Administrator's Guide for ioTurbine

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Introduction

Overview

The ioTurbine software by Fusion-io eliminates Input/Output (I/O) bottlenecks in virtualized environments. It accomplishes this by:

- Leveraging flash devices as a cache close to where the I/O is generated by the applications
- Tightly integrating into the file systems on Guest VMs

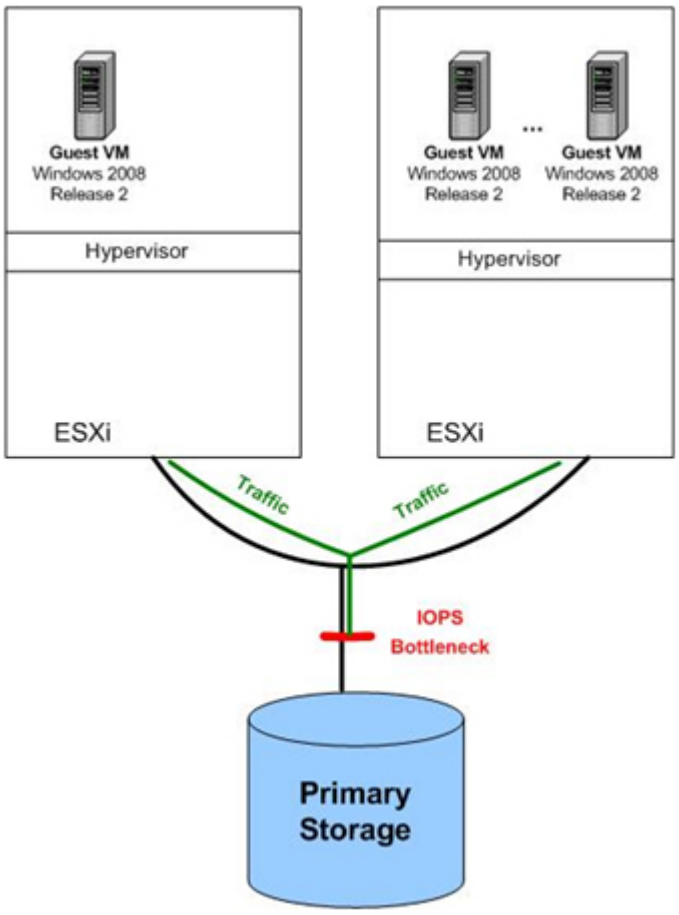
A typical datacenter contains multiple servers with numerous virtual machines. In a common configuration, a server runs on top of a VMware Hypervisor – with an ESX or an ESXi running on the Hypervisor – and a variety of Guest VMs on top of that. (A Guest VM could be configured to run Windows Server 2008, Release 2, for example.)

Usually, the Hosts are connected to shared storage systems, which Fusion-io refers to as Primary Storage. Primary Storage could be storage hardware from EMC or NetApp, or any other form of shared storage.

As more Guest VMs are created to take advantage of the available CPU power and memory, they produce significant traffic problems. Applications, attempting to access data, cause a bottleneck at the Primary Storage access point.

The point where the data is accessed is measured by I/O Operations Per Second (IOPS). As the number of IOPS increases, a chokepoint occurs at the Primary Storage site.

The following diagram illustrates this scenario in the datacenter:



The traditional way to eliminate the IOPS chokepoint or bottleneck is to add additional storage capacity (more Primary Storage), which is very expensive. The ioTurbine software solves this problem without the need for more Primary Storage. By caching the data that Guest VM applications are trying to retrieve, the software solution makes data retrieval easier and faster, and alleviates the traffic jam at the Primary Storage site.

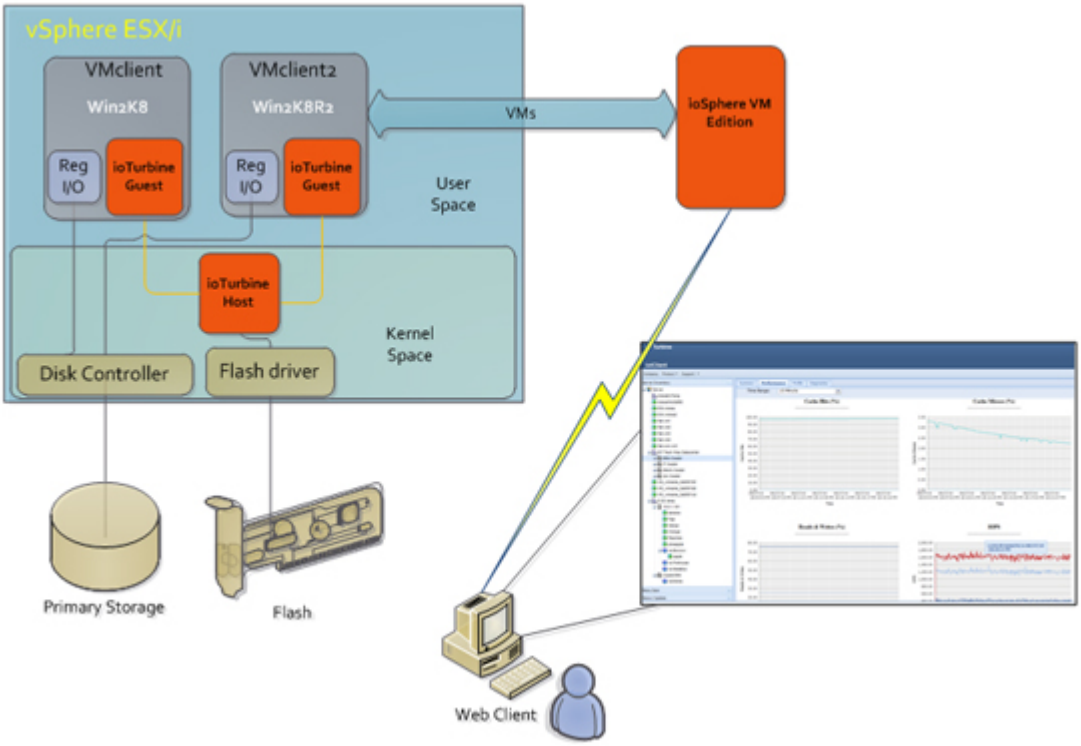
The ioTurbine software enables multiple I/O-intensive VMs to be run on the same Host. It also preserves all the benefits of vMotion while providing the performance benefits of a locally-attached Flash device.

The ioTurbine Software Components

The ioTurbine software consists of three components:

- **ioTurbine Driver**---Runs in the Guest VMs. There is one instance of this per Guest VM.
- **ioTurbine Virtual LUN (VLUN)**---Runs on the ESX Host. There is one instance of this per ESX Host.
- **ioSphere VM Edition (Management Server)**---Provides a management function for the environment. The Management Server is a 64-bit VM appliance delivered as an Open Virtualization Format (OVF) package. You can access the Management Server securely using a CLI shell or a Web-based GUI interface. The Management Server requires access to a vCenter Server to discover and manage all of the Hosts and Guest VMs in the virtual datacenter.

You install the Management Server on an ESX Host or a VMware Workstation on Linux or Windows. The other software components for the VMware Hosts and Guest VMs are installed from the Management Server (and the instructions are provided in the installation chapter in this manual).



Terminology and Supported Products

The following table provides a list of generic terms that correspond to specific hardware vendor components that ioSphere VM Edition supports. It also lists the applicable Fusion-io software products.

The definitions of the column headings are:

- **Generic Terms** — the general terms used throughout this guide to refer to the hardware and software components that ioTurbine interacts with. Although these terms (such as host, guest, management server) are not proper nouns, we capitalize them to emphasize their importance as placeholders for the growing list of vendor products that ioTurbine supports.
- **Supported Products** — the specific vendor hardware components, supported by ioSphere VM Edition, that the generic terms refer to. For example, the Guest OS that runs on the Guest VM could be Windows 2008 or Windows 2008 R2. The Hypervisor is the VMware Hypervisor.

- **Fusion-io Product Name** — the names of the ioTurbine software products that correspond to the generic terms, Management Server and the Management Server Client.

> ⚠ The grey areas within the table indicate that the column headings are not applicable.

> ℹ "ESX(i)" refers to ESX or ESXi.

> ⚠ ESX(i) 4.1 update 2 and ESXi 5.0 are not yet supported.

Generic Term	Supported Products	Fusion-io Product Name
Guest OS	Windows 2008, 64-bit Windows 2008 R2, 64-bit	
Hypervisor	VMware	
Host	See the *VMware Compatibility Guide*	
Hypervisor/Host OS	ESX(i) 4.0 ESX(i) 4.0 update 1 ESX(i) 4.0 update 2 ESX(i) 4.0 update 3 ESX(i) 4.1 ESX(i) 4.1 update 1	
Management Server		ioSphere VM Edition
Management Server Client (software appliance)		ioSphere VM Edition Client

System Requirements

This section provides the hardware and software requirements for:

- Host and Guest VM
- Management Server and Management Server Client

Hardware

The hardware requirements for the Host and Guest VM, and the Management Server and Management Server Client are defined in the sections that follow.

Host and Guest VM
The hardware requirements for the Host and the Guest VM are listed in the following table:

Item	Specifications

Host CPU	64-bit Intel/AMD processor (VT-Mode/AMD-V enabled in BIOS)
Host Memory	8 GB RAM (minimum)
Host Datastore	25 GB available disk size (minimum)
Host Networking	1 Gigabit Ethernet interface for server access (minimum)
Guest VM Disk	4 GB available virtual disk space (minimum)

Management Server and Management Server Client
The hardware requirements for the Management Server and the Management Server Client are listed in the following table:

Item	Specifications
CPU	64-bit
Memory	2 GB
Storage	20 GB
Networking	1 Gigabit Ethernet interface

Software Requirements

The software requirements for the Host and Guest, and Management Server and Management Server Client are defined in the sections that follow.

Host and Guest
The software requirements for the Host and the Guest are listed in the following table:

Item	Specifications
Host System	• VMware ESX Server version 4.0 update 1, 2, or 3 • ESX Server version 4.1 • ESXi 4.x
Guest VM	• 64-bit Microsoft Windows Server 2008 • 64-bit Microsoft Windows Server 2008 R2 • Windows PowerShell 2.0 installed

Management Server and Management Server Client
The software requirements for the Management Server and the Management Server Client are listed in the following table:

Item	Specifications
Management Server	• vSphere 4.x • Workstation 7.x or higher • Fusion 3.x or higher.
Browser	• Internet Explorer (IE) 8, 9 • Firefox 4.x or later • Cookies/Javascript must be enabled • Adobe Flash required for performance graphs

Installing the ioSphere VM Edition Software

Overview

The ioSphere VM Edition is delivered as a VMware virtual appliance.

You can manage the system from a browser-based graphical user interface (GUI) or a command line interface (CLI). Both interfaces provide all of the necessary commands to deploy, configure, and manage the product in stand-alone or clustered VMware environments.

The following set of installation instructions applies only to the GUI. Subsequent sections, however, provide GUI- and CLI-specific instructions to complete the setup, configuration, and operation of the ioSphere VM Edition.

Installation Instructions

The ioSphere VM Edition is delivered in the standard VMware appliance (OVF) format.

> The download will require approximately 3 GB of available disk space to download and unzip into.

- Download a zipped file that contains the files necessary to deploy an appliance and then perform the installation from local storage

> If you are installing the software more than once, it is recommended that you download the zipped files because it will save time later.

> Do not install the Management Server VM on any of the hosts on which you intend to deploy the ioTurbine caching software. The reason is that installing or removing ioTurbine host software components requires rebooting the Host.

> If you prefer to run the ioSphere VM Edition on a VMware Workstation instead of an ESX Host, refer to *Appendix C - Installing ioSphere VM Edition in a VMware Workstation* for detailed instructions.

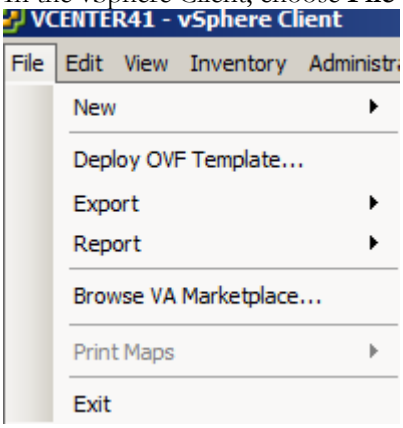
ioSphere VM Edition Installation Steps

> ⚠ Installing or upgrading the Host and Guest software packages will reboot your systems.

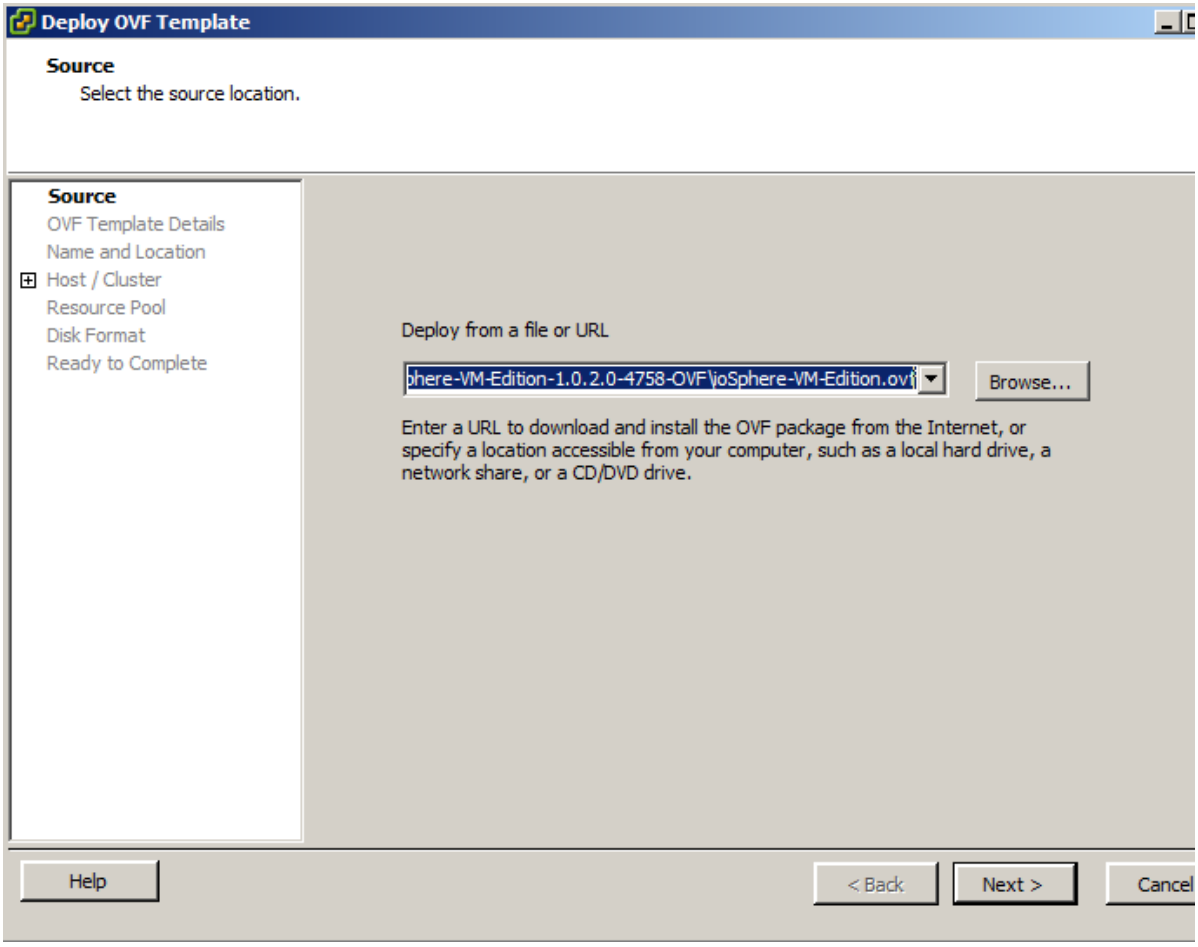
1. After downloading the `ioTurbine-OVF.zip` file, unzip it to a folder on your PC or to a VMware datastore that is accessible from your vSphere Client.

