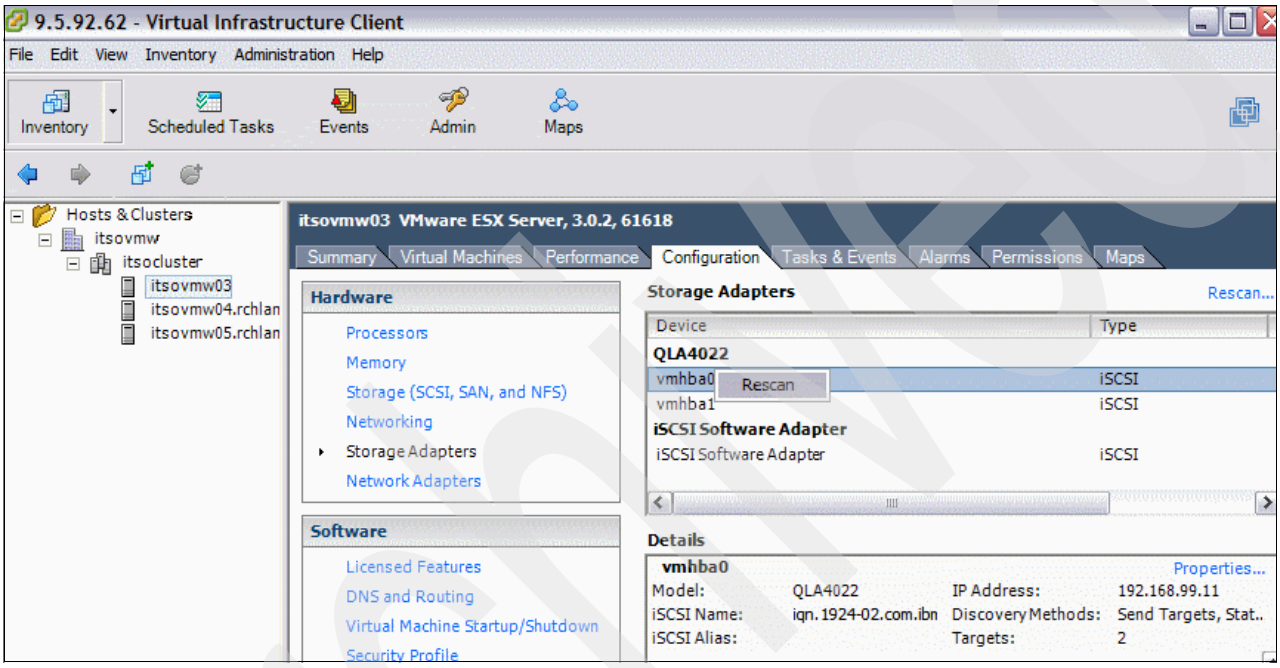

Figure 7-6 Storage Adapter Rescan in Virtual Center

7. After the rescan is completed, the new target appears. Figure 7-7 shows the new storage space as vmhba0:0:6.

> **Note:** If you right-click a storage adapter then click **Rescan**, you have to repeat the step on both adapters.
>
> If you click the **Rescan...** link in the upper right corner, the system rescans all the adapters at the same time.

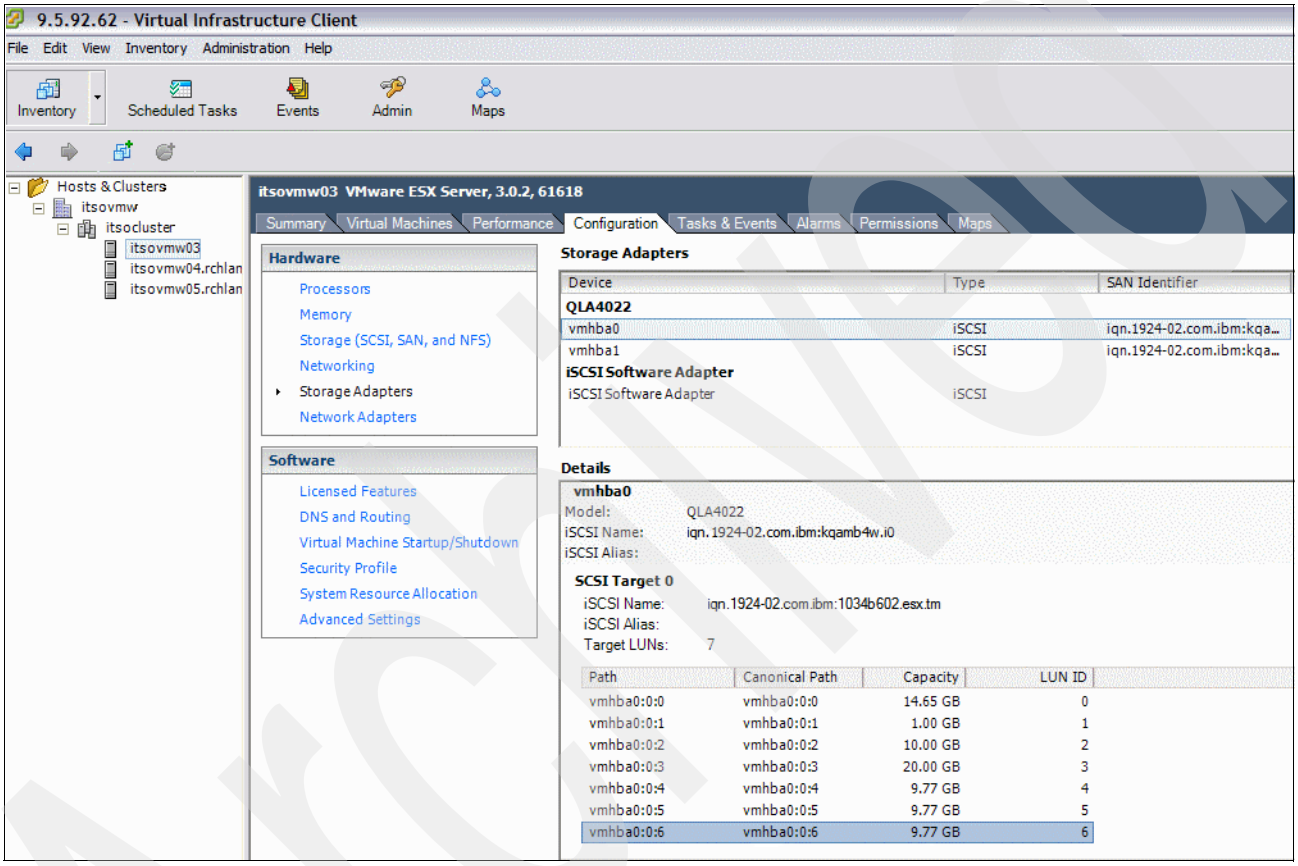

Figure 7-7 The new storage space after the rescan

8. Link the new storage space to the other servers. See 7.1.4, “Assigning the new storage space to all ESX Servers in the cluster” on page 164.
9. Create the VMFS data store. See 7.1.5, “Creating a VMFS data store in a storage space with partition alignment” on page 166.

7.1.4 Assigning the new storage space to all ESX Servers in the cluster

In order to enable VMotion of this Virtual Machine among the servers, repeat the following steps for each ESX Server in the Cluster:

1. Open System i Navigator. Expand **Integrated Servers Administration** → **All Virtual Disks**.

2. Right-click the storage space then select **Add Link** (Figure 7-8).

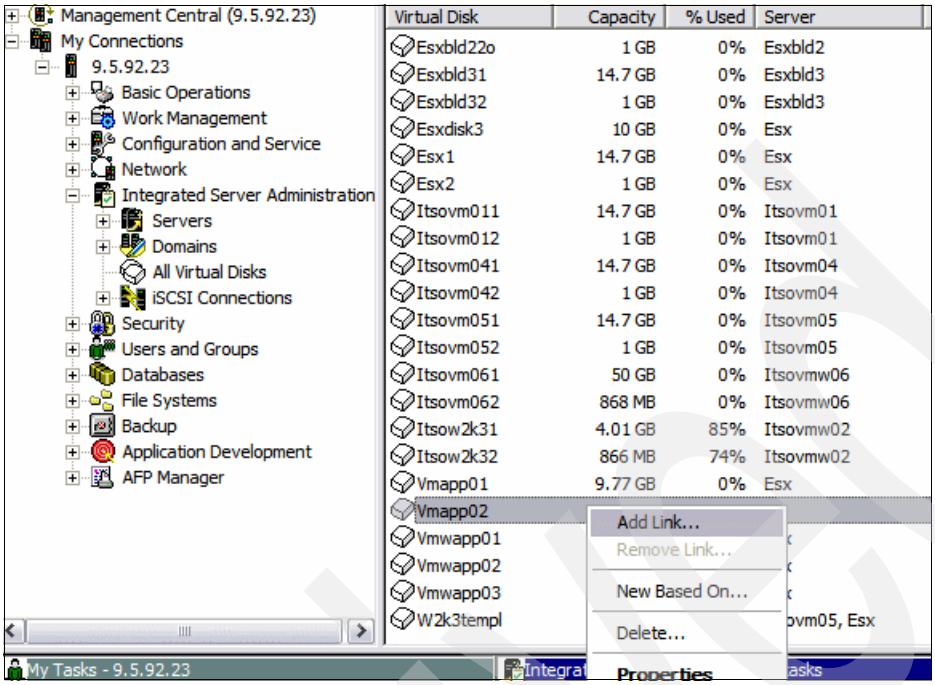

Figure 7-8 Storage space Add Link

3. On the Add Link to Server window, choose the ESX Server name that you are going to link the storage space to. Select the following parameters, as shown in Figure 7-9:

   – Linktype: **Dynamic**.
   – Link sequence position: Leave the default.
   – Storage Path: Select the default multipath group.
   – Access to disk: **Shared-Update**.

   Click **OK** to continue.

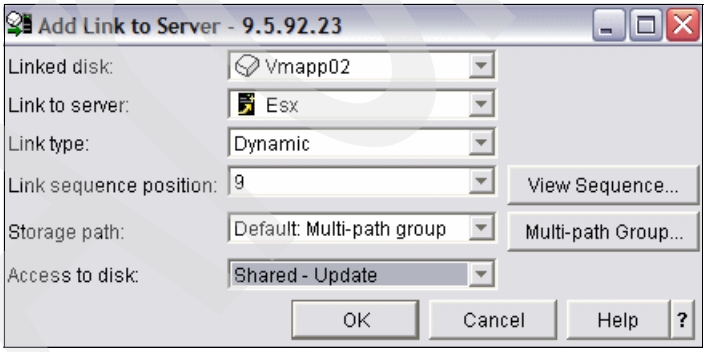

Figure 7-9 Add Link to Server parameters

The new storage space is now available to the ESX Server.

4. Now perform the rescan operations, as explained on 7.1.3, “Storage adapter rescan using Virtual Center” on page 162. Then create the VMFS data store as explained on 7.1.5, “Creating a VMFS data store in a storage space with partition alignment” on page 166.

7.1.5 Creating a VMFS data store in a storage space with partition alignment

To prevent potential performance problems that can arise due to misaligned ESX partitions, refer to the following:

http://www.ibm.com/systems/i/advantages/integratedserver/pdf/vmware_storage_alignment.pdf

7.1.6 Creating a VMFS data store in a storage space using VirtualClient

Note: Creating a VMFS data store using the Virtual Client can adversely affect disk I/O performance. When using the Virtual Client to create a VMFS data store, a VMFS partition is created that might be unaligned. Refer to 7.1.5, “Creating a VMFS data store in a storage space with partition alignment” on page 166.

On Virtual Center, click any of the ESX Servers in your cluster and proceed as follows:

1. Open the **Configuration** menu and click **Storage (iSCSI, SAN and NFS)**.
2. Click **Add storage** in the upper right corner (Figure 7-10).

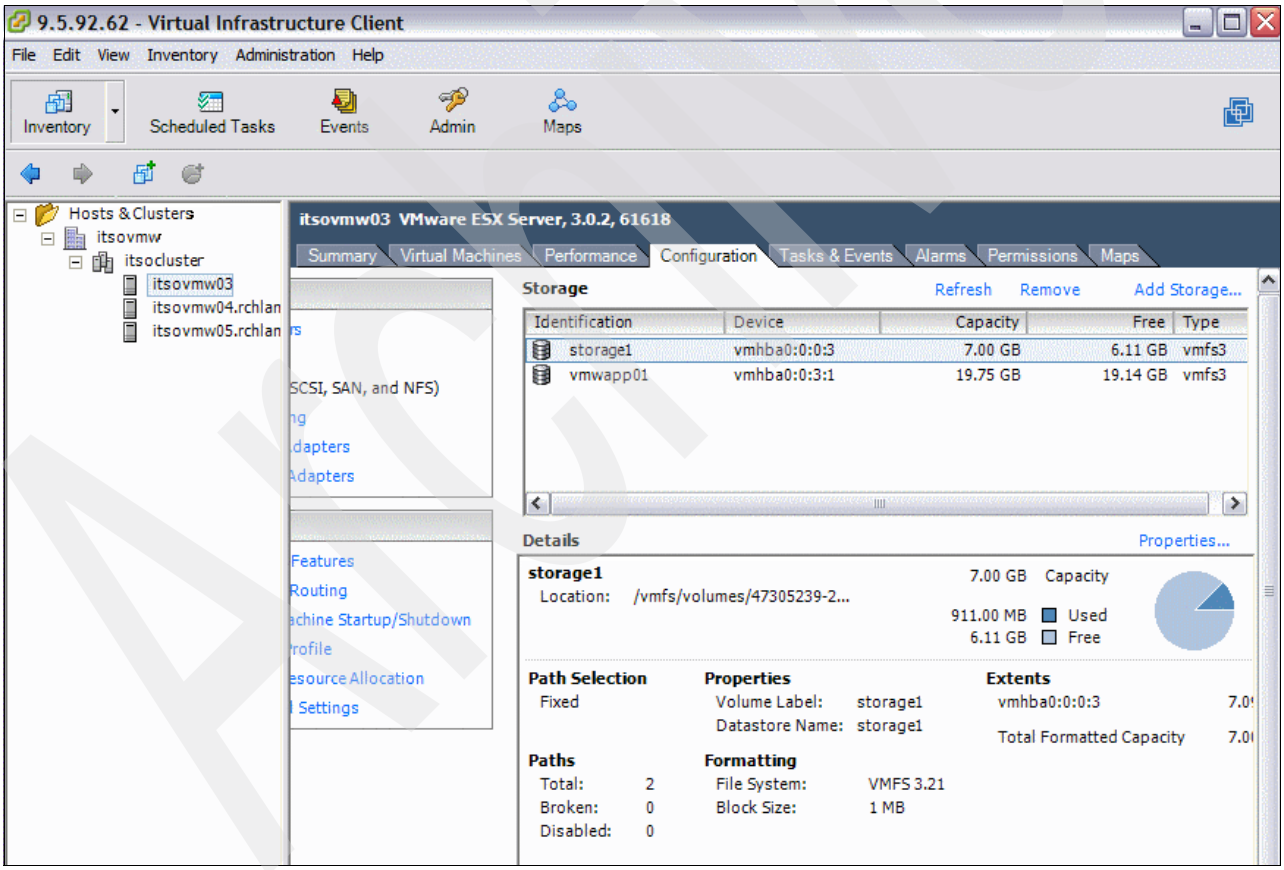

Figure 7-10 Add storage

3. A wizard named Add storage starts. Walk through its steps by clicking **Next**. Select the following:
   - Storage Type: **Disk/LUN**.
   - Device Location: Select the new storage space. You see that all the corresponding disk space is shown as available.
   - Current Disk Layout shows you that the disk has not yet been formatted as VMFS3.
   - Properties: Assign a name to the new disk. That name should be the same as the Virtual Machine that you are going to create on this data store.
   - Formatting: Choose the appropriate block size.

Note: For a disk size smaller than or equal to 256 GB select Block Size = 1 MB. For further explanation of this parameter refer to the official VMware documentation.

When the formatting process completes, the new storage space is available. Figure 7-11 shows the details of the new disk:

- File system level: VMFS 3.21
- Number of paths: 2
- Block size: 1
- Total formatted capacity: 9.14 GB

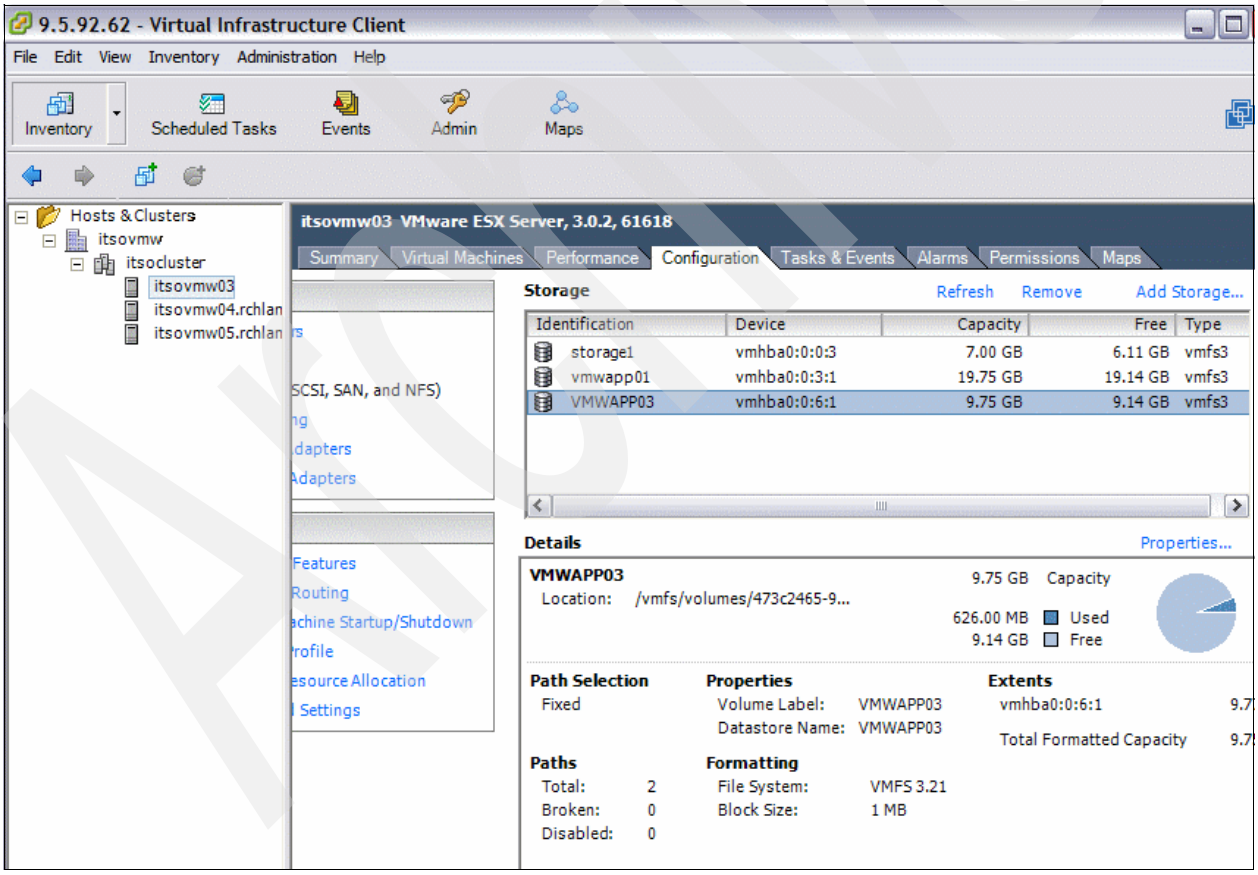

Figure 7-11 New data store

7.2 Configure networking for the Virtual Machines

In 3.3.2, “VMware ESX Server software installation steps” on page 38, we explained how to set up the basic networking for the ESX Service Console.

A VMware VI3 infrastructure requires additional networking configuration objects in order to manage:

- VMotion of the Virtual Machines among the ESX hosts in a cluster
- Network access for the Virtual Machines

The main configuration object for VMware VI3 networking is the Virtual Switch, also called vSwitch. Networking for the service console, which runs the management services, is set up by default during the installation of ESX Server.

If you selected the default option to create a port group for virtual machines during ESX Server installation, you do not need to configure networking for your virtual machines. In this default configuration, virtual machine network traffic shares a network adapter with the service console.

If you did not select the default option to create a port group for virtual machines during ESX Server installation, you must create a virtual network for your virtual machines as described below.

Create or add a virtual network for a virtual machine

To do this:

1. Log on to the VMware VI Client and select the server from the inventory window. The hardware configuration page for this server opens.
2. Click the Configuration tab, and click **Networking** (Figure 7-12).

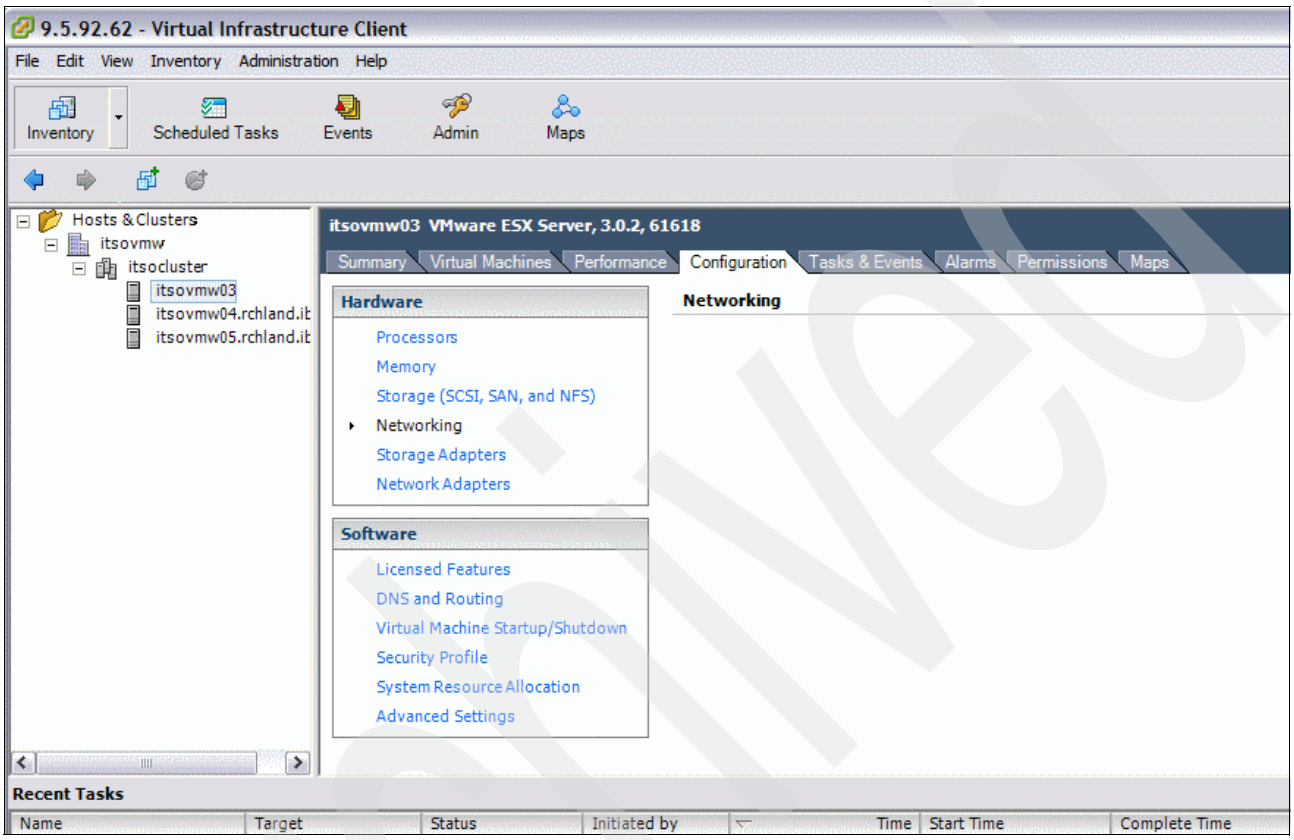

Figure 7-12 Networking configuration

3. Click the **Add Networking** link located on the upper right corner of the Configuration-Networking window. The Add Networking Wizard opens.

4. As a connection type, select **Virtual Machines**, which is the default. Selecting Virtual Machines lets you add a labeled network to handle virtual machine network traffic. Click **Next** (Figure 7-13).

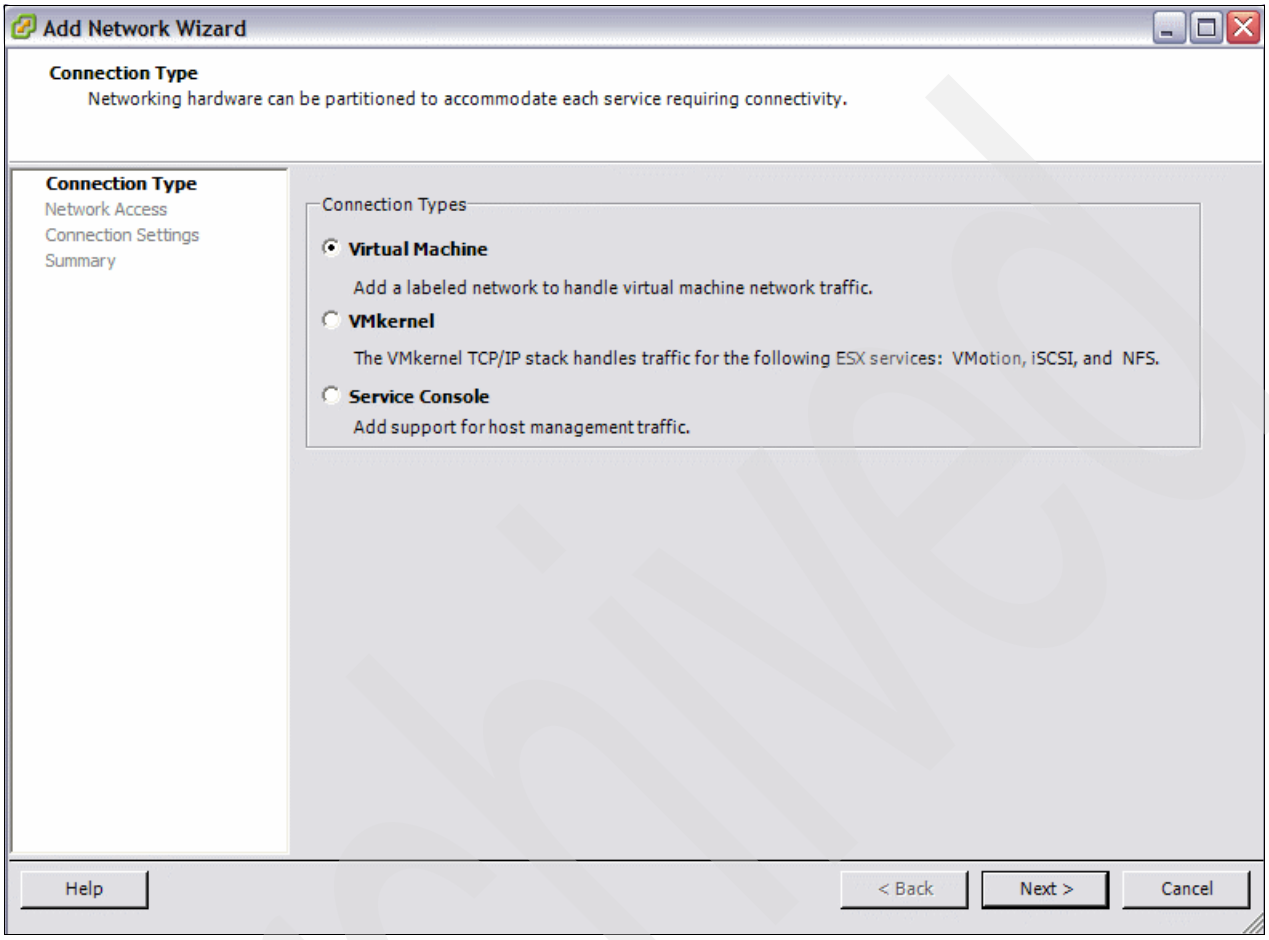

Figure 7-13 Add Network Wizard

5. The Network Access page opens. Virtual machines reach physical networks through uplink adapters. A vSwitch is able to transfer data to external networks only when one or more network adapters are attached to it. When two or more adapters are attached to a single vSwitch, they are transparently teamed.
6. Select **Create a virtual switch**. You can create a new vSwitch with or without Ethernet adapters. If you create a vSwitch without physical network adapters, all traffic on that vSwitch will be confined to that vSwitch. No other hosts on the physical network or virtual machines on other vSwitches will be able to send or receive traffic over this vSwitch. This might be desirable if you want a group of virtual machines to be able to communicate with each other but not with other hosts or with virtual machines outside the group.

Changes are reflected in the Preview pane. Outbound adapters are listed. Click **Next** (Figure 7-14).

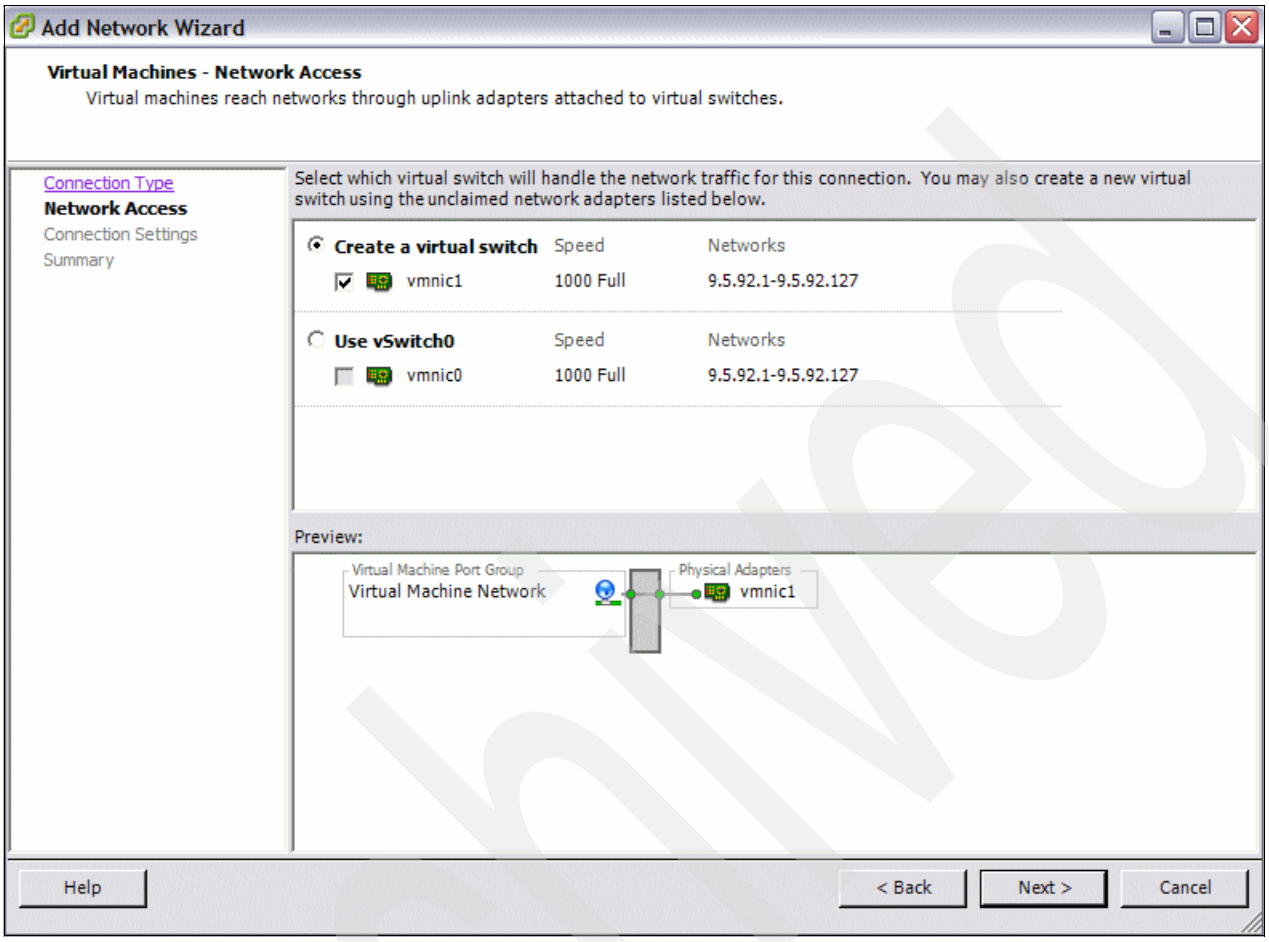

Figure 7-14 Create a new Virtual Switch

The Connection Settings page opens.

7. Under Port Group Properties, type a network label that identifies the port group that you are creating. To allow VMotion, use the same Virtual Switch network label on all of the ESX hosts.

   If you are using a VLAN, in the VLAN ID field, type a number between 1 and 4095. If you are unsure what to enter, leave this blank or ask your network administrator. Click **Next**.

8. The Ready to Complete page opens. After you have determined that the vSwitch is configured correctly, click **Finish** (Figure 7-15).

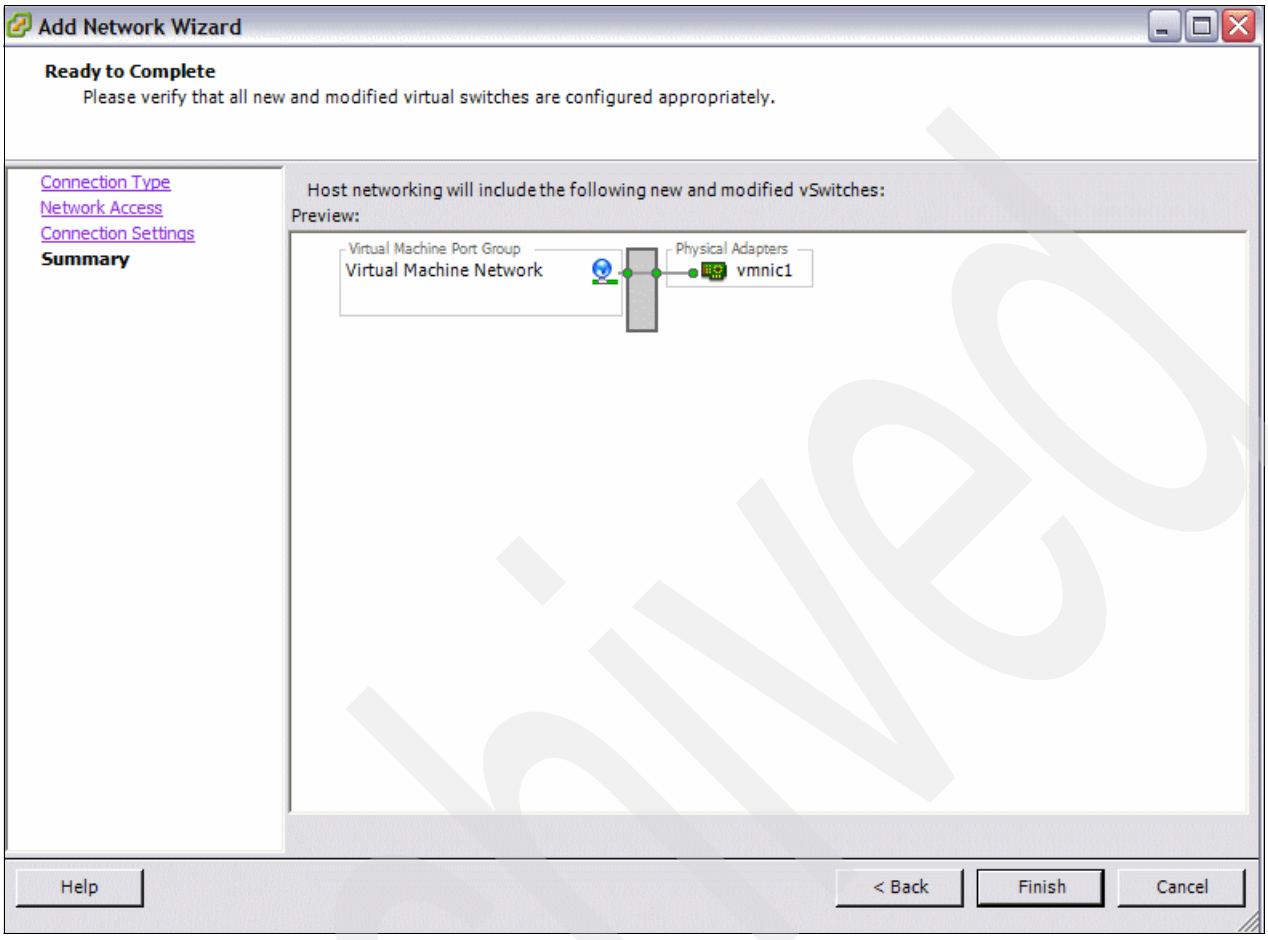

Figure 7-15 Add Network Wizard ready to complete

To enable failover (NIC teaming), bind two or more adapters to the same switch. If one outbound adapter is not operational, network traffic is routed to another adapter attached to the switch.

7.3 Configure networking for VMotion

Migration with VMotion lets you migrate virtual machines with no downtime. Your VMkernel networking stack must be set up properly to accommodate VMotion.

VMotion requires a Gigabit Ethernet connection between hosts.

Set up the VMkernel to enable VMotion

To do this:

1. Log on to the VMware Virtual Center and open the Inventory window.
2. Select the ESX host that you want to enable for VMotion.

3. Click the **Configuration** tab, and click **Networking**. Click the **Add Networking** link. The Add Network Wizard opens (Figure 7-16).

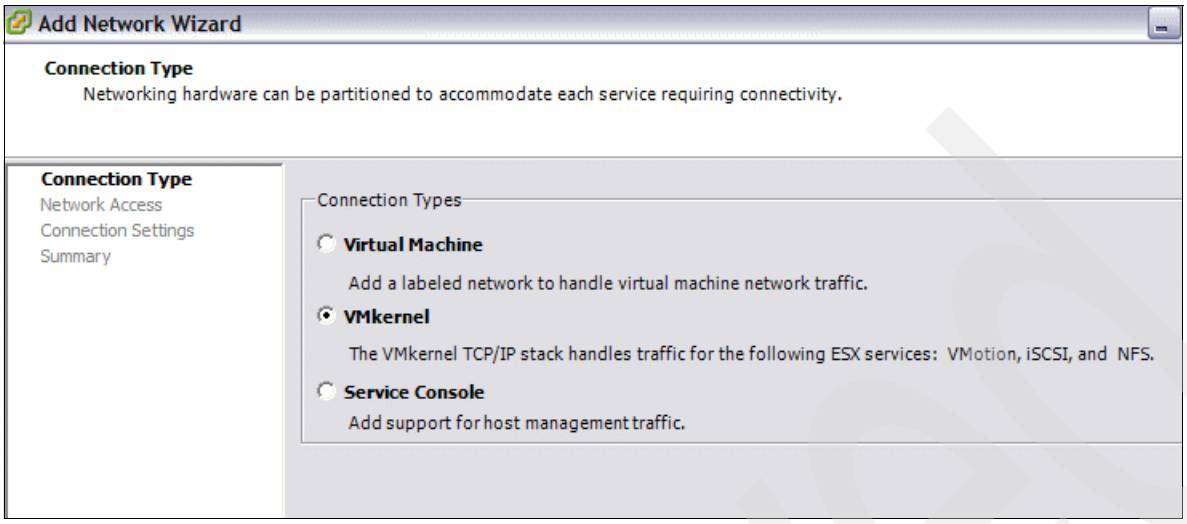

Figure 7-16 Add Network Wizard - Connection Type

4. Select **VMkernel** and click **Next**. Selecting VMotion and IP Storage lets you connect the VMkernel, which runs services for VMotion and IP storage (NFS or iSCSI) to the physical network. The Network Access page opens (Figure 7-17).