   There should be three files in the folder:
   - `ioSphere-VM-Edition.mf`
   - `ioSphere-VM-Edition.ovf`
   - `ioSphere-VM-Edition-disk1.vmdk.gz`

2. In the vSphere Client, choose **File** > **Deploy OVF Template**.



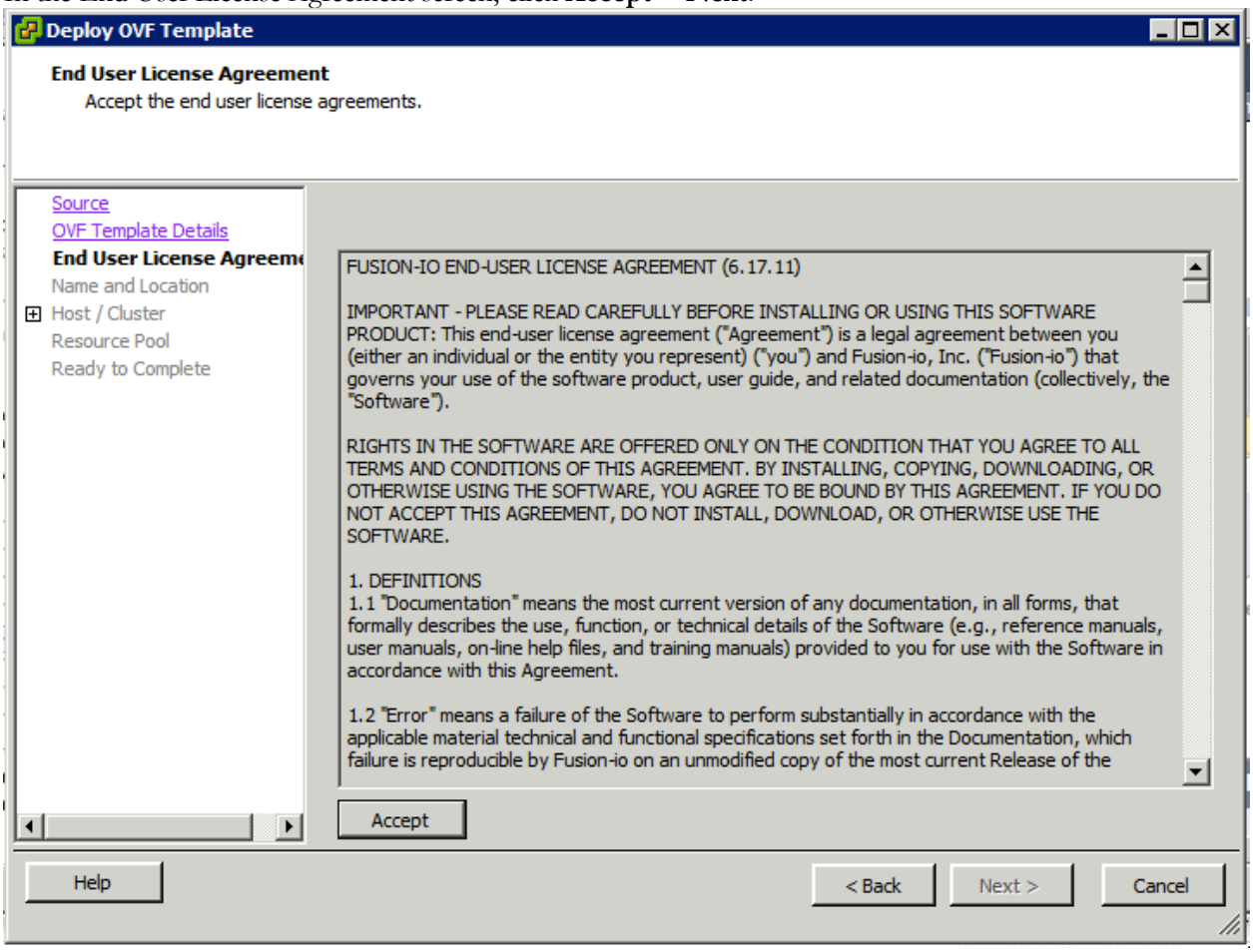
3. In the Source screen:
    a. Click Browse to navigate to the location of the unzipped files, and select `ioSphere-VM-Edition.ovf`
    .



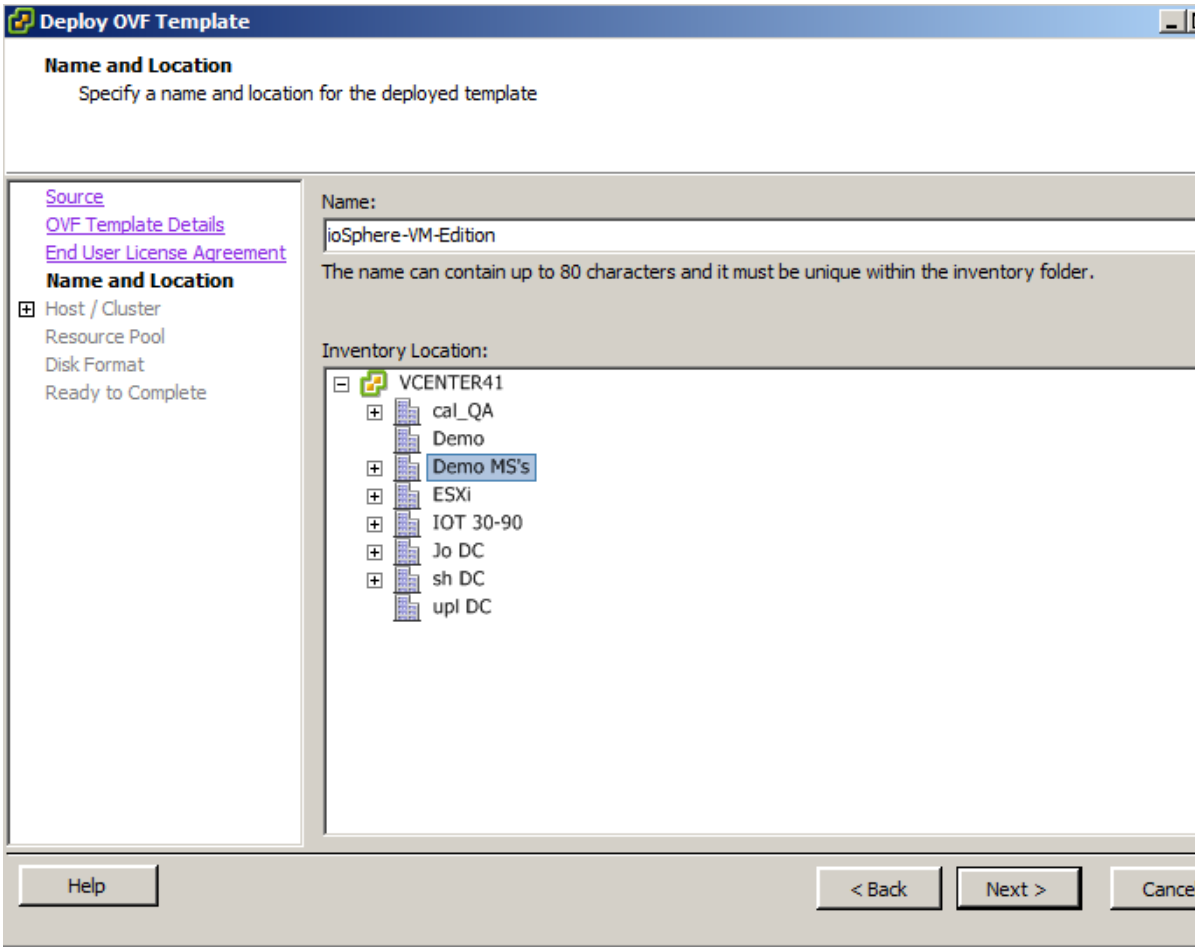
    b. Click **Next**.

4. In the OVF Template Details screen, click **Next**.

5. In the End User License Agreement screen, click **Accept** > **Next**.



6. In the Name and Location screen:
    a. In the Name field, accept the default name or change it if desired.
    b. Select the location for the VM.

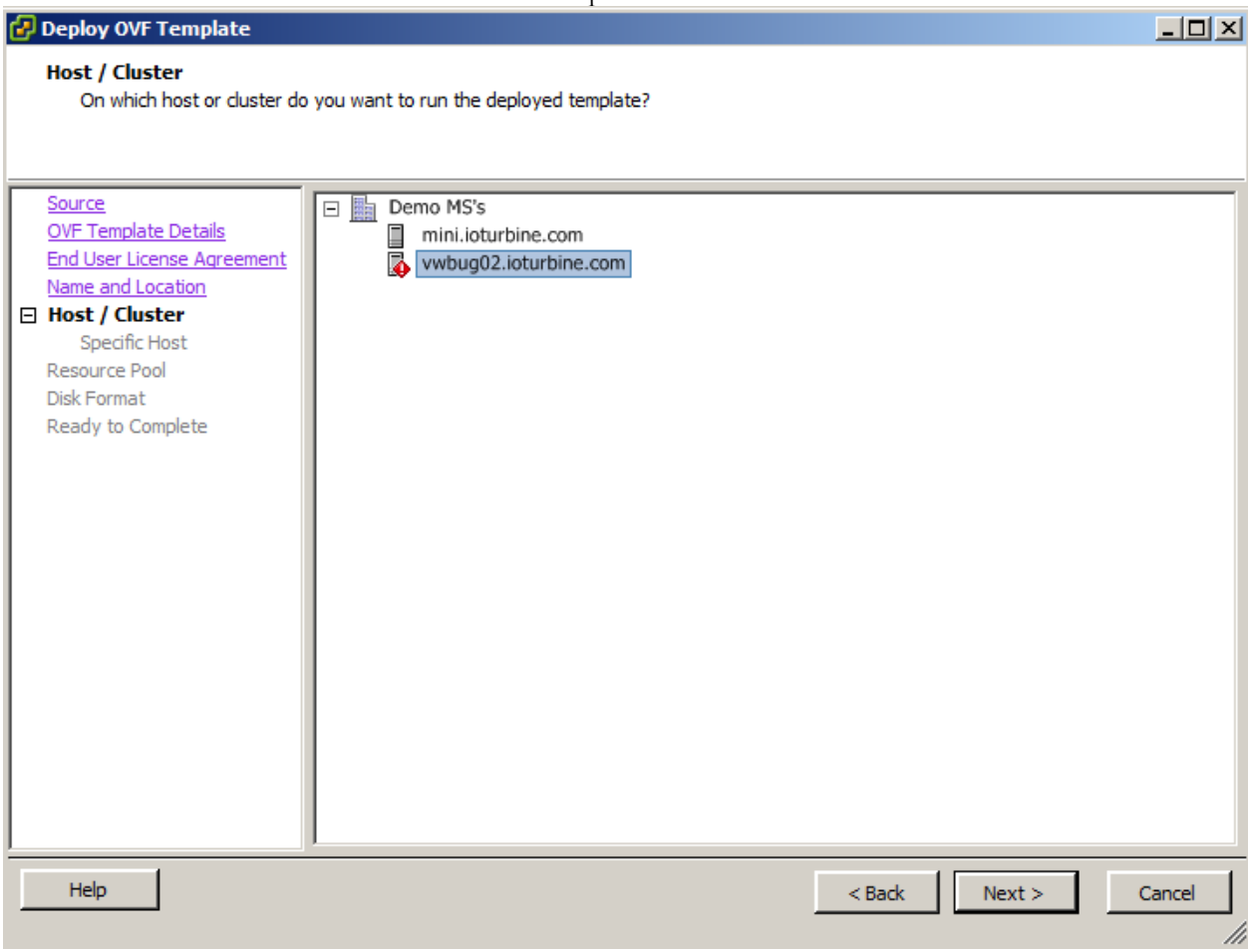


    c. Click **Next**.

7. In the Host / Cluster screen, select the cluster on which you want to deploy, and click **Next**.

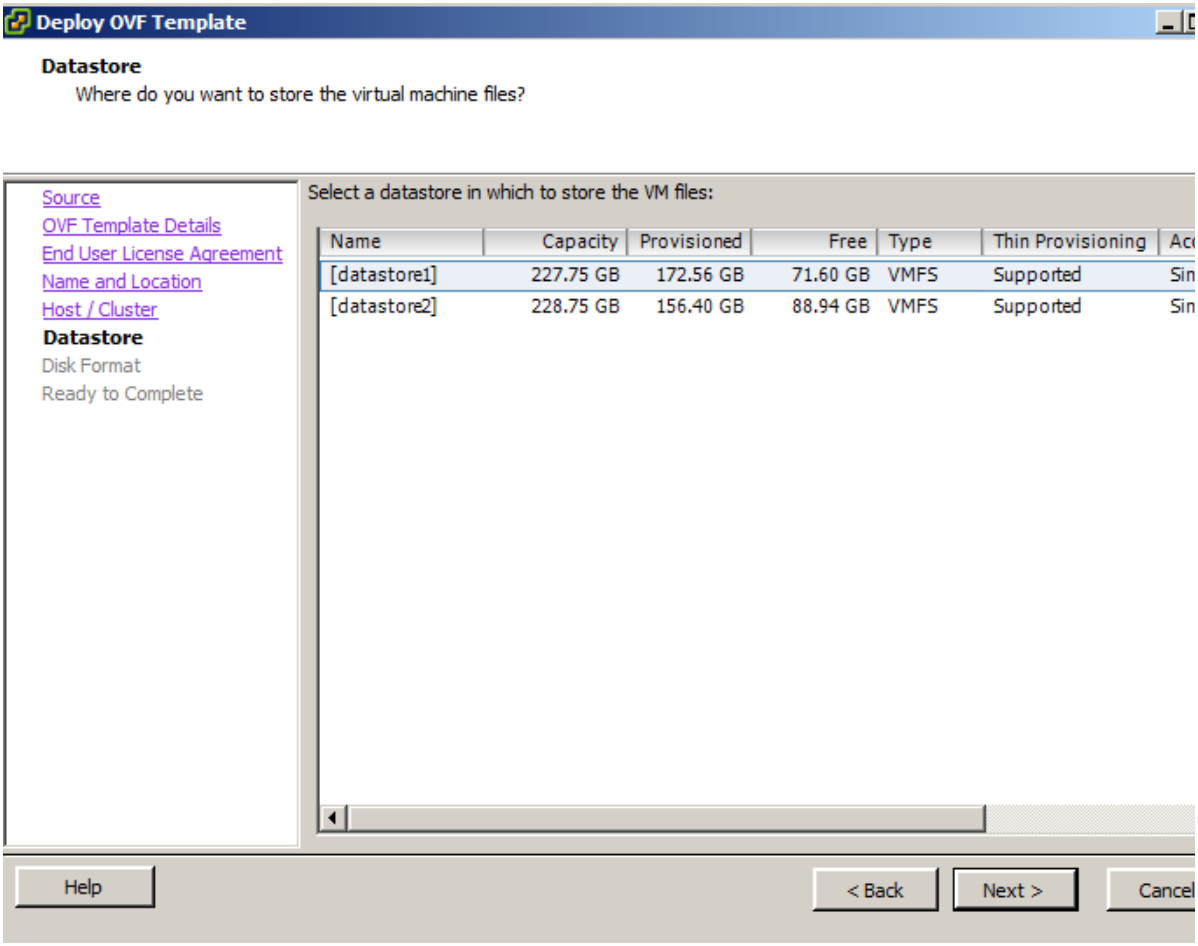
> ⚠ The MS must be installed on a host that will not have the ioTurbine software running on it.

8. Select the individual host on which to install the ioSphere VM Edition software and click **Next**.



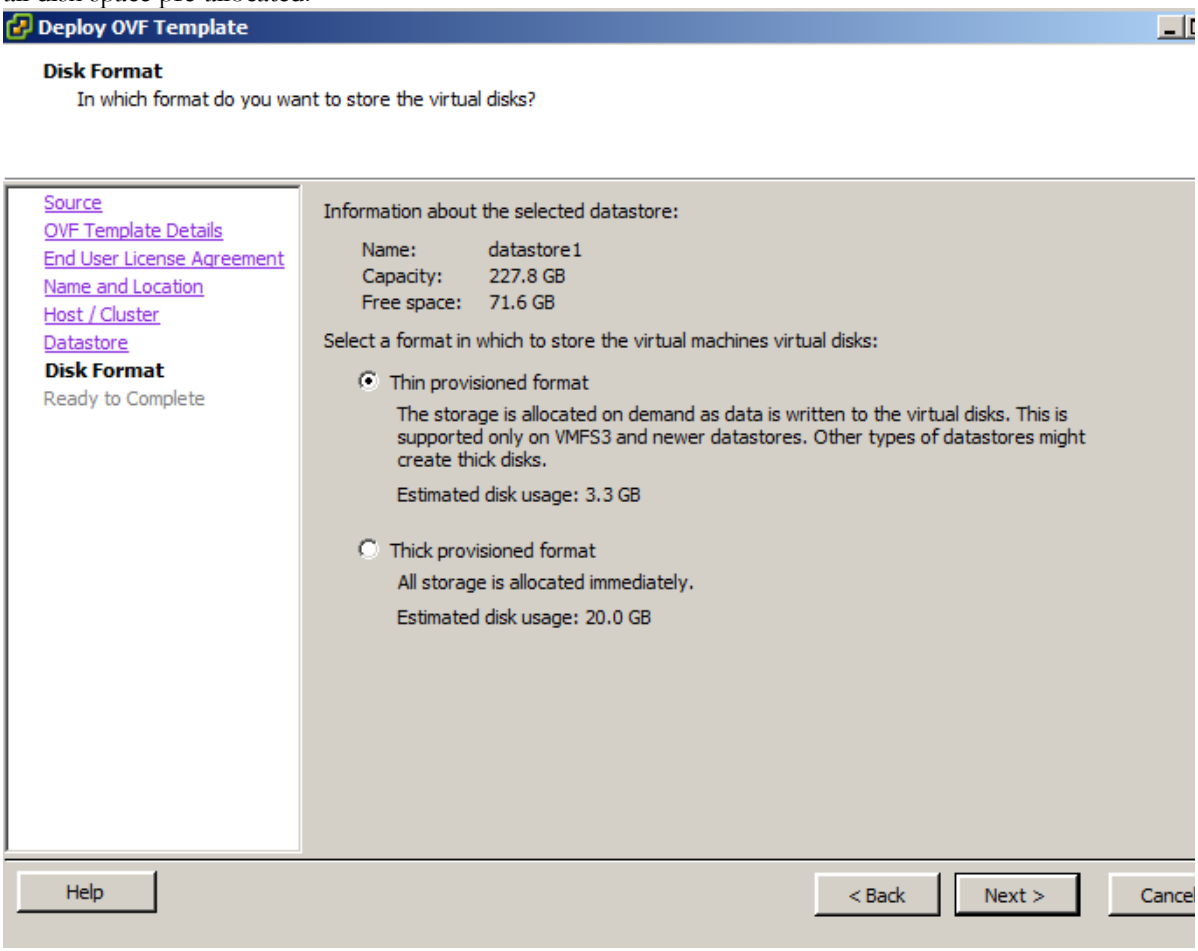
9. In the Datastore screen:
    a. Select the datastore on which to install the ioTurbine appliance.

> Make sure that the datastore has at least 25 GB of free space.



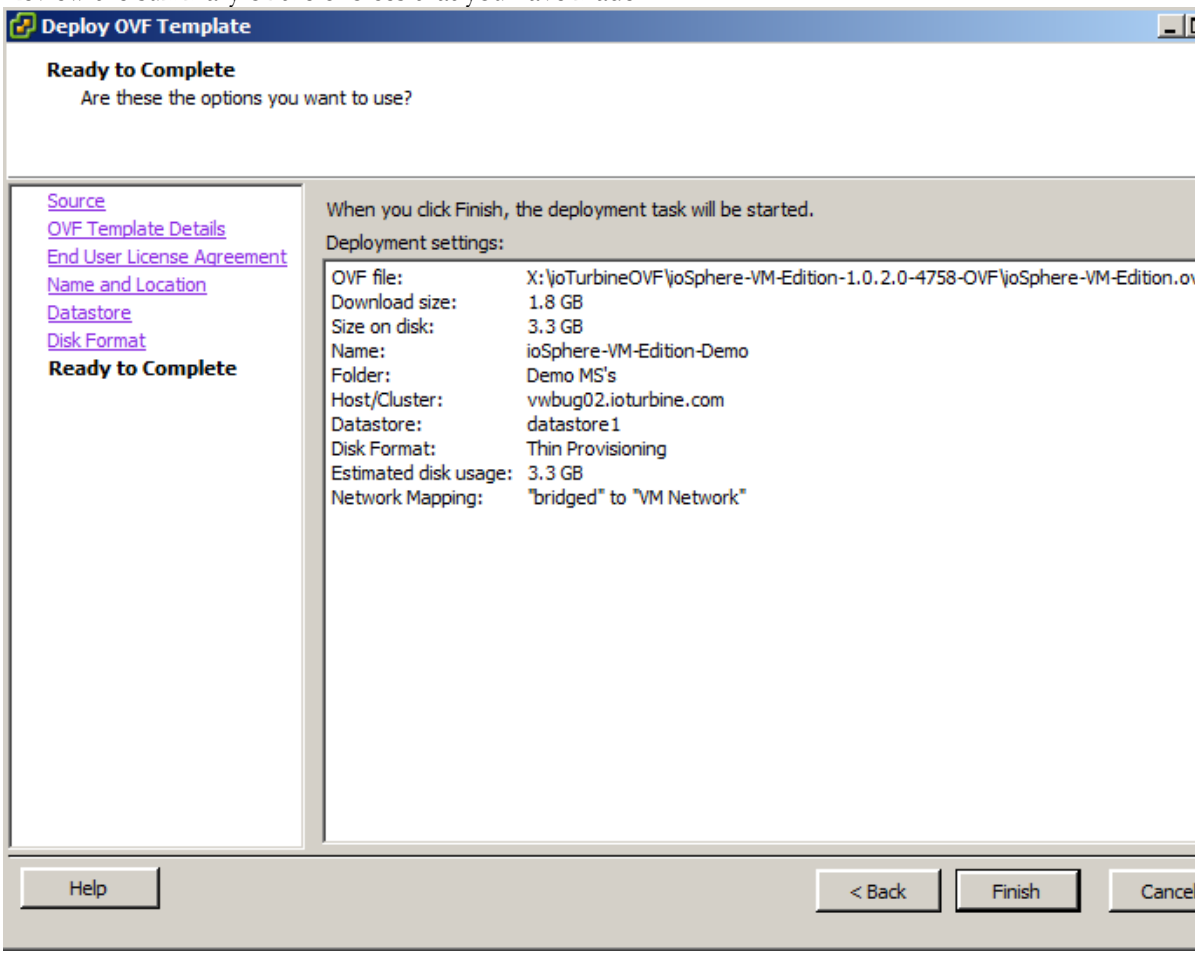
    b. Click **Next**.

10. In the Disk Format screen:
    a. Choose Thin provisioned format for on-demand allocation or Thick provisioned format to deploy with all disk space pre-allocated.



    b. Click **Next**.

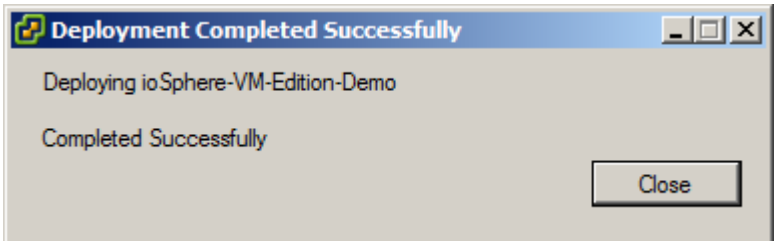
11. In the Ready to Complete screen:
    a. Review the summary of the choices that you have made.



    b. If everything is accurate, click **Finish**.

> If you are installing from a local copy, the installation takes a few minutes. If you are installing from the Web site, the time required depends on your connection speed.

12. When you see the popup box indicating that the ioSphere VM Edition has been successfully installed, click **Close**.



The ioSphere VM Edition appliance is now running.
In the next steps, you configure the system and install the software license.

Setting up Networking for the ioSphere VM Edition

This section provides the instructions for setting networking options upon initial log in and for ongoing administration. When you log in to the ioSphere VM Edition for the first time, the ioTurbine Setup Wizard runs automatically.

This section describes the various options that you can set.

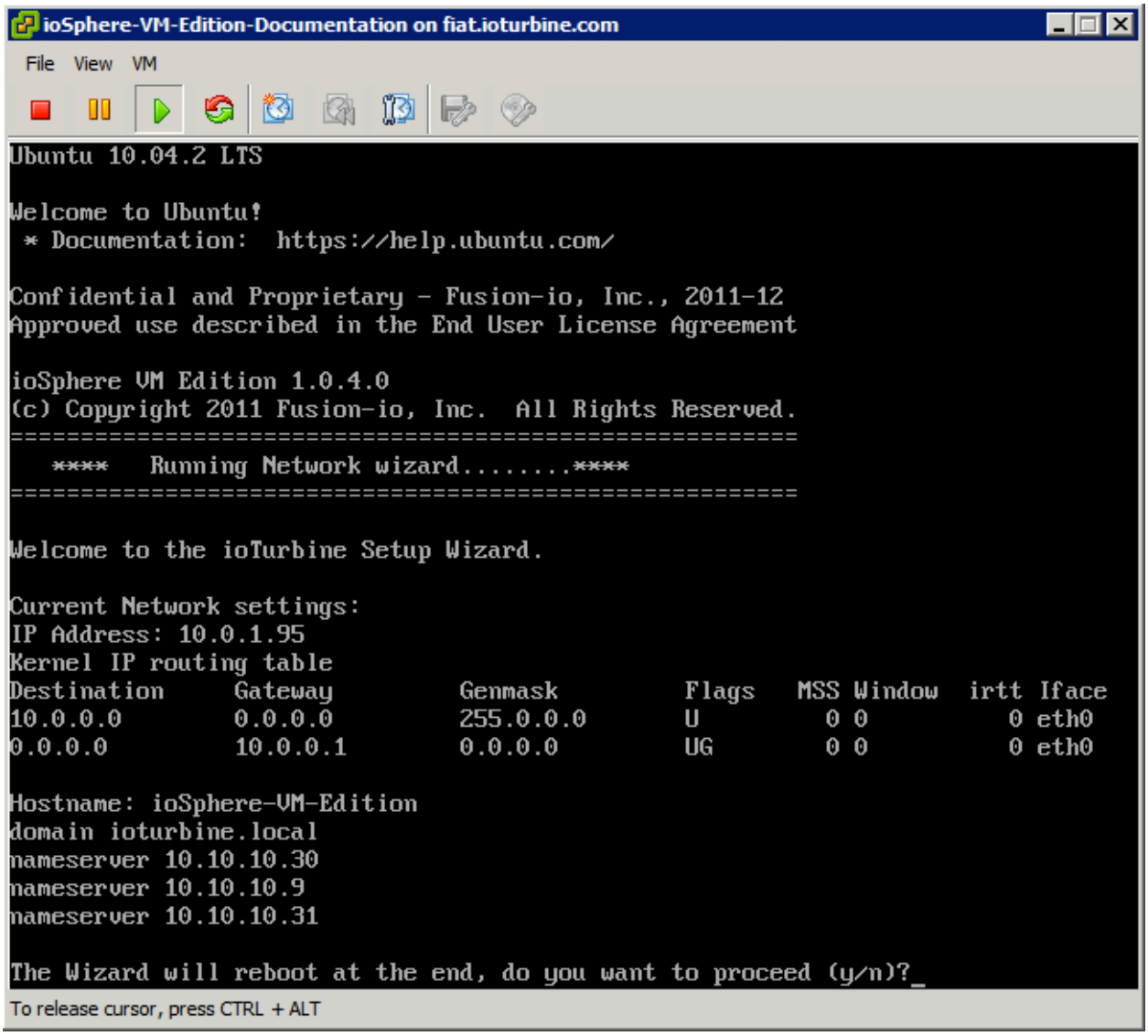
To set up networking for the ioSphere VM Edition:

1. To start the network setup, open a vCenter console session for the ioSphere VM Edition.
2. At the login prompt, `ioSphere-VM-Edition login:`, type:
   `ioturbine`

3. At the system prompt for a password, type:
   `IOadmin123`

> Passwords are case-sensitive.

After you log in, the ioTurbine Network Wizard is executed.
The Network Wizard displays the current configuration, which is based on the settings obtained from your DHCP server if one exists in your network.



4. At the prompt, enter ioSphere VM Edition Name:, to set the name that will be reported to any DNS servers:
   a. Type the desired name, which can be different from the name that you assigned to the VM during installation.

   b. Press **Enter** to continue.

5. At the prompt to `Enable DHCP (y/n):`, type `n` to manually configure a static IP address or type `y` to use DHCP and then press **Enter** to continue.

> ⚠ If entering a static IP, take care to enter the information correctly. You will not be able to modify the entered IP information until a license is uploaded and activated through the ioSphere VM Edition web interface.

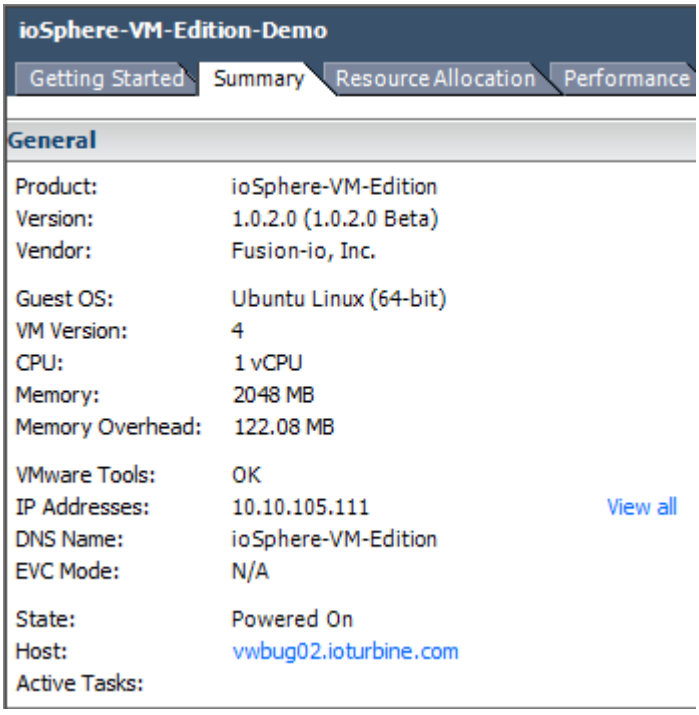
> ℹ If you intend to use a DHCP setting, the ioSphere VM Edition applies your changes and reboots. *Skip the next couple of steps* and verify that your changes have been applied.