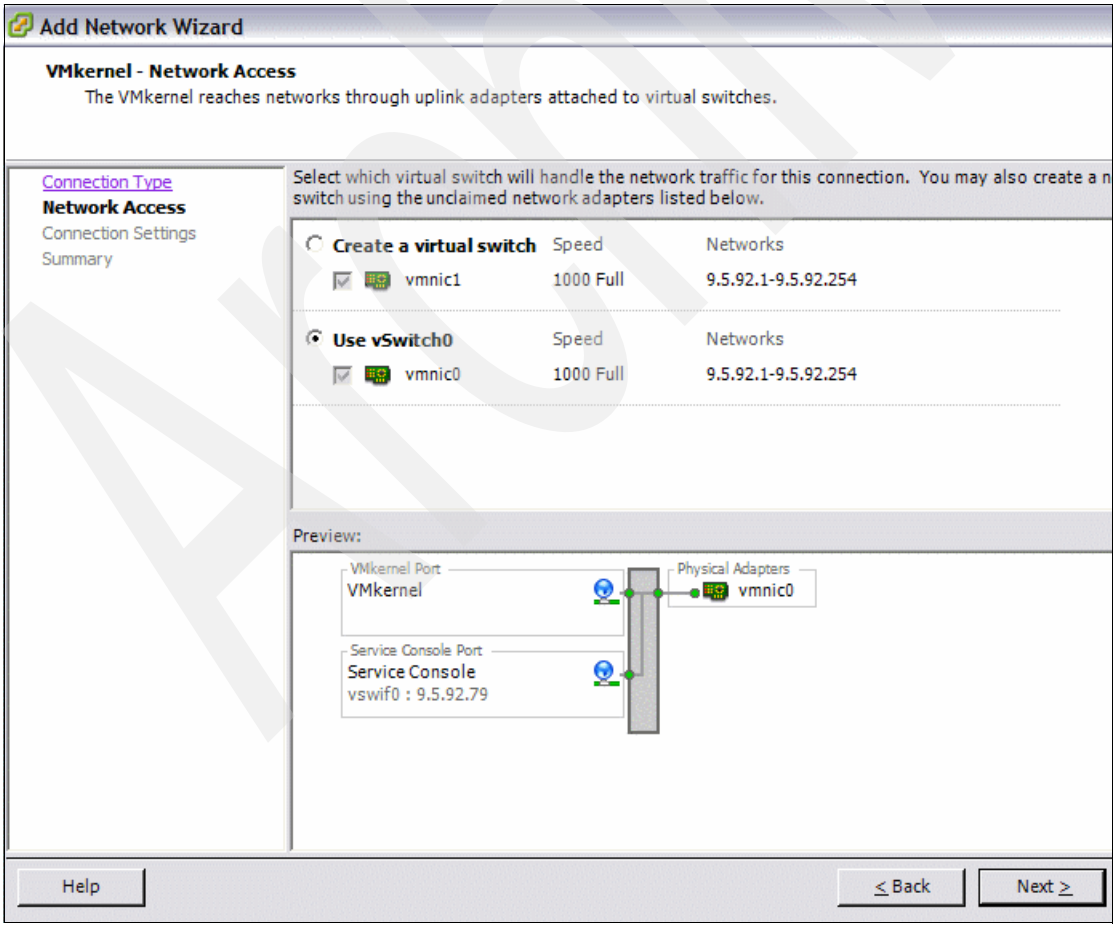

Figure 7-17 Add Network Wizard - Network Access

5. Select the vSwitch that you would like to use, or select the **Create a virtual switch** button to create a new vSwitch. For a blade server, we recommend selecting vSwitch0, sharing the network with the service console. For a System x server, you can use a separate vSwitch with a dedicated network adapter card.

   The Connection Settings page opens (Figure 7-18).

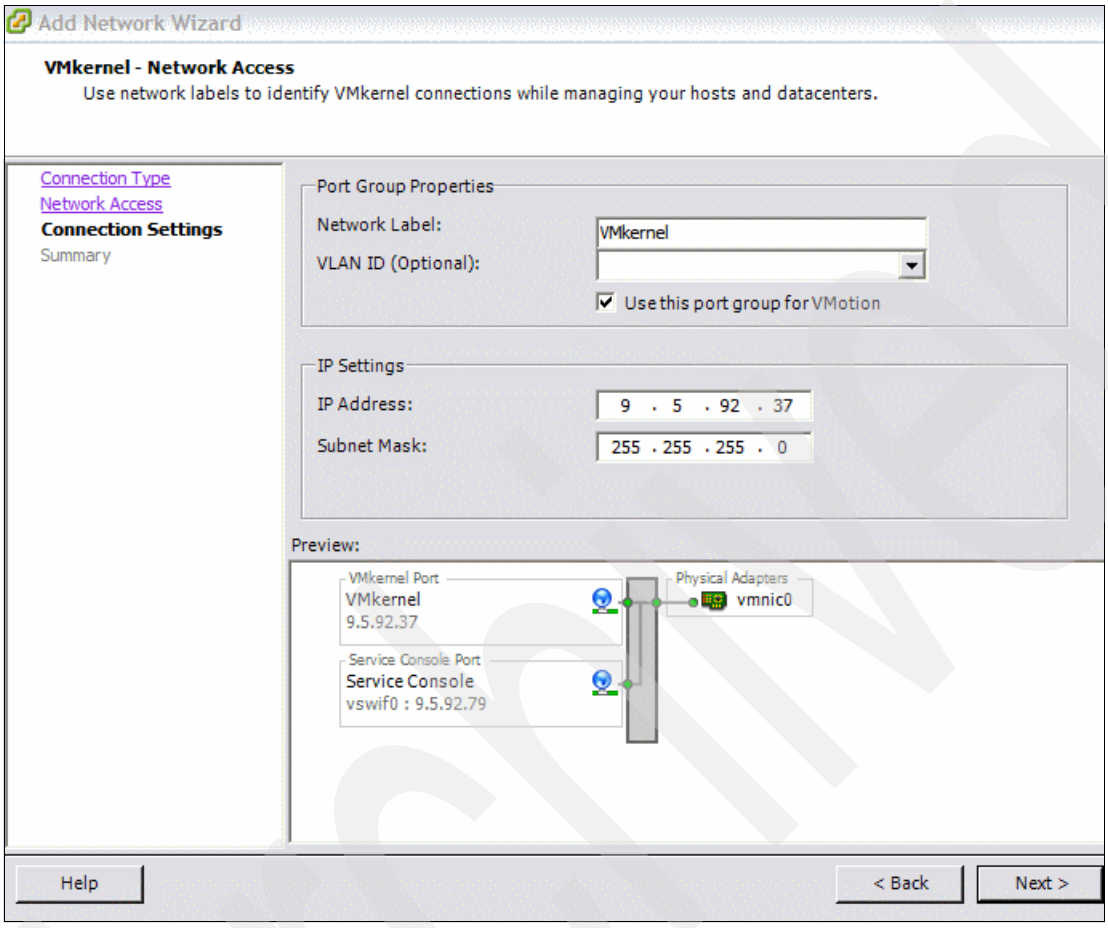

Figure 7-18 Add Network Wizard - Connection Settings

6. Under Port Group Properties, enter a network label. VLAN ID is optional.
   - Network Label: A name that identifies the port group that you are creating.
   - VLAN ID: Identifies the VLAN that the port group's network traffic will use.

   Select the **Use this port group for VMotion** check box to enable this port group to advertise itself to another ESX Server as the network connection where VMotion traffic should be sent.

   You can enable this property for only one VMotion and IP storage port group for each ESX Server host. If this property is not enabled for any port group, migration with VMotion to this host is not possible.

7. Under IP Settings, enter the IP address and subnet mask for the VMotion network. Click **Next**. The Summary window opens (Figure 7-19).

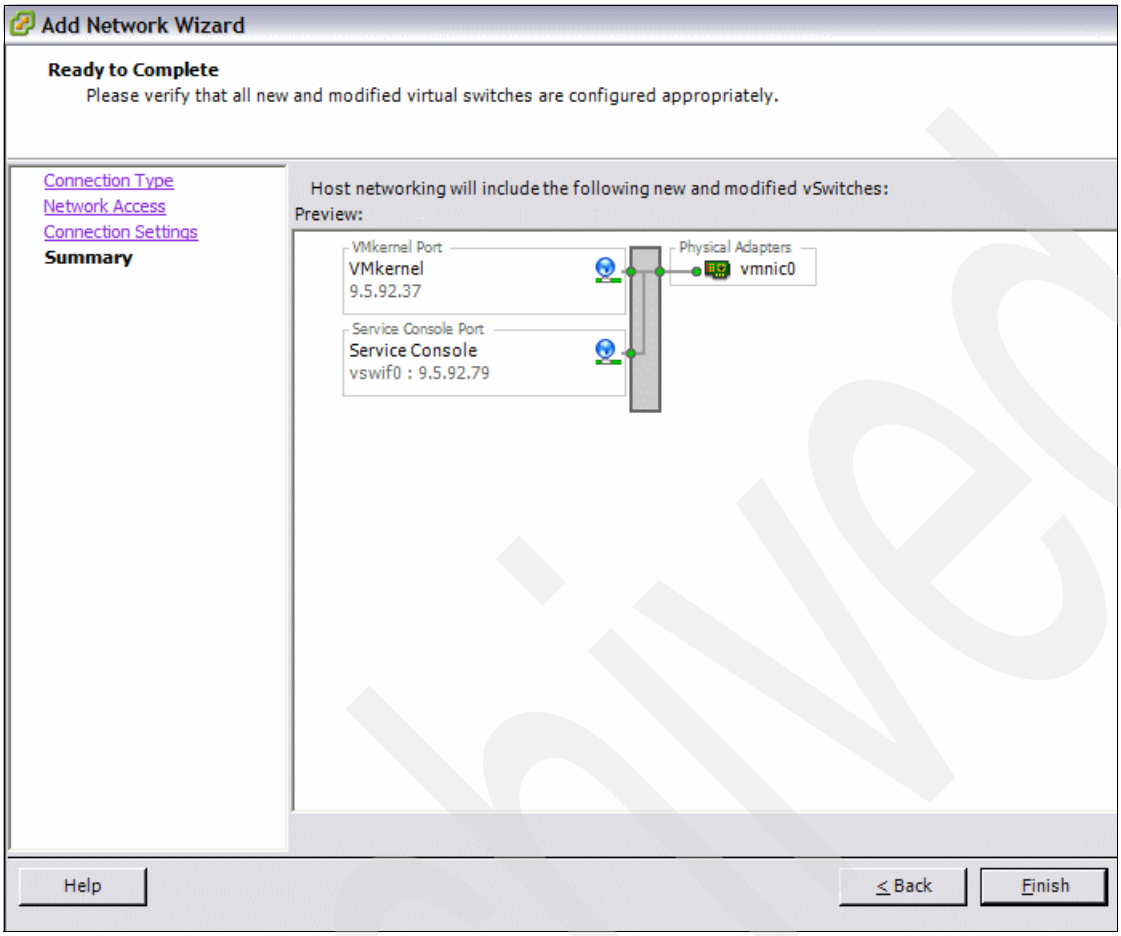

Figure 7-19 Add Network Wizard - Summary

8. Click **Finish** on the Summary window, then click **Yes** on the Warning message to enter the DNS Routing and Configuration window (Figure 7-20).

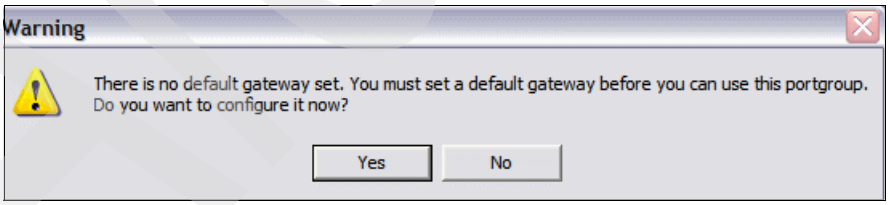

Figure 7-20 VMotion Gateway warning

The DNS and Routing Configuration dialog box opens (Figure 7-21).

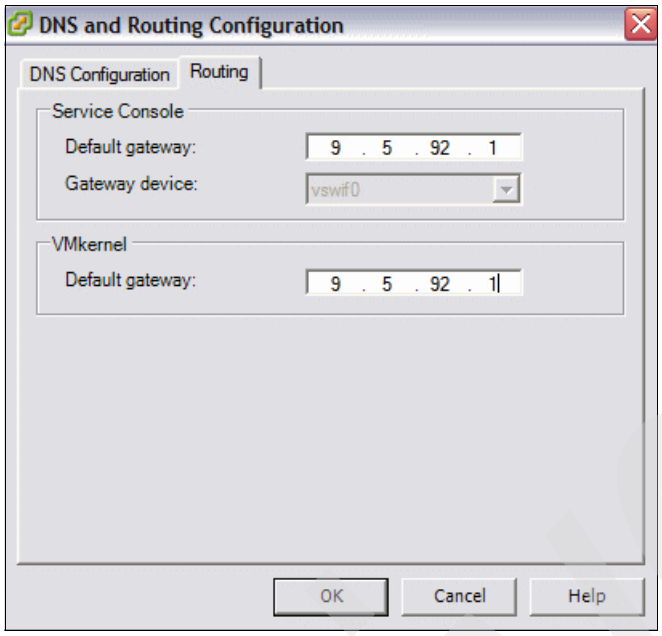

Figure 7-21 DNS and Routing Configuration

Under the DNS Configuration tab, the name of the host is entered into the name field by default. The DNS server addresses that were specified during installation are also preselected, as is the domain.

Under the Routing tab, the service console and the VMkernel each need their own gateway information.

Click **OK** to save your changes and close the DNS Configuration and Routing dialog box.

9. Repeat the above configuration steps on all of the ESX Servers.

VMotion is now enabled in your cluster.

7.4 Create a Virtual Machine using Virtual Center

This section explains how to create a Virtual Machine using Virtual Center as an interface.

7.4.1 Create the Virtual Machine

To do this:

1. To create a new Virtual Machine, start the Virtual Client on your PC and connect to the Virtual Center server that is in control of your Integrated VMware VI3 Infrastructure.

   Pull down the **Inventory** menu in the upper left corner and select **Host and Clusters**.

2. Expand your data center, select the ESX Host where you want to add the new VM, right-click and select **New Virtual Machine** (Figure 7-22).

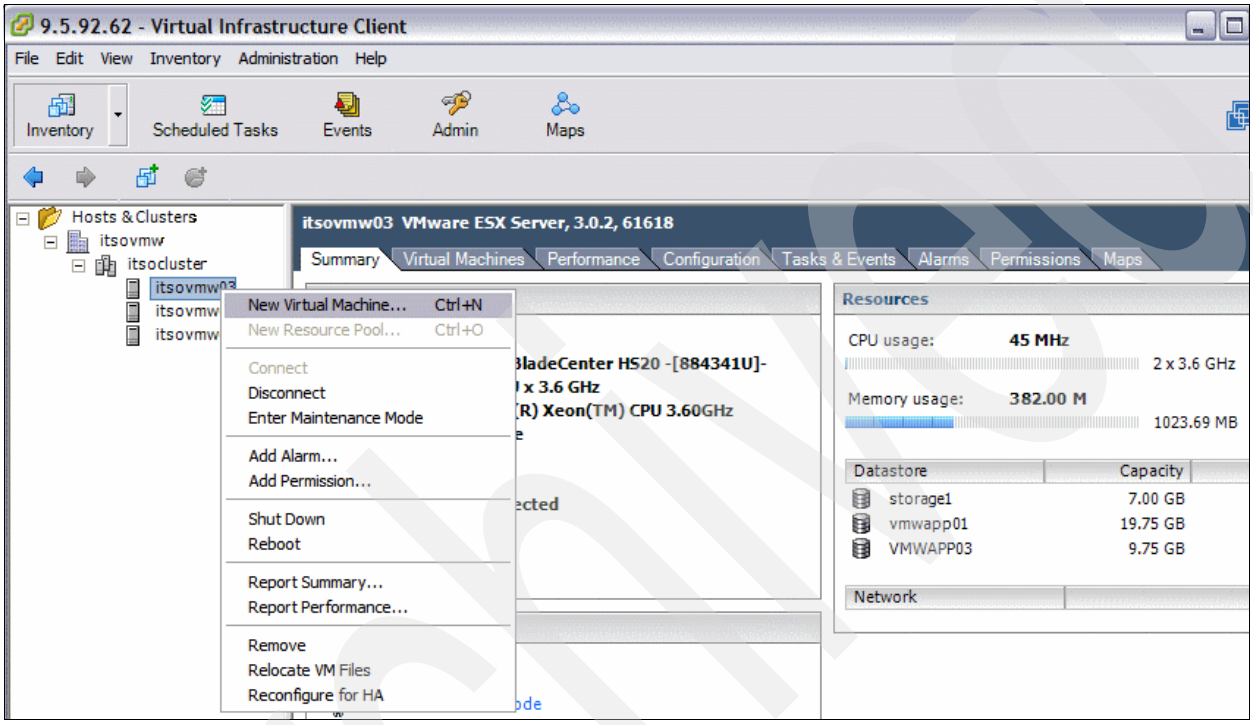

Figure 7-22 Creating a new Virtual Machine

3. The New Virtual Machine wizard opens. Select **Typical**. Custom Install can be selected for more flexibility and additional configuration options. Click **Next** to continue (Figure 7-23).

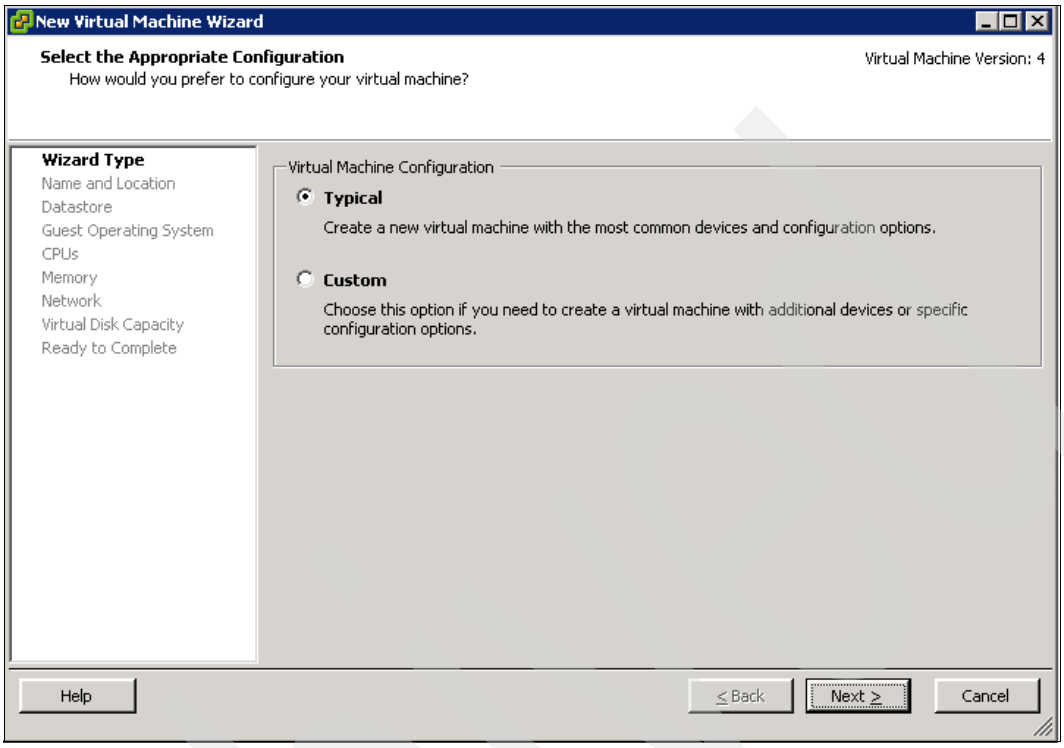

Figure 7-23 Select the New Virtual Machine Wizard type

4. Enter a name for the new Virtual Machine. Choose the folder where the VM will be placed into the Virtual Center tree. Click **Next** to continue (Figure 7-24).

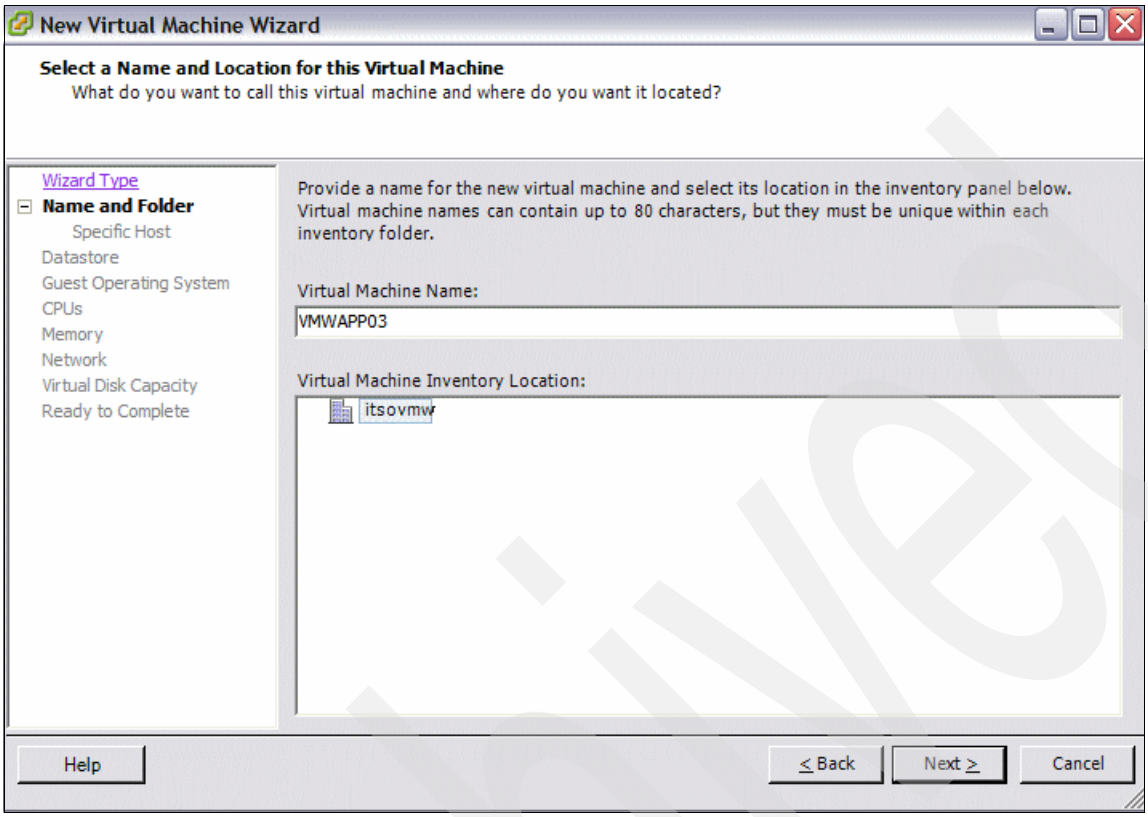

Figure 7-24 Assign a name to the Virtual Machine

5. Select an host in the cluster where the new Virtual Machine will be started. Select an host that has enough resources left for your Virtual Machine.

   Note: if DRS is enabled, the wizard selects the host automatically (Figure 7-25).

   Click **Next** to continue.

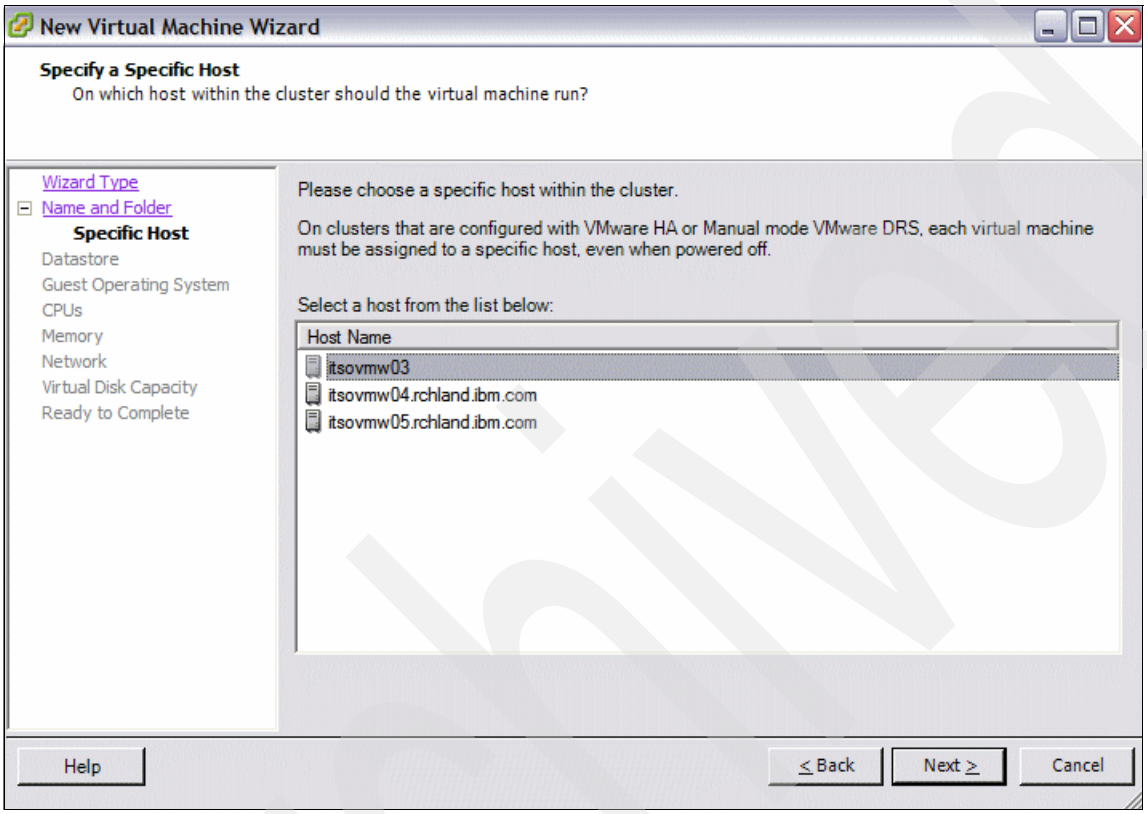

Figure 7-25 Select the target ESX host for VMotion

6. Now you are prompted for the data store. Select the data store created earlier for the Virtual Machine (Figure 7-26). Click **Next** to continue.

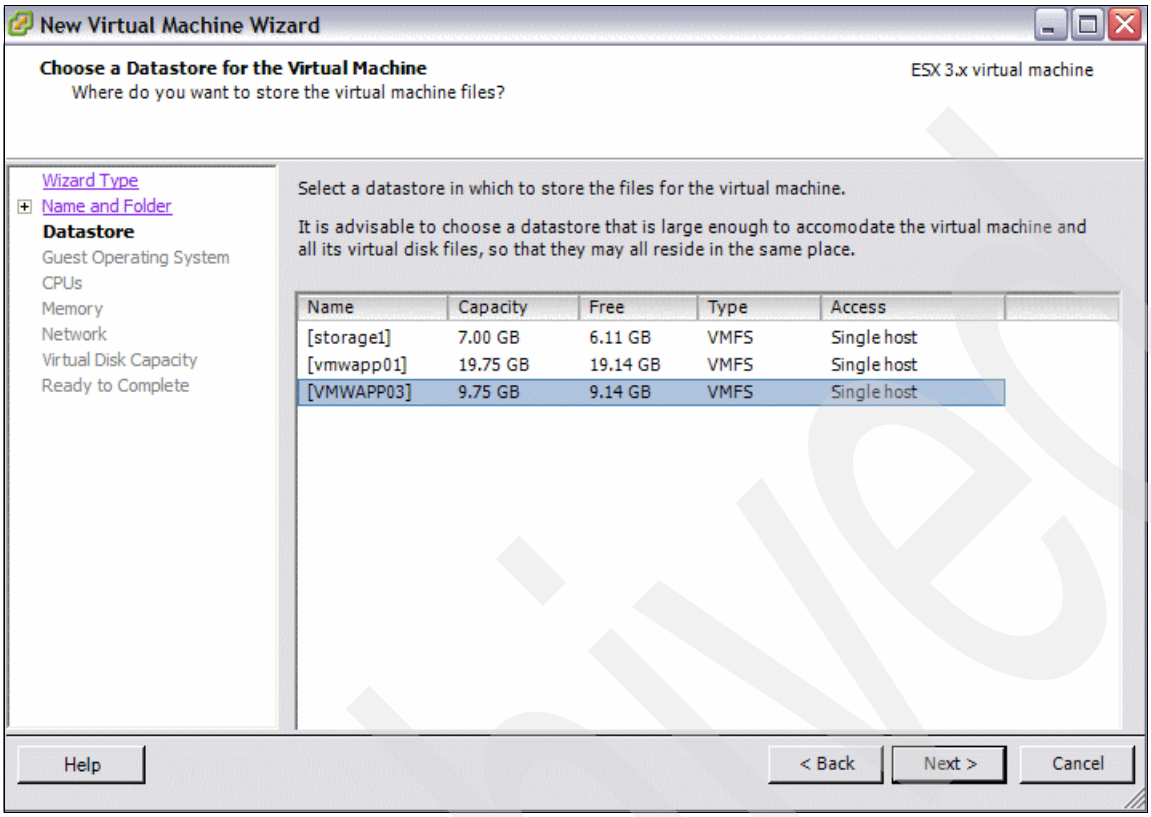

Figure 7-26 Select the data store

7. Choose the guest operating system for the Virtual Machine. This choice will affect some characteristics of the new VM as the storage adapter type (Figure 7-27). Click **Next** to continue.

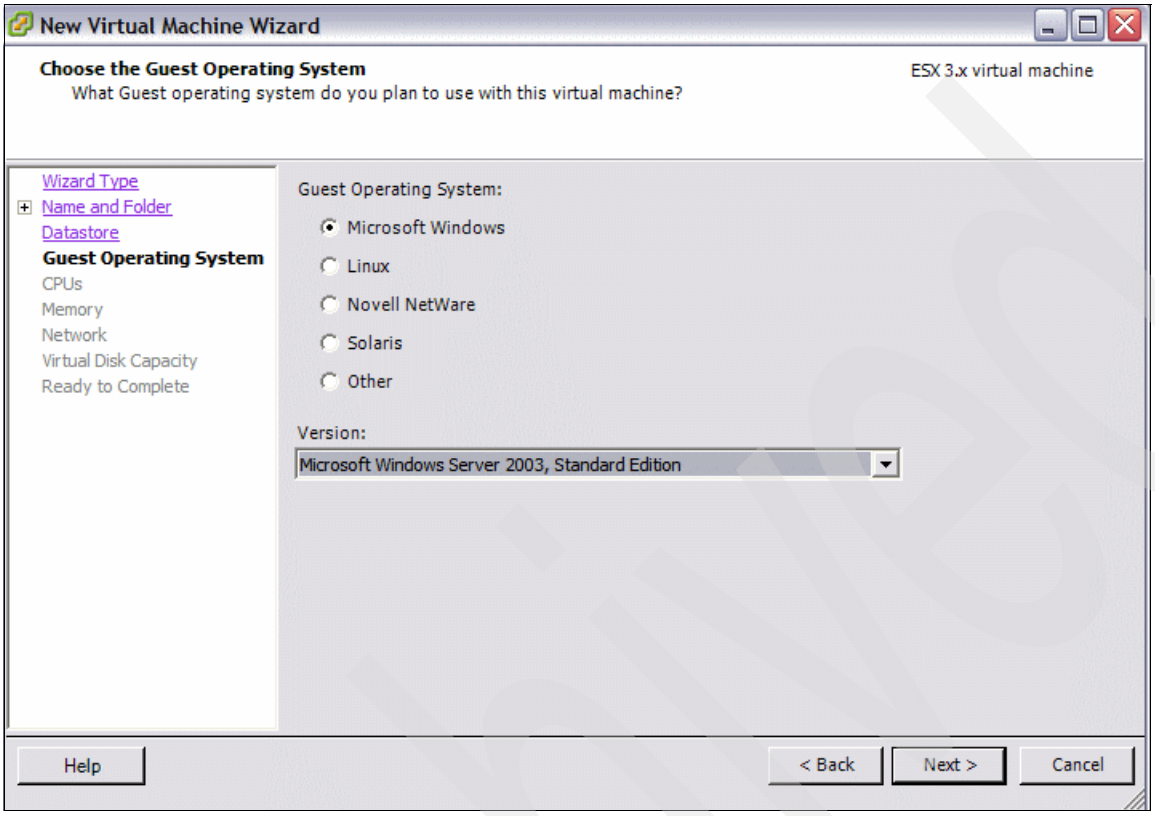

Figure 7-27 Select the guest operating system type

8. On the virtual CPU's window assign 1, 2, or 4 virtual CPU's to the Virtual Machine (Figure 7-28).

   Their number cannot exceed the number of the actual physical processors (sockets, cores, or hyperthreaded CPUs) installed on the underlying host (System x or blade).

   Assign only one CPU to each Virtual Machine, unless you are sure that the applications running on the virtual machine require multiple CPUs. Setting up Virtual Machines for multiple CPUs can easily drain the physical server's resources.Click **Next** to continue.

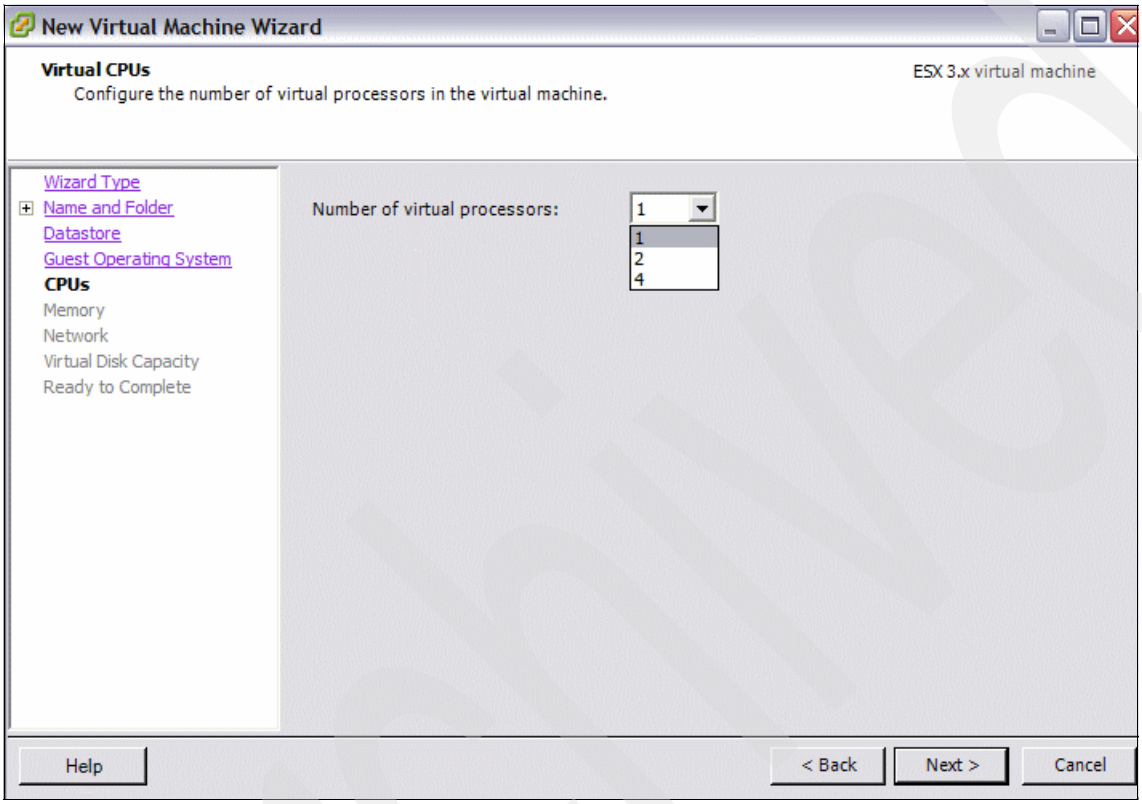

Figure 7-28 Assign the virtual CPUs

9. Configure the Virtual Machine memory (Figure 7-29).

   The memory size can be adjusted by dragging the slider left and right, or entering the value in the box. Set the proper amount of memory, depending on the applications that will run on the guest operating system. We recommend keeping the default size.

   Do not give the Virtual Machine more memory than needed. Click **Next** to continue.

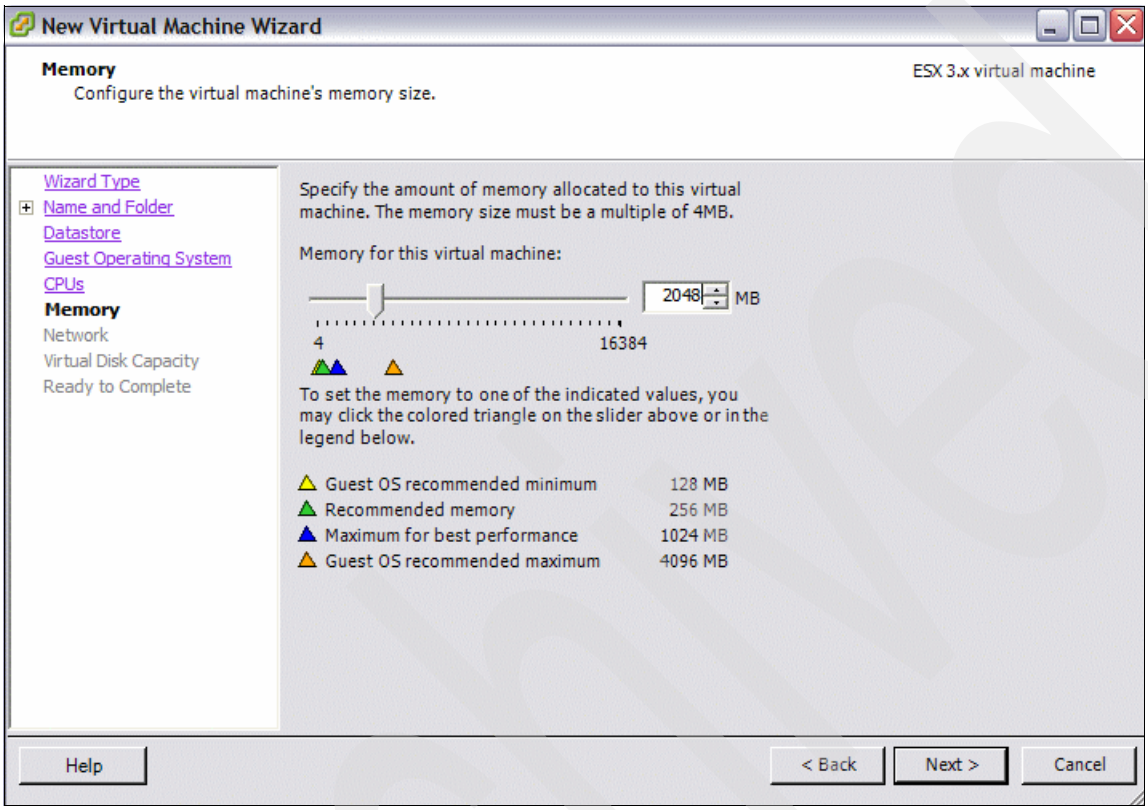

Figure 7-29 Assign the Virtual Machine memory

10. Select the number of virtual network interfaces for the Virtual Machine using the pull-down menu (Figure 7-30).

    Configure each NIC using the network pull-down menu. Check the Connect at Power On box if you want to give the VM access to the network at the first power on.