6. At the next three prompts for IP Address, IP Netmask (subnet mask), and IP Gateway (default gateway), enter the settings that are appropriate to your environment.
7. At the final two prompts for Domain List and Nameserver List, enter the applicable values.

> ℹ The Domain List and the Nameserver List accept multiple entries, separated by commas.

After you enter the last item, the ioSphere VM Edition applies your changes and reboots.

8. After the system reboots, verify that your changes have been applied to the ioSphere VM Edition by looking at the details in the Summary tab in the vSphere Client.



Initial Connection, Licensing, and Configuration of ioSphere VM Edition

You can use the GUI or the CLI to establish an initial connection, obtain licensing, and configure the ioSphere VM Edition.

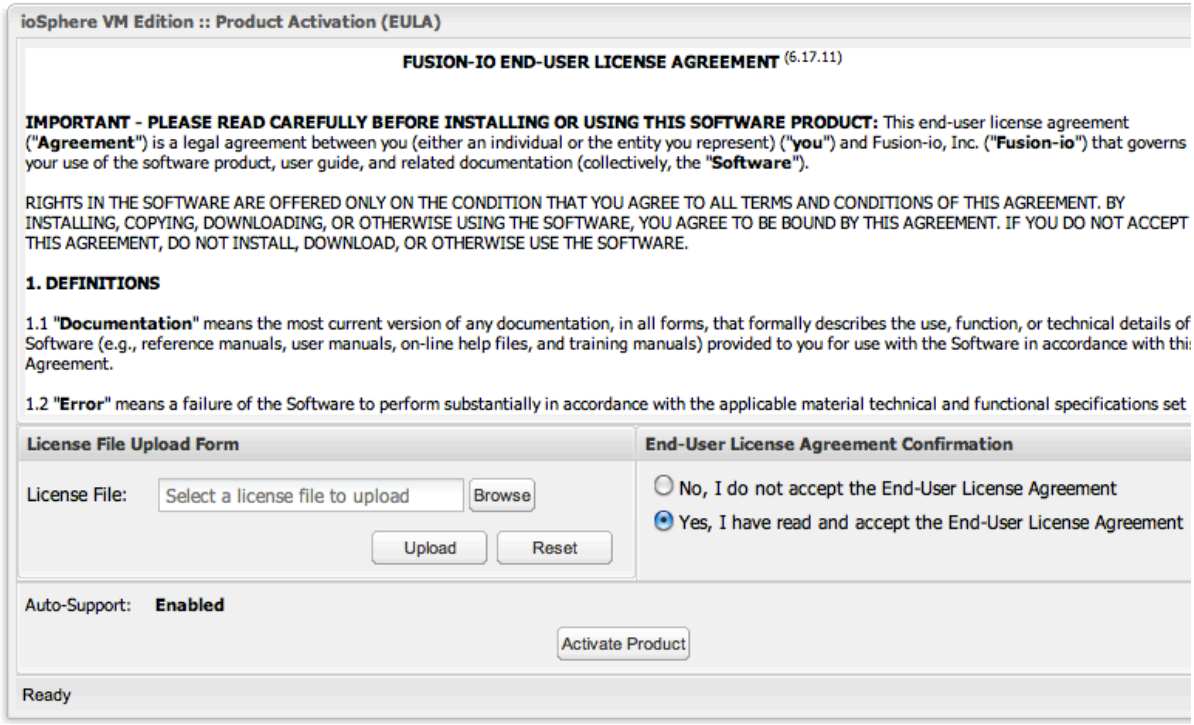
Using the GUI

1. Start your browser and type the address:
   `https://<management server address>`
   where `<management server address>` is the IP address of your ioSphere VM Edition.

2. In the ioSphere VM Edition login dialog box:
   a. Type:
   `ioturbine` for the User Name
   `IOadmin123` for the Password

   b. Click **Login**.

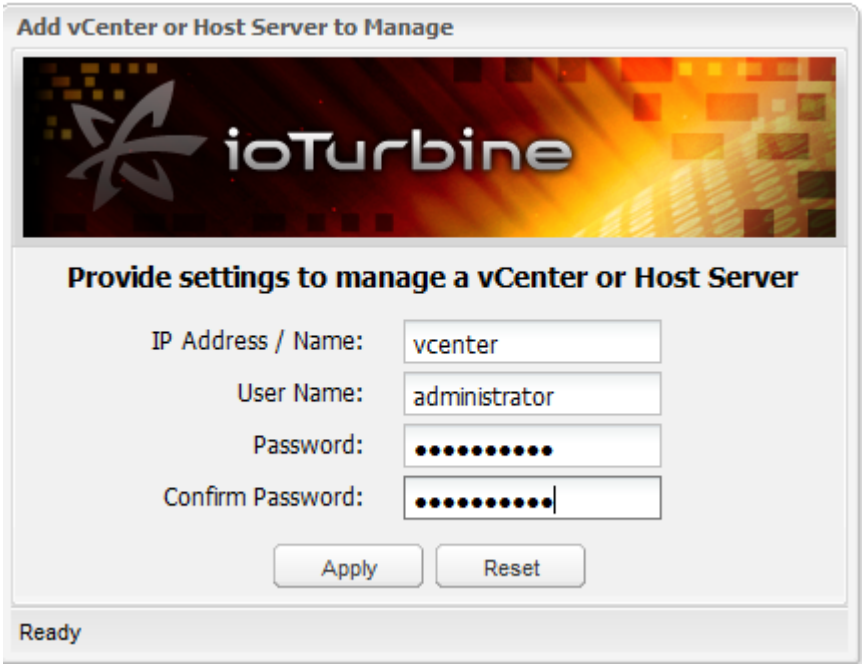
3. In the End-User License Agreement screen:
   a. Click **Browse** to navigate to the location where you stored the Fusion-io license file provided to you.
   b. Click **Upload**.
   c. Click **OK** to dismiss the message dialog informing you that the license has been successfully uploaded.
   d. Select **Yes**, I have read and accept the End-User License Agreement.



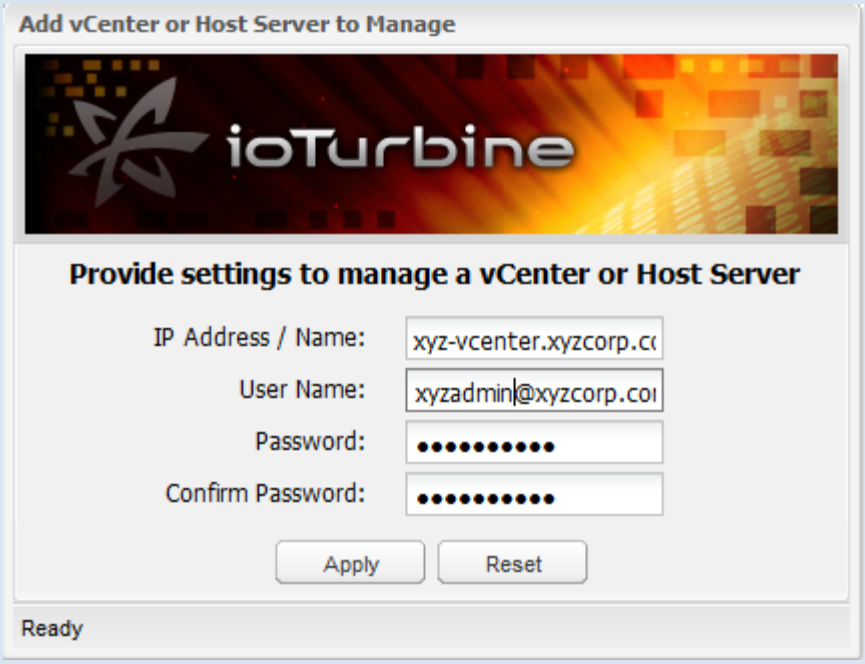
   e. Click **Activate Product**.
   When you log in to the system for the first time, you are prompted to add a vCenter or an ESX Server to be managed.

4. In the Add vCenter or Host Server to Manage screen:

a. Complete the fields to add a vCenter Server or an ESX Server to be managed.



If your vCenter Server uses Active Directory user authentication, enter your user name using the convention, `name@domain`, as shown in the following screen:



> The server host name that is provided needs to be resolvable from the ioSphere Management Server to successfully add the server. Otherwise, Fusion-io recommends configuring the Host in a DNS server or using the server's IP address.

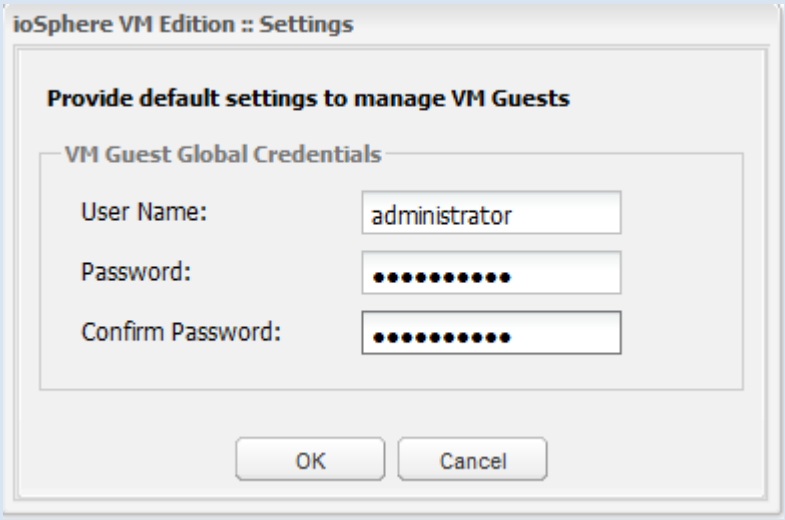
b. Click **Apply**.

To simplify the management of multiple Guests, the system provides a means to define a set of global credentials, which are used when authenticating to the managed Guest VMs.

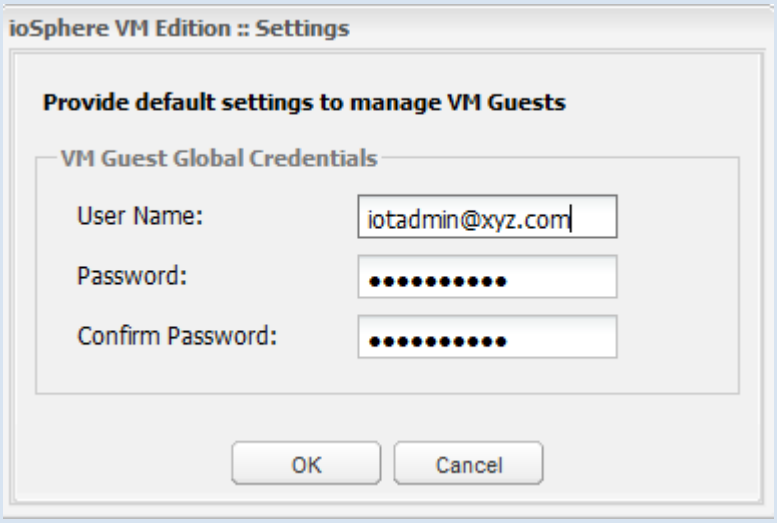
> These default Guest VM credentials can be overridden using the GUI or the CLI interface.

5. In the ioSphere VM Edition Settings screen:
   a. Complete the fields to authenticate access to all Guest VMs that the ioSphere VM Edition is to manage.

If you ever need to change these credentials, right-click the Inventory tree and choose Configuration.



If you are using Active Directory user authentication, enter your user name using the convention, `name@domain`, as shown in the following screen:



   b. Click **OK**.
   The main ioTurbine management interface displays.

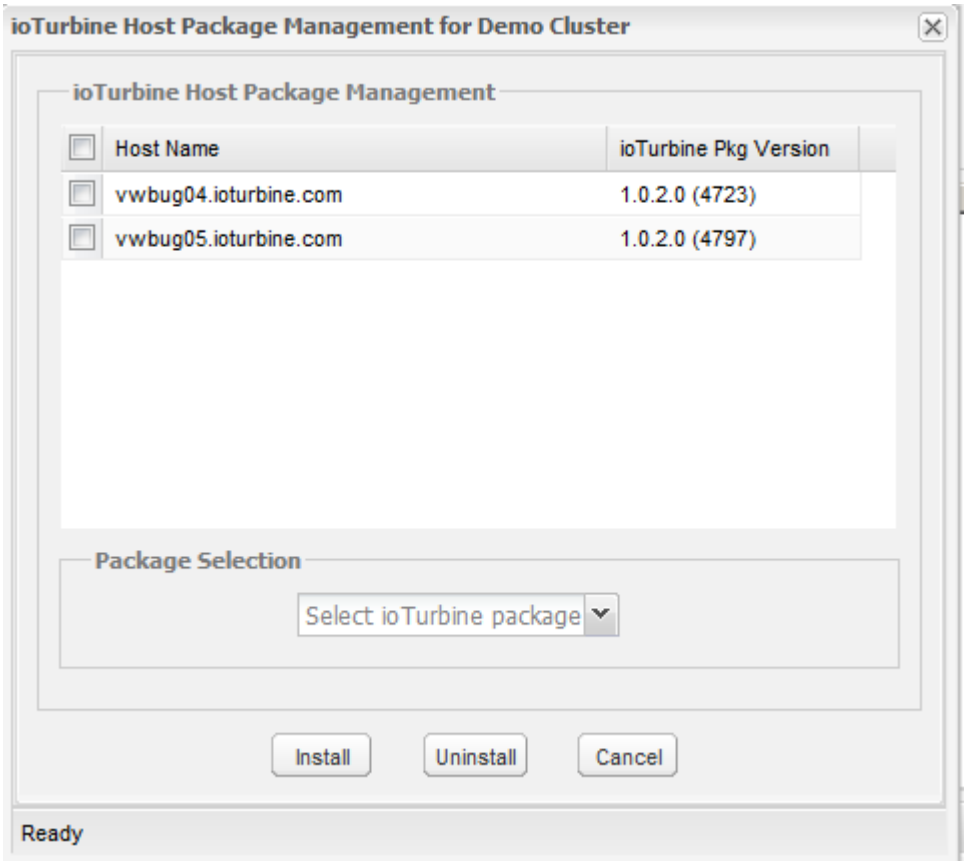
Using the ioTurbine VM Interface

The interface was designed to mimic the look-and-feel of the VMware Sphere Client—with the Inventory tree on the

left, and the status and other information on the right—making it instantly familiar.

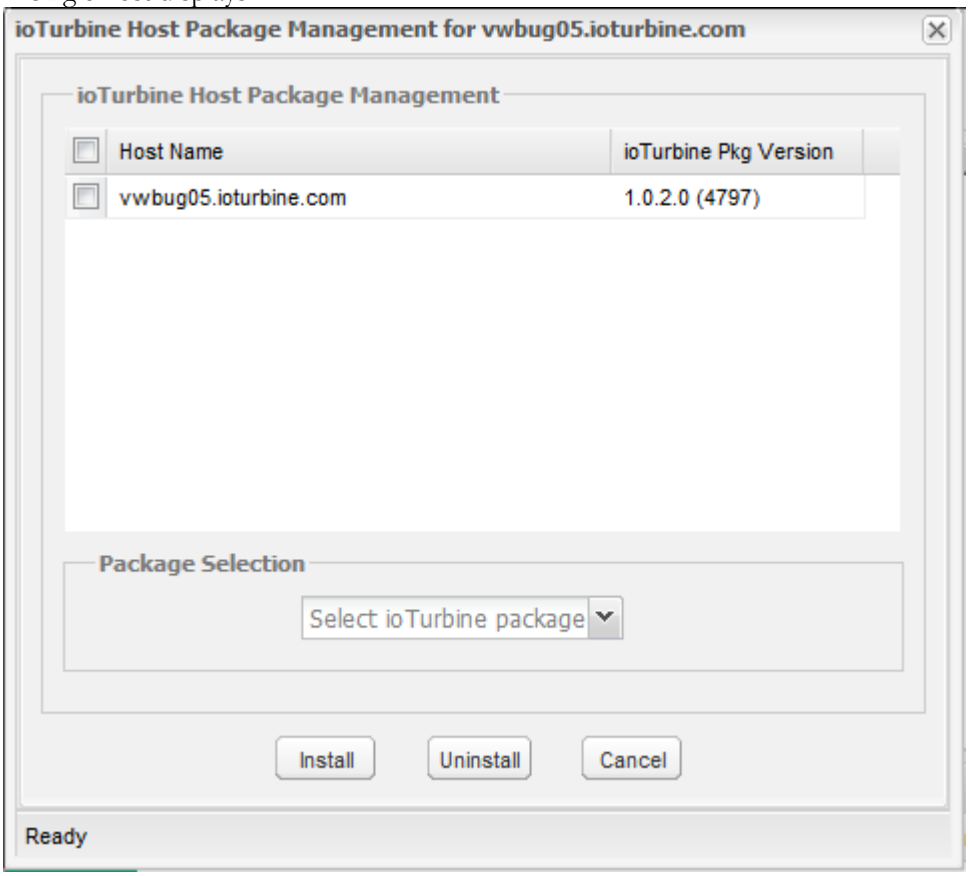
Here are a few tips for using the ioTurbine interface:

- The first time a new ESX Host or vCenter is added to the ioTurbine system, only the root of the tree is displayed. Click the [+] sign next to the Data Center Network to expand the Inventory Tree.
- To expand a particular cluster or data center so that you can see the Hosts and VMs contained within it, click the [+] sign next to the cluster name.
- If you need to refresh the Inventory view, right-click the top of the tree, and choose Refresh Tree.
  Whenever you right-click in the Inventory tree and choose a task, the operation that you select is applied from that point and below in the tree.
  Example:
  1. Right-click on a cluster.
  2. Choose ioTurbine ESX Package Management.
     A list of hosts within that cluster displays.



  3. Right-click on a single host.

4. Choose ioTurbine Host Package Management.
   A single host displays.



Using the CLI

This section includes the CLI commands for the following tasks:

- Configuring the user accounts
- Connecting to the vCenter Server

Both the GUI and the CLI instructions are listed for the following tasks:

- Installing the ioTurbine Host Package
- Configuring an SSD or PCI Flash device on the ESX Host
- Installing the ioSphere VMGuest Package
- Configuring the Guest VM settings

Configuring the User Accounts

The ioTurbine system utilizes several user accounts. This section explains their use, and how to modify them for your environment.
To simplify the management of multiple Guest VMs, the Management Server lets you define a global account named DefaultGuest, which is used to authenticate access to all managed VMs. A second account was already created when you entered your vCenter Server information in *Step 4 of the previous section*.

Follow these steps to view, modify, or delete a user account:

1. To view the full list of configured accounts in the User Account Table, type:

```
account --list
```

2. To modify a User Account in the User Account Table, type:

```
account –-modify <name> --user <user> [–-password <password>]
```

3. To delete a User Account from the User Account Table, type:

```
account –-delete <name>
```

> If you have set up the default user account, `DefaultGuest`, as described in this section, then the `GuestUser` and `GuestPassword` arguments in all of the examples that follow are optional. You only need to enter them if you want to override the default account for that particular Guest VM.

Connecting to the vCenter Server

To perform ESX Host and Guest VM operations, you must first connect to a vCenter Server:

1. To connect to a specific vCenter Server, type:

```
connect-viserver –-server <server> --user <user> [–-password
<password>]
```

Where `<server>` is the name of your vCenter server.
Example:

```
connect-viserver –-server iot-vcenter –user administrator
user administrator password:
Ok
```


The password argument is optional because it is a clear text password. For security reasons, it is recommended that you do not use it. Enter a secure, hidden password when you are prompted to do so. This password security feature applies to all CLI commands requiring password arguments.

2. To disconnect from the existing server connection, type:

```
Disconnect-viserver
```

Installing the ioTurbine Host Package

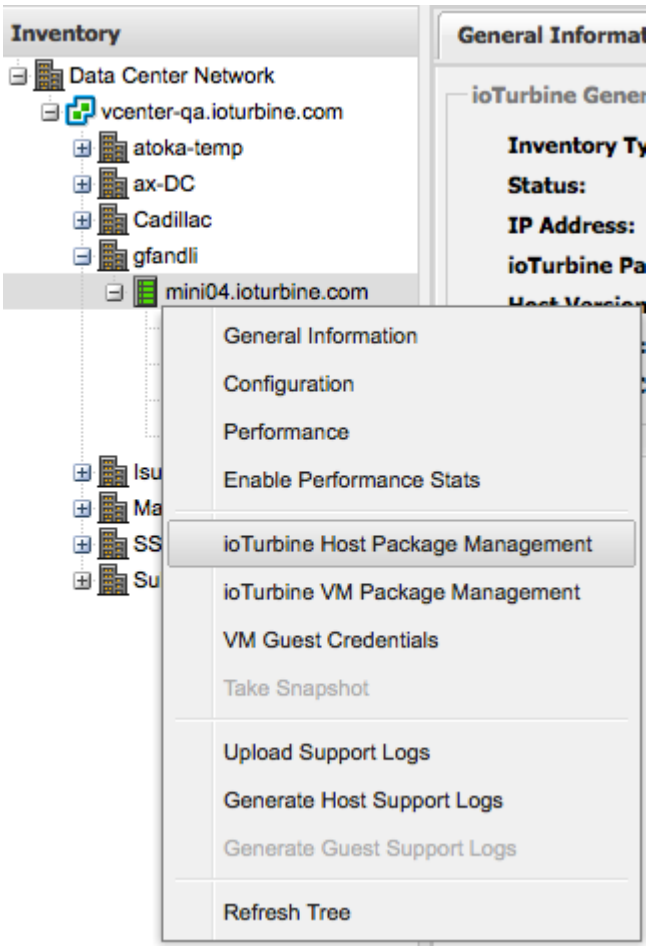
This section provides the GUI and the CLI instructions to install the software on your ESX Host (or Hosts).

Using the GUI

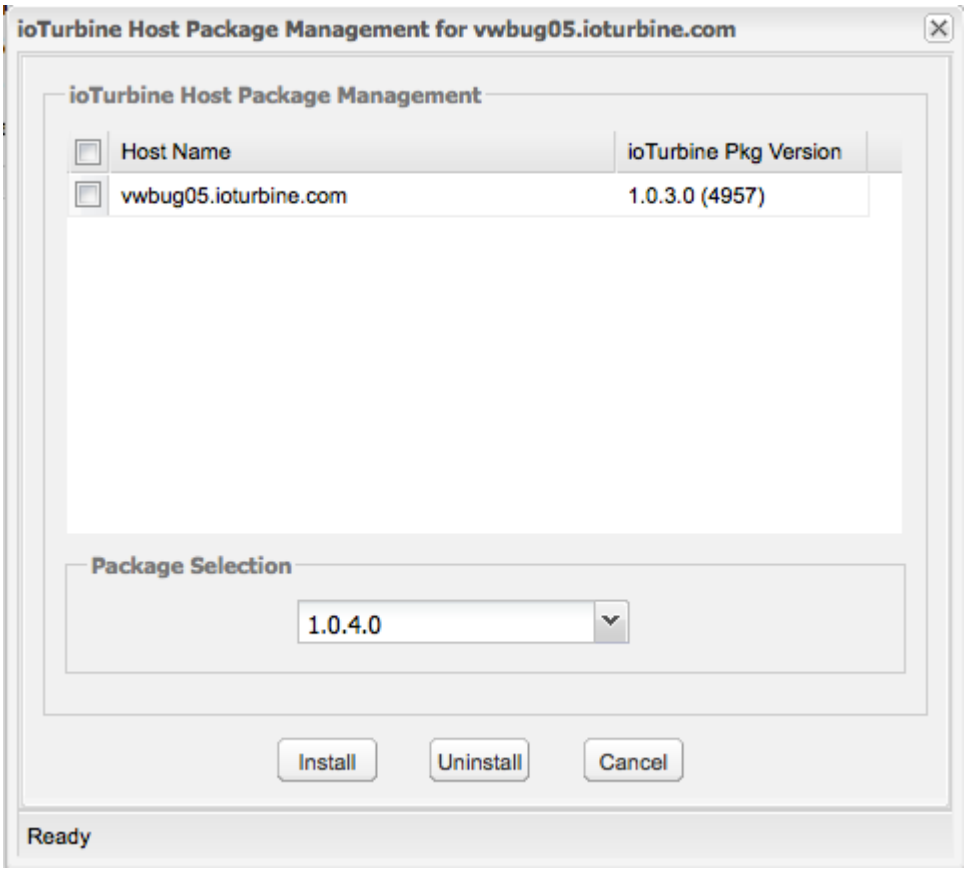
With the ioSphere VM Edition now connected to your Host or vCenter Server, the next step is to install the ioSphere VM Edition on your ESX Host (or Hosts).

This set of instructions shows you how to install on one Host:

1. In the Inventory tree:
    a. Right-click on one of the ESX Hosts.
    b. Choose **ioTurbine Host Package Management**.



2. In the ioTurbine Host Package Management screen:
   a. Click the check box next to the host on which you want to install the software.
   b. In the Package Selection drop-down list, select the current version of the software.



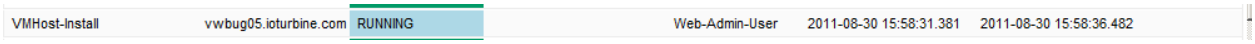
   c. Click **Install**.

> ⚠ Clicking Install will automatically reboot the host.

The installation task is scheduled for execution.

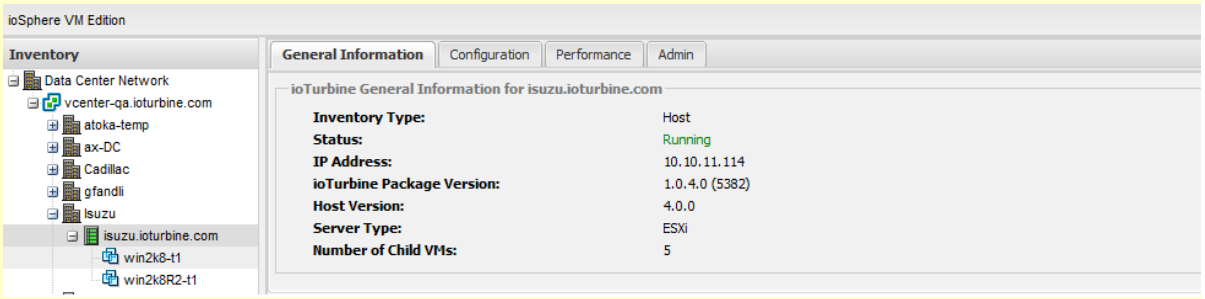
> ℹ To upgrade the Host software, select the newer software release version and click **Install**. This action upgrades the Host software package and maintains/upgrades the previous Host configuration.

3. Check the status of a particular task in the Recent Tasks window at the bottom of the screen.



The Recent Tasks window is updated every 20 seconds. The task field is also color-coded to make it easy to check the status at a glance.

Refresh the information:
The information in the General Information tab does not dynamically update in this release. Therefore, it will contin to show that the package is not installed. Click the name of the target Host in the Inventory tree to refresh the information to reflect the current status.



Using the CLI

Now that the Management Server is connected to your vCenter Server, the next step is to install the ioSphere VM Edition on your ESX Host (or Hosts).
The following commands are available to install or uninstall the ioTurbine package on an ESX Host:

1. To install the ESX Host package on a specific VM Host, type:

```
package –-install –-VMHost <host name> --version <version>
```

Where `<version>` is the current software version
Example:

```
package –-install –vmhost cartman.ioturbine.com –version 1.0.4.0
```

Reboot:
Installing and uninstalling the Host package requires a Host reboot.

2. To determine the software packages available for installation, type:

```
package --list
```

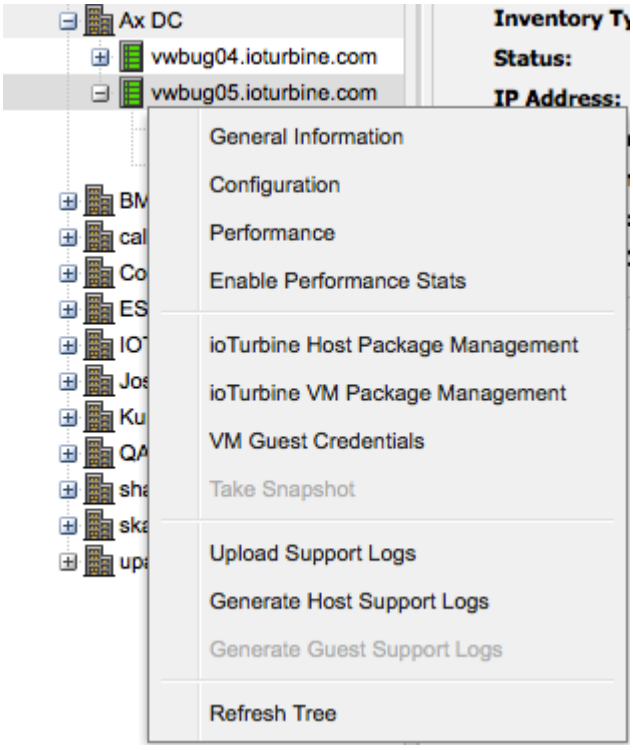
Configuring an SSD or PCI Flash Device on the Host

This section provides the GUI and the CLI instructions to configure the SSD or PCI Flash device.

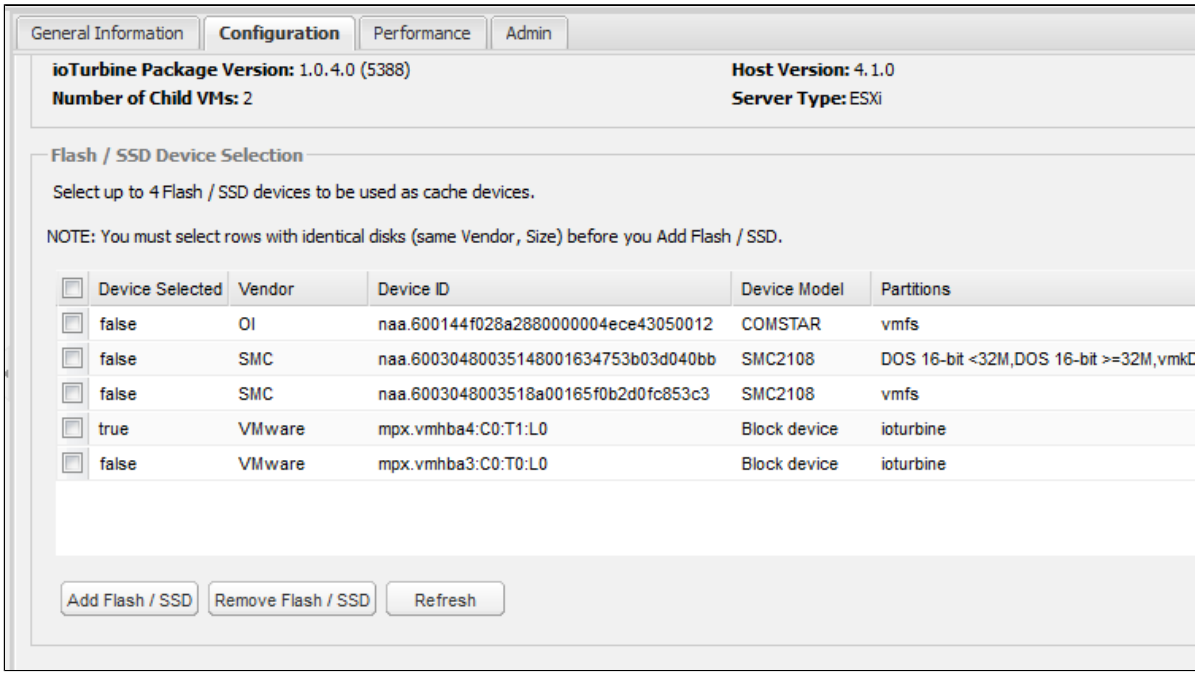
Using the GUI

In this procedure, you determine the IDs of the devices on the ESX Host and assign a device as your cache. Follow these steps to list all the ESX Host disks, and to assign the SSD or Flash devices to the ioTurbine system:

1. In the Inventory tree:
   a. Click on a specific Host.
   b. Choose **Configuration**.



The screen shows a list of all devices on the host, their sizes, and their associated vendor names. If your SSD/Flash device is installed on one of the many RAID controllers in the market, it most likely does not appear in the list by name. Your device name might also be unlisted if the device uses software drivers. Because of the potential lack of device information, and the cryptic nature of the device IDs that VMware supplies, the ioTurbine VMware Edition displays the device's model, partition type, and size to assist in selecting the proper device.