    If you prefer to assign a fixed IP address first, leave the box unchecked. This way, the VM will not try to get an IP address from a DHCP server in the network.

    Click **Next** to continue.

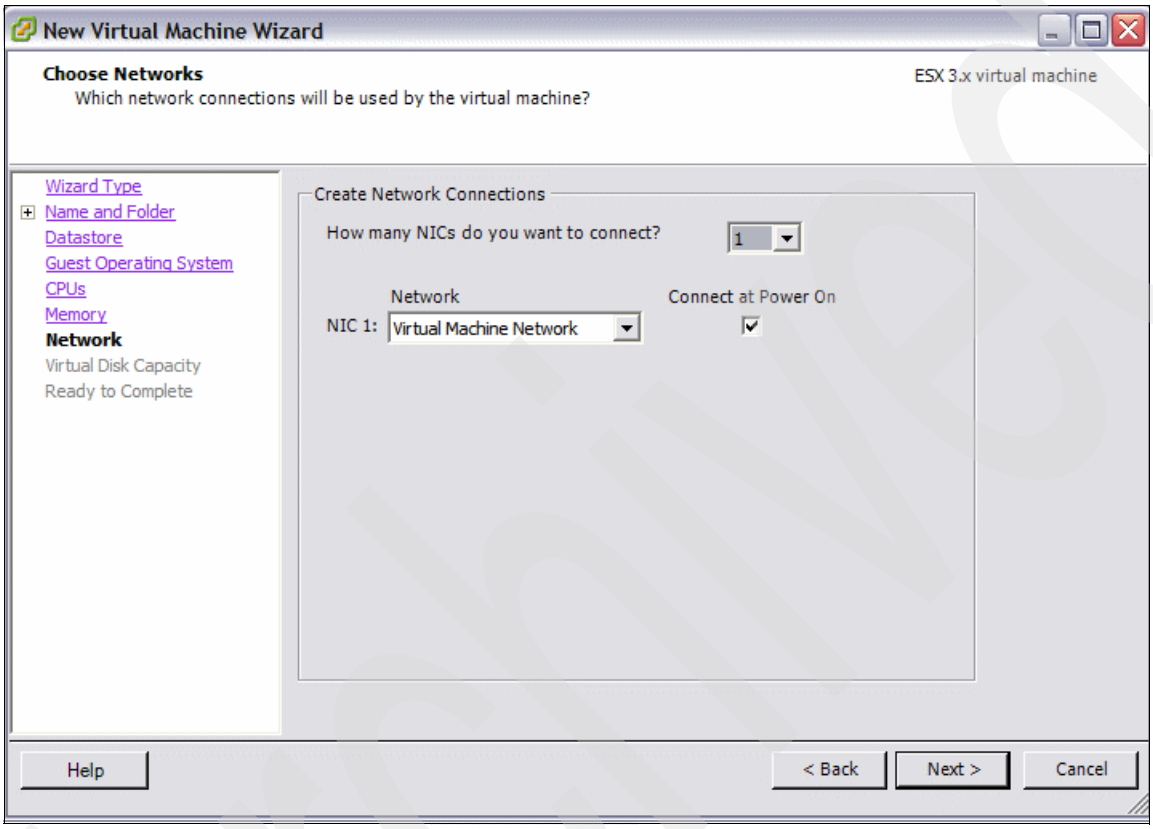

Figure 7-30 Selecting the number of virtual network interfaces

11. Specify the capacity for the first virtual disk (Figure 7-31). If you do not plan to create additional disks for this Virtual Machine, take almost all of the available space. Refer to 2.3.2, “System i storage sizing” on page 13, for a correct sizing.

    If you are going to create additional disks later, leave the appropriate free space.

    Click **Next** to continue.

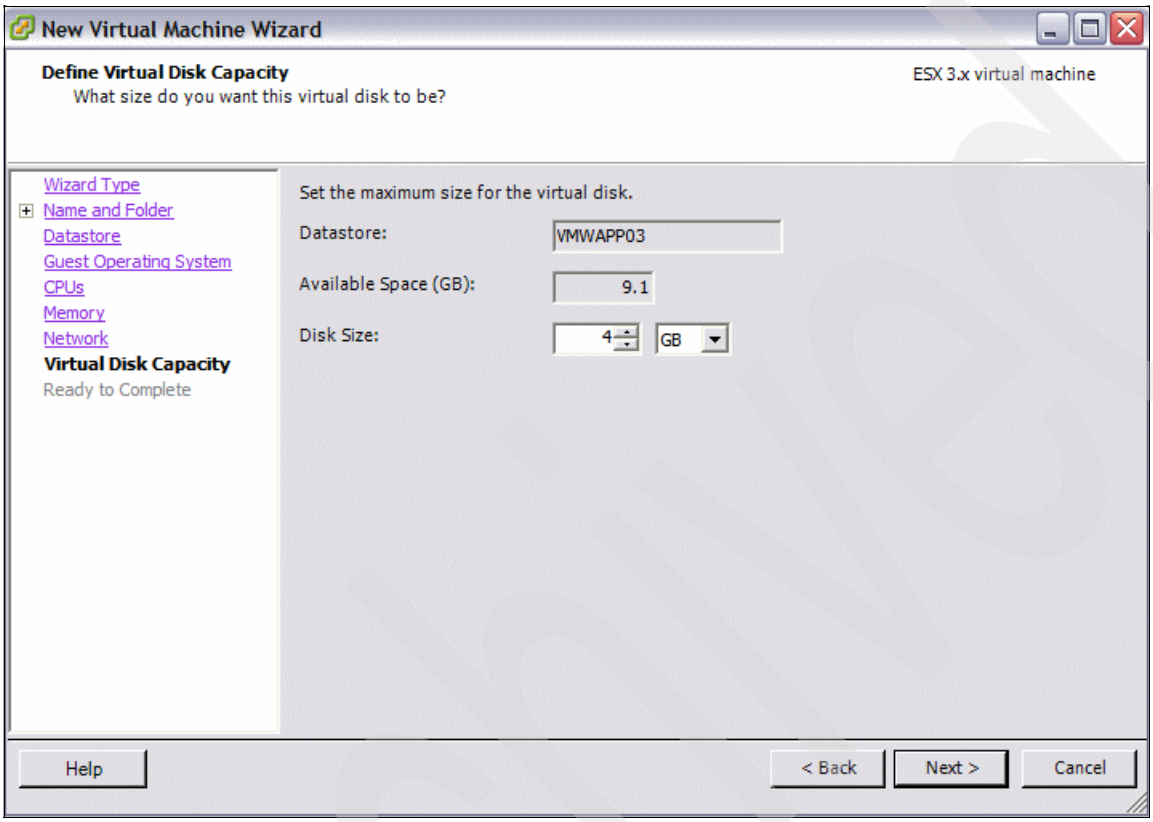

Figure 7-31 Define Virtual Disk Capacity

12. Review the configuration settings. Click **Back** if you need to change anything.

    When you are happy with the new Virtual Machine’s characteristics, click **Finish** to continue.

When the creation completes, the new Virtual Machine can be found on the Virtual Machines tab, as shown in Figure 7-32.

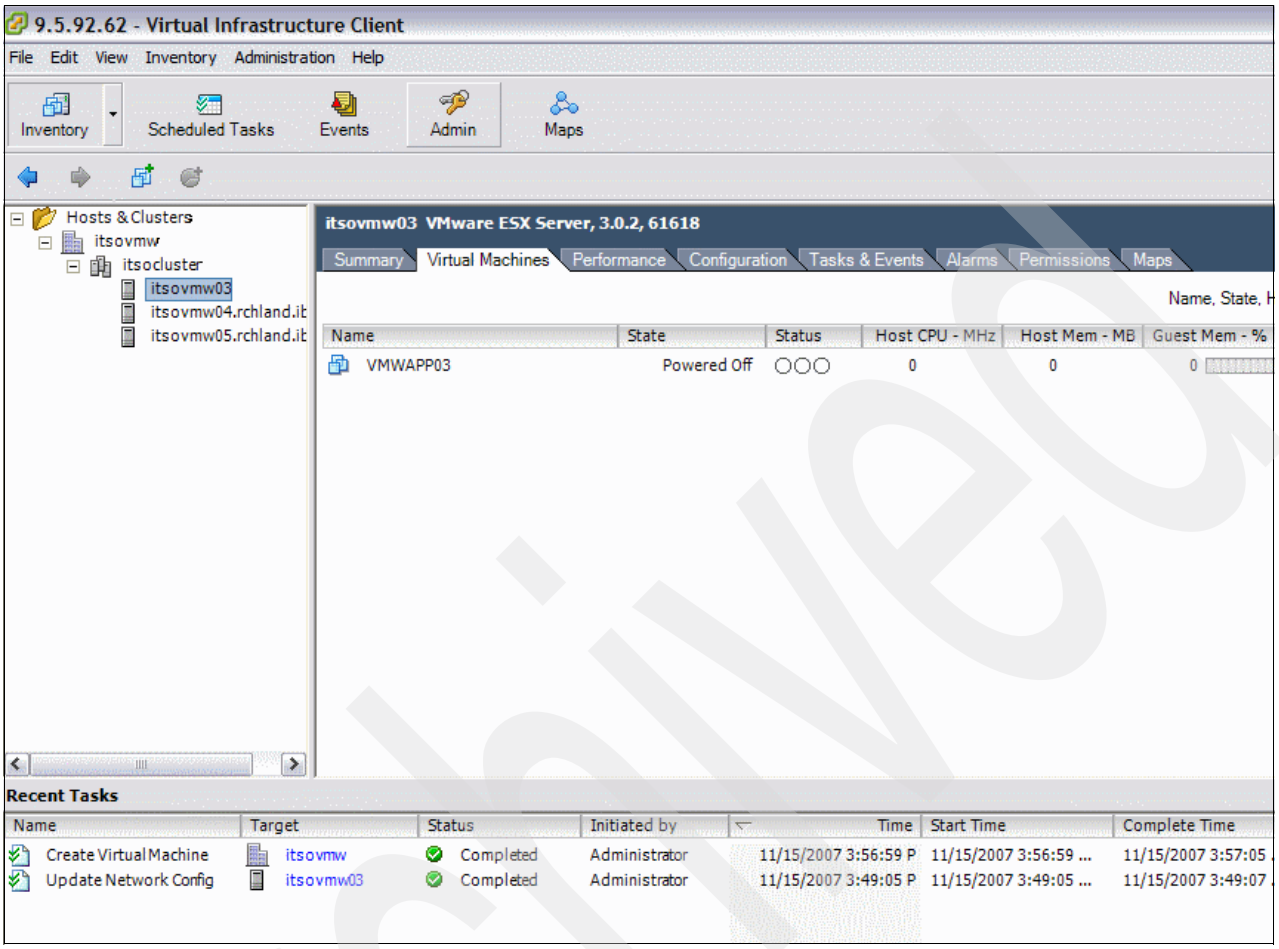

Figure 7-32 New Virtual Machine

After the above wizard completes, you will find inside the storage space a folder named as the Virtual Machine itself.

Inside this new folder, VMware VI3 creates some objects as:

- The Virtual Machine's configuration file, named *VMname*.vmx
- The disk file descriptor, named *VMname*.vmdk

To look at the Virtual Machine structure, on the Virtual Center select one of the ESX Servers accessing that storage space (Figure 7-33).

On the right pane select **Summary**, then find the new data store under Resources. Right-click the data store, then select **Browse Datastore**.

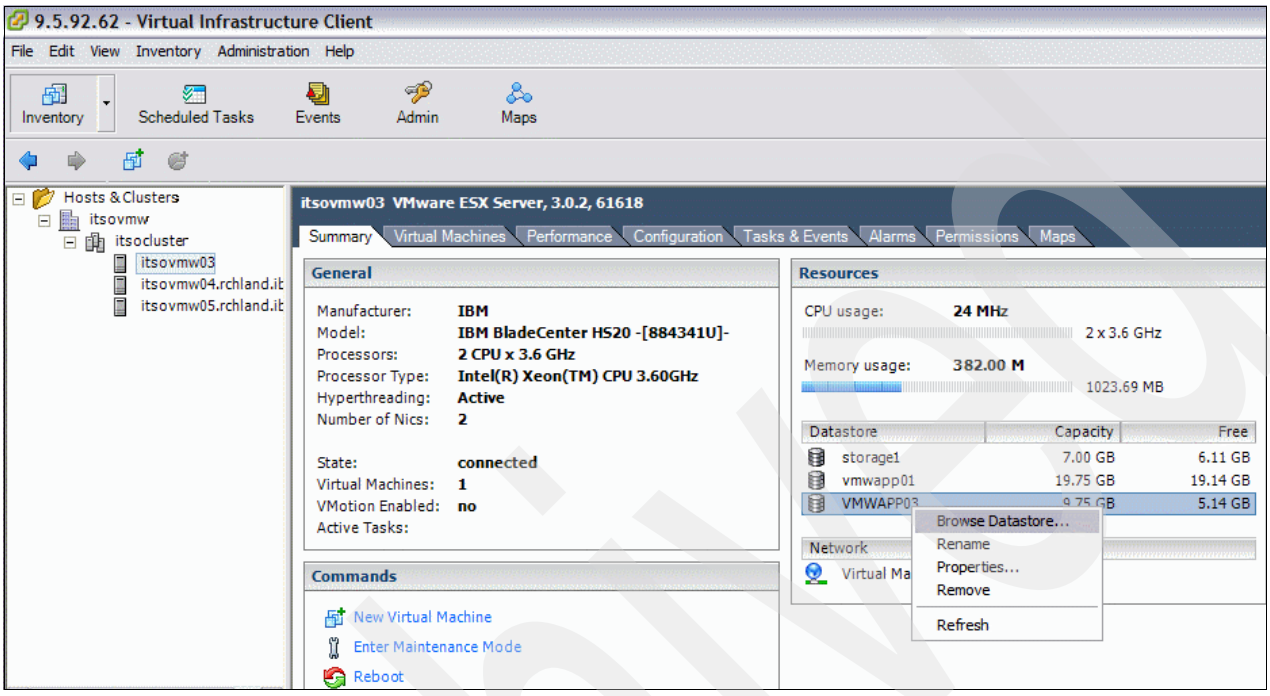

Figure 7-33 Browse Datastore

The Browse Datastore window opens, where you can drill down the Virtual Machine's folder and find the Virtual Machine's files (Figure 7-34).

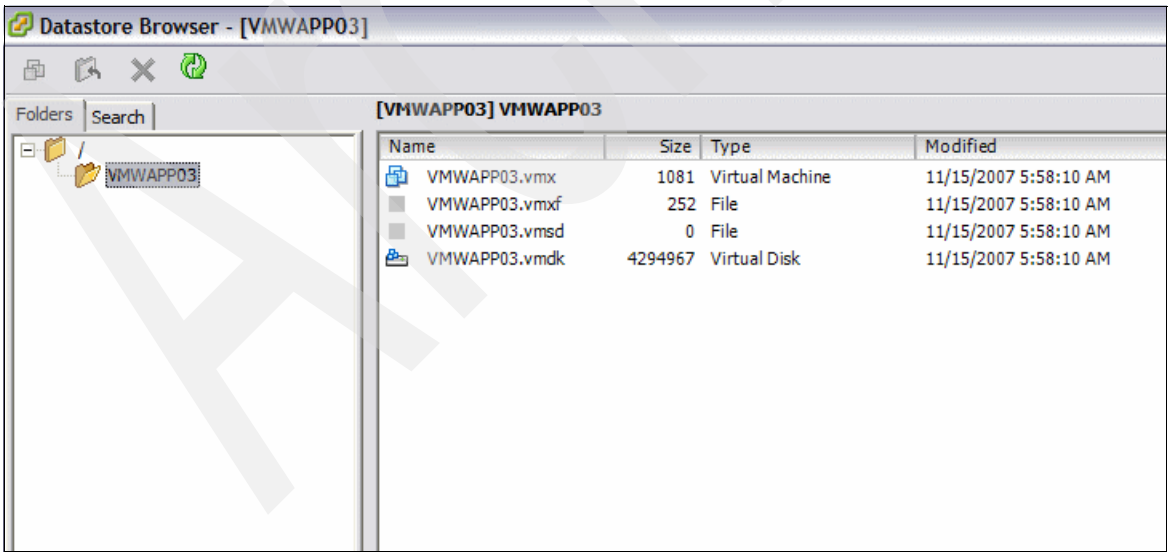

Figure 7-34 Virtual Machine's folder and files

More files will be created at the first Virtual Machine power on. Refer to the official VMware documentation to find a complete explanation of their purpose.

7.4.2 Adding a disk to a Virtual Machine

If you planned your Virtual Machine for more than a single disk, you can now add further disks until you have available room on the storage space. Refer to 2.3.2, “System i storage sizing” on page 13, for information about leaving free space on the storage space.

1. On the Virtual Center interface, right-click the new Virtual Machine (Figure 7-35) and select **Edit Settings**.

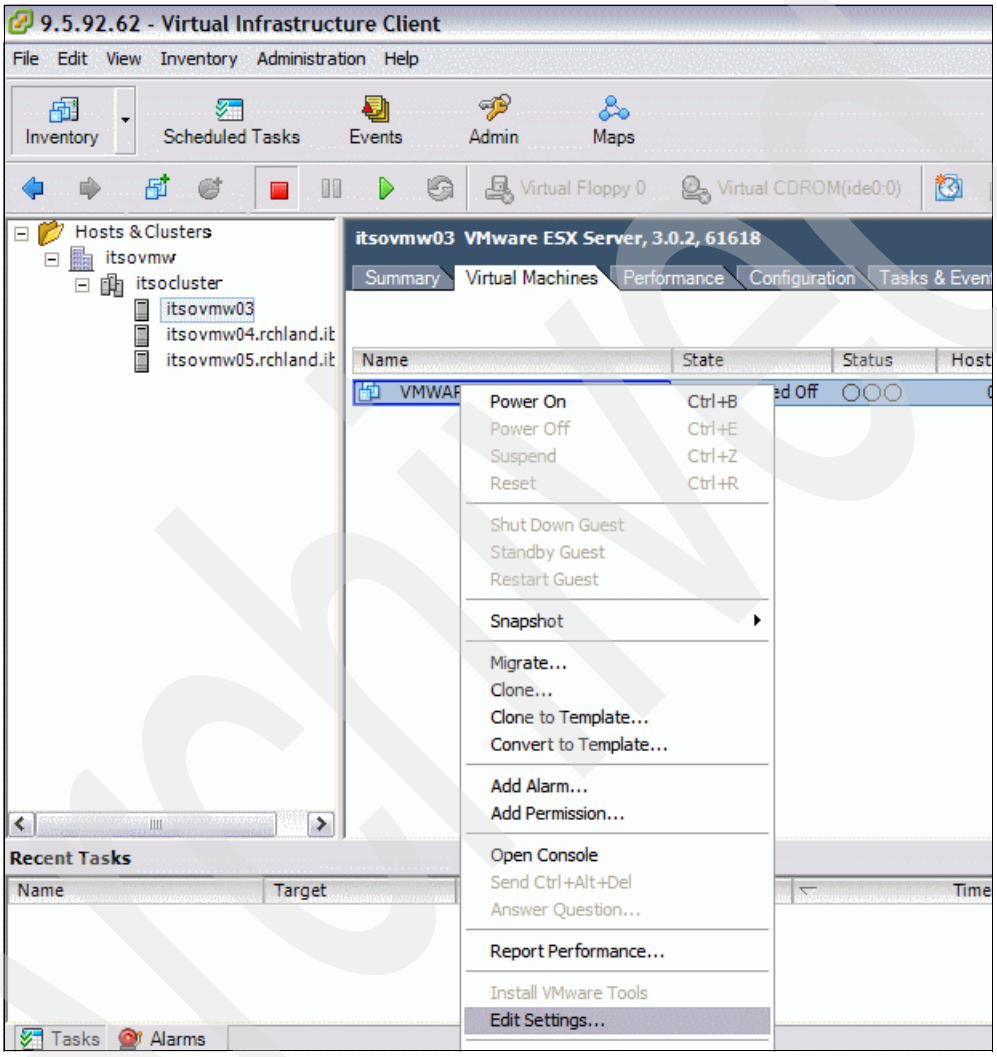

Figure 7-35 Edit Virtual Machine settings

2. On the Virtual Machine Properties window, select **Add** → **Hard Disk** (Figure 7-36). Click **Next** to continue.

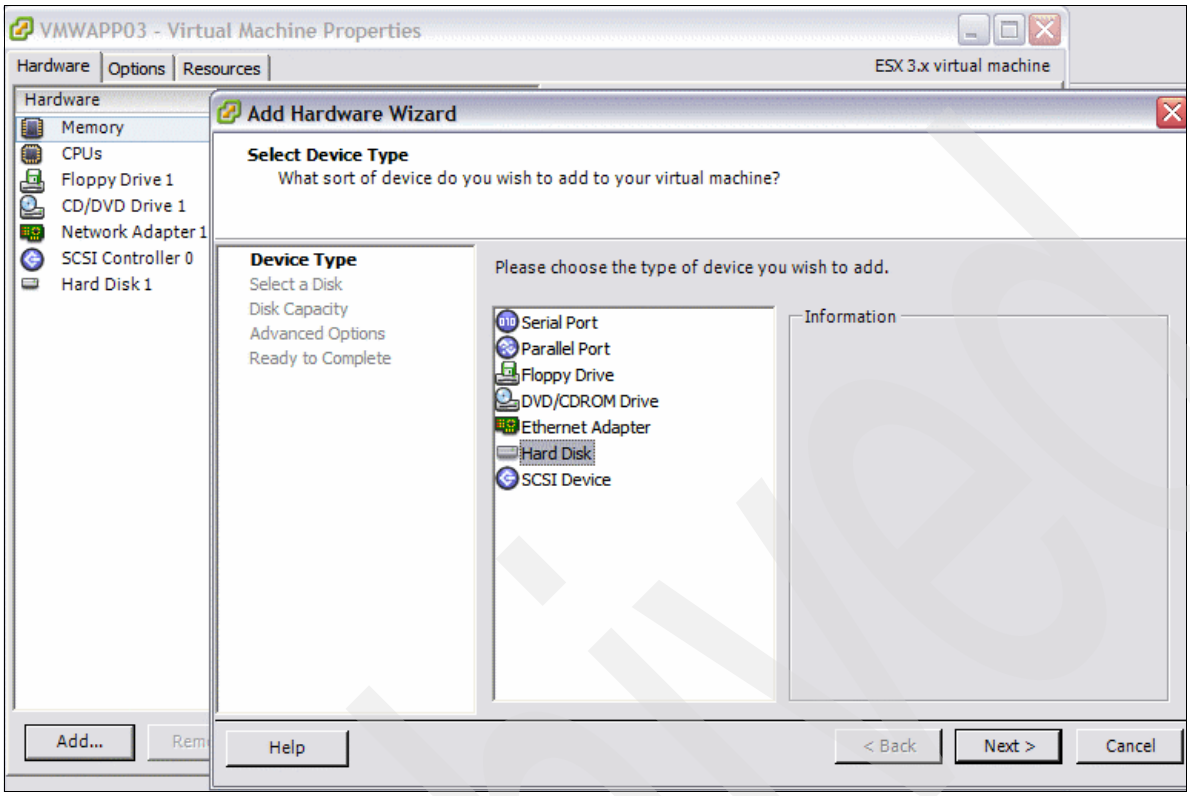

Figure 7-36 Add a new hard disk

3. Select **Create a new virtual disk** (Figure 7-37). Click **Next** to continue.

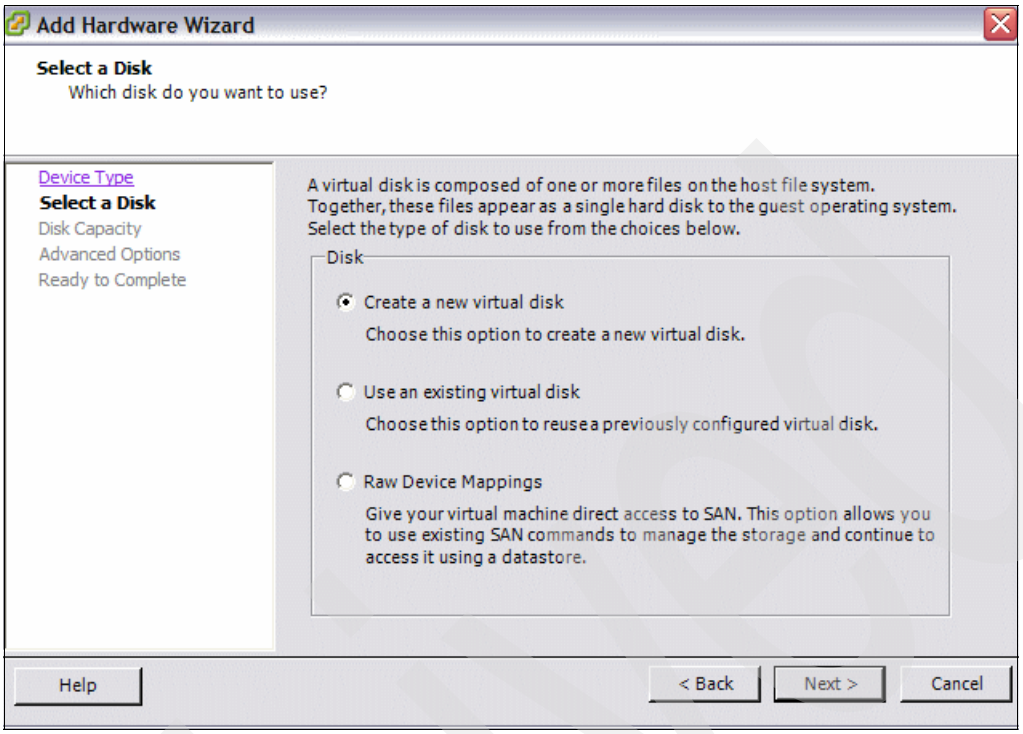

Figure 7-37 Create a new virtual disk

4. Choose the size of the new disk (Figure 7-38). Leave the default option Store with the virtual machine. The new disk will be stored into the same data store and directory as the other Virtual Machine files. Click **Next** to continue.

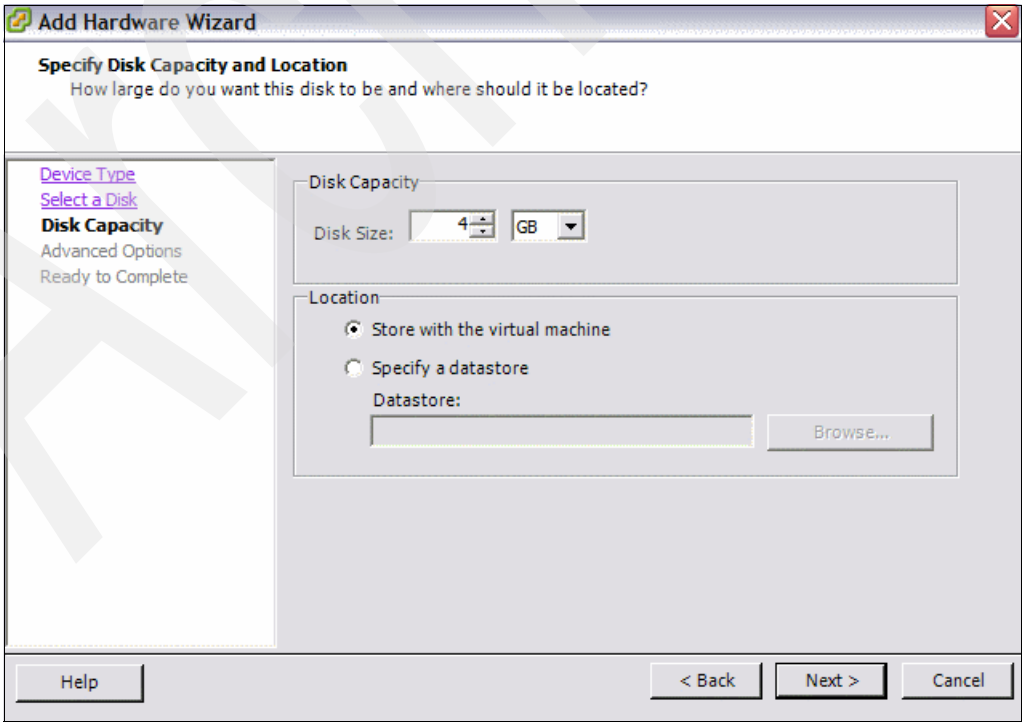

Figure 7-38 Assign the new disk size and location

5. Leave the defaults in the Specify Advanced Options window and click **Next** (Figure 7-39).

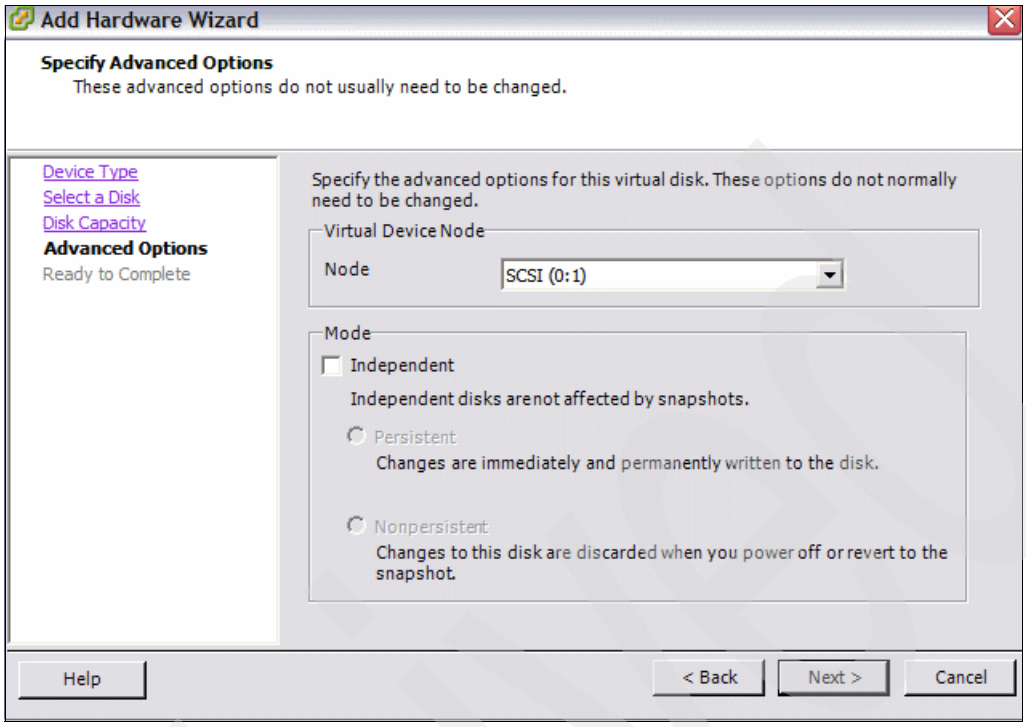

Figure 7-39 Specify Advanced Options

6. Review the new disk characteristics. If all is okay, click **Finish**. Click **OK** on the next window (Figure 7-40).

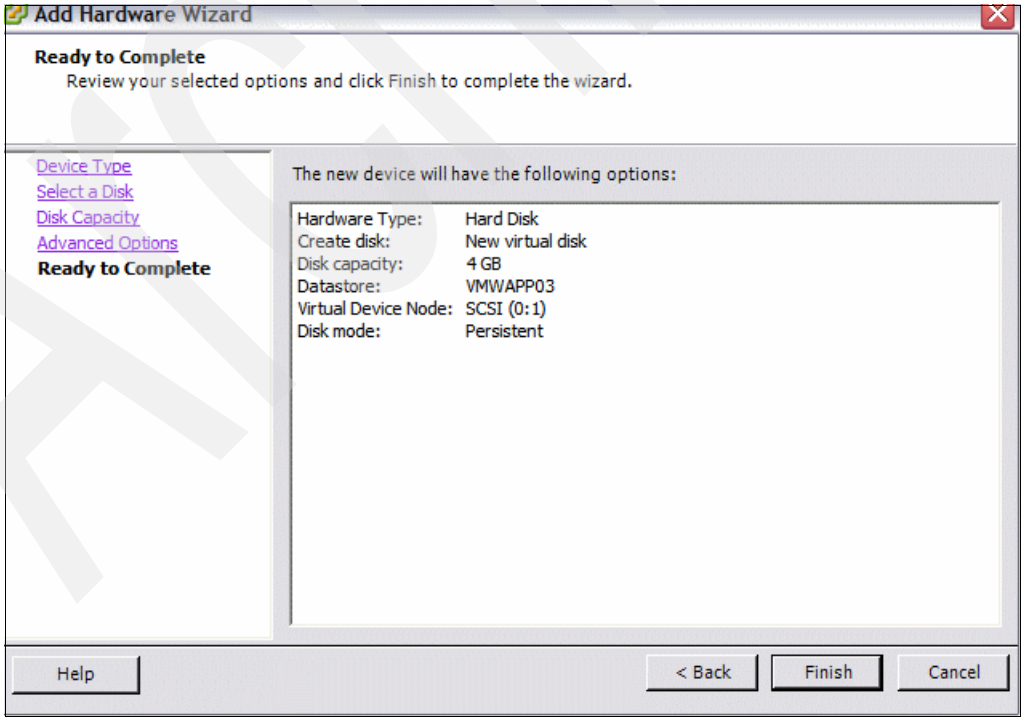

Figure 7-40 Ready to complete the creation of a new disk

7.4.3 Virtual Machine Console

The console of a powered-on Virtual Machine is available with the VMware Virtual Client.

To pop out the Virtual Machine console, right-click the Virtual Machine name on the Inventory tree and select **Open Console** from the menu (Figure 7-41).

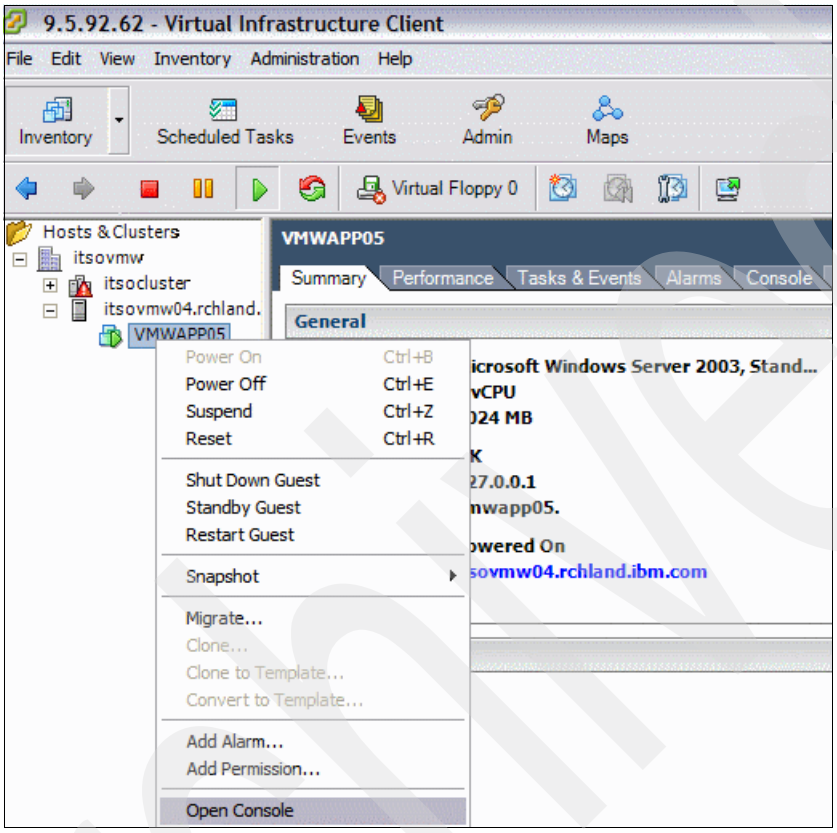

Figure 7-41 Opening the Virtual Machine console

The console window opens (Figure 7-42).

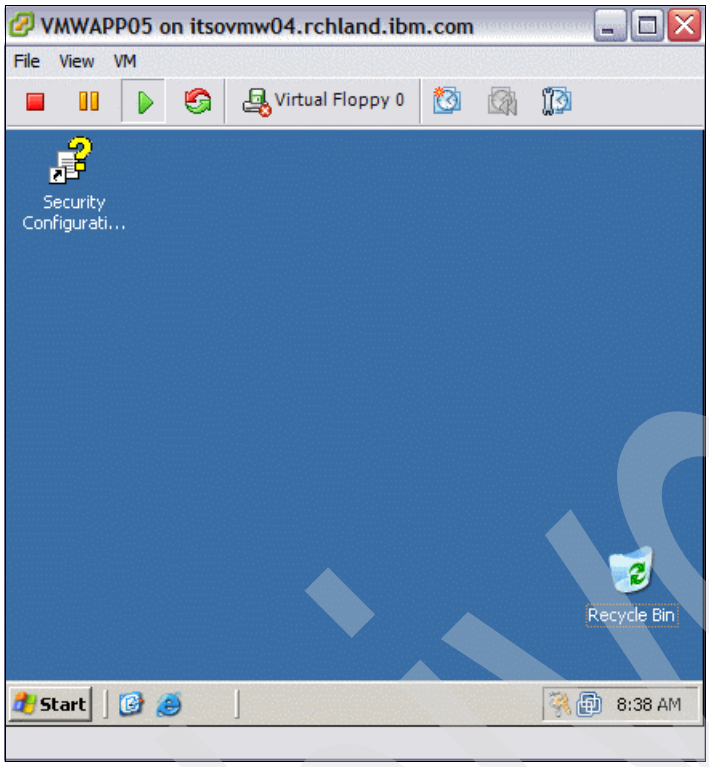

Figure 7-42 Virtual Machine console

On the graphic toolbar you find icons for starting, stopping, pausing, and resetting the guest operating system.

Click the console to get the focus and manage the guest operating system.

To exit the console, slide the mouse pointer outside the console border. You need to have the VMware Tools installed in order to move the mouse pointer in and out of the console.

If VMware Tools are not installed, or you have a non-GUI guest operating system, press the Ctrl+Alt key combination to exit the console.

To manage the Virtual Machine status, click **VM** on the main toolbar and choose one of the available power options. You can start, stop, suspend, and reset a Virtual Machine. Use the Shut Down Guest option rather than Power Off to shut down your guest operating system.

To handle the Virtual Machine properties, click **VM** on the main toolbar and select **Edit Settings** (Figure 7-43).