2. In the Configuration tab:
   a. Check the box next to the device that you are using.

Adding Devices:
If you want to use more than one device for caching, you must add all of them at this time. The devices that you select must all be identical in size, type, and vendor.

Data Deletion:
Make certain that the device or devices selected are correct because all information on the device(s) will be deleted. Be absolutely certain of your selections.

   b. Click **Add Flash/SSD**.

3. When you see the two warning messages, verify again that the devices you have selected are the correct ones, and click **Yes** to proceed (or click **No** to dismiss the dialog box).

Using the CLI

In this task, you determine the IDs of the devices on the ESX Host and then assign a device as your cache.
Use the following set of CLI commands to list all of the ESX Host disks and assign the SSD or Flash devices to the ioSphere VM Edition:

1. To list all LUNs on the specified host, type:

```
list --vmhost <host> --listluns
```

Example:

```
ioTurbine-mgmt-server-1.0> list --vmhost cartman.ioturbine.com
--listluns
```

The list shows each device's vendor name, model, size, and device ID.
In the following example, `[disk.04]` – actually a Fusion-io PCI device – is the potential candidate to use. If your SSD is installed on one of the many RAID controllers in the market, it probably will not be appear by name in the list. Because of this lack of device identification and the cryptic IDs of the VMware device IDs, the Management Server also displays the device's vendor name and size to assist in selecting the proper device.

```
Sr. no.     Vendor    Model        Size  Unit   Device Id
[disk.00]:  NETAPP    LUN          500.0 GB
naa.60a98000486e53735834624f6c756168
[disk.01]:  NETAPP    LUN          210.0 GB
naa.60a98000486e53496d346343414b4c6a
[disk.02]:  SEAGATE   ST3146855SS  136.7 GB     naa.5000c5000699fe23
[disk.03]:  NETAPP    LUN          525.0 GB
naa.60a98000486e53735834644f756c7352
[disk.04]:  VMware    Block device 298.0 GB     mpx.vmhba3:C0:T0:L0
```

Data Deletion:
Make certain that the device or devices that you select are correct because all information on the device(s) will be deleted. Be absolutely certain of your selections.

2. Once you know the device to use, assign it as the cache device by typing:

```
provision --vmhost <host> --addssd <device_id>
```

Example:

```
provision --vmhost cartman.ioturbine.com --addssd mpx.vmhba3:C0:T0:L0
```

> **Adding Devices:**
> If you want to use more than one device for caching, you must add them all, individually, at this time. You can use a maximum of four devices but all of them must be identical in size, vendor, and type.

3. Get a list of the assigned devices for a specific host by typing:

```
list --vmhost <host> --listssds
```

Installing the ioSphere VM Edition Guest VM Package

> **Reboot:**
> Installing and upgrading the Guest VM package requires a reboot.

This section provides the GUI and the CLI instructions to install the ioSphere VM Edition Guest components on one or more VMs. .

Using the GUI

The ioSphere VM Edition Management System makes it very easy to install the software package onto one or more Guest VMs in a cluster.

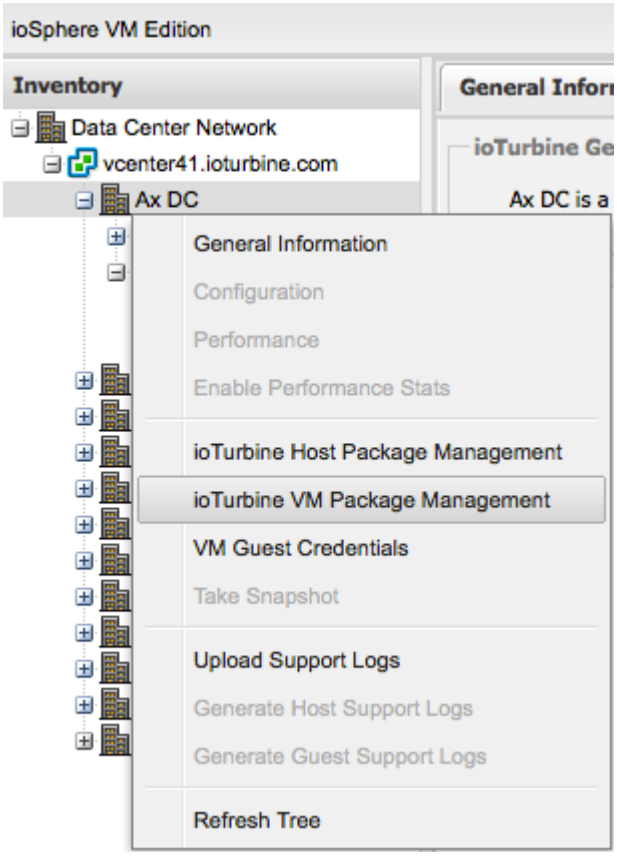
> **Active Directory Domain:**
> If the network on which you are testing ioSphere VM Edition is part of an Active Directory domain, you must make some changes to allow the ioSphere VM Edition Guides components to install and run properly. Refer to *Appendix B - Configuring Active Directory*, which provides the required steps.

Follow these steps to download and install the Guest VM Packages:

> **Power-on Guest VMs:**
> The Guest VMs must be powered-on and running VMware Tools before you can install the ioSphere VM Edition software.

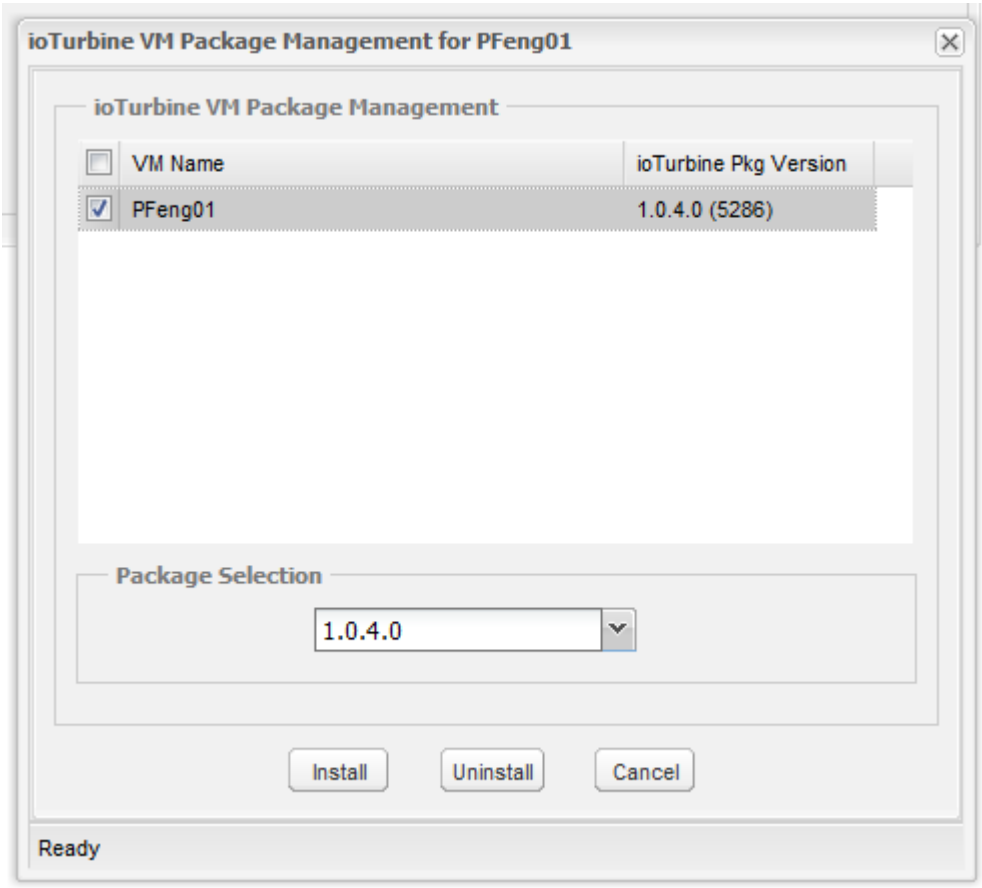
1. In the Inventory tree:
    a. Right-click the name of the target cluster that your Guest VMs reside in.

    b. Choose **ioTurbine VM Package Management**.



The system displays all of the Guest VMs within the selected cluster.

2. In the ioSphere VMPackage Management screen:
    a. Click the check box next to each Guest VM on which you want to install.
    b. In the Package Selection drop-down list, select the current version.



    c. Click **Install**.

> To upgrade the Guest software, select the newer software release version and click **Install**. This action upgrades the Guest software package and maintains/upgrades the previous Host configuration.

3. At the warning prompt informing you that the installation process will **reboot** your Guest VMs, click **Yes** to proceed.

Using the CLI

> **Power-on Guest VMs:**
> The Guest VMs must be powered-on and running VMware Tools before you can install the ioSphere VM Edition software.

Active Directory Domain:
If the network on which you are testing ioSphere VM Edition is part of an Active Directory domain, you must make some changes to allow the ioSphere VM Edition Guide components to install and run properly. Refer to *Appendix B - Configuring Active Directory*, which provides the required steps.

The following set of commands provides the ability to install and uninstall Guest VM packages:

- To install the Guest VM software package onto a specified Guest VM, type:

```
package --install vmguest <guest> --version <version> [--guestuser
<user> [--guestpassword <password>]]
```

  Example:

```
package ---install --vmguest 2k8r2cartman ---version 1.0.4.0
```

Reboot:
Installing and uninstalling the Host package requires a Host reboot.

- To uninstall the Guest VM software package and automatically reboot the VM, type:

```
package ---uninstall vmguest <guest> [--guestuser <user>
[--guestpassword <password>]]
```

- To check which software packages are available for installation, type:

```
package --list
```

Configuring Guest VM Settings

Configuring Guest VM settings involves setting capacity shares to provision Guest VMs and cache information at the volume level, disk level, and file level. For more information, please refer to the *Caching* section.

Overview

Before you can cache any information, you need to decide what it is that you want to cache:

- If you are running Microsoft Exchange or SQL Server, for example, then volume-level caching is advised (cache the database volume, not the log volume).

- If you are running applications that require direct (raw) disk access, then disk-level caching is the appropriate choice.
- If you have "hot" files that you do not want paged from disk, then you can specify those using file-level caching.

> The three caching levels are mutually exclusive. If you specify a volume to be cached, you cannot designate individual files on that same volume, and vice-versa. If you specify a disk to be cached, you cannot use volume-level or file-level caching on that disk.

For all three types of caching, ioSphere VM Edition follows the VMware "shares" model. This model determines resource allocation based on the relative weighting of the shares of two or more VMs when assigning cache capacity.
Once you have assigned some portion of the Flash to an individual Guest VM, you can then assign it to one of the three filtering levels:

- Volume level
- Disk level
- File level

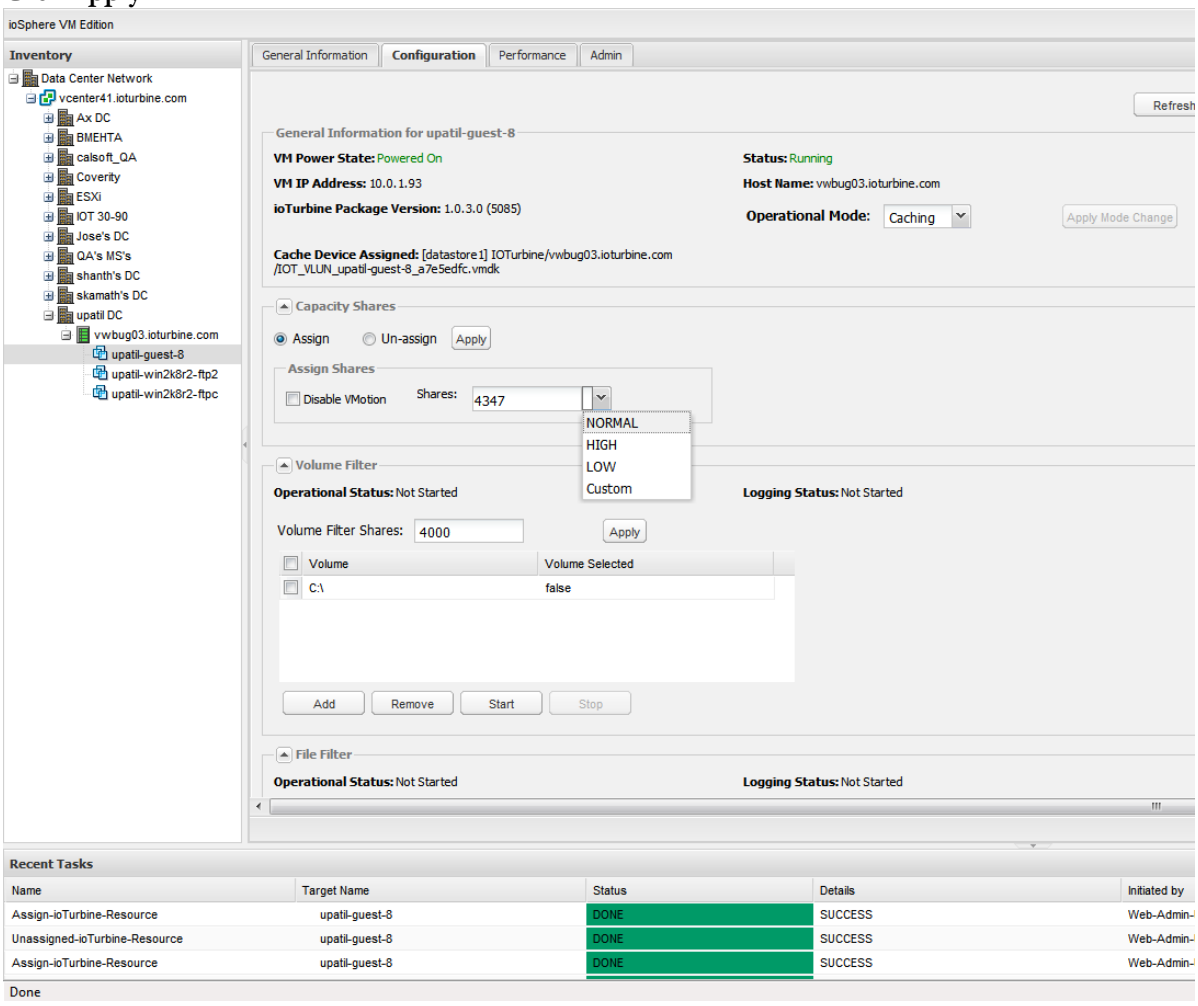
All of the shares are assigned to the volume-level filter by default. If you anticipate using the other two filters (file level and disk level) as well, then you can specify the subset re-allocation using the GUI or the CLI.

Using the GUI

Use the GUI to set Capacity Shares to configure caching at the volume level, disk level, and file level.
Follow these steps:

1. Go to the ioSphere VM Edition Inventory tree.
2. Expand a particular cluster or data center by clicking the + sign next to the cluster name to see the Hosts and Guest VMs contained within it.
3. Select a particular Guest VM.
4. Click the **Configuration** tab.
5. In the Capacity Shares section, select **Assign** or **Un-assign**.
    - If you select **Assign**, the following options appear:
        - **Disable VMotion**: If vMotion is disabled, then shared storage is not required for setting capacity shares.
        - **Shares** drop-down list: In the Shares drop-down list, select **NORMAL** (4000), **HIGH** (8000), **LOW** (2000), or **CUSTOM**. If you select CUSTOM, enter the desired value in the Shares field.
    - If you select **Un-Assign**, no additional options appear. Continue to the next step.

6. In the Volume Filter section, perform one of two options:
   - Change the number of shares and click Apply.
   - Alternatively, select which drive (C, D, or E volume, for example) that you want to cache.
7. In the Disk Filter section:
   a. Click the **Add** button.
   b. In the Disk Filter Shares field, type `0` or `1` (to specify the disk).
   c. Click **Apply**.
8. In the File Filter section:
   a. Change the number of shares.
   b. Click the **Rules** check box if you want to specify rules as to which files can be cached (such as caching all `.exe` files, for example).
   c. Click **Apply**.



Using the CLI

This section provides the configuration commands available for provisioning a Guest VM in the ioSphere VM Edition and those you can use for day-to-day operations.

Commands to Specify Capacity Shares

This section provides the commands to assign shares to a Guest VM and to specify the number of shares to use for each level of caching.

1. To see how many share are assigned to a Guest VM, type:

```
list --vmguest <guest> --getcapacityshares
```

2. To assign a specific number of shares to a Guest VM, type:

```
provision --vmguest <guest> --setcapacityshares <shares>
[--disablevmotion]
```

   This share value represents the total SSD/Flash capacity being allocated to this VM relative to all other running VMs.

   Use the `[--disablevmotion]` option if you do not require vMotion support.
   Example:

```
provision --vmguest 2k8r2cartman --setcapacityshares 4000
--disablevmotion
```

3. Divide the Flash further:
   All of the shares are assigned to the volume-level filter by default. If you anticipate using the other two filters (file level and disk level) as well, then you must use the setallshares command (described in the next step).

4. Specify the number of shares to use for each level of caching by typing:

```
setallshares <file volume disk> [--guestuser <user> [--guestpassword
<password>]]
```

The values set here adjust the relative weighting of the capacity allocation – granted in Step 1 – among the three filtering levels (file level, volume level, disk level).
Example:

```
provision --vmguest 2k8r2cartman --setallshares 1000 2000 1000
```

Volume-Level Commands

This section provides the volume-level commands to:

Identify What Volumes Exist on a Guest VM

```
list --vmguest <guest> --listallvolumes [--guestuser <user> [--guestpassword
<password>]]
```

Cache a Specific Volume (for example, `C:`)

```
provision --vmguest <guest> --addvolume <primary_volume_name> [--guestuser
<user> [--guestpassword <password>]]
```

Example:

```
provision --vmguest 2k8r2cartman ---addvolume e:
```

Start Caching at the Volume Level

```
provision --vmguest <guest> --startvolumecache [--guestuser <user>
[--guestpassword <password>]]
```

See the List of Cached Volumes Defined for a Guest VM

```
list ---vmguest <guest> --listvolumes [--guestuser <user> [--guestpassword
<password>]]
```

Remove a Cached Volume From the Caching List

```
provision ---vmguest <guest> --deletevolume <primary_volume_name>
[--guestuser <user> [--guestpassword <password>]]
```

Example:

```
provision --vmguest 2k8r2cartman ---deletevolume d:
```

Stop Volume Caching

```
provision ---vmguest <guest> --stopvolumecache [--guestuser <user>
[--guestpassword <password>]]
```

Disk-Level Commands

This section provides the disk-level commands to:

Cache a Specific Disk (for example, Disk1)

```
provision --vmguest <guest> --adddisk <primary_disk_name> [--guestuser
<user> [--guestpassword <password>]]
```

Example:

```
provision --vmguest 2k8r2cartman ---adddisk disk2
```

Start Caching at the Disk Level

```
provision --vmguest <guest> --startdiskcache [--guestuser <user>
[--guestpassword <password>]]
```

Remove a Cached Disk From the Caching List

```
provision ---vmguest <guest> --deletedisk <primary_disk_name> [--guestuser
<user> [--guestpassword <password>]]
```

Example:

```
provision --vmguest 2k8r2cartman ---deletedisk disk2
```

Stop Disk Caching

```
provision ---vmguest <guest> --stopdiskcache [--guestuser <user>
[--guestpassword <password>]]
```

File-Level Commands

This section provides the file-level commands to:

Specify a File for Caching (for example, `C:appsmyfile.exe`)

```
provision --vmguest <guest> --addfilerule <full_path_filename>
```

```
[--guestuser <user> [--guestpassword <password>]]
```

Example:

```
provision --vmguest 2k8r2cartman ---addfilerule c:windowssystem32wow64.dll
```

Start Caching at the File Level

```
provision --vmguest <guest> --startfilecache [--guestuser <user>
[--guestpassword <password>]]
```

Modify the List of Files Being Cached
You cannot remove individual file rules in this release.
The workaround is to:

1. Delete the entire list of file rules by typing:

   ```
   provision ---vmguest <guest> --deleteallfilerules [--guestuser <user>
   [--guestpassword <password>]]
   ```

2. Add the file names that you want to cache.

Stop File Caching

```
provision ---vmguest <guest> --stopfilecache [--guestuser <user>
[--guestpassword <password>]]
```

Caching

ioTurbine provides write through caching software that can take advantage of Flash devices on the host to accelerate IOs.

Levels of caching

ioTurbine supports caching at three levels – volume, disk, and file. Flash cache can be allocated at three levels – volume, disk, and file using **capacity shares**.

1. By default, volume level gets 100% of the capacity shares, while disk and file levels have 0%.
2. Users can allocate 'x' shares for file level caching, 'y' shares for volume level caching, and 'z' shares for disk level caching. The host component of the ioTurbine software manages aggregate amount of shares (x + y + z) allocation across volume, disk, and file levels inside the guest VM.

Limits of caching at different levels

The following limits apply to the different levels of caching on a per guest VM basis.

Level	Number Limit	Size Limit
Volume	16 volumes	4TB each volume
Disk	16 disks	4TB each disk
File	8192 files	8GB per file

Cache Invalidation

The following operations will result in invalidating the cache in a guest VM and thereby causing the process of warming it up again. Cache invalidation in one guest VM doesn't affect the caches on other VMs running on the host.

1. Changing shares at different caching levels – disk, volume, and file.
2. VM is vMotion.
3. Changing parameters such as: compression ratio, cache page size, and cache maximum read/write IO size.

Caching Notes

1. ioTurbine software does not cache data on network file systems (such as CIFS, NFS) inside the guest VMs.
2. ioTurbine File Level caching only caches data on NTFS file systems.
3. ioTurbine File Level caching doesn't cache sparse files.
4. ioTurbine File Level caching doesn't cache files with NTFS transactional feature enabled.
5. ioTurbine File Level caching doesn't cache *non-cached/direct* IOs. If an application does *non-cached/direct* IO, we recommend the use of ioTurbine Volume Level caching or ioTurbine Disk Level caching.
6. ioTurbine File Level caching supports only one paging file (e.g. "pagefile.sys") per guest OS. If there are more than one paging files in the guest OS, ioTurbine File Level caching caches the one opened first.
7. ioTurbine File Level caching requires a guest VM reboot to enable paging file (e.g. "pagefile.sys") caching if the paging file is not currently included at file level caching.
8. ioTurbine File Level caching invalidates the cached data at file level when an NTFS volume is detached regardless of whether there are files in the volume that are cached.
9. If a file, volume, or disk exceeds the size limit, ioTurbine software only caches the data located within the size limit of the respective layer.

Using Data Compression

This chapter provides information about data compression in Guest VM provisioning, and the GUI and CLI instructions to use this advanced, optional feature.

Overview

The ioSphere VM Edition software supports storing data in a compressed format in the cache.

The ioTurbine Compression feature enables Flash capacity to be optimized by compressing the virtual workload cache data where possible. However, the effective compression ratio (for example, 2:1 or 4:1) depends on the specific workload data in question and the compressibility of this data.

It is important to note that the Compression feature has CPU and memory overhead, which varies depending on data compressibility. Therefore, you must be fully aware of the intricacies and trade-offs associated with this feature before

purchasing it.

Compression Settings

The Compression feature is turned off by default because it requires the purchase of an additional license to enable the feature. Once enabled, you can use the Compression feature on a per Guest VM basis.
The settings for the Compression feature are:

- 1 — Compression is turned off.
- 2 — Compression is turned on, and ioTurbine compresses the data that needs to be stored in the cache. If it compresses at 2x or higher, then the data is stored in the compressed format. If the compression is less than 2x, the data is stored uncompressed in the cache.

> ⚠ Memory Consumption:
> The Compression feature consumes more CPU and two times more memory in the Guest VM.

Using the CLI

To compress the data in the cache, type:

```
---vmguest <guest> – SetVolumeCompressionRatio <1 | 2> [optcreds]
```

Status Monitoring

This chapter provides the GUI and the CLI instructions to obtain information about a Guest VM.

You can view the following details about a Guest VM:

- General information
- Volume-specific status
- Disk-related status
- File-specific status
- The ioSphere VM Edition package version

Using the GUI

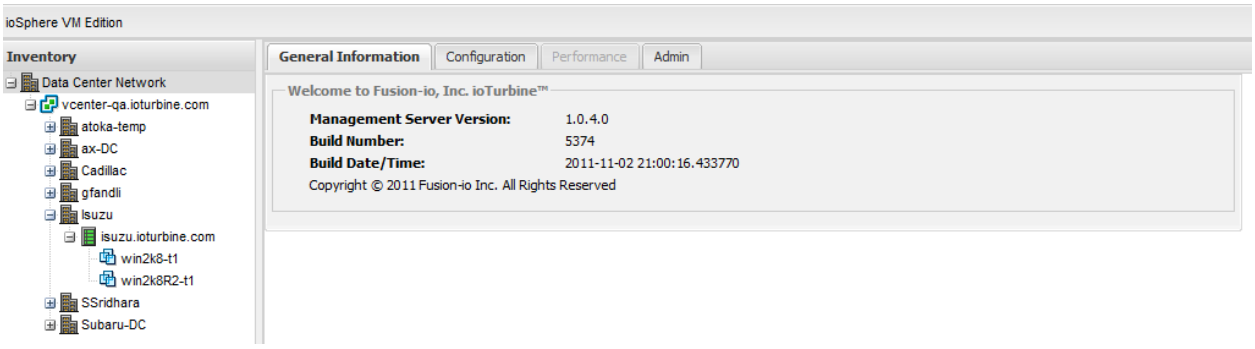
This section contains the GUI instructions to obtain:

- General information about a Guest VM
- Disk-related status for a Guest VM

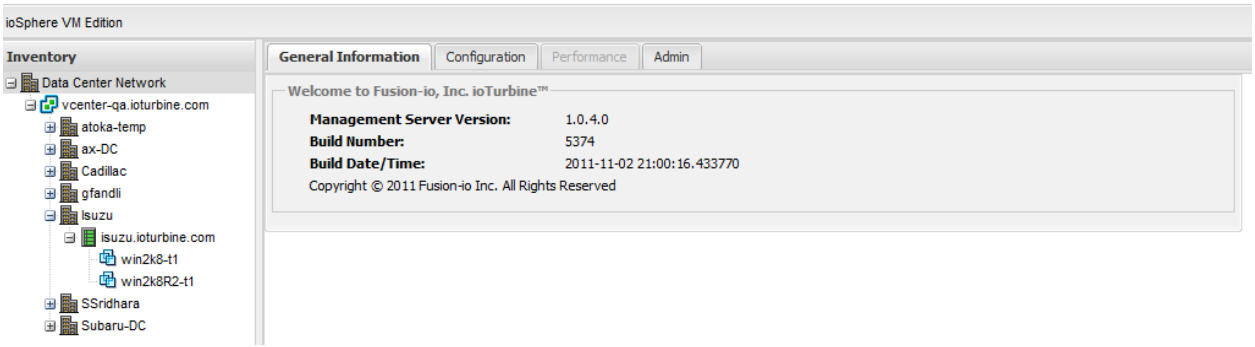
View General Information about a Guest VM

To obtain information about a Guest VM:

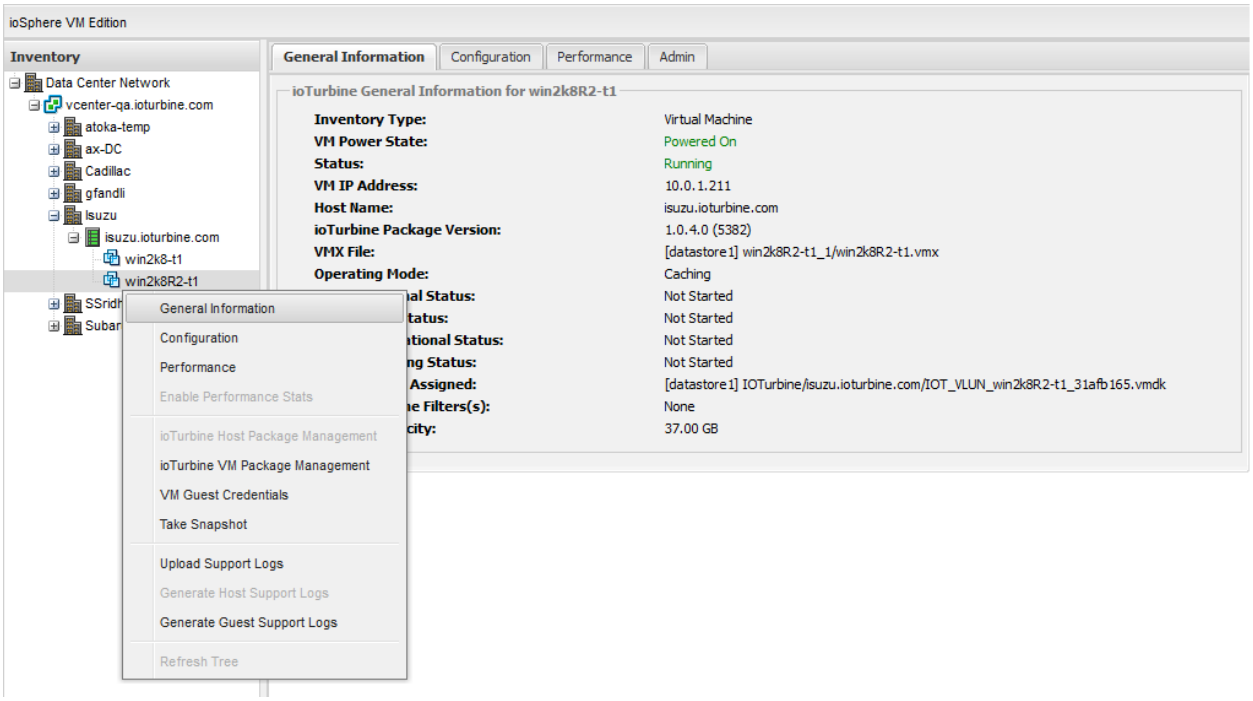
1. Go to the ioSphere VM Edition Inventory tree.