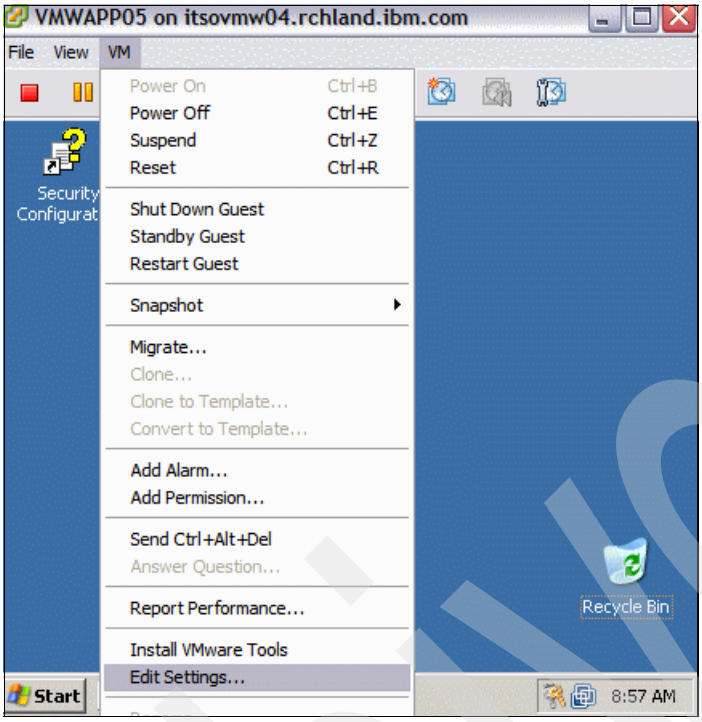

Figure 7-43 Edit Settings

The Virtual Machine Properties window opens, where you can manage both the basic and advanced options of your Virtual Machine (Figure 7-44). You can modify the amount of memory assigned to the Virtual Machine, create or delete disks, handle networking, and so on. Refer to VMware documentation for a complete explanation of the console settings.

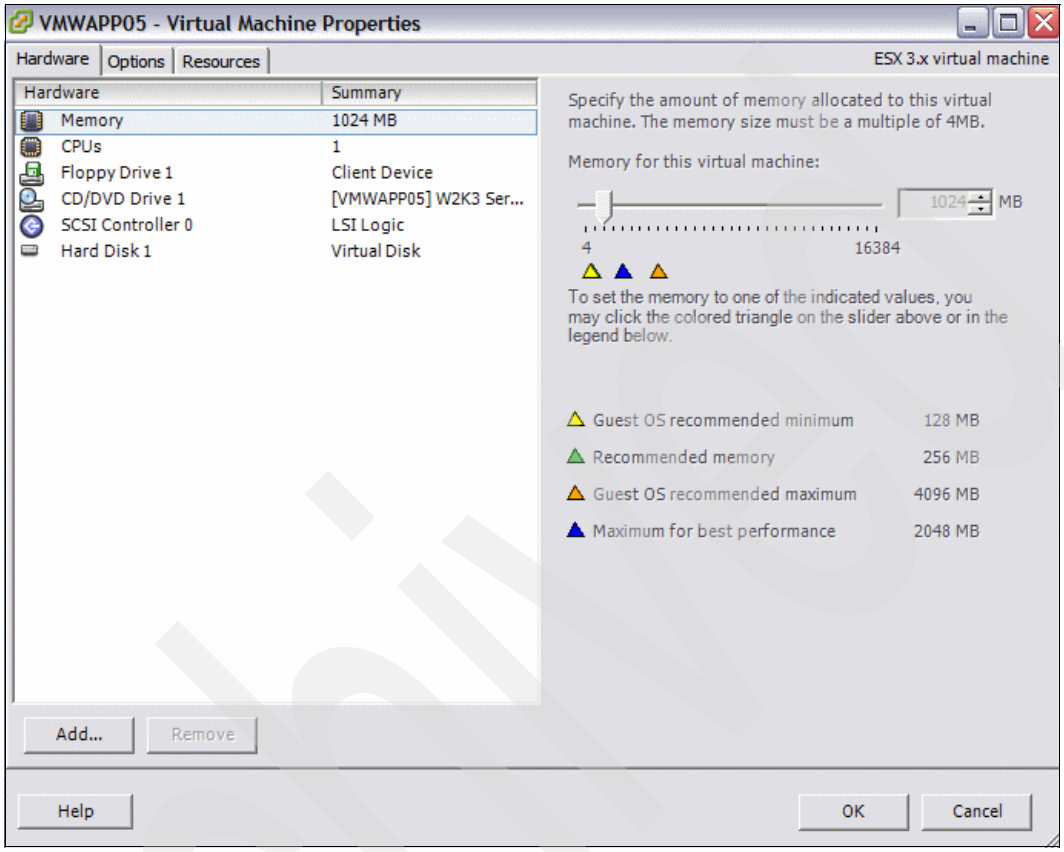

Figure 7-44 Virtual Machine Properties

7.4.4 Prepare the guest operating system installation source

When the new VM has been created with the above settings, you can install the guest operating system. To perform the OS installation you need the installation CD-ROMs and, for Windows, a license key.-ROM drive, from a network share, or from an ISO image placed on the VMFS3 file system itself.

The VMware VMFS3 file system is capable of hosting not only the Virtual Machine's files, but also any ISO image to get any files from. Figure 7-45 shows a data store containing both a Virtual Machine and two ISO disk images.

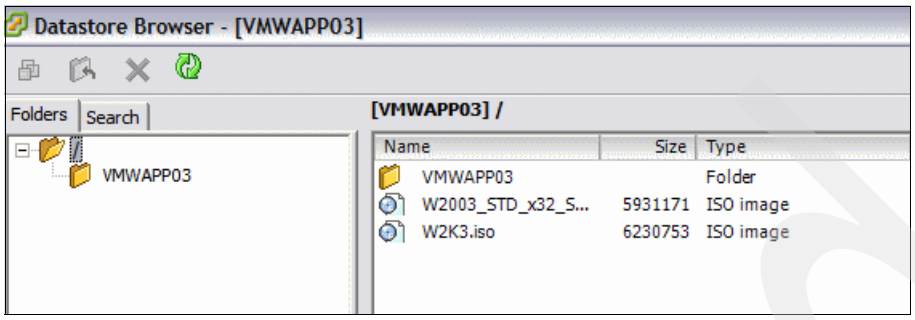

Figure 7-45 ISO images in a VMFS3 data store

Working with ISO images rather than physical CD-ROM's allows you to perform many installations without accessing the physical servers in the machine room. It also makes any file repository easily available, as service packs, toolkit, and so on.

To be able to access the same ISO files from all of the ESX hosts in a cluster, place them in a shared storage space. You can create a small storage space on purpose, or find some room in a Virtual Machine's storage space.

When you create an ISO image on your workstation, move it to a storage space using an SCP client. SCP is a secured file transfer protocol. An SCP server daemon is active on the ESX service console, and can be accessed to copy data into the VMFS3 file system. Remember that an FTP server is not active by default on a VMware VI3 Service Console, as usual for a Linux-based operating system, so you have to use SCP instead.

On a Windows workstation you can install a SCP GUI client in order to simplify the file transfer operations. MindTerm by Appgate and WinSCP are the most widely known SCP clients for Windows.

To upload an ISO image to a VMFS data store using MindTerm, proceed as follows:

1. Download the Java-based MindTerm client from:

   `http://www.appgate.com`
2. Launch mindterm.jar. The MindTerm console opens.

3. On SSH Server/Alias, enter the ESX host's IP address (Figure 7-46).

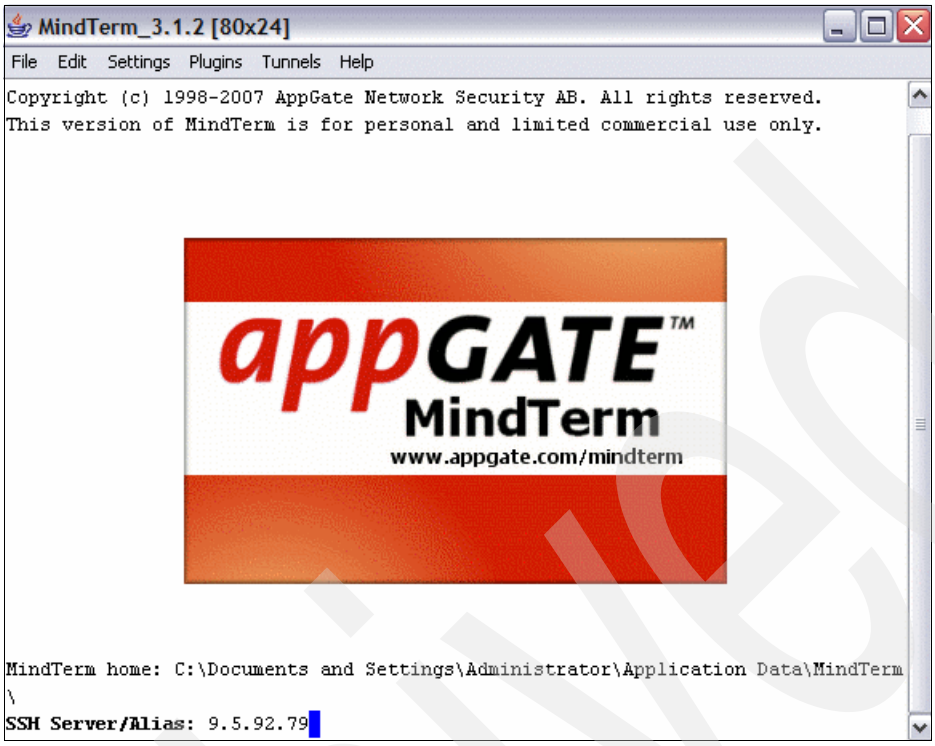

Figure 7-46 MindTerm console

4. Log in with a user enabled to write on the data store where you want to upload the ISO image file.
5. Accept the defaults to create a new alias and directory for the target server.

6. On the toolbar select **Plugins** → **SCP File Transfer** (Figure 7-47).

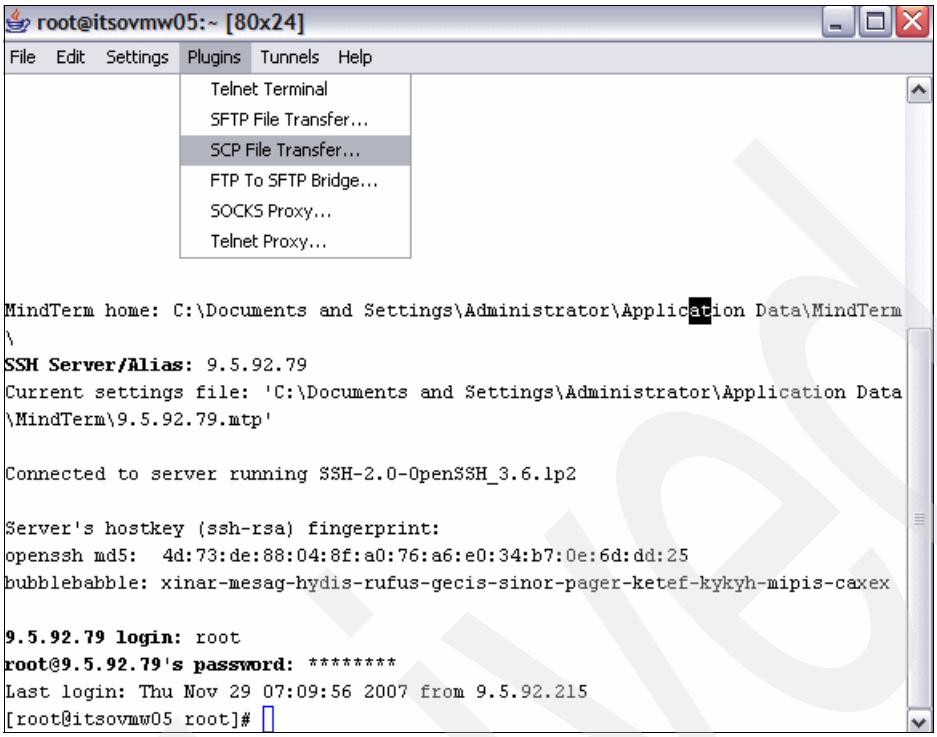

Figure 7-47 Starting the SCP File Transfer plugin

7. On the left pane of the SCP window, browse your workstation directory tree and find the ISO image file that you want to upload.
8. On the right pane select the VMFS data store on the target ESX host. The target path will be /vmfs/volumes/*YourDatastore* (Figure 7-48).

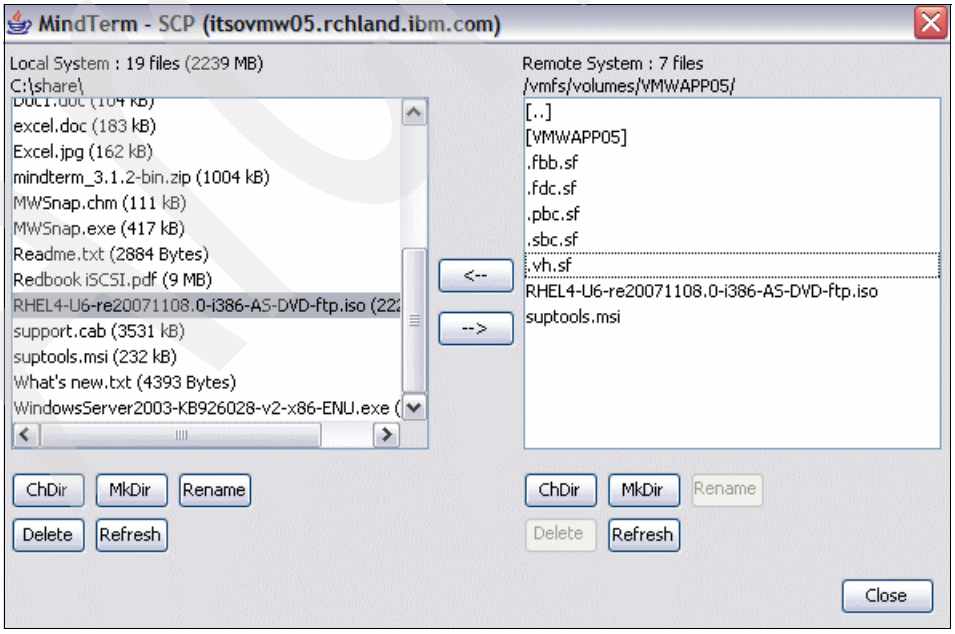

Figure 7-48 SCP file transfer

9. Click the **-->** button. The file transfer starts (Figure 7-49).

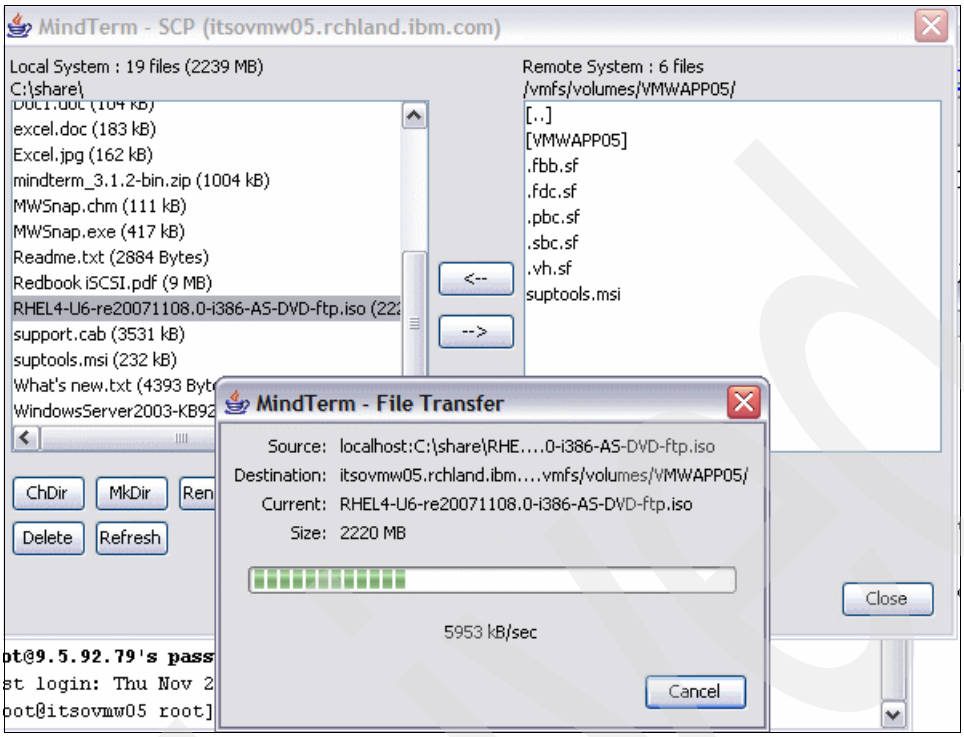

Figure 7-49 MindTerm - File Transfer

7.4.5 Install the guest operating system

To do this:

1. Open the Virtual Machine console.
2. Click **VM** on the toolbar, then **Edit Settings**.
3. On the Virtual Machine Properties window, select **CD/DVD Drive 1**.
   - If you are installing from a physical media on the host CD-ROM drive, select a host device.
   - If you are installing from an ISO image, select **Datastore ISO File** and browse the data store where you are used to placing the ISO images.

4. Check the Connect at power on box under Device Status then click **OK** (Figure 7-50).

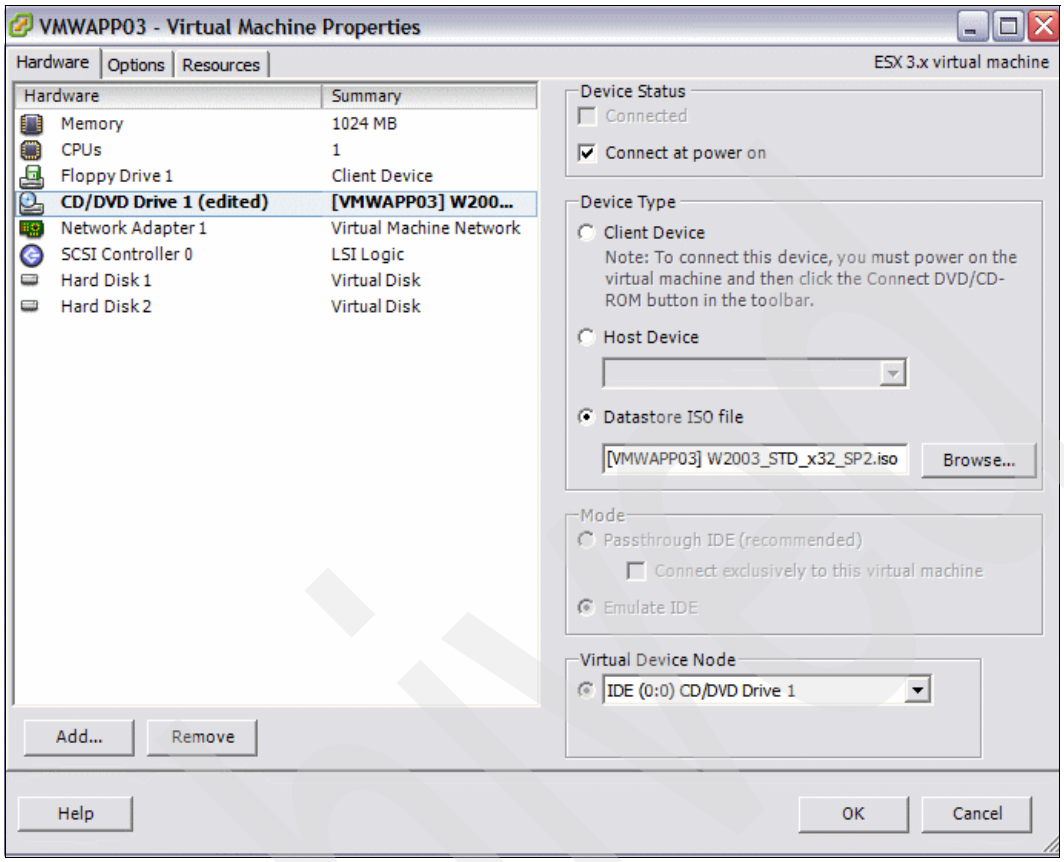

Figure 7-50 Select an ISO image to start the installation

5. When the Virtual Machine Reconfiguration task completes, click the green arrow on the Console to start the VM.

6. The VMware Boot window opens (Figure 7-51). If the VMware Boot window should not display, reset the Virtual Machine by clicking the reset icon on the console toolbar.

Figure 7-51 VMware ESX boot window

7. Click the window to take the control of the guest session. Press Esc while the VMware boot window is displayed. On the guest boot menu select 3, CD-ROM Drive (Figure 7-52).

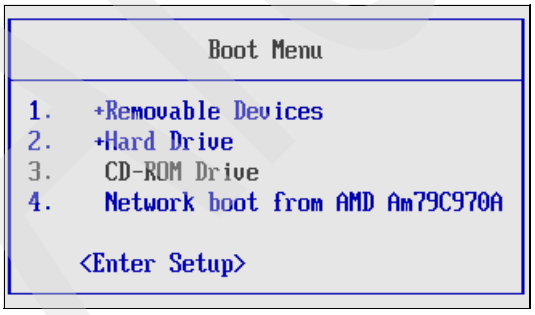

Figure 7-52 Boot Menu

8. The guest operating system installation starts. Complete all of the steps as per a standard installation.
9. Remember to disconnect the CD drive or the ISO image at the end of the installation.

7.4.6 Install VMware Tools on a Windows Virtual Machine

After the Windows operating system has been installed, you need to install the VMware Tools.

VMware Tools includes display, networking, memory, and SCSI drivers that enable that hardware to work better in the guest OS.

Guest OS will run without VMware Tools, but with reduced functionality. Without VMware Tools you experience a slow and erratic mouse pointer, and the pointer itself cannot move across the console boundary.

To install VMware Tools on a Windows Virtual Machine, do the following:

1. Start the Virtual Machine console. See 7.5.1, “Moving a Virtual Machine to a larger storage space” on page 208.
2. Click **VM** on the toolbar.
3. Select **Install VMare Tools** (Figure 7-53).

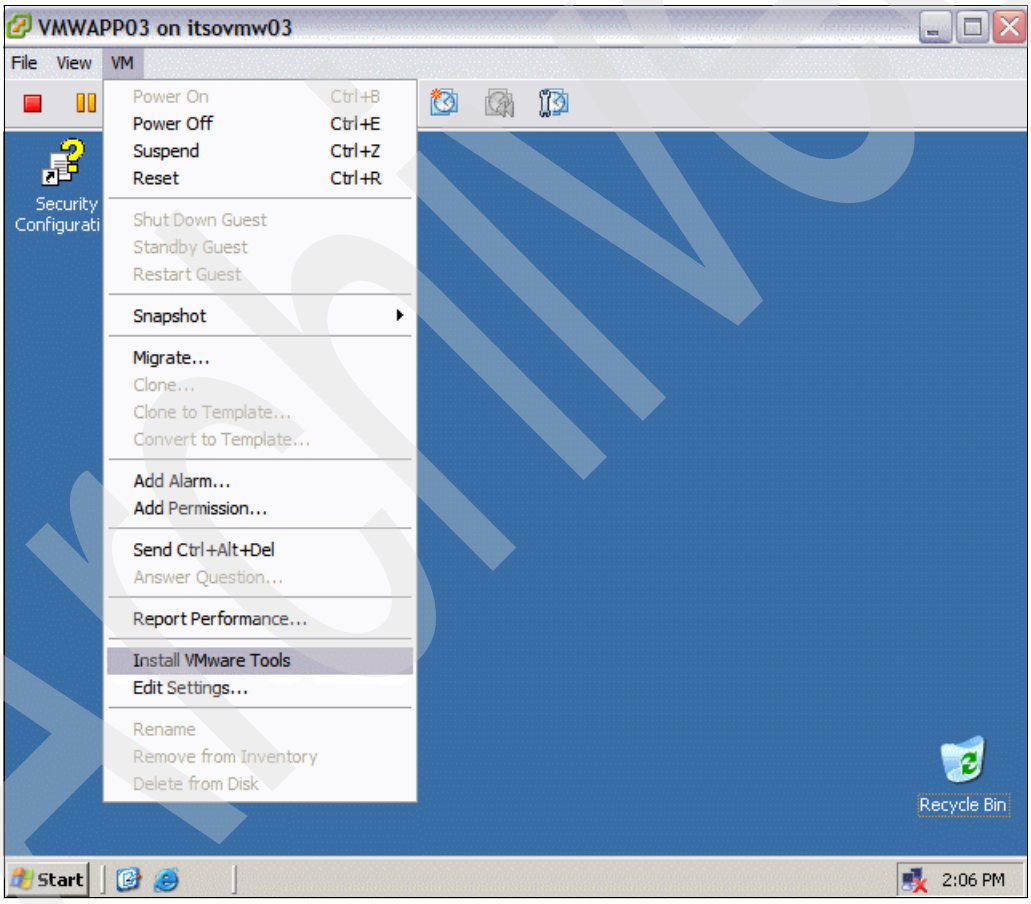

Figure 7-53 Installing VM Tools on a Windows system

The VMware Tools installation starts. The guest operating system will be restarted during the process, as explained on the informational window (Figure 7-54).

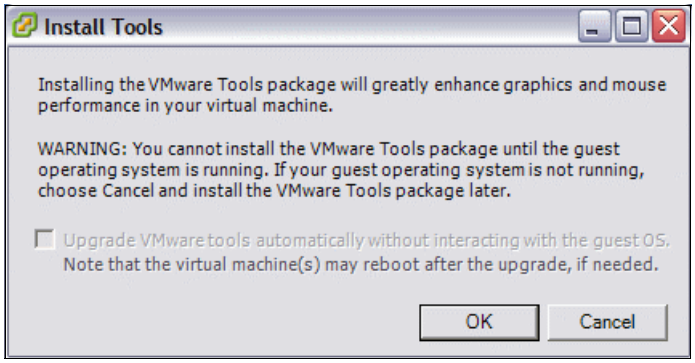

Figure 7-54 VMware Tools details

4. On the Setup Type window (Figure 7-55), choose the **Typical** option and click **Next** to continue.

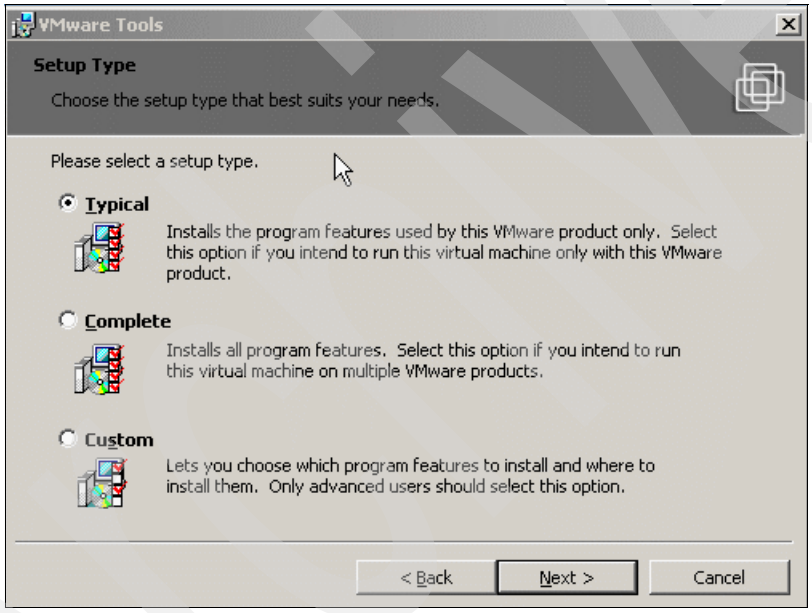

Figure 7-55 Select the Typical installation

5. Depending on the guest operating system type, a window can open suggesting that you enable hardware acceleration. Select **Yes** (Figure 7-56).

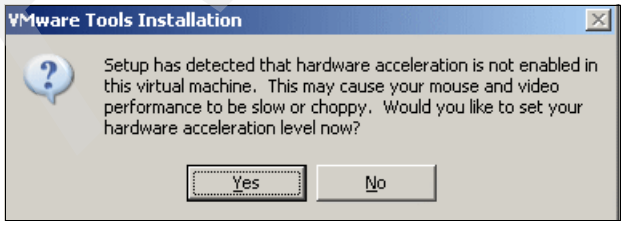

Figure 7-56 Hardware acceleration

6. A text box opens (Figure 7-57). Follow the instructions to enable hardware acceleration. If you do not do this, the mouse pointer will be erratic and hard to control.

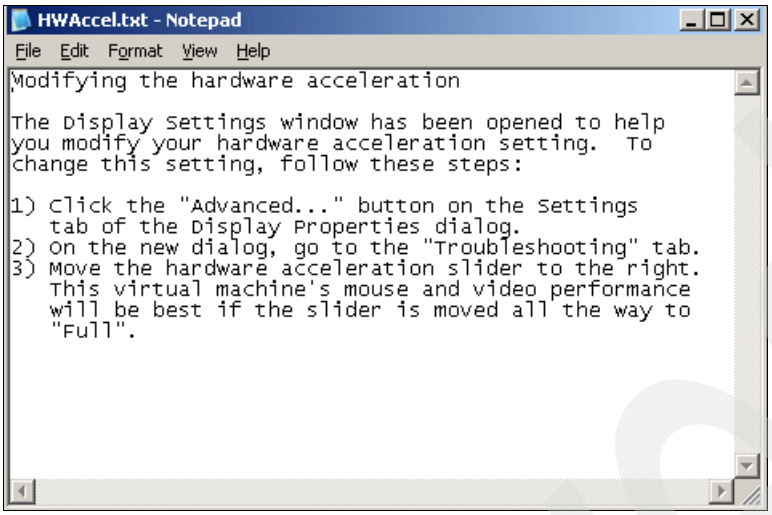

Figure 7-57 Hardware acceleration instructions

7. When the VMware Tools installation completes, restart the Virtual Machine.

   After the next boot, click the VMware Tools icon on the Windows taskbar to open the VMware Tools configuration window (Figure 7-58).

   Check the Time Synchronization box to align the guest operating system time to the ESX host server time. Click **OK** to complete the VMware Tools configuration.

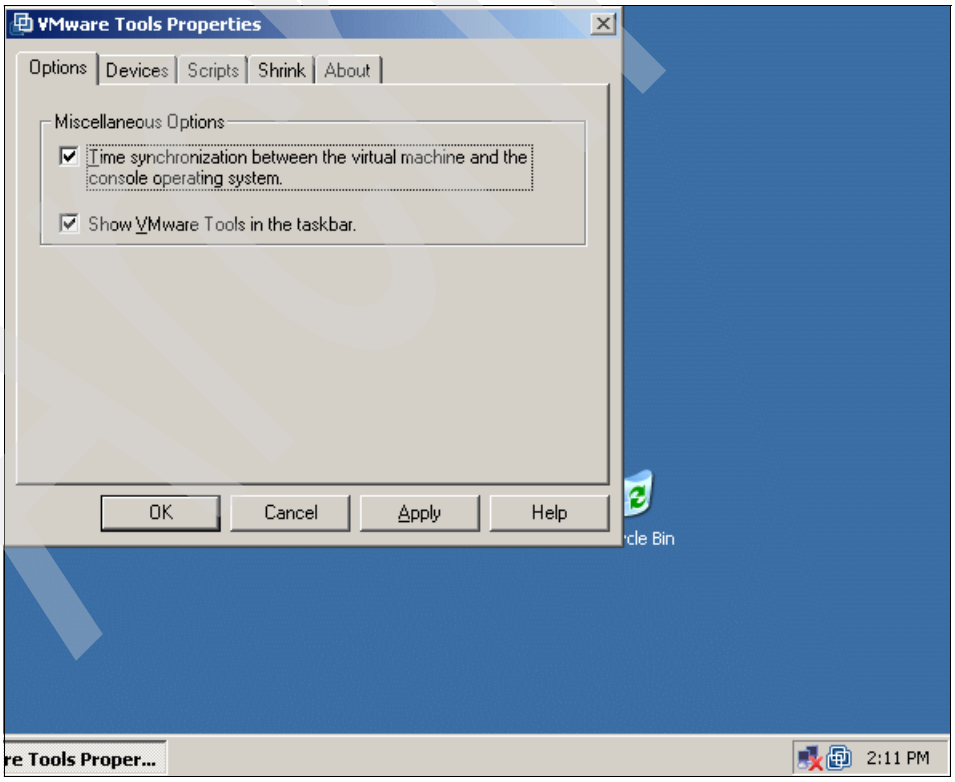

Figure 7-58 Enabling Time Synchronization in VMware Tools

When the VMware Tools are installed, the new Virtual Machine is ready to work in your Integrated VMware VI3 infrastructure. Remember to unlink any CD-ROM drive or image from the Virtual Machine.

7.4.7 Install VMware Tools on a Linux Virtual Machine

VMware Tools need to be installed also on a Linux Virtual Machine. Unlike with a Windows Virtual Machine, no installation wizard is provided. You have to enter commands on the Linux console in order to install the VMware Tools.

Follow these steps to install VMware Tools on a Linux Virtual Machine:

1. Open the Virtual Machine Console. See 7.5.1, “Moving a Virtual Machine to a larger storage space” on page 208.
2. On the toolbar, click **VM** → **Install VMware Tools** (Figure 7-59).

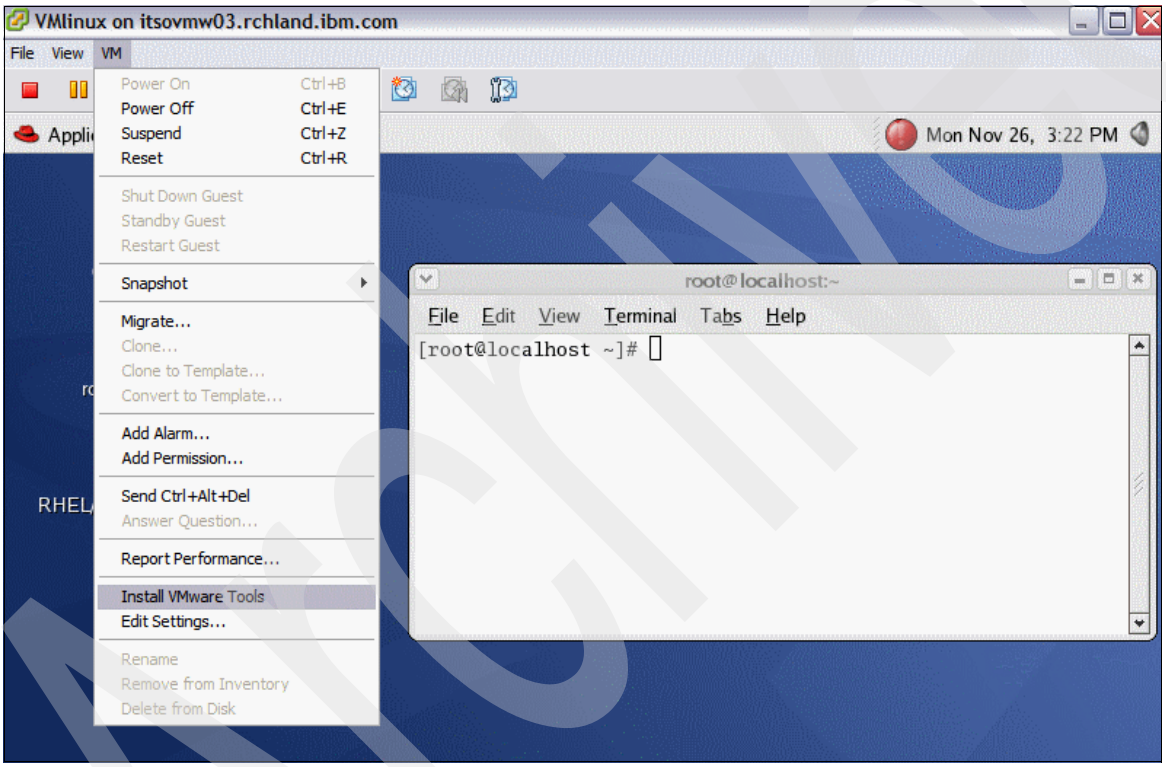

Figure 7-59 Install VMware Tools on a Linux Virtual Machine

3. On the Virtual Machine Console, open a Linux Terminal session as root. Enter the commands shown in Figure 7-60.

```
[root@localhost ~]# cd/media/cdrom
[root@localhost cdrom]# cp VMwareTools-3.0.2-55869.tar.gz /tmp
[root@localhost cdrom]# cd /tmp
[root@localhost tmp]# tar -xzvf VMwareTools-3.0.2-55869.tar.gz
[root@localhost tmp]# cd vmware-tools-distrib/
[root@localhost vmware-tools-distrib]# ./vmware-install.pl
```

Figure 7-60 VMware Tools installation commands

The instructions in Figure 7-60 on page 206 are given only as a guideline. They worked fine on a
Red Hat 4 Upgrade 6 distribution. Other Linux distributions can use a different name for the *media* directory. The VMwareTools filename depends on the VMware Tools release.

a. The vmare-install program prompts for many options. Accept all the defaults.

b. At the end of the installation, the message shown in Figure 7-61 is issued. Delete the content of the /tmp directory and restart the Virtual Machine.

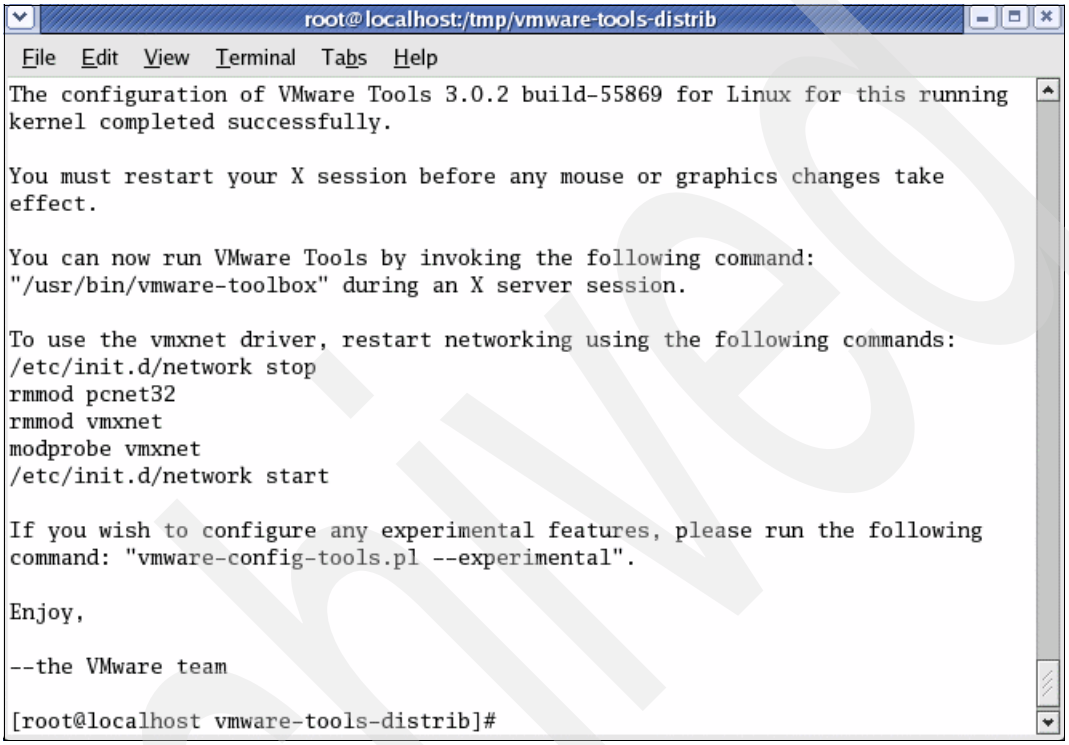

Figure 7-61 VMware Tools completion message

7.5 Enlarging a disk partition assigned to an existing VM

Although the storage space size should be carefully planned before creating a Virtual Machine, the need can arise for adding more disk space to an existing VM.

If the data store where the Virtual Machine's files are located has enough free space available, you can enlarge the vmdk files. Then run a disk management utility inside the guest operating system in order to increase the disk size. See 7.5.2, "Enlarging a vmdk file using VMware ESX commands" on page 212, and 7.5.3, "Enlarging a disk drive inside the guest operating system" on page 214.

If the data store is not large enough to host the new disk size, you need to increase the data store size first. You have two options for increasing the size of a storage space:

- Create a larger data store. Migrate the Virtual Machine files to the new data store using the Virtual Center interface. Start the Virtual Machine from the new data store. This technique requires only the Virtual Machine to be shut down during the resize process. You do not need to power off any of the Integrated ESX Servers. Then you can reuse the original storage space to create a new Virtual Machine when you need it. Refer to 7.5.1, "Moving a Virtual Machine to a larger storage space" on page 208.

- Use the i5/OS interfaces (System i Navigator or command line) to enlarge the existing storage space. In this case you need to power off all of the ESX Servers that have access to that storage space. This is not likely to be an option in a production environment where many Virtual Machines are running on the cluster. Refer to 7.5.5, “Enlarging a storage space using System i Navigator” on page 215, or to 7.5.6, “Enlarge a storage space using CL commands” on page 217.

7.5.1 Moving a Virtual Machine to a larger storage space

To move a Virtual Machine to a new, larger data store:

1. Create a new, larger storage space using System i Navigator or the System i command line, as explained in 7.1, “Creating new storage spaces for Virtual Machines” on page 158.
2. Link the new storage space to all of the VMware ESX Servers in the cluster. See 7.1.4, “Assigning the new storage space to all ESX Servers in the cluster” on page 164.
3. Format the new storage space. Assign a new name, as explained in 7.1.5, “Creating a VMFS data store in a storage space with partition alignment” on page 166. The name cannot be the same as the existing storage space. Assign a name consistent with the Virtual Machine name itself.
4. Open the Virtual Center interface. Select your Virtual Machine on the data center tree.
5. Shut down the Virtual Machine.
6. Right-click the Virtual Machine and click **Migrate** (Figure 7-62).

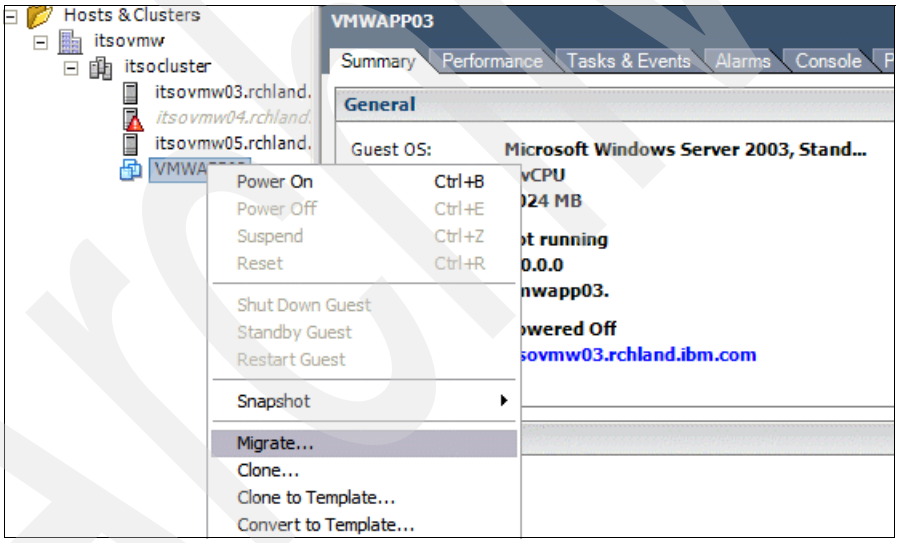

Figure 7-62 Virtual Machine storage relocation

7. The Migrate Virtual Machine Wizard opens. This is the same wizard used for VMotion, but here you can relocate the Virtual Machine's files to a different data store since the Virtual Machine itself is powered down. On the Select Destination window, select the target ESX Server in the cluster. If you only need to relocate the storage, keep the source ESX Server (Figure 7-63).

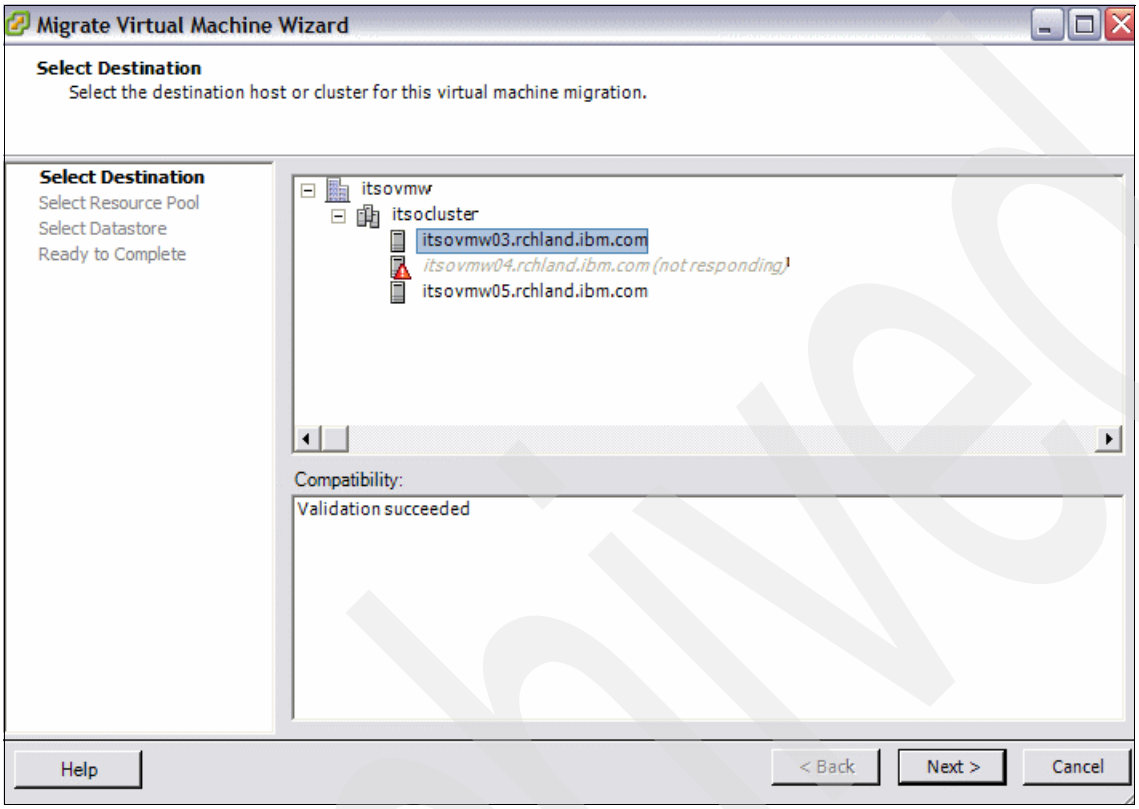

Figure 7-63 Select the target ESX Server

8. On Select Datastore, choose the target resource pool. Resource pools can be defined in a VMware VI3 cluster to help manage the physical resources of the ESX Servers. If you did not define any child resource pool inside the main resource pool, you can only pick up the main pool (Figure 7-64). Click **Next** to continue.

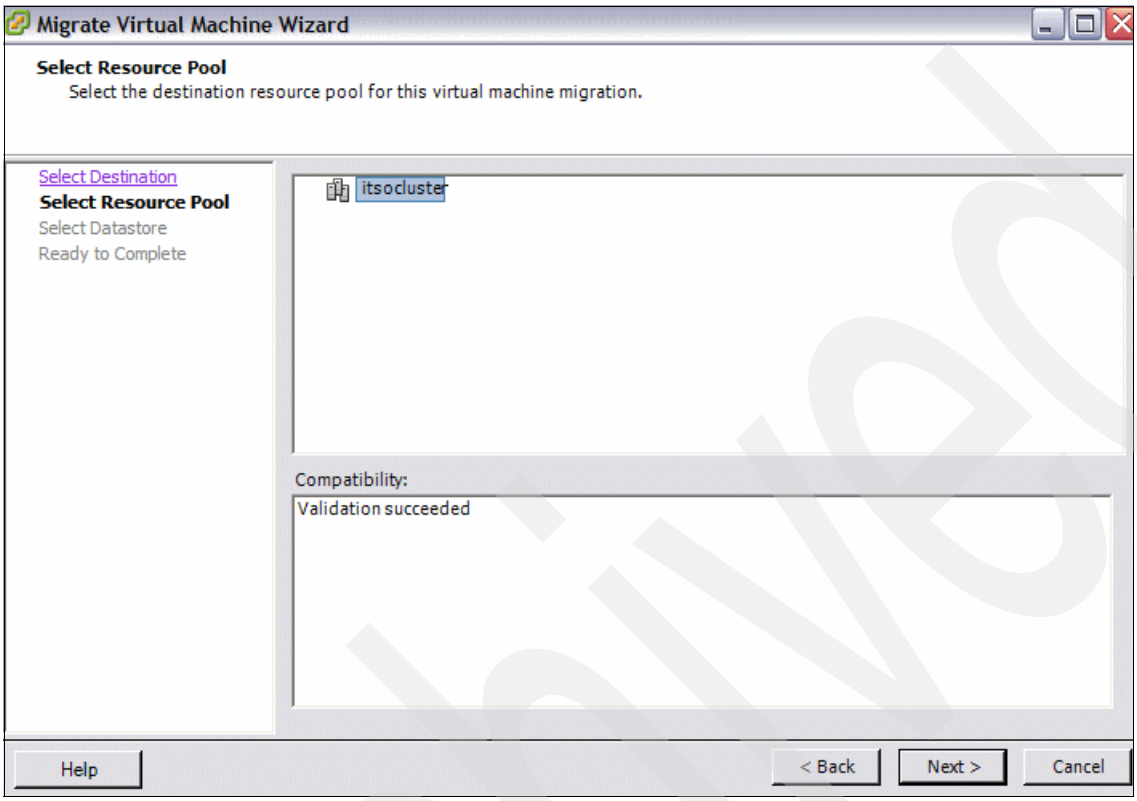

Figure 7-64 Select the resource pool

9. Because the Virtual Machine is turned off, the migration wizard allows us to relocate the storage. Check the option **Move the Virtual Machine configuration files and virtual disk**. Select the target data store (Figure 7-65). Click **Next** to continue.

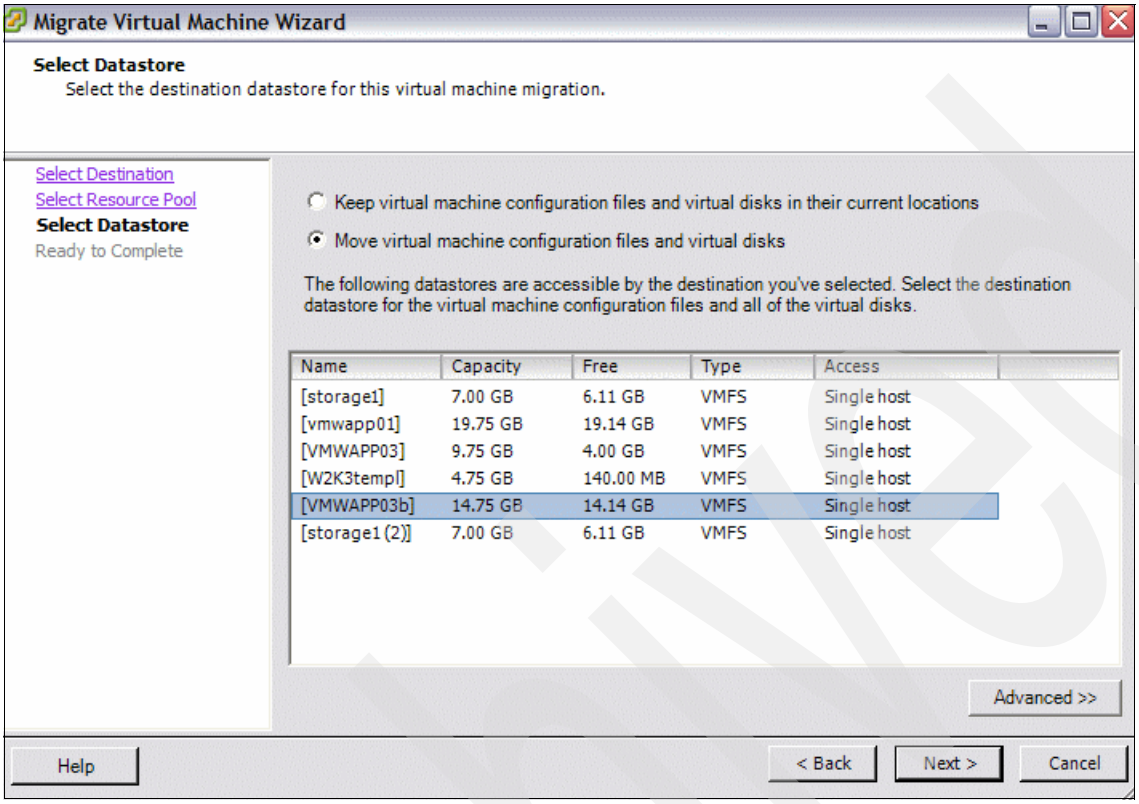

Figure 7-65 Select the target data store for storage relocation

10. On the Summary window, review the options, then click **Finish** (Figure 7-66).

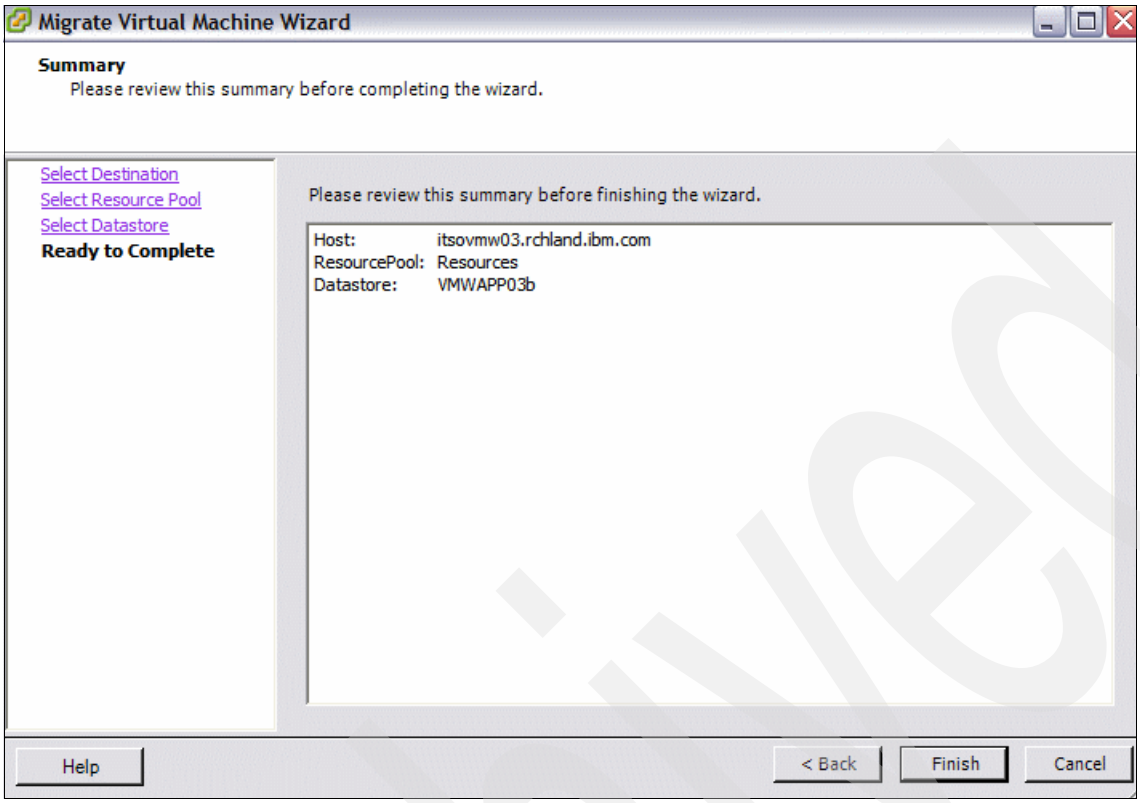

Figure 7-66 Migration wizard Summary window

Now look at the Recent Tasks bottom pane of the Virtual Center interface. A status bar shows the operation in progress (Figure 7-67).

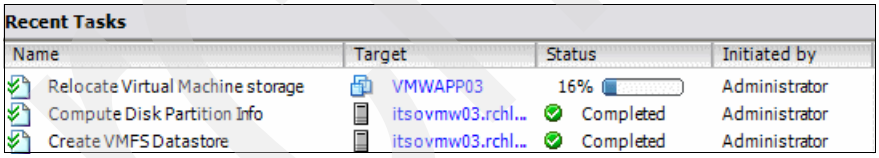

Figure 7-67 Migration in progress

When the migration completes, the Virtual Machine's files are moved to the new, larger data store. The vmdk files, representing the actual Virtual Machine disks, need now to be enlarged, taking advantage of the additional space. See 7.5.2, "Enlarging a vmdk file using VMware ESX commands" on page 212.

7.5.2 Enlarging a vmdk file using VMware ESX commands

The VirtualCenter interface does not provide a GUI utility to enlarge a vmdk file.

Use the Service Console command **`vmkfstools -X`** to enlarge a vmdk file.

You can start a Service Console session from the server's console itself, using the Advanced Management Module (for a blade server) or the Remote Supervisor Adapter II (for a System x server).

From a Linux client, you can directly open a Service Console session to the ESX Server, entering the SSH command followed by the ESX Servers console IP address.

If you want to access the ESX Server console from a Windows PC, you need to install an SSH client. For example, download and install the Putty GUI utility from the Internet.

Open the SSH session as root, then drill down the file system to enter the Virtual Machine folder on the new storage space. The path will be /vmfs/volumes/*YourStoragespace*/*YourVM*. Run the VMware utility **vmkfstools -X** against the vmdk file that you want to enlarge. Do not try to modify the size of the *flat* file. That is done automatically by the system.

Note: SSH access for user *root* is disabled by default on ESX VI3. Refer to VMware documentation to enable the root user to log in using SSH

Figure 7-68 shows the **vmkfstools -X** command to enlarge a vmdk file from 4 GB to 6 GB. The Virtual Machine's directory and files have been relocated from a data store named VMWAPP04 to the new data store VMAPP04b. The Virtual Machine's directory and files keep the original name VMWAPP04.

```
[root@itsovmw03 root]# cd /vmfs/volumes/VMWAPP04b/VMWAPP04/
[root@itsovmw03 VMWAPP04]#
[root@itsovmw03 VMWAPP04]# ll *.vmdk
-rw-------    1 root     root     4294967296 Nov 19 19:27 VMWAPP04-flat.vmdk
-rw-------    1 root     root           338 Nov 19 13:53 VMWAPP04.vmdk
[root@itsovmw03 VMWAPP04]# vmkfstools -X 6G VMWAPP04.vmdk
[root@itsovmw03 VMWAPP04]# ll *.vmdk
-rw-------    1 root     root     6442450944 Nov 19 19:29 VMWAPP04-flat.vmdk
-rw-------    1 root     root           339 Nov 19 19:31 VMWAPP04.vmdk
[root@itsovmw03 VMWAPP04]#
```

Figure 7-68 Use vmkfstools to enlarge a vmdk file

The size of the vmdk file is extended almost immediately. Exit the console session and verify the new disk size using the browse data store utility in Virtual Center. Then proceed with 7.5.3, "Enlarging a disk drive inside the guest operating system" on page 214.

7.5.3 Enlarging a disk drive inside the guest operating system

After the vmdk file has been enlarged, the guest operating system needs to acquire the new space.

Figure 7-69 shows the Windows 2003 Disk Management window. The space of 6 GB has been added to a vmdk file. Windows Disk Management shows the additional storage as unallocated.

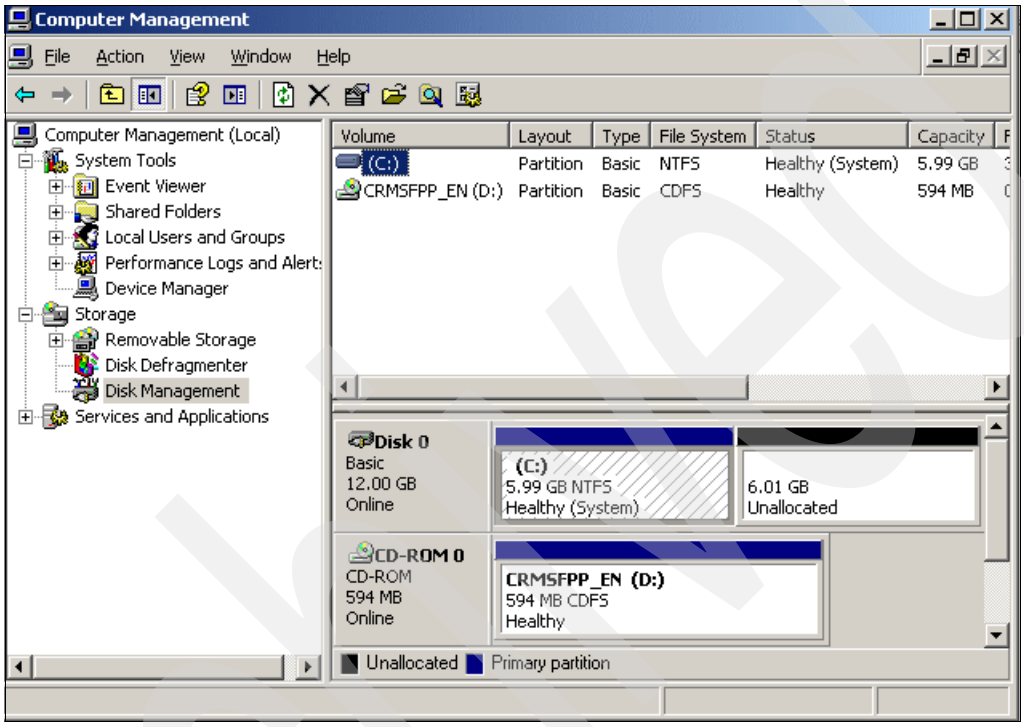

Figure 7-69 Disk Management within Windows Server 2003

Both a data drive and a system drive can be enlarged.

- To enlarge a data drive of a Windows Virtual Machine, run the Microsoft **`diskpart`** utility on the guest Windows operating system.
- To enlarge a system drive you have two options:
  - Boot the Virtual Machine from a disk management utility boot disk or ISO image. For example, Acronis Disk Director 10 can handle both Windows and Linux OS, allowing you to enlarge their partitions.
  - Attach the partition to another Virtual Machine, as follows:
    i. Power down the Virtual Machine that you want to enlarge.
    ii. Link its data store to another Virtual Machine so that the system partition appears as a data drive to the second VM.
    iii. Run **`diskpart`** on the second VM against the partition that you want to enlarge.
    iv. Unlink the data store from the second VM.
    v. Restart the first Virtual Machine.

7.5.4 Diskpart utility

diskpart is a Microsoft disk utility included in Windows 2003 Server OS.

To perform **diskpart**:

1. Open a DOS prompt by selecting **Start** → **Run**.
2. On the command prompt, type `Diskpart` and press Enter. The prompt changes from C:\....> to DISKPART>, and you are now in the Diskpart utility.
3. Type `list volume` and a list with volumes opens. You see all the drives and their drive letters.
4. Select the new volume by typing `select volume x`, where *x* is the volume number. A message returns saying that the volume is selected.
5. Type `extend` to expand the drive with the added disk space. It returns with the message `DiskPart successfully extended the volume`. See Example 7-1.

Example 7-1 Example

```
C:\Documents and Settings\Administrator\diskpart

Microsoft DiskPart version 5.2.3790.1830
Copyright (C) 1999-2001 Microsoft Corporation.
On computer: VMWAPP01

DISKPART> list volume

Volume ###  Ltr  Label      Fs    Type        Size     Status   Info
----------  ---  --------   ----  ----------  -------  ------   ----
Volume 0     E                   DVD-ROM         0 B  Healthy
Volume 1     C   VMWAPP01   NTFS  Partition   3997 MB  Healthy  Boot
Volume 2     D   VMWAPP04   NTFS  Partition   3997 MB  Healthy

DISKPART> select volume 2

Volume 2 is the selected volume

DISKPART> extend

DiskPart successfully extended the volume
```

Now your guest operating system and its applications are able to take advantage of the new disk space.

You also need to shutdown all of the servers in the cluster (that were linked to the source, smaller storage space) to unlink and delete it. You can perform this activity during a scheduled maintenance activity on your infrastructure, or you can format the storage space and keep it ready to host a new Virtual Machine.

7.5.5 Enlarging a storage space using System i Navigator

The entire ESX Server (and all active VMs) must be shut down before enlarging a storage space that is linked to that ESX Server. See 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.

To expand a storage space using System i Navigator:

1. Expand **YourSystem** → **Integrated Server Administration** → **All Virtual Disks**.
2. Right-click the drive that you want to expand and select **Properties** (Figure 7-70).

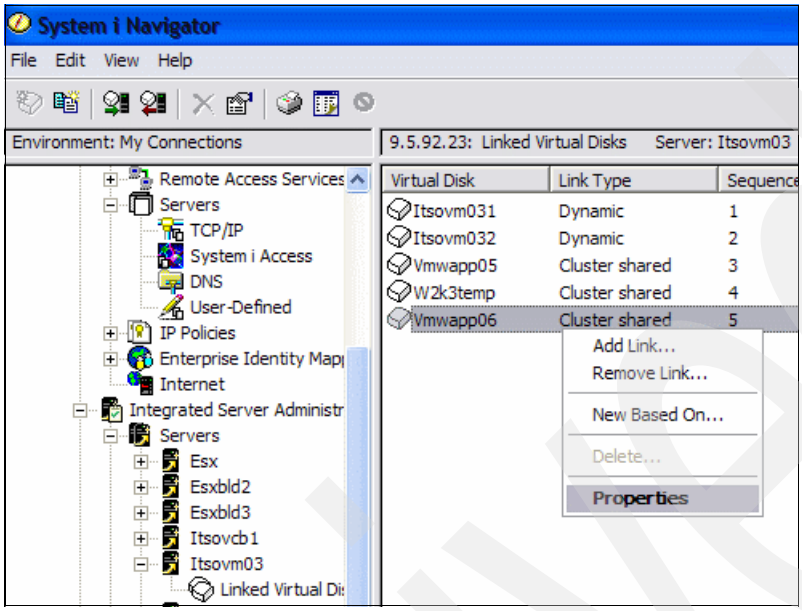

Figure 7-70 Storage space properties

3. The Properties window opens. Select the **Capacity** tab.
4. Enter the increased disk size in the New capacity field and click **OK** (Figure 7-71).

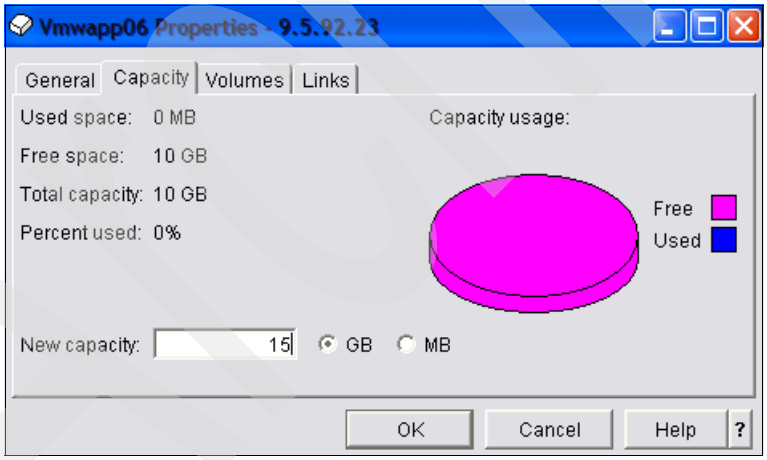

Figure 7-71 Assign the new disk size

5. Click **Change**. A status window opens saying that it is expanding the drive. When it finishes, an information window opens and says that the drive is expanded to the capacity specified (Figure 7-72).

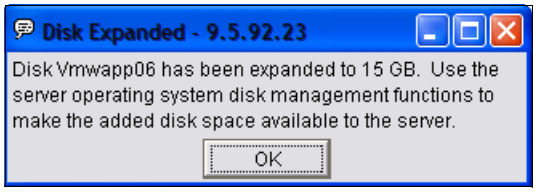

Figure 7-72 The storage space has been resized

6. Power on the ESX Servers linked to the data store. See 6.2.1, “Starting an Integrated ESX Server using System i Navigator” on page 146.
7. Now the ESX operating system needs to acquire the new disk space. See 7.5.7, “Extend the VMFS3 volume size” on page 218.

7.5.6 Enlarge a storage space using CL commands

Although System i Navigator is the best tool for enlarging a storage space, you can use CL commands as well. Follow these steps to enlarge a storage space using CL commands:

1. Shut down all of the ESX Servers (and their VMs) linked to that storage space. See 6.3.1, “Place an integrated ESX Server in maintenance mode before stopping it” on page 151.
2. Vary off all the NWSDs linked to the storage space that you are going to expand. See 6.3.3, “Stopping an integrated ESX Server using the System i command line” on page 153.
3. Type `WRKNWSSTG` on a command line. The Work with Network Server storage spaces display opens.
4. Scroll to the storage space and enter option 2 (Change) in the option column in front of the drive and press Enter. The Change NWS storage space (CHGNWSSTG) display opens. For size (NWSSIZE), enter the new capacity in MBs. Press Enter.
5. Restart the ESX Servers (and their VMs). See 6.2.1, “Starting an Integrated ESX Server using System i Navigator” on page 146.
6. Now the ESX operating system needs to acquire the new disk space. See 7.5.7, “Extend the VMFS3 volume size” on page 218.

7.5.7 Extend the VMFS3 volume size

After the storage space has been enlarged by i5/OS, the ESX operating system needs to acquire this newly enlarged space to the existing data store. The following steps show how to extend the data store.

Figure 7-73 shows the original data store size. The underlying storage space has been enlarged from 10 GB to 15 GB.

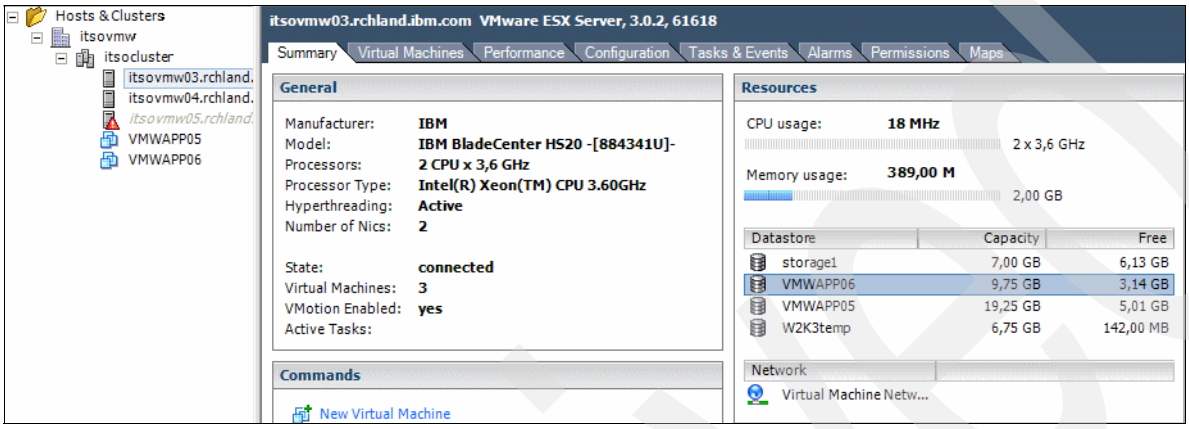

Figure 7-73 Data store original size

Take the following steps:

1. In Virtual Center, right-click the data store object and select **Properties** (Figure 7-74).

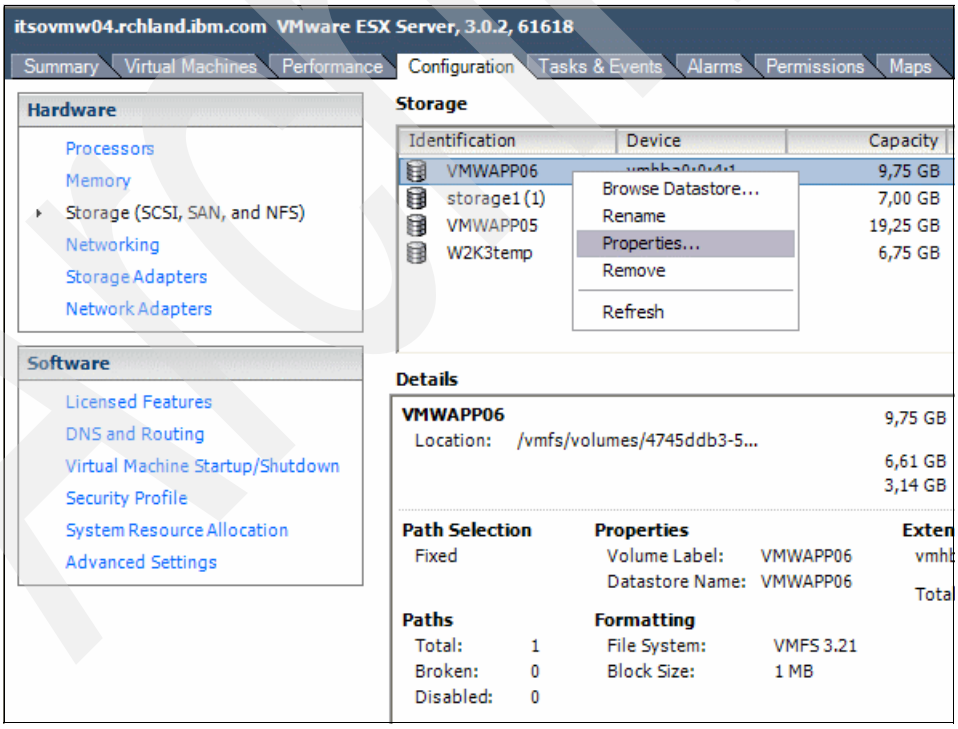

Figure 7-74 Data store properties

2. The Volume Properties window opens. Click **Add Extent** (Figure 7-75).

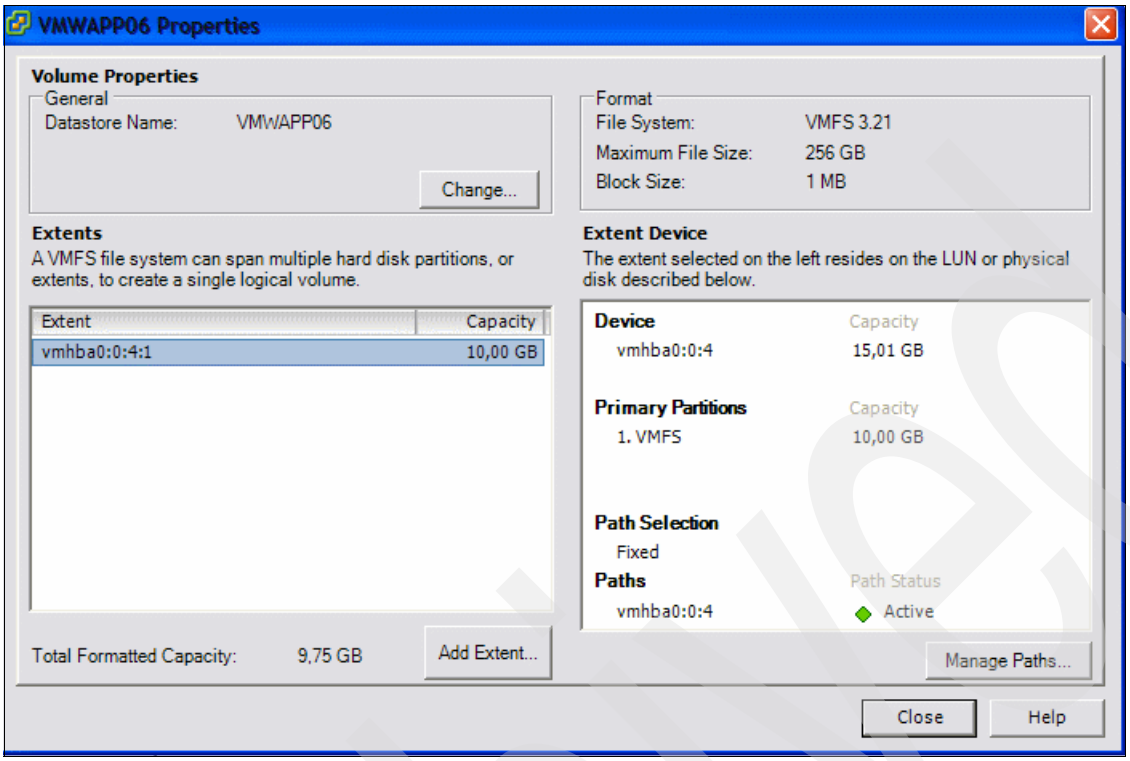

Figure 7-75 Add Extent

3. The Add Extent wizard shows the new disk capacity: 15 GB. It also shows the available additional space: 5 GB. Select the disk device and click **Next** (Figure 7-76).

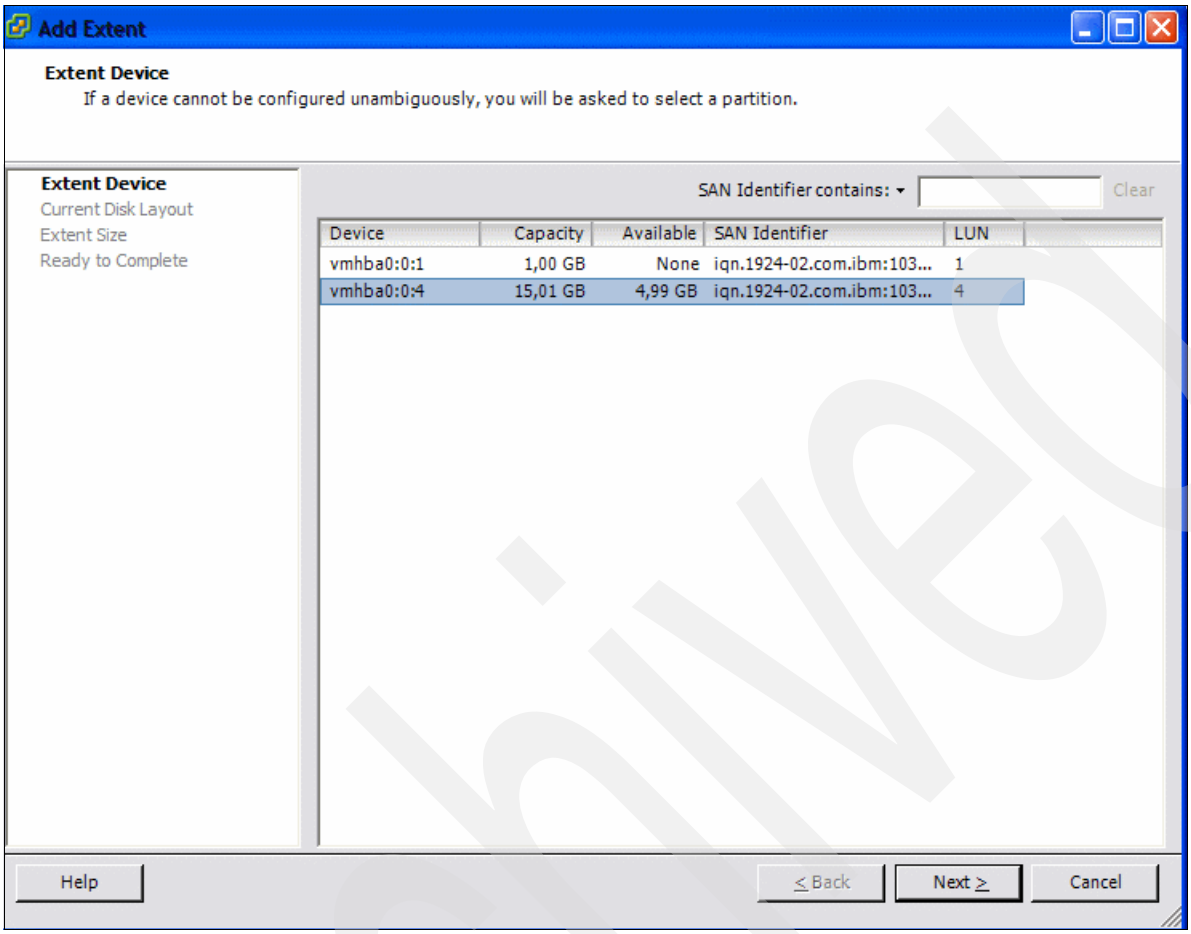

Figure 7-76 Add Extent Wizard

4. On Current Disk Layout window, a warning message says that all the data will be lost permanently. Actually, the new extension will be acquired without losing any data on the original disk. Click **Next** to continue (Figure 7-77).

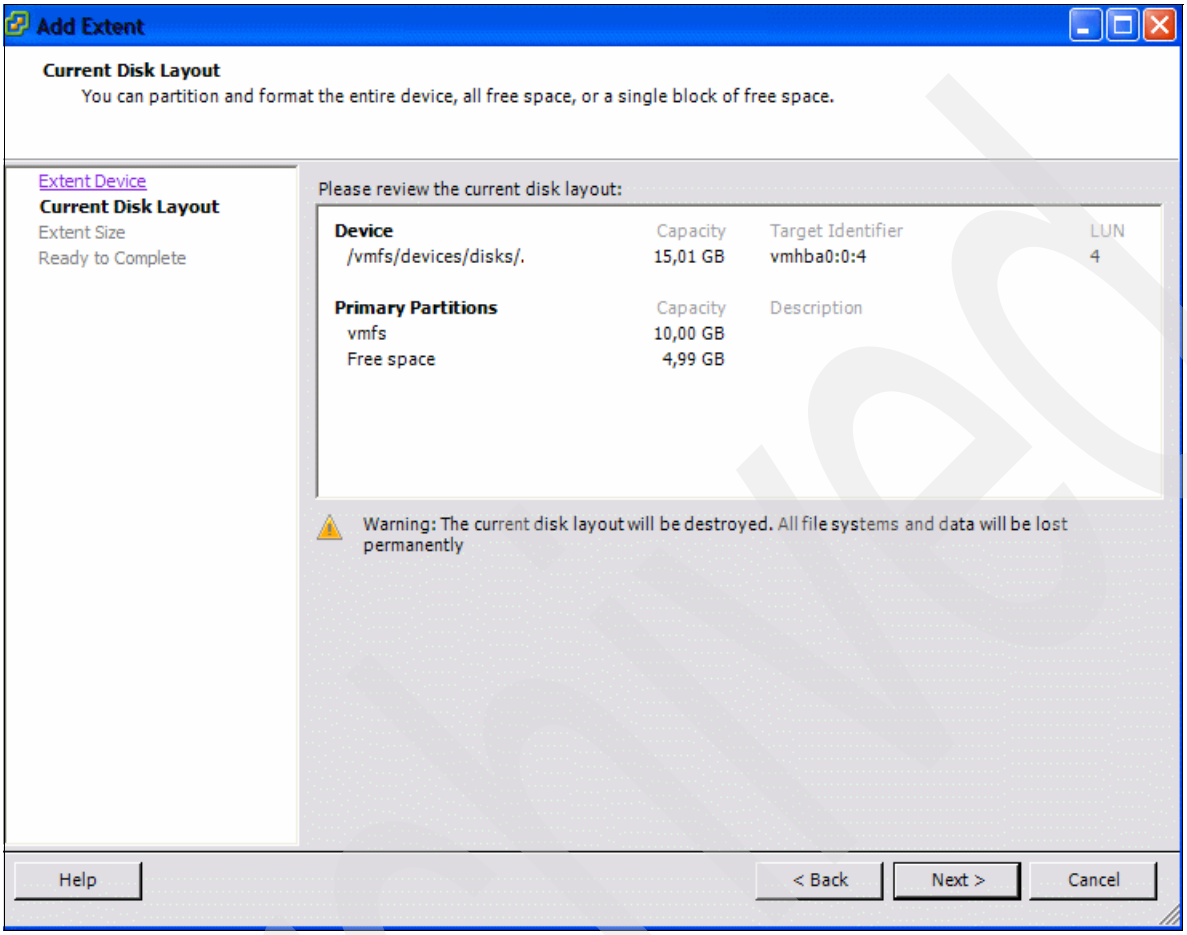

Figure 7-77 Warning message - no data will be actually lost

5. In the Extent Size window check the Maximize Capacity box in order to acquire all of the additional disk space. Click **Next** to continue (Figure 7-78).

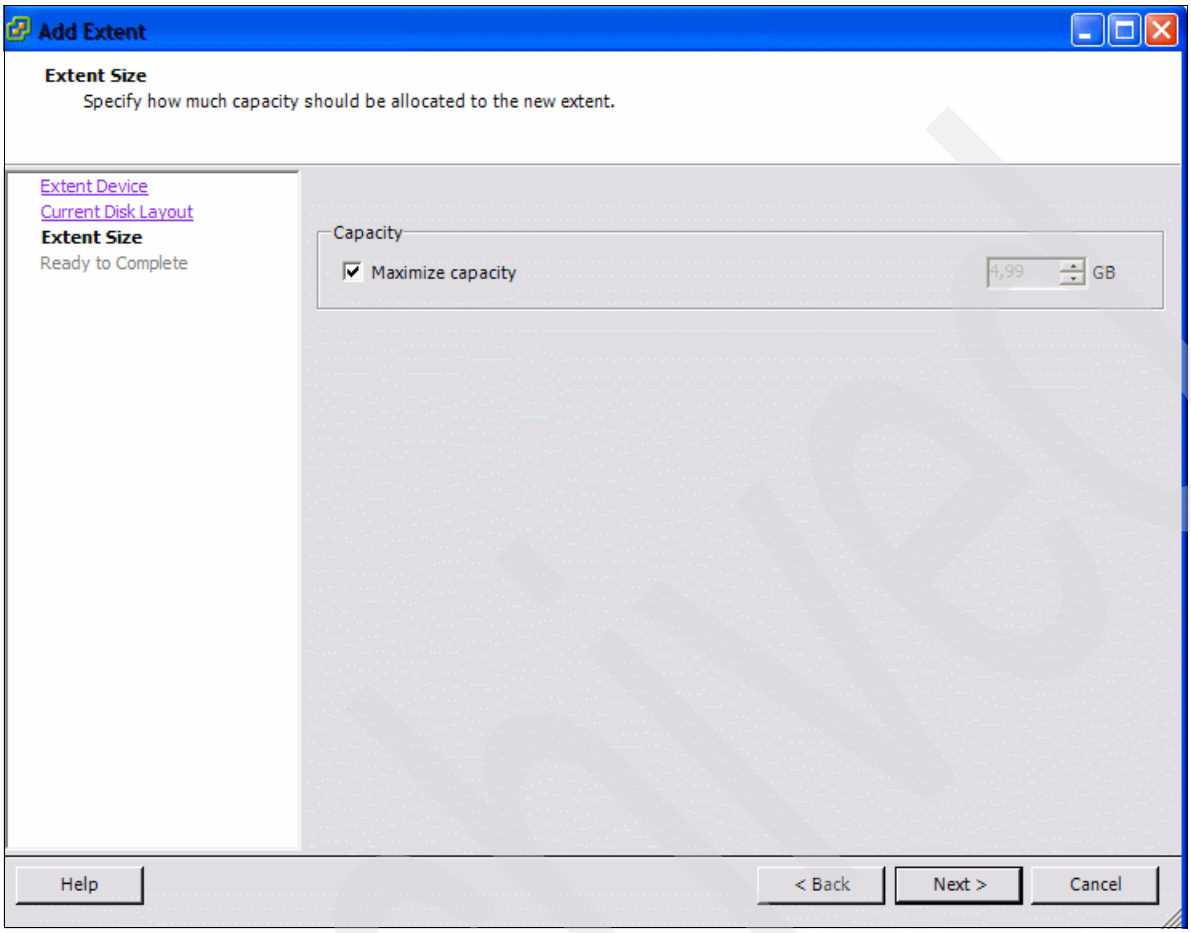

Figure 7-78 Maximize Capacity

6. The Ready to Complete window shows the new disk structure and partitions. Review the details, then click **Finish** (Figure 7-79).

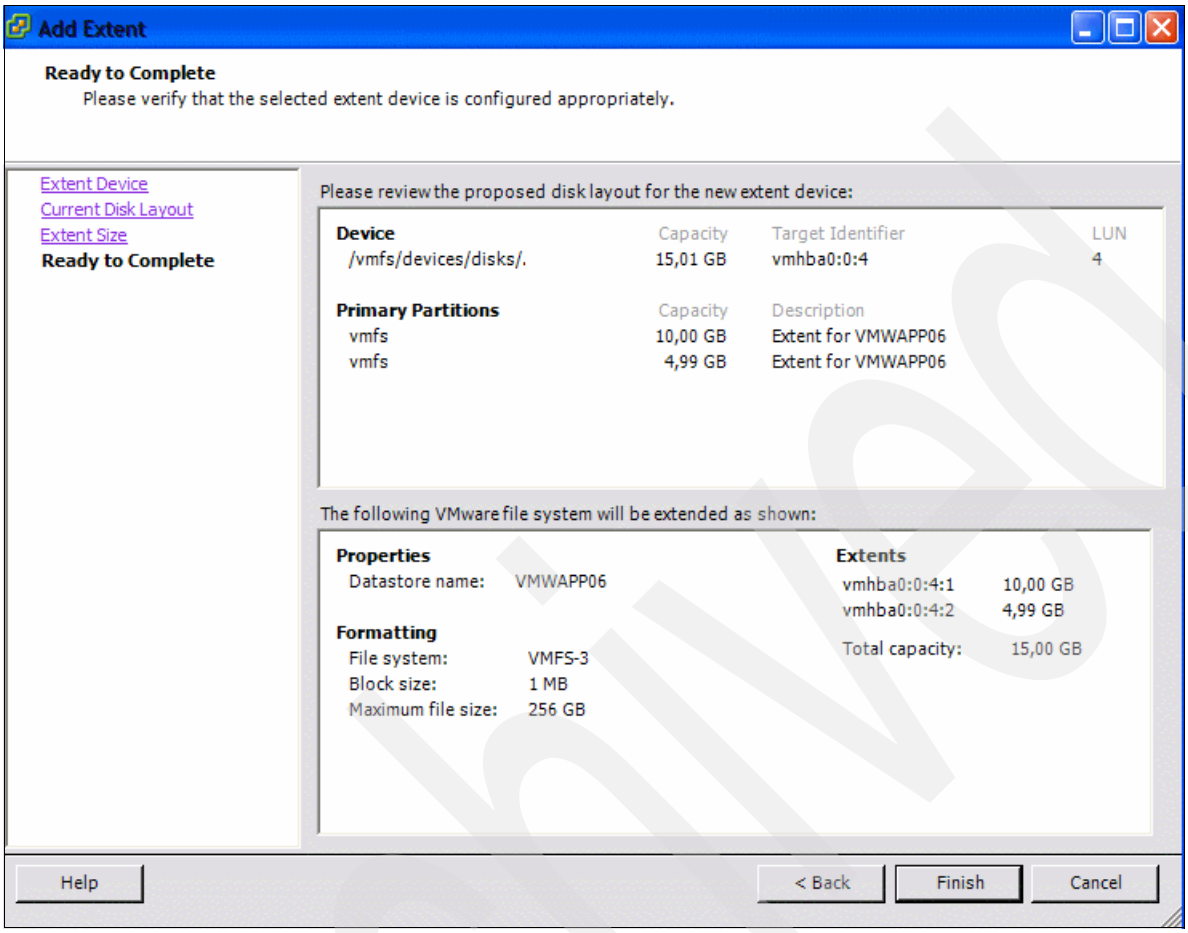

Figure 7-79 Ready to complete the data store resizing

On the Recent Tasks pane, the Extend Datastore task is completed (Figure 7-80).

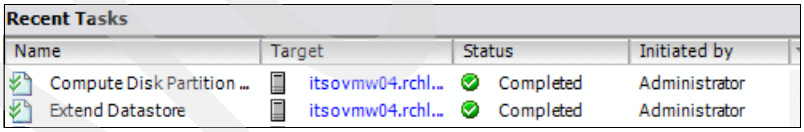

Figure 7-80 Extend Datastore task

7. Review the data store properties and find the new disk capacity (Figure 7-81).

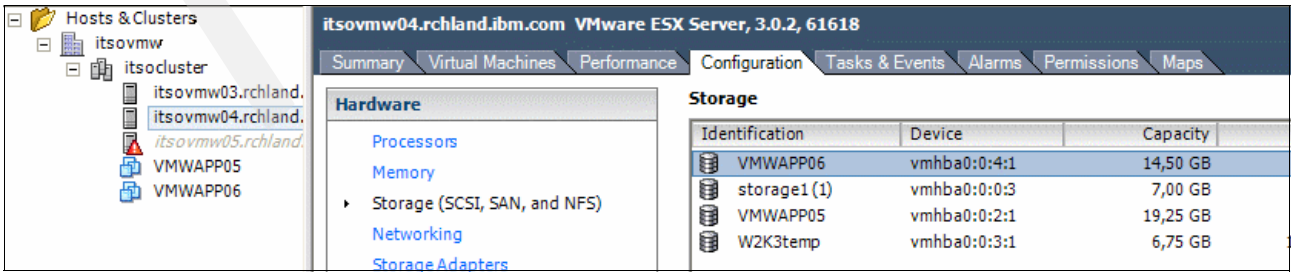

Figure 7-81 Data store size has been enlarged

8. Rescan the storage on all the ESX Servers. See 7.1.3, “Storage adapter rescan using Virtual Center” on page 162.
9. Now proceed to enlarge the vmdk files inside the new available data store space. Refer to 7.5.2, “Enlarging a vmdk file using VMware ESX commands” on page 212.

7.6 VMotion

As explained on 4.3, “VMware High Availability (HA)” on page 97, the VMotion feature allows us to move a Virtual Machine from a source ESX Server to target ESX Server.

The Virtual Machine itself stays active during the VMotion, without any loss of network connectivity or service availability.

7.6.1 VMotion prerequisites

To be configured for VMotion, each host in the cluster must meet the following requirements:

- The VMotion network has to be configured on both the source and the target ESX hosts. See “Set up the VMkernel to enable VMotion” on page 172. VMotion requires a Gigabit Ethernet connection between hosts.
- Ensure that the source and target hosts have a compatible set of processors. Processor clock speeds and cache sizes might vary, but processors must come from the same vendor class (Intel versus AMD™) and same processor family to be compatible for migration with VMotion.
- Each Virtual Machine is contained in a data store. The storage space must be accessible by both the source and target hosts.
- A Virtual Machine is connected to one or more network port groups. The port groups must be configured on both the source and target ESX hosts.
- If a CD-ROM drive or an ISO disk image are linked to a Virtual Machine, they have to be disconnected before starting VMotion.

7.6.2 Migrate an active Virtual Machine with VMotion

When you want to move an active Virtual Machine from a source ESX Server to a target ESX Server, use the Virtual Center interface as follows:

1. Open a session from a VMware VI3 Virtual Client to the Virtual Center server.
2. Log in as administrator, or as a user allowed to run VMotion on the Virtual Machines that you want to manage.
3. On the left pane, click the **Inventory** button on the upper left corner. Select **Host and Clusters** on the pull-down menu.
4. Expand the inventory tree and look for the Virtual Machine that you want to migrate.

5. Right-click the Virtual Machine name and select **Open Console**. The Console window opens. On the toolbar, select **VM** → **Migrate** (Figure 7-82). With the console open you can verify that the guest operating system is not experiencing any downtime during VMotion. For example, start a ping command to an external address, or keep the system clock GUI running on window.

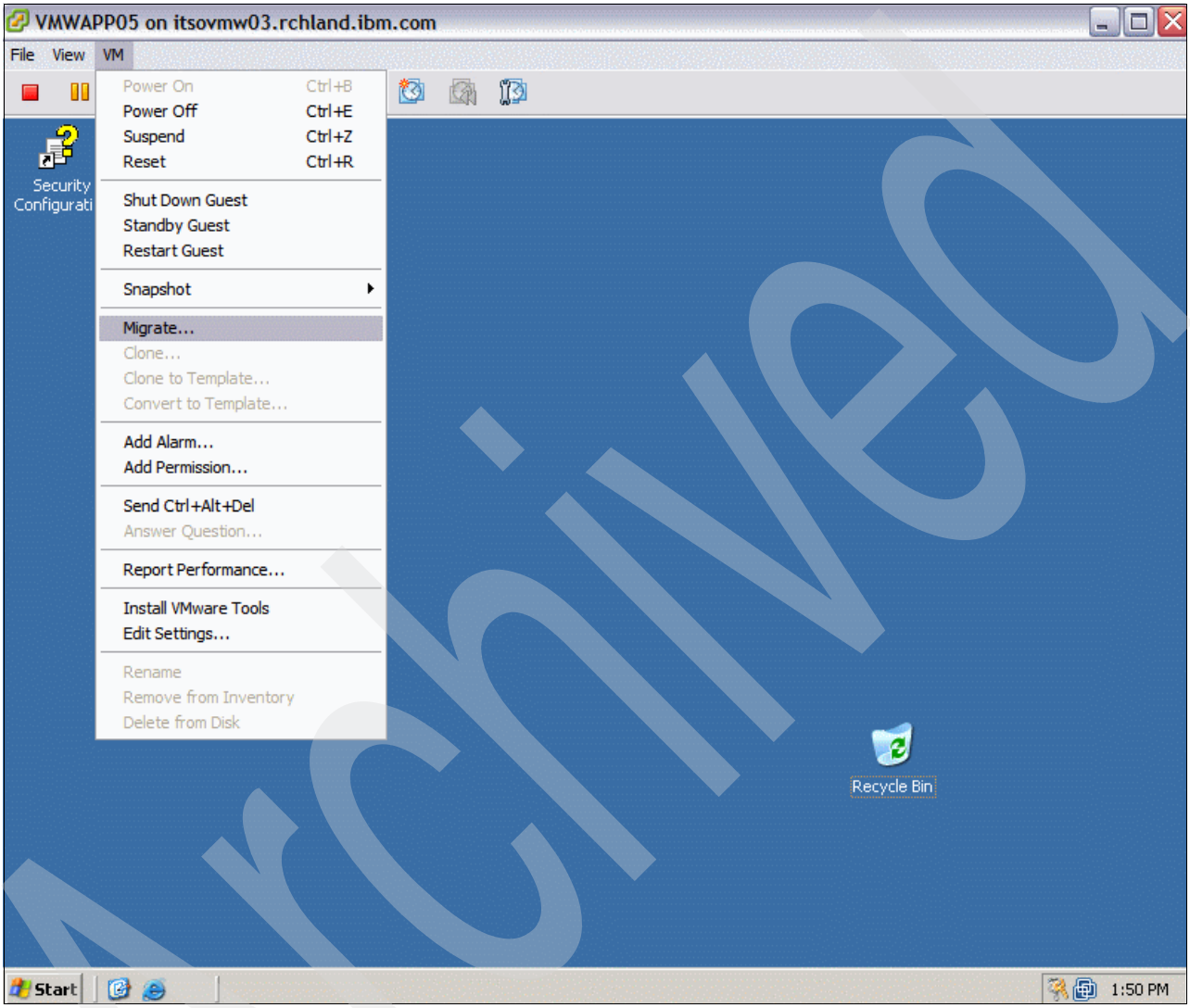

Figure 7-82 Starting the VMotion wizard

6. The VMotion wizard starts. Select Destination is the first step. Select a target ESX host. The target host must match the prerequisites listed in 7.6.1, “VMotion prerequisites” on page 224. If everything is okay, the `Validation Succeeded` message is displayed on the Compatibility window (Figure 7-83). Select a target host with enough available CPU and memory resources for the Virtual Machine that you are going to migrate. Click **Next**.

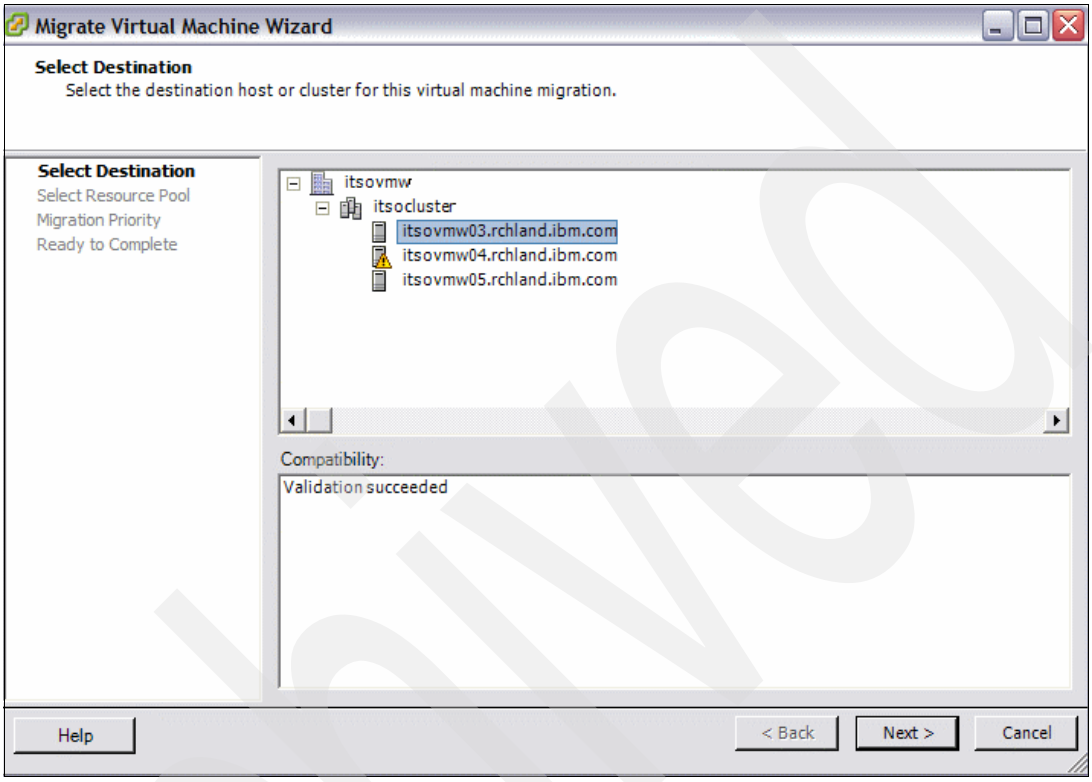

Figure 7-83 VMotion Wizard - Select Destination

7. In the Select Resource Pool step, you can select the target resource pool (Figure 7-84).

   Accordingly, with the VMware documentation, resource pools can be used to hierarchically partition available CPU and memory resources.

   If you created any resource pool on your cluster, the VMotion wizard allows you to select the pool where the Virtual Machine will run after the migration.

   Refer to the VMware *Resource Management Guide* for information about creating and managing resource pools.

   Click **Next** to continue.

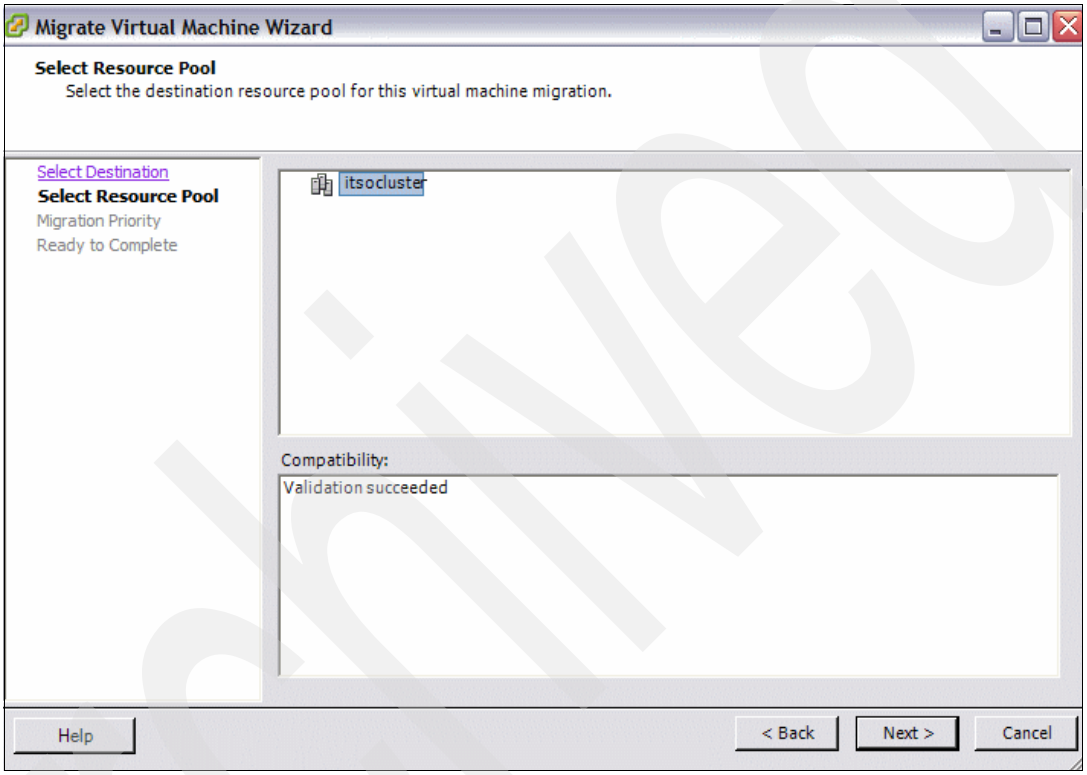

Figure 7-84 VMotion Wizard - Select Resource Pool

8. The Migration Priority step allows you to choose between high and low priority. Select **High Priority** and click **Next** (Figure 7-85).

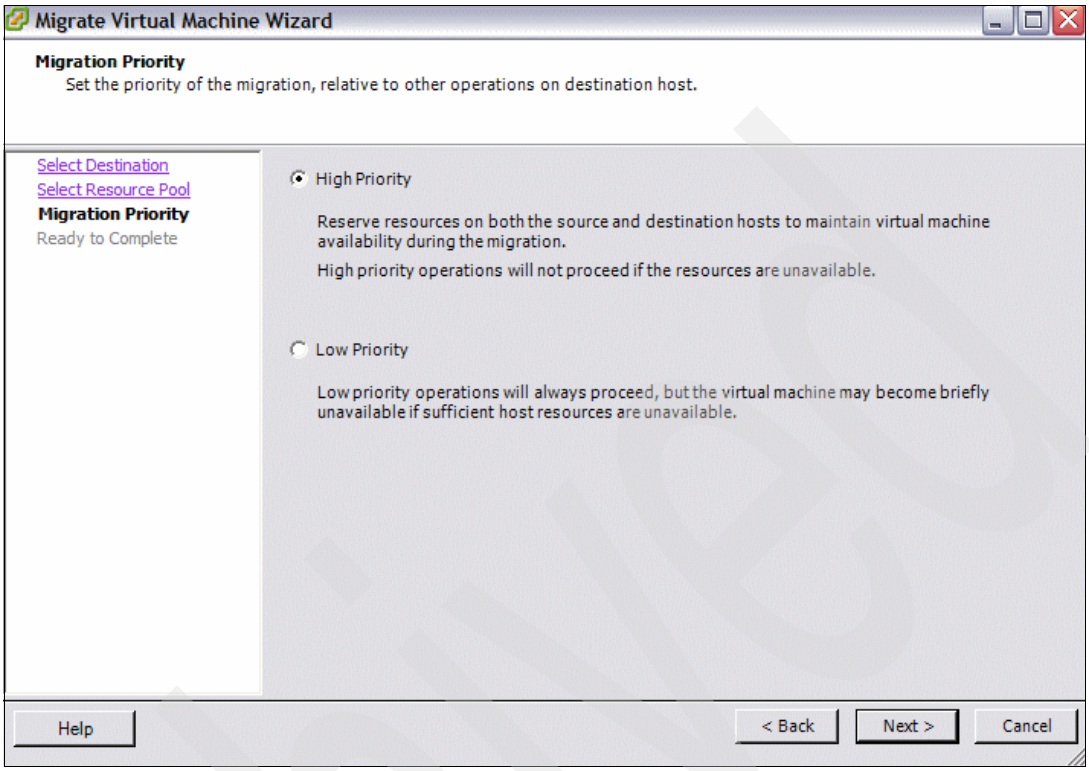

Figure 7-85 VMotion Wizard - Priority

9. Review the migration summary on the Ready to Complete step, then click **Next** to start the VMotion process (Figure 7-86).

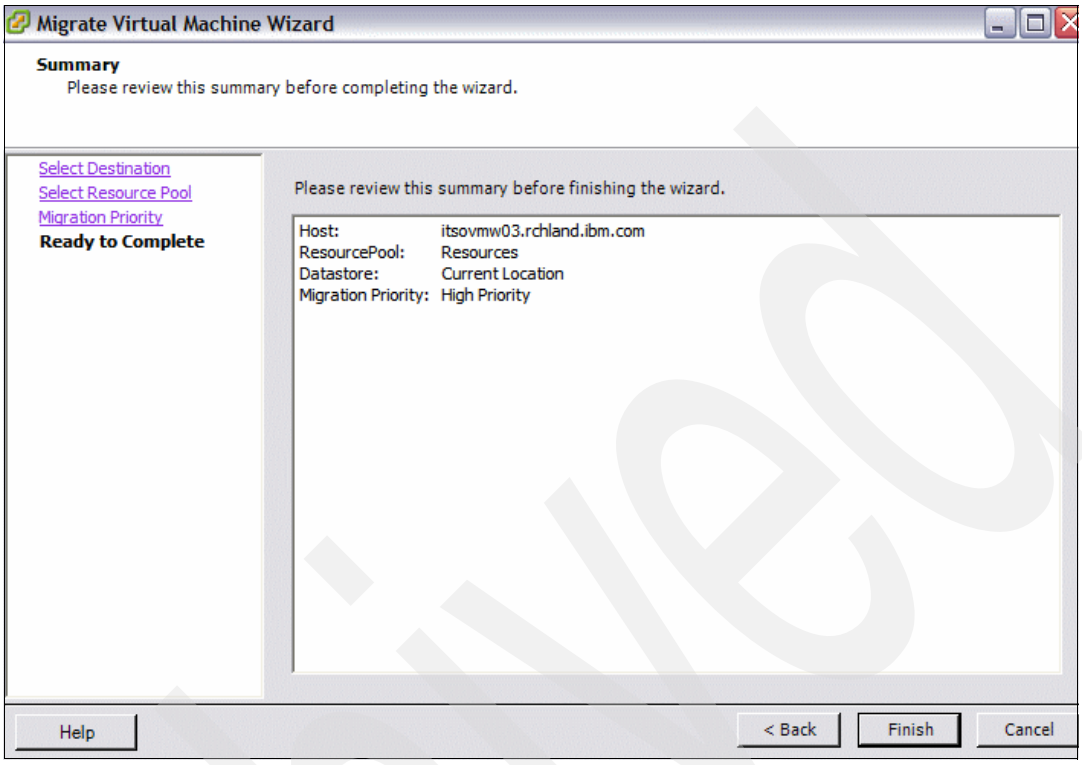

Figure 7-86 VMotion Wizard - Ready to Complete

The Migrate Virtual Machine task starts on the Recent Tasks pane. A status bar shows the VMotion in progress (Figure 7-87).

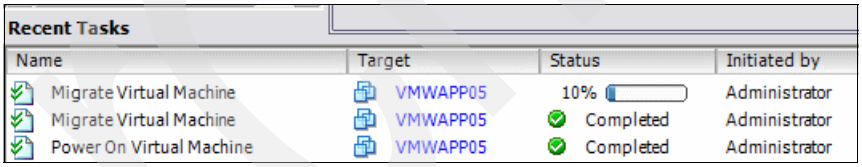

Figure 7-87 Vmotion Progress Bar

7.7 Cluster, HA, and DRS

VMware introduced the cluster concept and the new DRS and HA features with Virtual Infrastructure 3.

A cluster in VMware ESX is a collection of hosts sharing the same resources and managed by the same VirtualCenter server.

VMware HA, or high availability, allows the virtual machines in a cluster to be restarted automatically on other ESX hosts in the cluster in the event of a host failure.

VMware Distributed Resource Scheduler (DRS) monitors the distribution of CPU and memory resources for all hosts and virtual machines in the cluster. When a cluster enabled for DRS becomes unbalanced, DRS makes recommendations or migrates the virtual machines, depending on the automation level.

By default, the automation level is specified for the whole cluster. You can also specify a custom automation level for individual virtual machines.

Refer to the official VMware documentation for a complete explanation of the HA and DRS features.

To enable the HA and DRS features, right-click the cluster's object in Virtual Center and select **Edit Settings** (Figure 7-88).

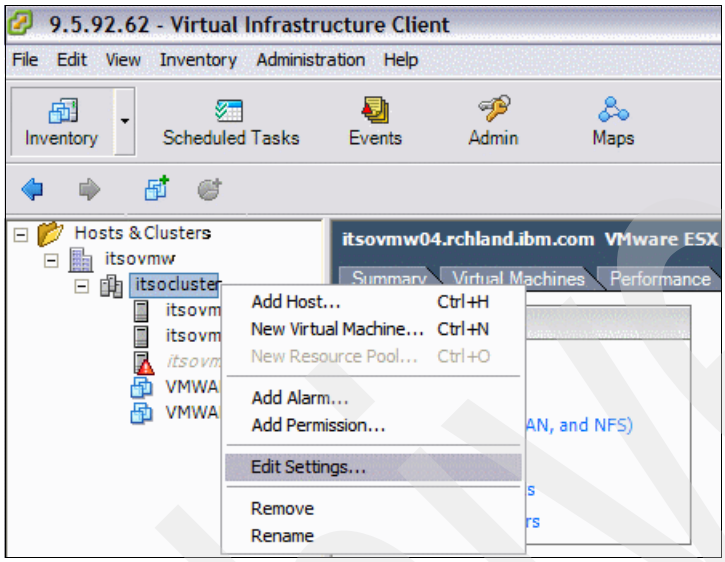

Figure 7-88 Cluster edit settings

The cluster settings configuration window opens. On the General window read the HA and DRS descriptions and check the boxes next to the features that you want to enable (Figure 7-89).

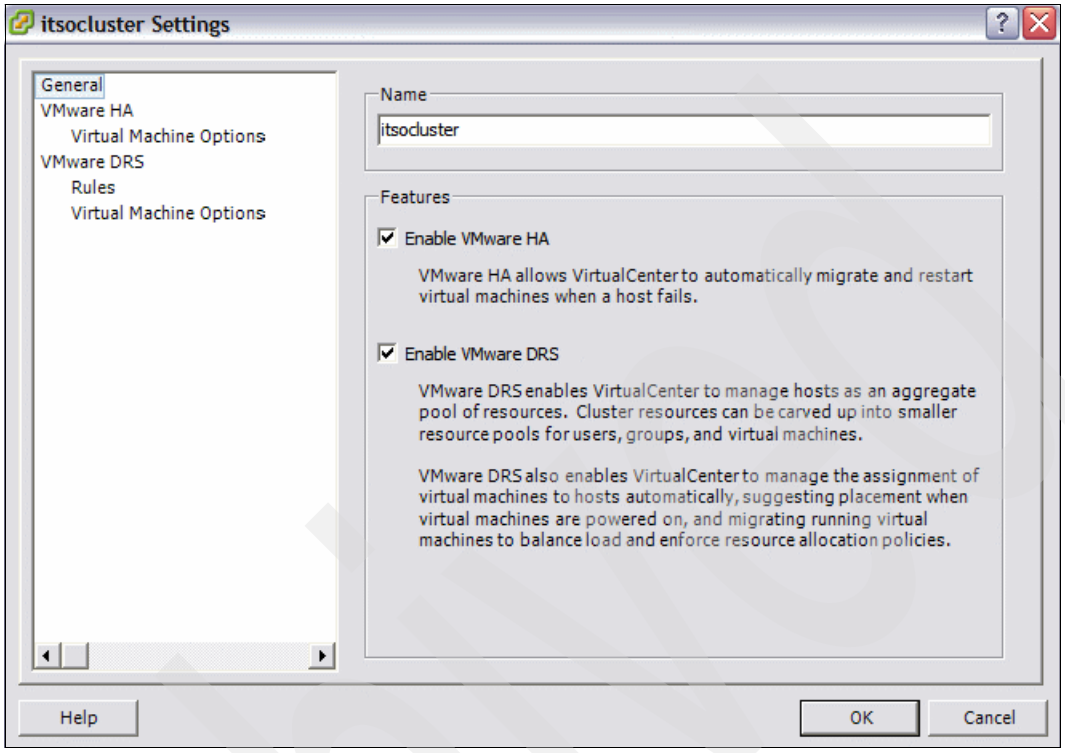

Figure 7-89 Enabling HA and DRS

If you check the Enable VMware HA box and click **OK**, a task starts that enables the ESX hosts in the cluster for the high availability feature (Figure 7-90).

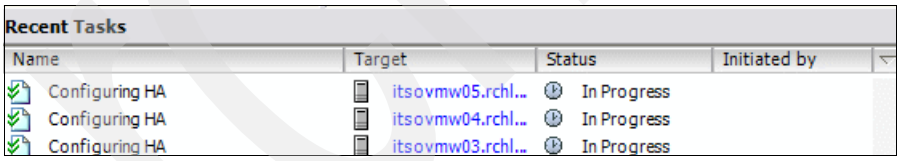

Figure 7-90 Configuring HA task

To refine the VMware HA configuration click **VMware HA**. You can decide how many ESX host failures can be handled by the cluster, and how to handle the Virtual Machine startup requests when the resource availability is low (Figure 7-91).

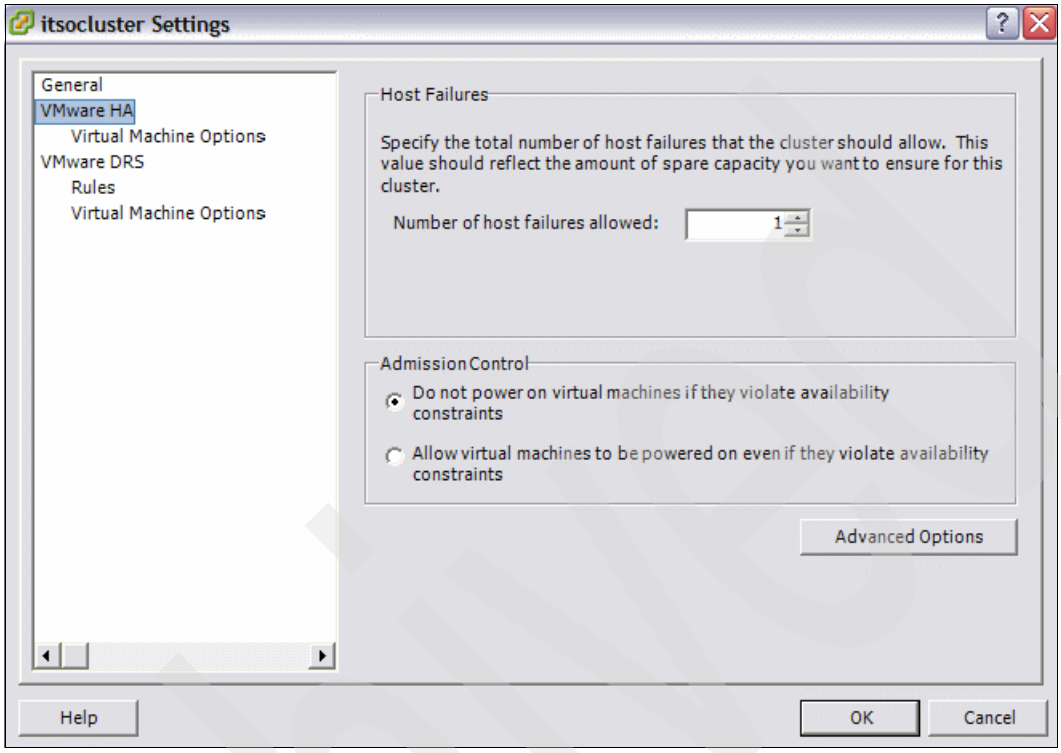

Figure 7-91 High Availability Settings

On the Virtual Machine Options window you can decide how the Virtual Machines behave in case of ESX host failure (Figure 7-92).

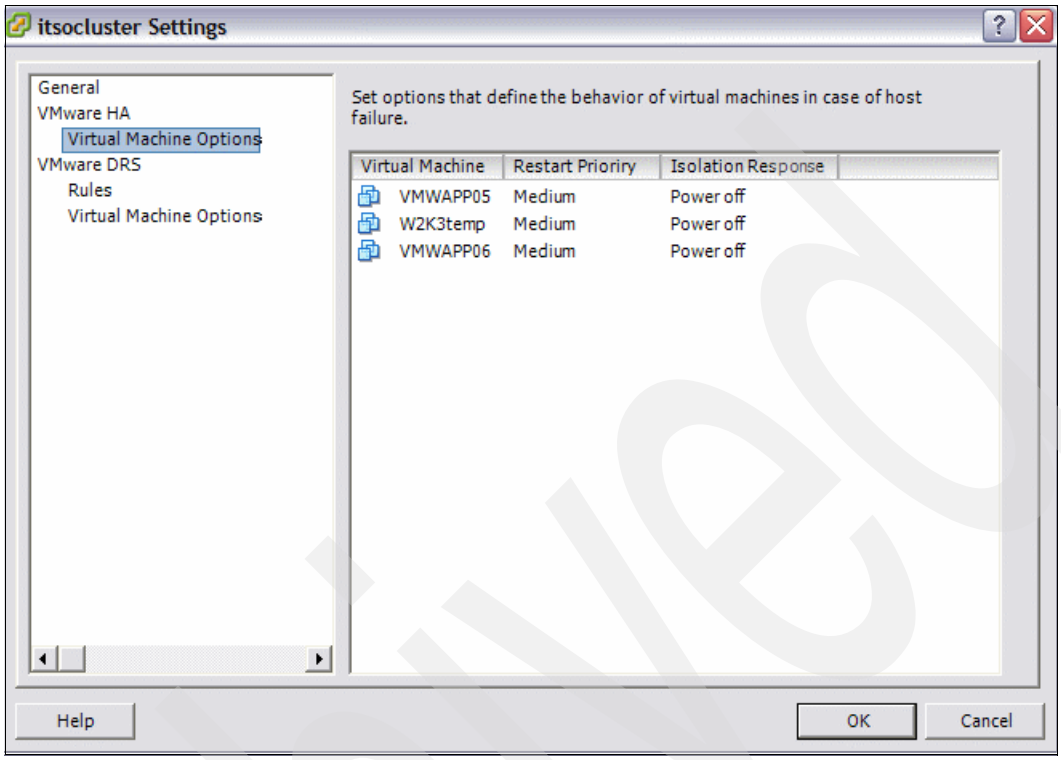

Figure 7-92 Virtual Machine HA settings

On the VMware DRS window you can set up the automation level. DRS is able to start VMotion automatically to migrate a Virtual Machine from an overloaded ESX host to a target ESX host where more resources are available. In fully automated mode you can reduce the VMotion traffic on your network by sliding the migration threshold cursor to the left (Figure 7-93).

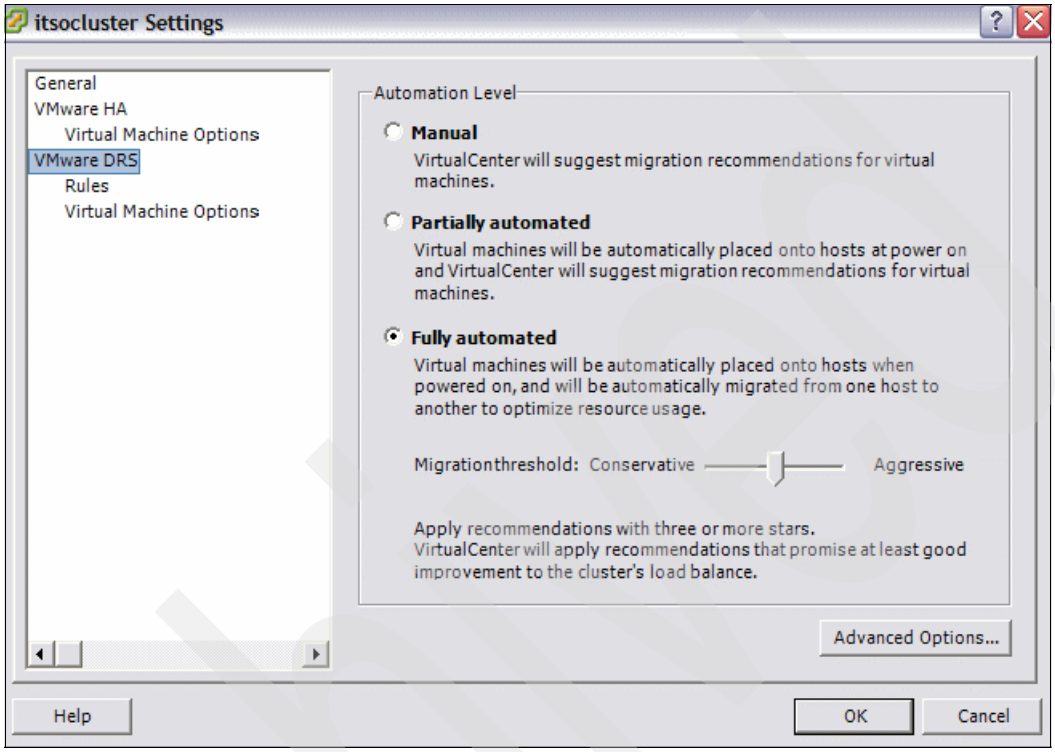

Figure 7-93 VMware DRS Automation Level

Find detailed information about VMotion and DRS see the *VMware VI3 Resource Management Guide*.

8

Migration

After you have set up Integrated VMware VI3 infrastructure, you can begin moving some of the existing servers to the new platform.

These servers can be originally located on physical standalone systems, IXS, IXA, or iSCSI integrated servers on System i, VMware virtual servers from other platforms.

Servers from which you might need to move include:

- Physical stand-alone systems
- IXS, IXA, or iSCSI integrated servers on System i
- VMware virtual servers on other platforms

This chapter explains the different techniques to migrate your systems onto your Integrated VMware VI3 environment.

8.1 Benefits of migrating servers to Integrated VMware VI3

Why should you move an existing and running server to the Integrated infrastructure? There are many meaningful reasons to do so:

- Get rid of old and outdated hardware.
- Free some expensive machine room space.
- Be able to upgrade the hardware without stopping the application services.

All of the above are well-known advantages of a VMware Virtual Infrastructure. Additional advantages are provided by the Integrated System i platform, such as:

- Store the Virtual Machine data in a fast and reliable storage subsystem, provided by System i, avoiding the higher costs of a SAN storage solution.
- Easy and reliable backup and restore allowed by the Storage Space System i objects.
- The possibility for the System i administrators to manage a VMware infrastructure using System i Navigator and CL commands.

8.2 Migration tool: VMware Converter

Starting from VI3, the new VMware migration tool is Converter. The new tool replaces the former P2V Assistant, adding more options and a wizard console (Figure 8-1).

Figure 8-1 VMware Converter

P2V Assistant is no longer available for purchase. VMware enforces the use of Converter for any migration requirements.

VMware Converter allows you to import a standalone server to the VI3 infrastructure, moving both the system and data partitions. For Windows OS, it automatically adds the drivers needed to enable the server on the VI3 Infrastructure. On a Linux server, you have to perform manual configuration steps after the migration.

VMware Converter is also able to import a Virtual Machine from another platform, or from a system image created by third-party tools.

Figure 8-2 shows the VMware Converter migration options.

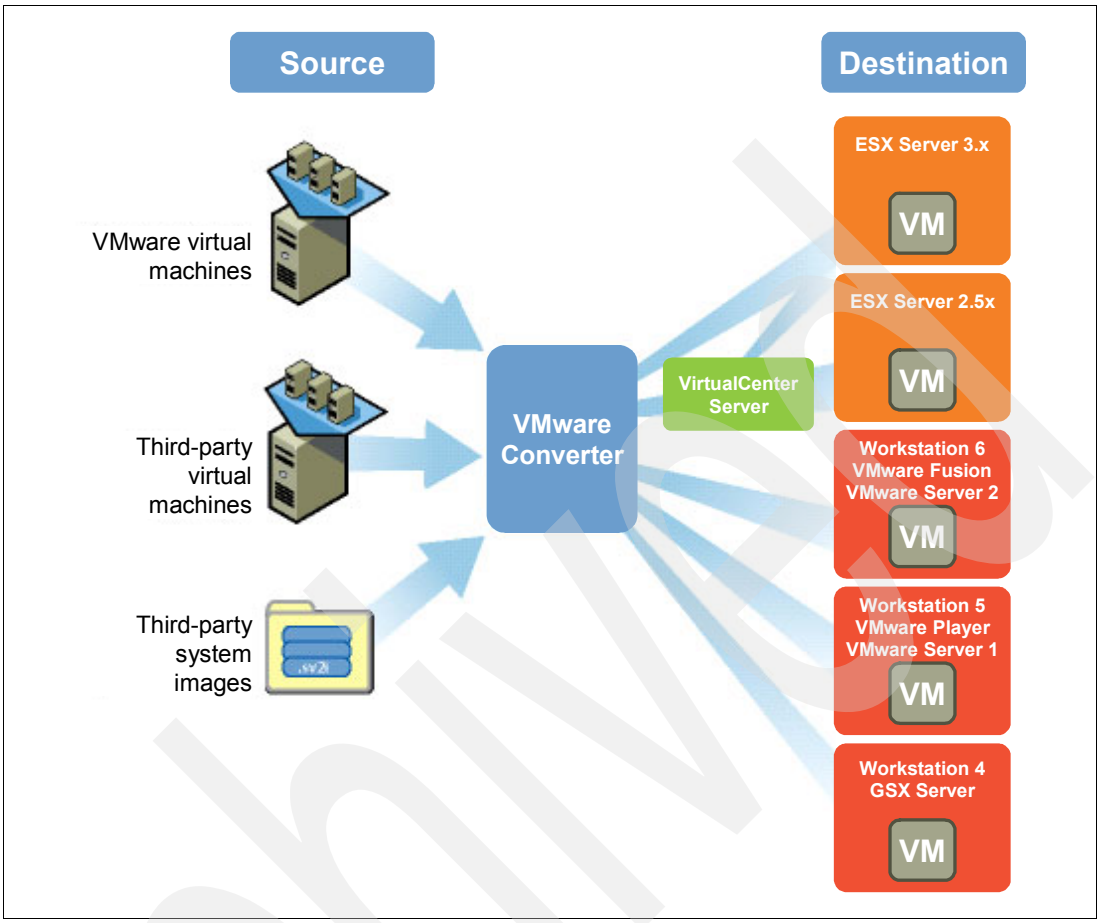

Figure 8-2 VMware Converter migration options

VMware Converter can be downloaded from the VMware Web site. At the time of writing this book, the product link was:

`http://www.vmware.com/products/converter`

VMware Converter is available in two versions:

- VMware Converter Starter
  - Free download.
  - Ideal for single tasks.
  - Support needs to be purchased on a per-incident basis.
- VMware Converter Enterprise
  - Licensed
  - Ideal for volume tasks
  - Support included in support for VirtualCenter

Both versions allow you to hot clone a physical machine while it is still running.

8.2.1 VMware Converter-supported OS

VMware Converter allows you to migrate a wide variety of operating systems. Depending on the OS type, the post-cloning configuration steps are executed automatically or manually performed by the user.

Table 8-1 shows the different migration options.

Table 8-1 Migration options

Operating system	Clone	Configure
Windows NT® 4.0	Yes	Yes
Windows 2000	Yes	Yes
Windows XP 32-bit and 64-bit	Yes	Yes
Windows 2003 32-bit and 64-bit	Yes	Yes
MS-DOS®	Yes*	No
Windows 9x	Yes*	No
Novell®	Yes*	No
Linux	Yes*	No

**Cold cloning required*

8.2.2 Installing VMware Converter

VMware Converter can run on Windows NT SP4, Windows 2000, Windows 2003, and Windows 2003 Professional.

Download the installation file from the VMware Web site, and launch the installation on a Windows system.

Typically, install VMware Converter on the same server on which your VirtualCenter 2.x is running.

If you install the VMware Converter Enterprise version, obtain a license file from VMware, then add the license to Converter as follows:

1. Start the VMware Converter console.
2. Click **Administration**.

3. Click **Licensing Information**. See Figure 8-3.

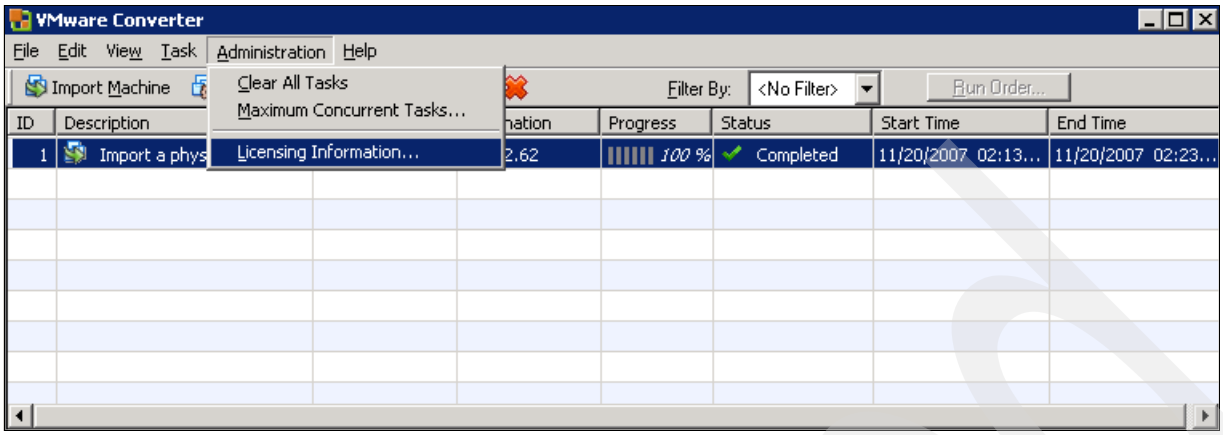

Figure 8-3 Adding License to VMware Converter

4. On the License Information window, click **Add License** and look for the directory where the Converter .lic file has been stored (Figure 8-4).

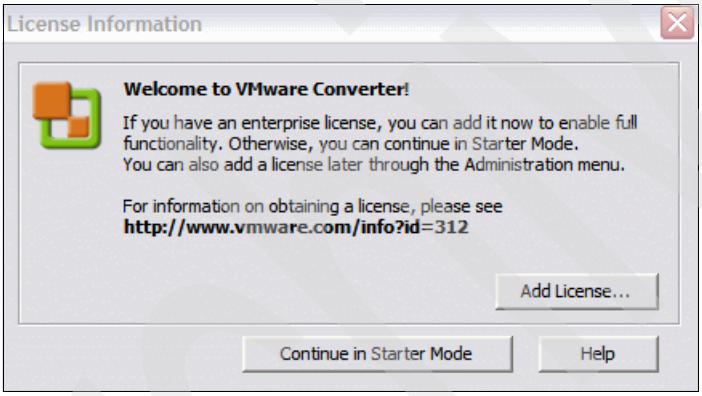

Figure 8-4 License Information window

When the License step is done, the VMware Converter Console is ready to import several kind of servers onto the Integrated VMware VI3 infrastructure.

8.3 Migration from a standalone server

To import a stand-alone Windows server onto the Integrated VI3 infrastructure:

1. Create a new storage space large enough to receive the source server's files. See 7.1.2, "Create a new storage space using i5/OS command line" on page 161, or 7.1.1, "Create a new storage space using System i Navigator" on page 159. Give the storage space the same name as the Virtual Machine that you are going to create.
2. Link the new storage space to all the ESX hosts in the cluster. See 7.1.4, "Assigning the new storage space to all ESX Servers in the cluster" on page 164.
3. Format the new storage space as VMFS3. See 7.1.5, "Creating a VMFS data store in a storage space with partition alignment" on page 166.

4. Start VMware Converter. On the Converter console click **Import Machine** (Figure 8-5).

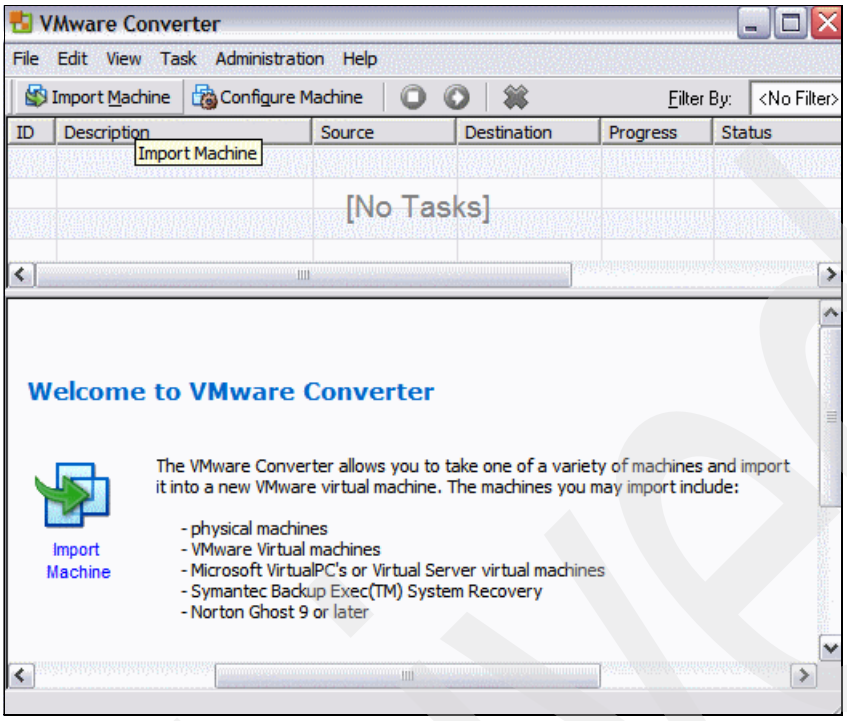

Figure 8-5 VMware Converter console

5. The VMware Converter Import wizard opens. Click **Next** to continue (Figure 8-6).

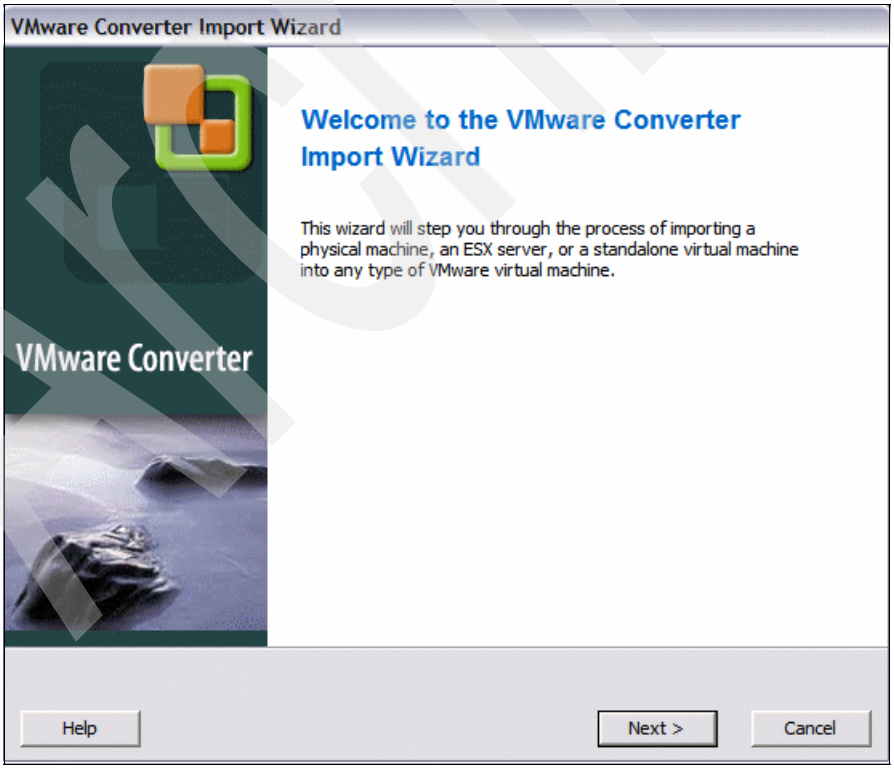

Figure 8-6 VMware Converter Import Wizard

6. Step1 allows you to select the source server to be imported in your virtual infrastructure. Click **Next** to proceed (Figure 8-7).

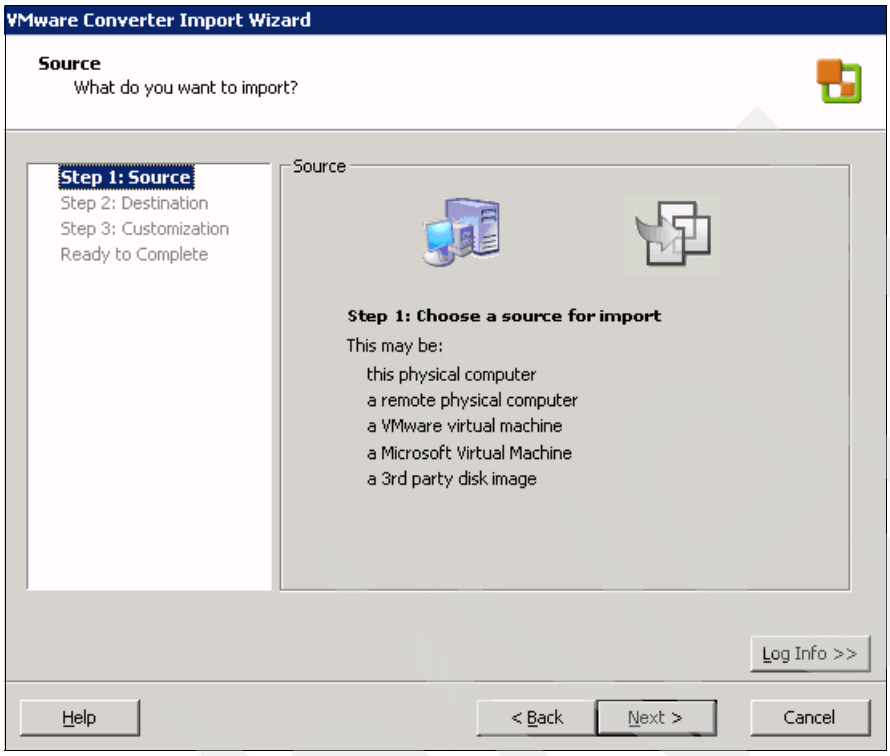

Figure 8-7 Source server selection

7. On the Source Type step, select **Physical Computer** and click **Next** (Figure 8-8).

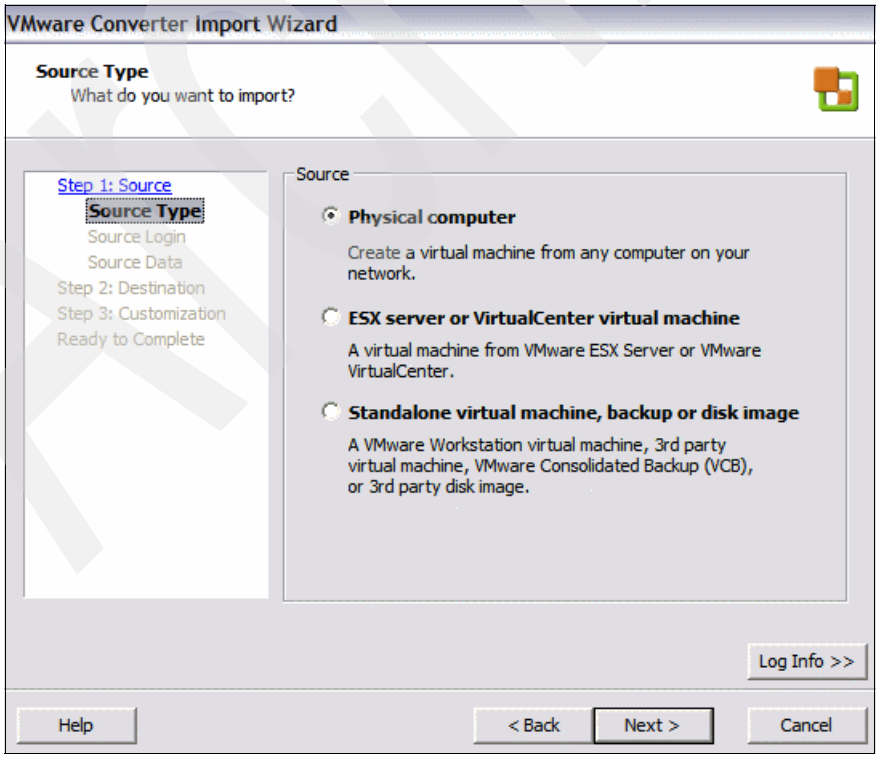

Figure 8-8 Select the source server type

8. In order to perform the migration, Converter needs to log in to the physical server. On the Source Login step enter the physical system's IP address and the administrator password (Figure 8-9).

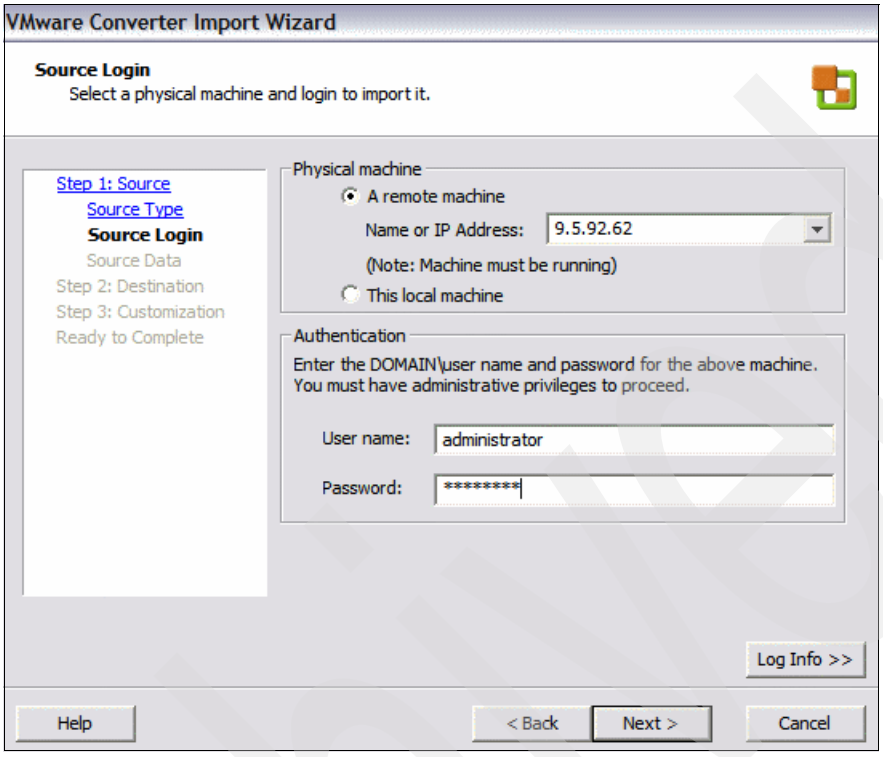

Figure 8-9 Source Login information

9. When the login is successful, the wizard shows the physical system's disks. Select the disks that you want to import: system drive and data drives (Figure 8-10).

> **Note:** Some hardware-specific partitions can show up as drive letters. The target virtual machine does not need these partitions. Uncheck the box to avoid importing a disk that is not useful.

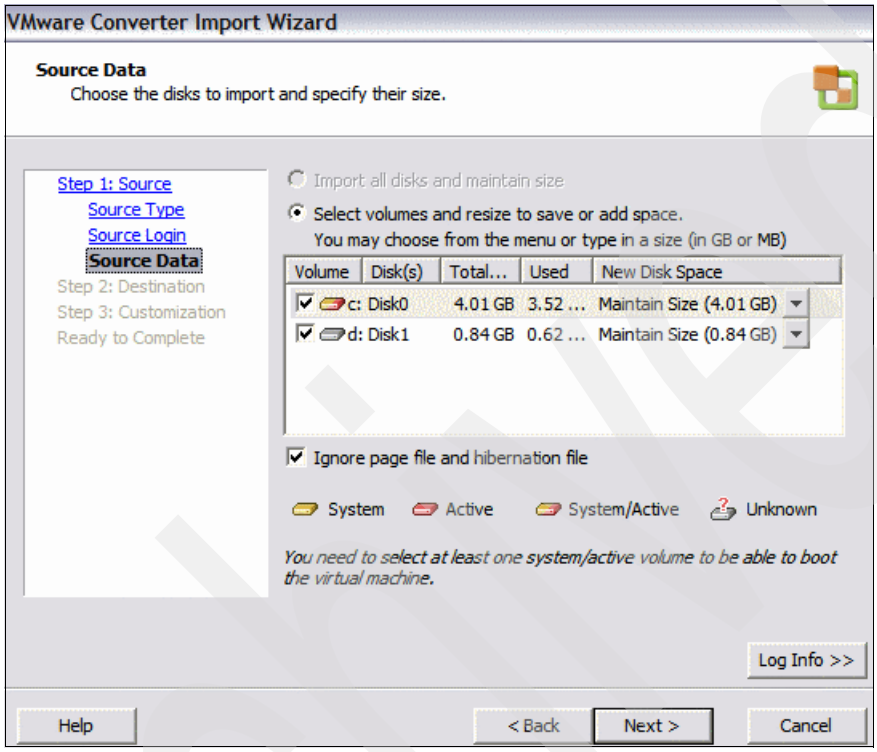

Figure 8-10 Source Data selection

Click **Next** to select the destination for the migration (Figure 8-11).

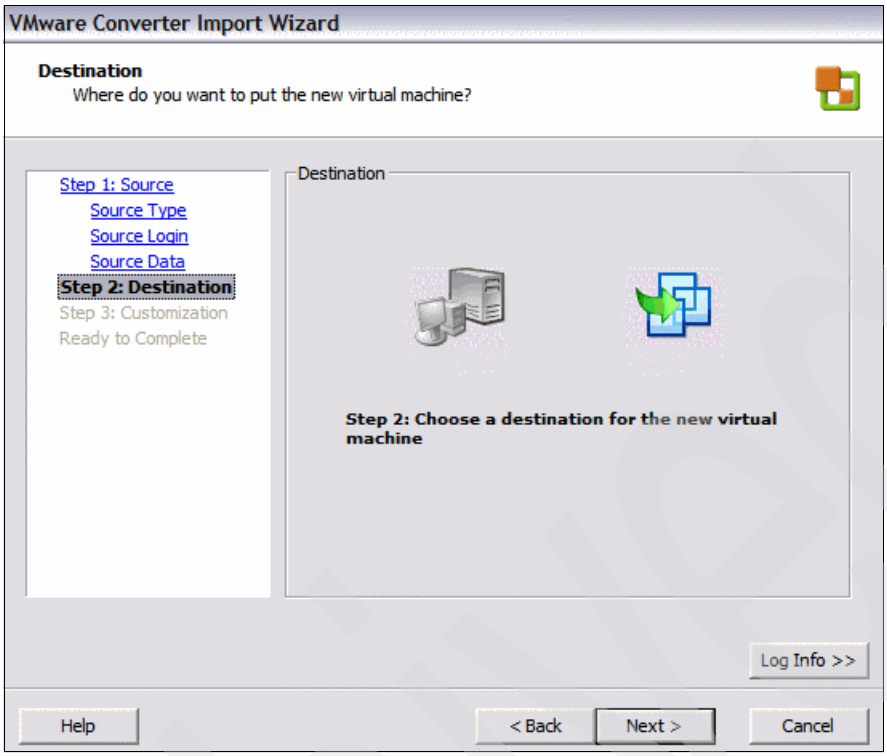

Figure 8-11 Step 2: Destination

10. For destination type, select **VMware ESX Server or Virtual Center virtual machine** (Figure 8-12).

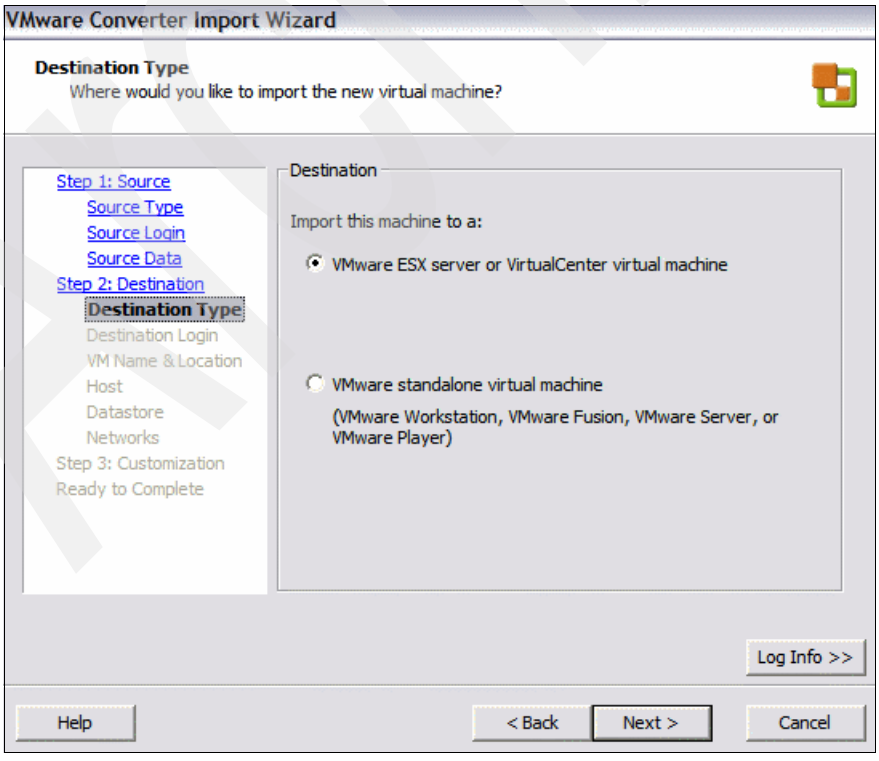

Figure 8-12 Destination type

11. On the Destination Login window, enter your VirtualCenter IP address, user name, and password (Figure 8-13).

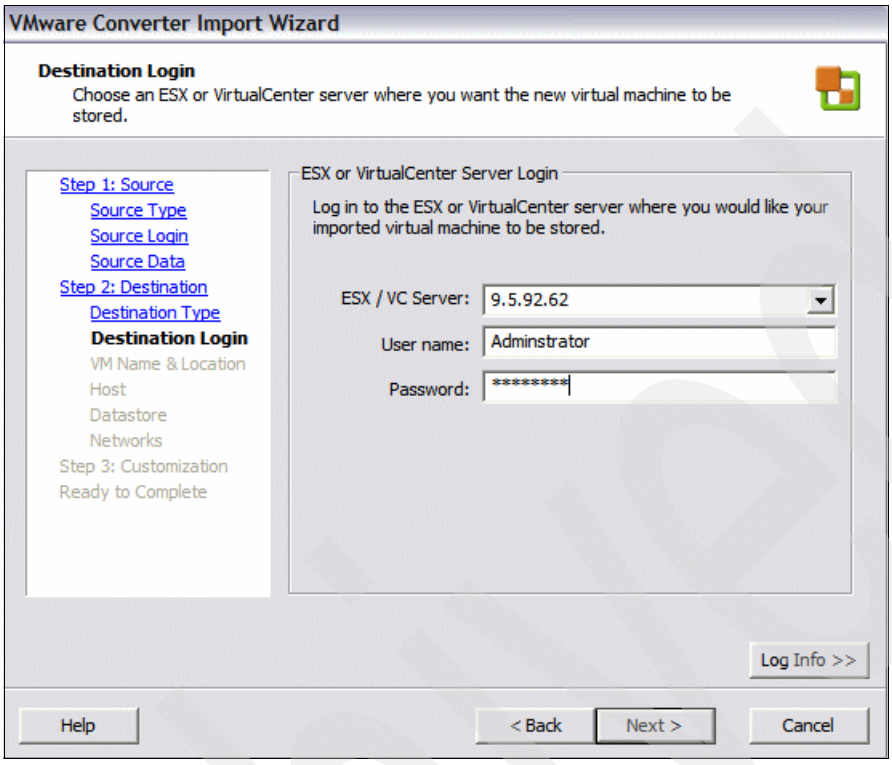

Figure 8-13 Destination Login

12. For VM Name & Folder, assign a name to the new Virtual Machine, and select the folder in the data center where you want to locate the Virtual Machine (Figure 8-14).

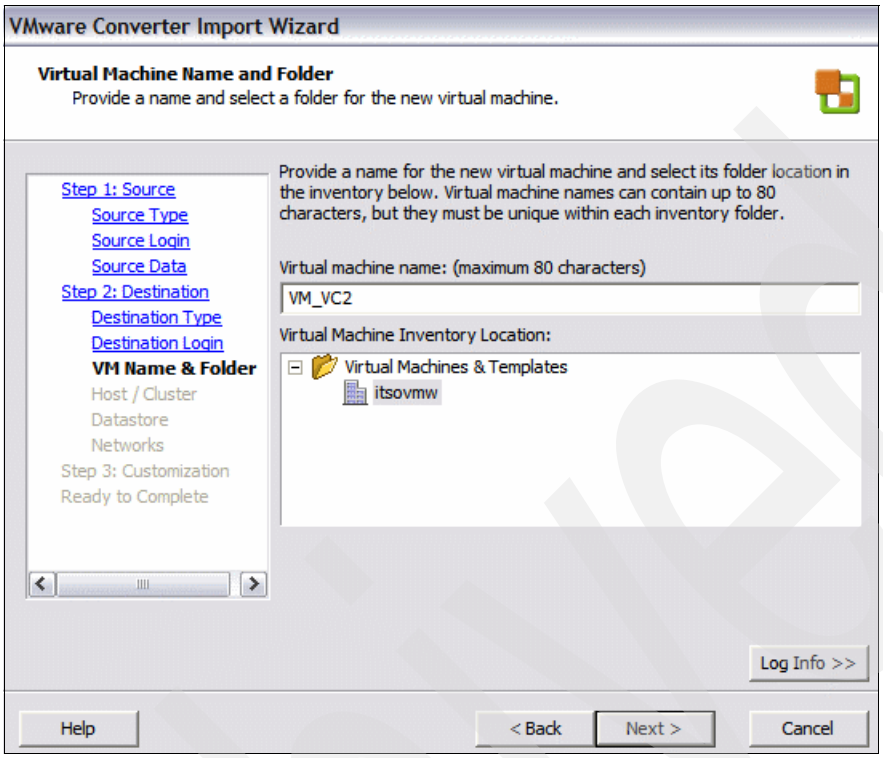

Figure 8-14 Assign Virtual Machine Name & Folder

13. Depending on your clusters configuration, on the Host/Cluster step you can select a target cluster or a specific target ESX host in a cluster (Figure 8-15).

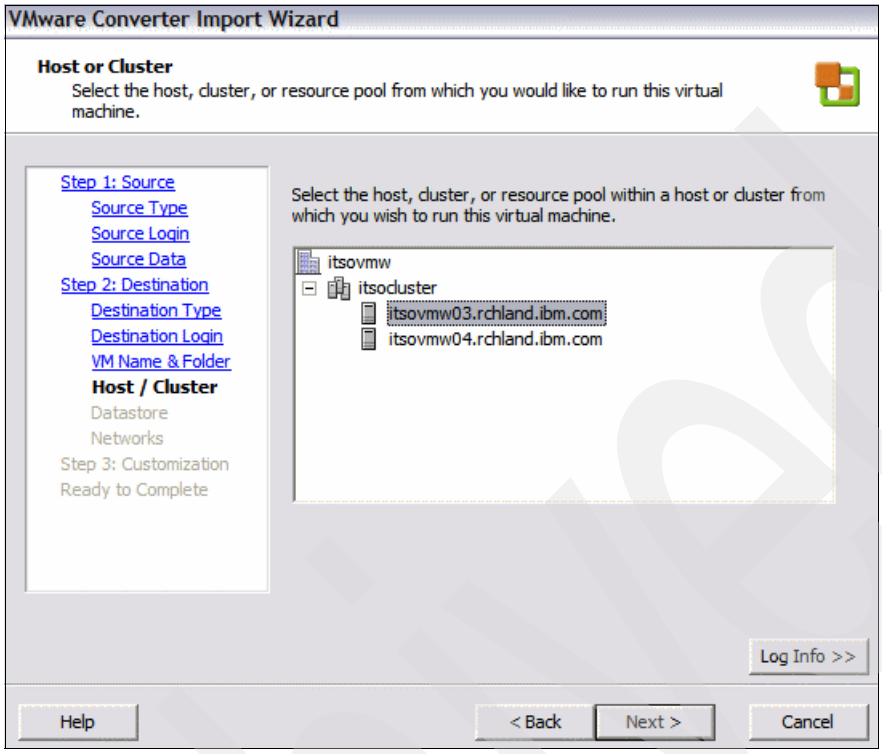

Figure 8-15 Select the target host or cluster

14. The data store step allows you to select the target disk data store. Choose the data store created for this Virtual Machine (Figure 8-16).

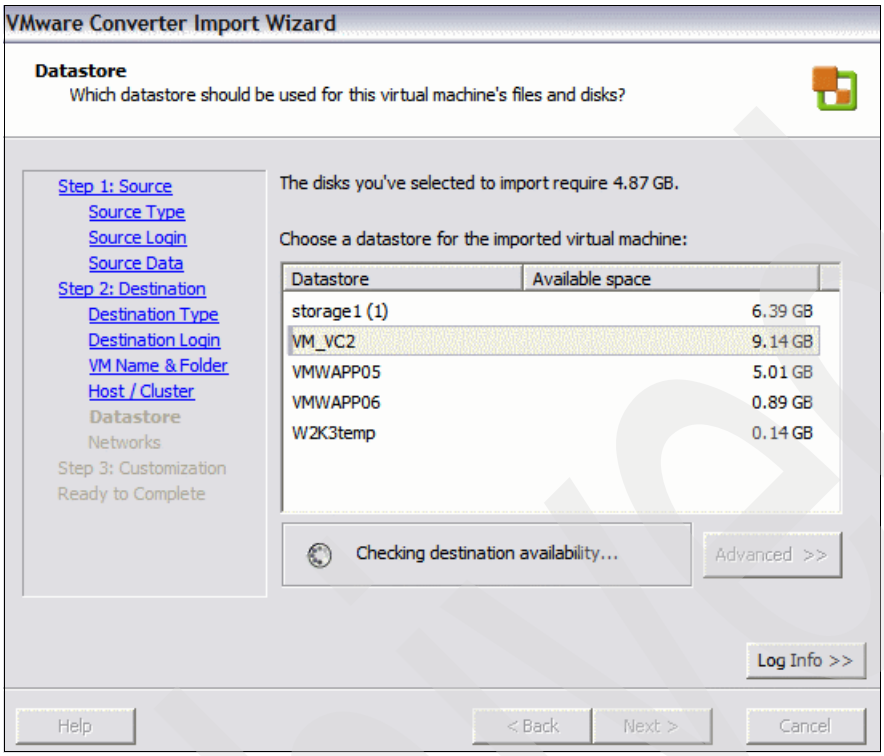

Figure 8-16 Select the target data store

15. On the Networks window, select the port group to which the new Virtual Machine will be connected. Uncheck Connect at Power On if you need to modify the Virtual Machine's IP address before accessing the network (Figure 8-17).

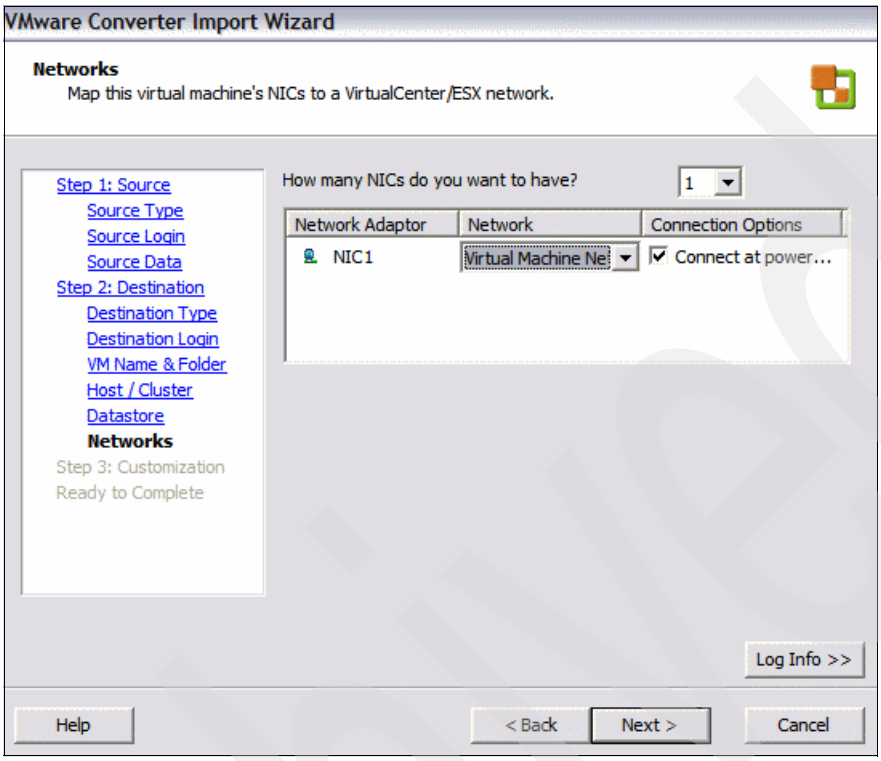

Figure 8-17 Network setup

The last step is Customization (Figure 8-18).

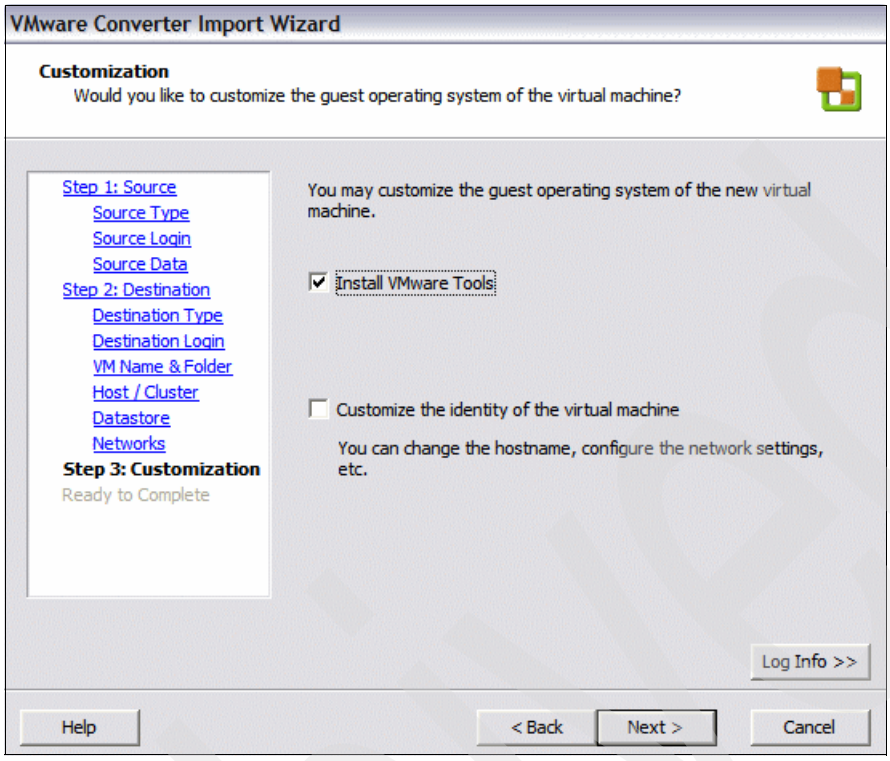

Figure 8-18 Customization

16. Check the option **Install VMware Tools** if you want the VMtools to be automatically applied. See 7.4.6, “Install VMware Tools on a Windows Virtual Machine” on page 203, for more information about the VMtools.
17. Check the option **Customize the identity of the virtual machine** if you want to run sysprep automatically in order to customize the target operating system. Sysprep is a Microsoft tool designated to deploy and clone a Windows operating system to multiple computers, assigning a unique security ID (SID). Download the sysprep tool from the Microsoft support site. Install sysprep on the same system as VMware Converter.

If you choose to not customize the operating system, the Ready to Complete window is displayed. Review the migration parameters, choose whether to power on the new VM after creation, and click **Finish** (Figure 8-19).

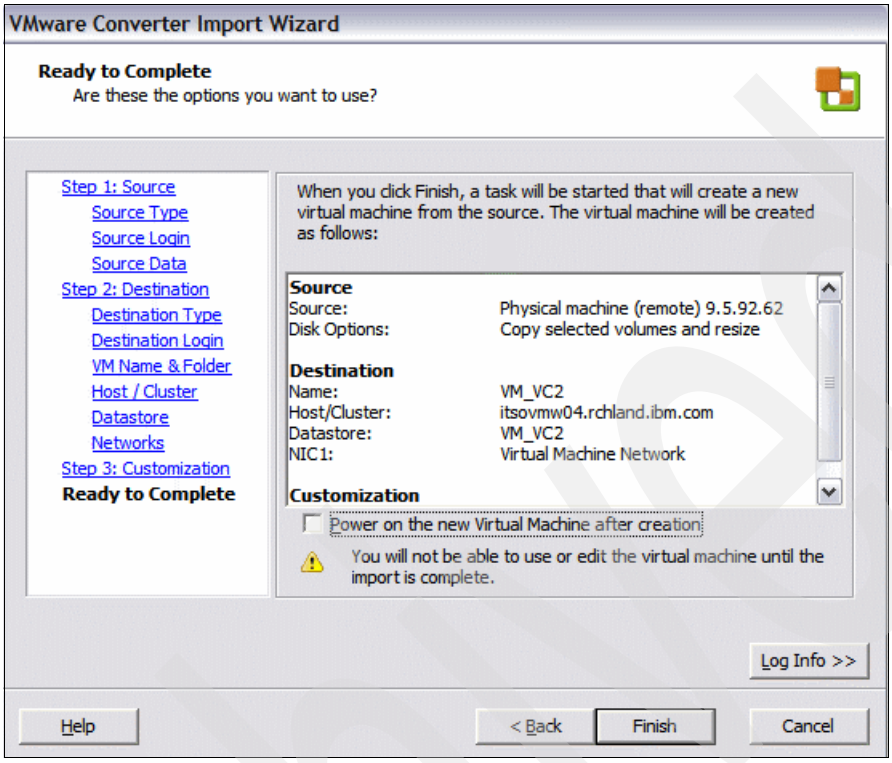

Figure 8-19 Migration review: Ready to Complete

A migration task starts on the VMware Converter console. The Progress field shows the migration in progress (Figure 8-20).

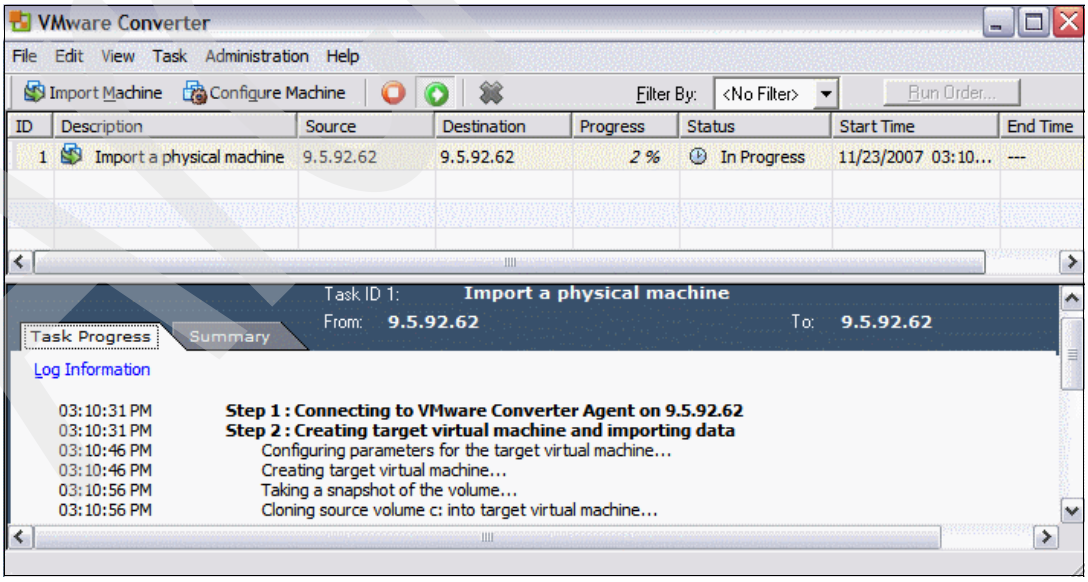

Figure 8-20 Migration task in progress

At the end of the migration task, a note explains where the migration logs can be retrieved (Figure 8-21).

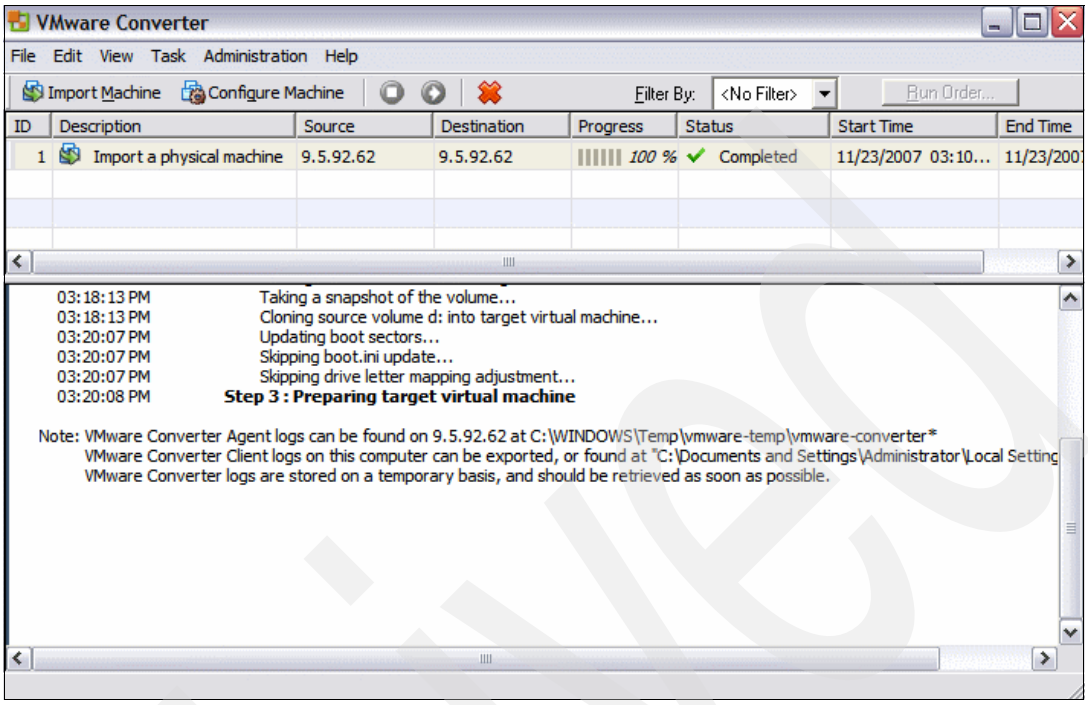

Figure 8-21 Migration task completed

After the migration, before starting the target Virtual Machine, remember to power down the source physical server in order to avoid any IP address conflicts in the network.

8.4 Migration from a System i Integrated server

System i Integrated servers can be migrated to VMware VI3 using VMware Converter. Both IXS/IXA and iSCSI based servers can be moved to the virtual infrastructure. Some additional configuration steps are needed on the target Virtual Machine in order to disable or delete the Integration components.

The Integrated Server Support installs Windows Services to interface with the System i5® and allow some Integration functions as file level backup, user enrollment and password synchronization, logging, and command execution. These services have to be disabled on the Virtual Machine after the migration.

The Integrated Server Support also installs a Virtual Ethernet Adapter, a program group, and other integration-specific components. You might want to delete them from the target Virtual Machine.

8.4.1 Exclude the installation drive from the migration

An Integrated server is made of two system storage spaces. Additional user storage spaces can be created to store data. The second system storage space is an installation disk required only by the integration structure. Thus, when an integrated server is moved to a VMware Virtual Machine, the second server storage space is no longer required.

During the Source Data step of the Converter Wizard, unselect the D: drive (Figure 8-22).

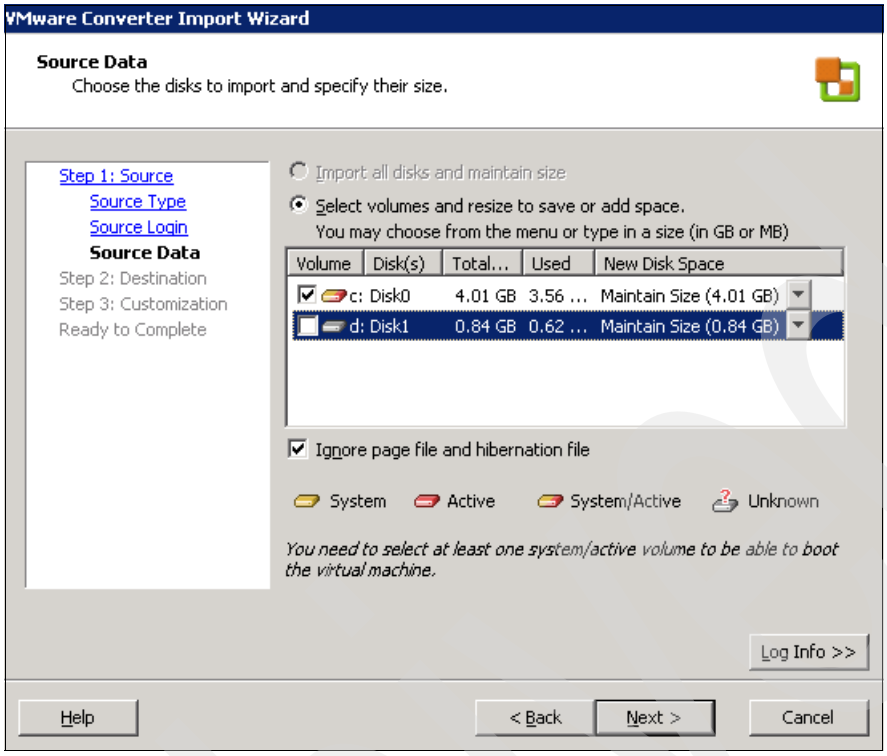

Figure 8-22 Uncheck the D: drive when importing a Series i integrated server

8.4.2 Post conversion activities

Use VMware Converter to migrate an IXS/IXA or iSCSI server, as explained in 8.2, “Migration tool: VMware Converter” on page 236. Then execute the following steps on the target Virtual Machine to delete the Integration objects not used by the new, virtual environment.

1. Disable the Windows Integration Services.

   a. On the Windows desktop right-click **My Computer**. Select **Manage** (Figure 8-23).

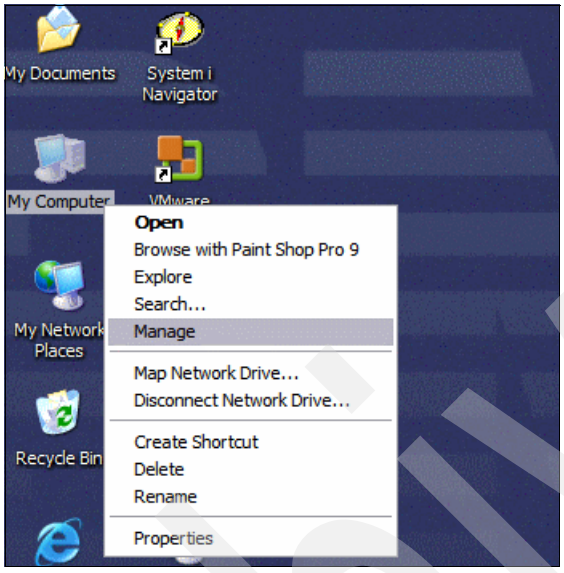

Figure 8-23 Windows Computer Management

   b. On the Computer Management window expand **Service and Applications** → **Services**.

c. Look for the three integration services. Depending on the Integration release of the source server, their names can change. For a Windows 2003 server running on i5/OS Integration V5R4, look for the services shown in Figure 8-24:

- i5/OS administration
- i5/OS integration manager
- System i remote command

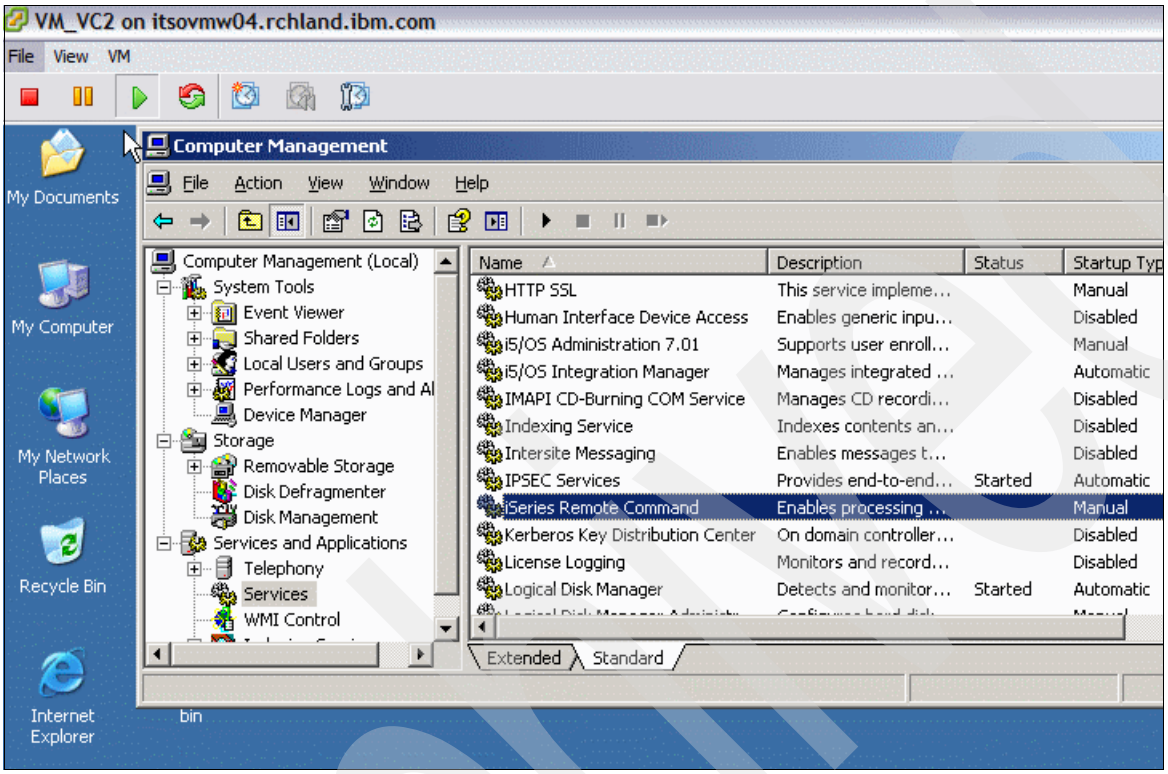

Figure 8-24 Windows Integration Services

d. Right-click the first service and select **Properties**. In the configuration window set the status type to disabled and click **OK** (Figure 8-25).

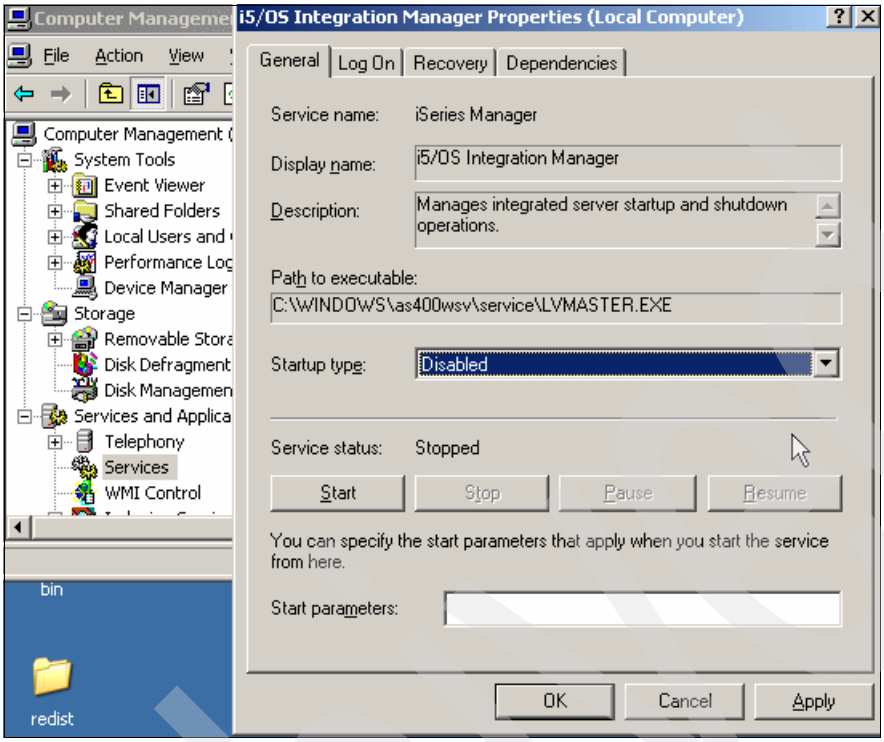

Figure 8-25 Service disabled

Repeat the same operation on the other two integration services.

2. Remove the Virtual Ethernet connection.
   a. On the Virtual Machine, open a DOS prompt and enter the commands:

```
set devmgr_show_nonpresent_devices=1
start devmgmt.msc
```

b. A Windows management console opens. On the toolbar, select **View** → **Show hidden devices** (Figure 8-26).

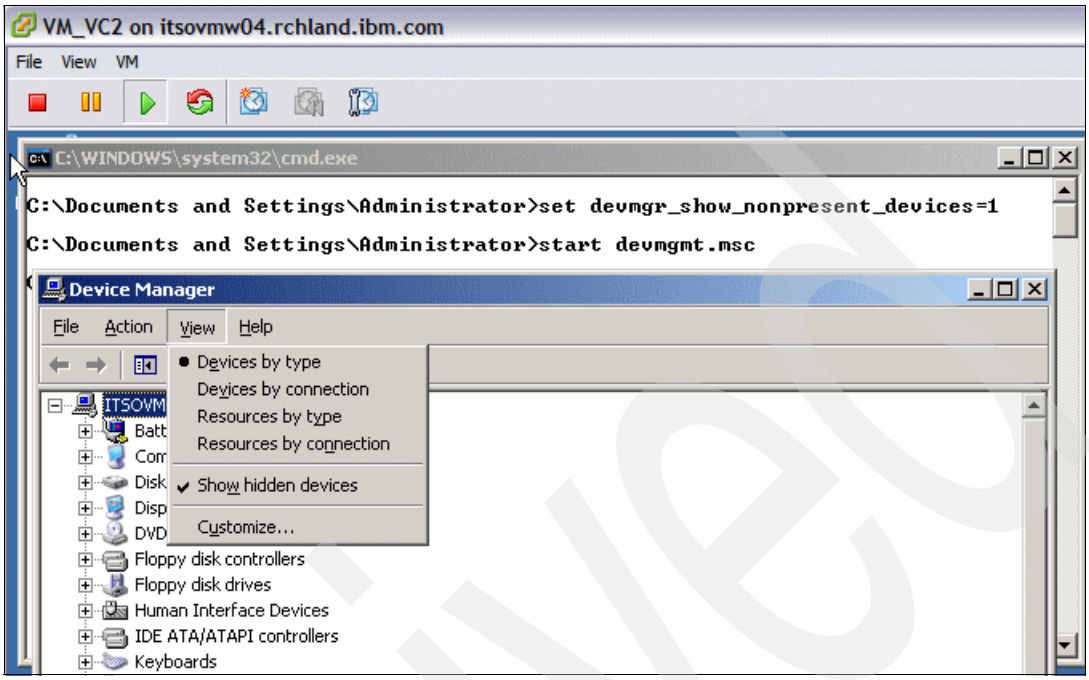

Figure 8-26 Show hidden devices

c. Expand the **Network adapters** section. The IBM System i Virtual Ethernet Point to Point adapter is marked with a yellow splash. Right-click the adapter and select **Uninstall** (Figure 8-27).

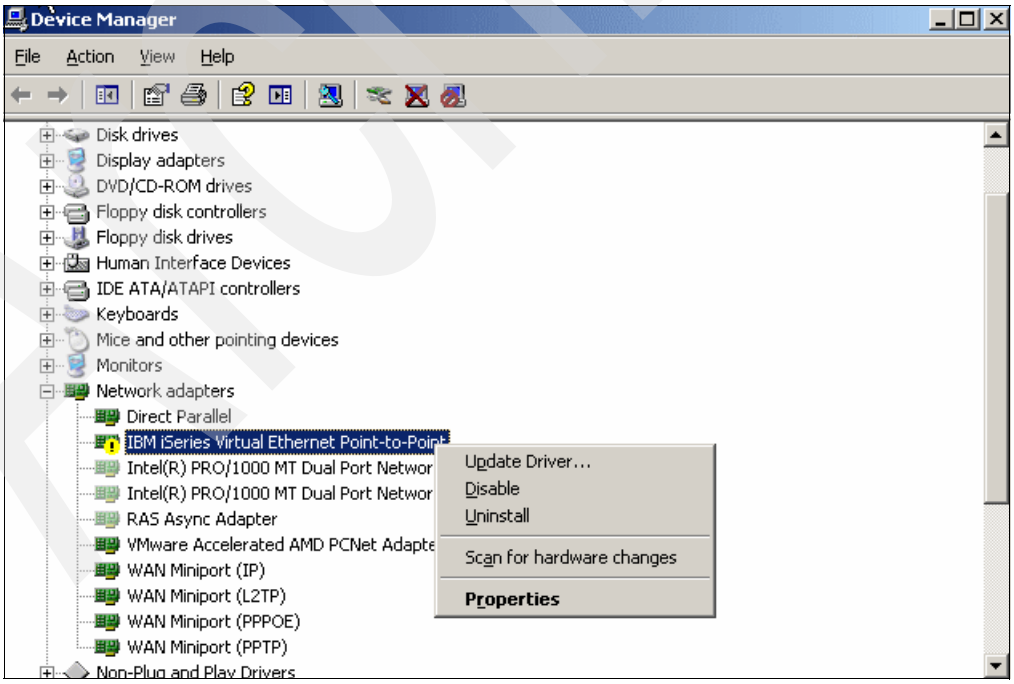

Figure 8-27 Virtual Ethernet adapter

d. Click **OK** on the warning message. The Virtual Ethernet adapter, not needed by the Virtual Machine, is removed (Figure 8-28).

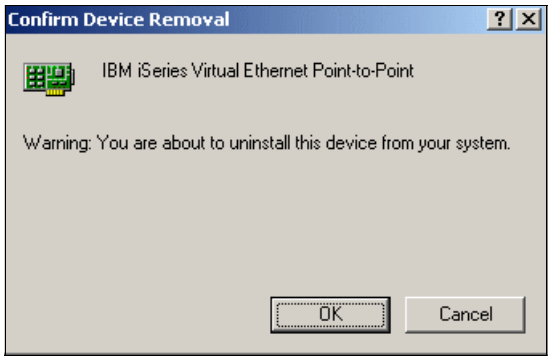

Figure 8-28 Uninstall the Virtual Ethernet adapter

You can browse the Device Manager tree looking for grayed out devices no longer present on the Virtual Machine, and uninstall them.

3. Remove the integration folders.

   Two additional folders have been created on the guest operating system during the installation on IXS/IXA or iSCSI:

   – C:\WSV
   – C:\WINDOWS\AS400WSV (Figure 8-29)

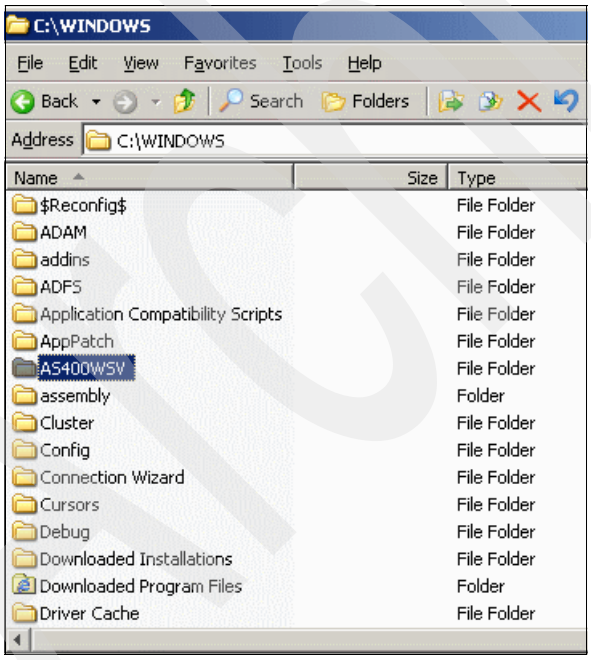

Figure 8-29 Integration folders

Delete both folders from the Virtual Machine hard disk.

4. Remove the IBM System i program group.

On the Windows desktop click **Start** → **Programs** and right-click **IBM iSeries** and select **Delete** (Figure 8-30).

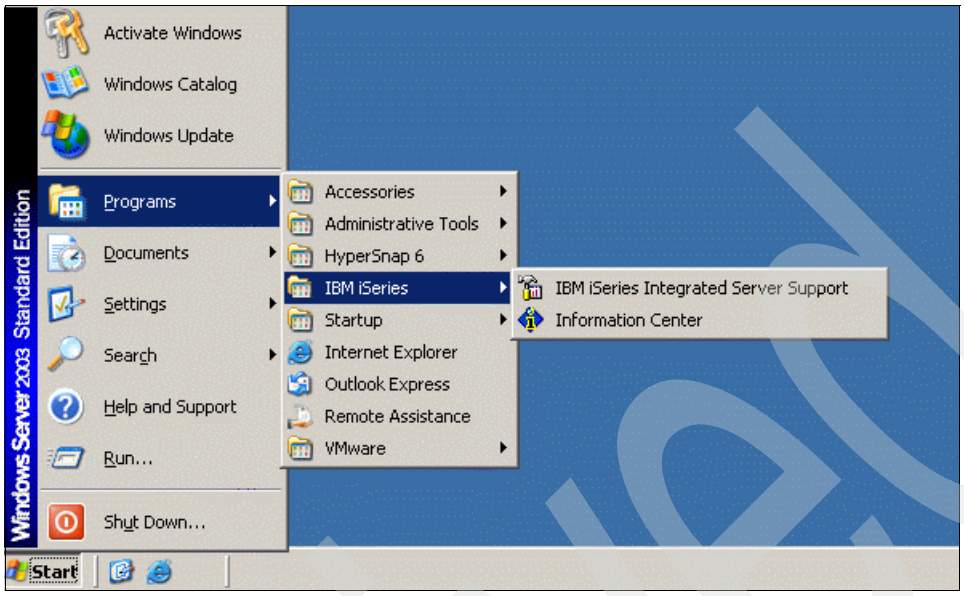

Figure 8-30 Delete the Integration program group

5. Disable the integration service pack synchronization.
   a. On the Windows console click **Start** → **Run**. Enter `regedit`.
   b. On the Registry Editor expand the menu **HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\Current Version\Run**.
   c. On the right pane delete the i5/OS Support Login key.

8.5 Migration of V5R4 ESX Integrated servers to V6R1

If you installed an Integrated VMware VI3 infrastructure on i5/OS V5R4, you have to do additional steps when i5/OS is upgraded to V6R1. Go to the System i integration Web site for instructions:

`http://www.ibm.com/systems/i/advantages/integratedserver/vmware/`

Related publications

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

IBM Redbooks publications

For information about ordering these publications, see “How to get IBM Redbooks publications” on page 261. Note that some of the documents referenced here might be available in softcopy only.

- *Implementing Integrated Windows Server through iSCSI to System i5*, SG24-7230

Online resources

These Web sites are also relevant as further information sources:

- The complete list of supported iSCSI HBAs and System i models is available at:

  http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/#support
- For the complete list of supported System x and BladeCenter systems go to:

  http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/servermodels/
- Information about network switch requirements and configuration considerations is available at:

  http://www.ibm.com/systems/i/advantages/integratedserver/iscsi/switches.html

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VMware VI3 on BladeCenter and System x Integrated with System i

(0.5” spine)
0.475”<->0.873”
250 <-> 459 pages

VMware VI3 on BladeCenter and System x Integrated with System i

Planning for VMware VI3

Installation and administration of VMware VI3

VMware VI3 advanced functions (VMotion, HA, DRS)

IBM i integration with BladeCenter and System x allows businesses to operate heterogeneous environments that include Intel-compatible servers running VMware ESX Server in addition to core business applications on the IBM i platform. VMware ESX Server is the host server for abstracting processor, memory, storage and networking resources of a physical server into multiple virtual machines. The ESX Server is part of the VMware Infrastructure.

Implementing VMware Infrastructure 3 with System i integration with BladeCenter and System x brings together the strengths of System i along with the benefits that VMware Infrastructure 3 brings to the BladeCenter and System x.

This IBM Redbooks publication presents some of the reasons for considering implementing VMware Infrastructure 3 through System i integration with BladeCenter and System x and guides you through the following important topics:

- Planning and installation VMware Infrastructure 3 via System i integration with BladeCenter and System x
- Summary of VMware Infrastructure 3 advanced capabilities
- Backup and recovery
- Managing integrated ESC server
- Administration and management of a VMware infrastructure
- Migration

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