2. Expand a particular cluster or data center by clicking the + sign next to the cluster name to see the hosts and the Guest VMs contained within it.



3. Right-click on the Guest VM that you want to obtain information about and click the General Information tab.



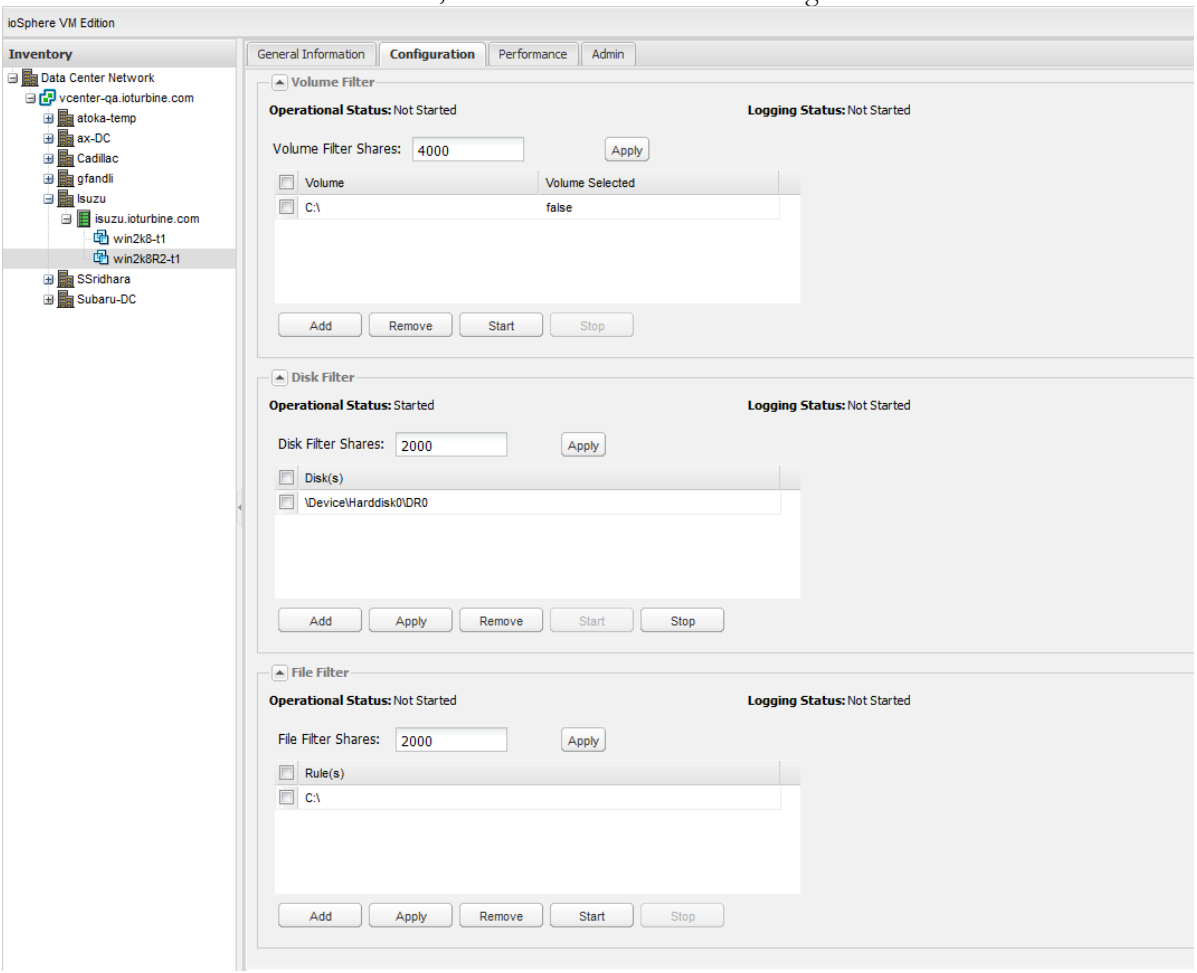
View Disk-Related Status for a Guest VM

You can add a disk for a Guest VM if you know the disk name. You can also delete a disk.

> The 1.0.4.0 release does not presently support the capability to obtain a list of available disks on a particular Guest VM.

Follow these steps:

1. Go to the ioSphere VM Edition Inventory tree.
2. Expand a particular cluster or data center by clicking the + sign next to the cluster name to see the Hosts and Guest VMs contained within it.
3. Click the **Configuration** tab.
4. In the Disk Filter section:
    a. Click **Add** to add the name of the disk, or select the name of an existing disk and click *Remov*e.



    b. Click **Apply**.

Using the CLI

This section provides the commands to monitor the status of Guest VMs in the ioSphere VM Edition ecosystem.

View General Information about a Guest VM

```
list –-vmguest <guest> [--guestuser <user> [--guestpassword <password>]]
```

Example:

```
list --vmguest 2k8r2cartman
[2011-07-12 11:48:51,502]
RESULT:
Uuid: 5023c55a-4954-ee81-d2d6-a7c45e84f903
Logging Status: Logging Not Started
Vmx File: [lun500] 2K8R2cartman/2K8R2cartman.vmx
Host: cartman.ioturbine.com
ioTurbine Resource Pool Assigned Name: None
Caching Status: Caching Started
Type: VM
Vlun Connected: true
Guest: Microsoft Windows Server 2008 R2 (64-bit)
ioTurbine Package Name:
Host IP Address: 10.10.105.80
IP Address: 10.0.1.92
Compression Ratio: 1
ioTurbine Package Version: 1.0.1.0 (4313)
Operating Mode: Caching
```

View Volume-Specific Status Information for a Guest VM

```
list –vmguest <guest> --volumestatus [--guestuser <user> [--guestpassword
<password>]]
```

Example:

```
list --vmguest 2k8r2cartman --volumestatus
RESULT:
Opmode: 0x0
Mode: Caching
Caching Status: Started
Logging Status: Not Started
Caching Device Assigned: true
Cache Device Name: VLUN Device
Cache Size in Use: 106300440576
Cache Size in Chunks: 396
Compression Ratio: 1
Configured Filters (1):
E:
Shares Allocated: 2000
```

View Disk-Related Status Information for a Guest VM

```
list --vmguest <guest> --diskstatus [--guestuser <user> [--guestpassword
<password>]]
```

View File-Specific Status Information for a Guest VM

```
list --vmguest <guest> --filestatus [--guestuser <user> [--guestpassword
<password>]]
```

View ioSphere VM Edition Package Version Information for a Guest VM

```
list --vmguest <guest> --version [--guestuser <user> [--guestpassword
<password>]]
```

View Current Status of a Task Started by a CLI Command

```
jobsched --status <task-id>
```

Performance Monitoring

This chapter provides the GUI and CLI instructions to monitor the statistics in the ioSphere VM Edition ecosystem.

> **Adobe Flash:**
> You must install Adobe Flash to see the performance graphs.

Using the GUI

This section provides the steps to view performance statistics using the GUI.
Viewing Current Performance Statistics
Follow these steps:

1. From the Guest VM drop-down list, select the desired Guest VM.
   The list of Guest VMs that appear are those participating in the caching process (reading data from the cache as opposed to the Primary Storage database).
2. In the Filter drop-down list, select **VOLUME**.
3. In the Type drop-down list, select **CURRENT**.

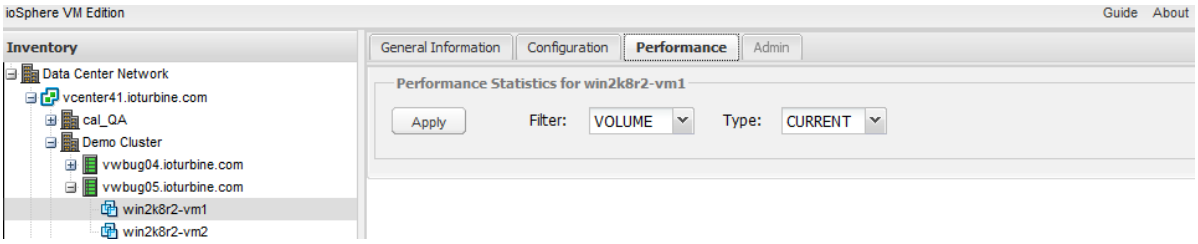
   > The CURRENT setting plots the last 60 minutes worth of statistics.

4. Click **Apply**.
   The ioSphere VM Edition collects statistics data from each ESX Host every five minutes. Therefore, it takes this amount of time for the performance graphs to start showing the information.

5. To view the performance statistics for an individual Guest VM:
    a. In the Inventory tree, select the applicable Guest VM.
    b. Click the **Performance** tab.
    c. Keep the Type drop-down list value as **CURRENT**.

> The CURRENT setting plots the last 60 minutes worth of statistics.

    d. In the Filter drop-down list, select **VOLUME** or **FILE** to obtain volume-level or file-level statistics.



    e. Click **Apply**.

6. See different performance statistics in the three tabs:

- Cache Hits and Capacity Utilization (%) tab

Cache Hits captures the percentage of read I/O offloaded from the primary storage to the cache. A high value usually indicates that a significant fraction of the application's working set is present in the cache. Cache Utilization is the percentage of cache space currently in use.

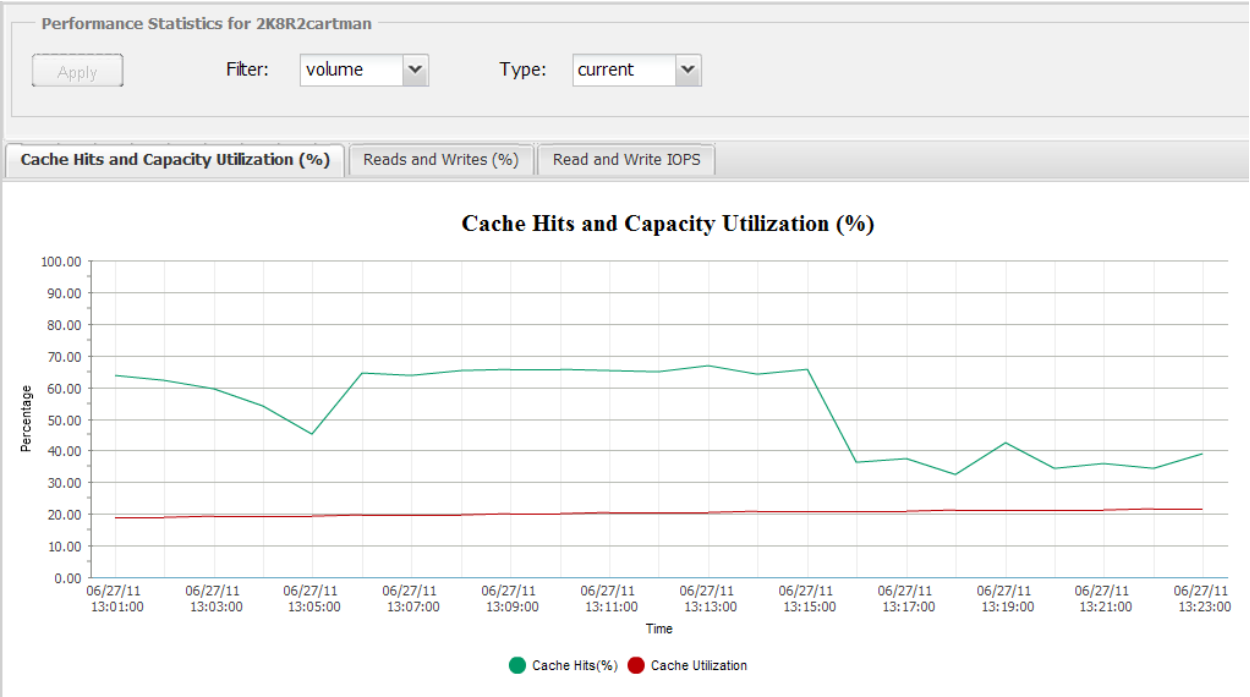
- Read and Writes (%) tab - These statistics capture the percentage of read and write operations performed in the guest VM.
- Read and Write IOPS tab - These statistics capture the total number of read and write I/O operations per second performed in the guest VM.

The purpose of these statistics is to report on the effectiveness of the ioTurbine caching software. By offloading read I/Os from the primary storage system to a locally attached cache device, ioTurbine software helps alleviate the IO bottleneck in the primary storage system. As well, depending on the performance characteristics of the cache device, this offloading of reads can accelerate application performance.

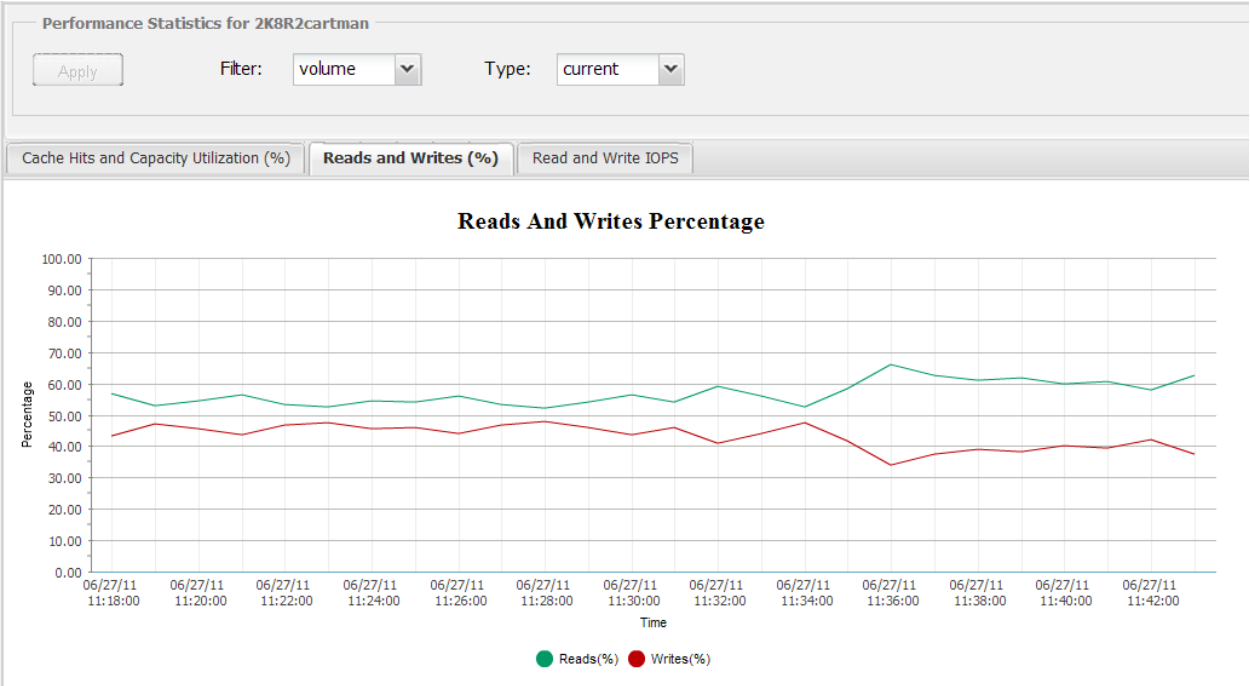
You will see a marked difference in the IOPS count when caching is disabled versus enabled: the green line for IOPS will jump up.

The Cache Hit ratio indicates when the ioSphere VM Edition is "warming the cache." This means that every time your Reads access the Prmary Storage to retrieve data, ioSphere VM Edition writes that data to the cache. The next time the application reads the same data, it reads it from the cache, and this action causes the Cache Hit ratio to increase.

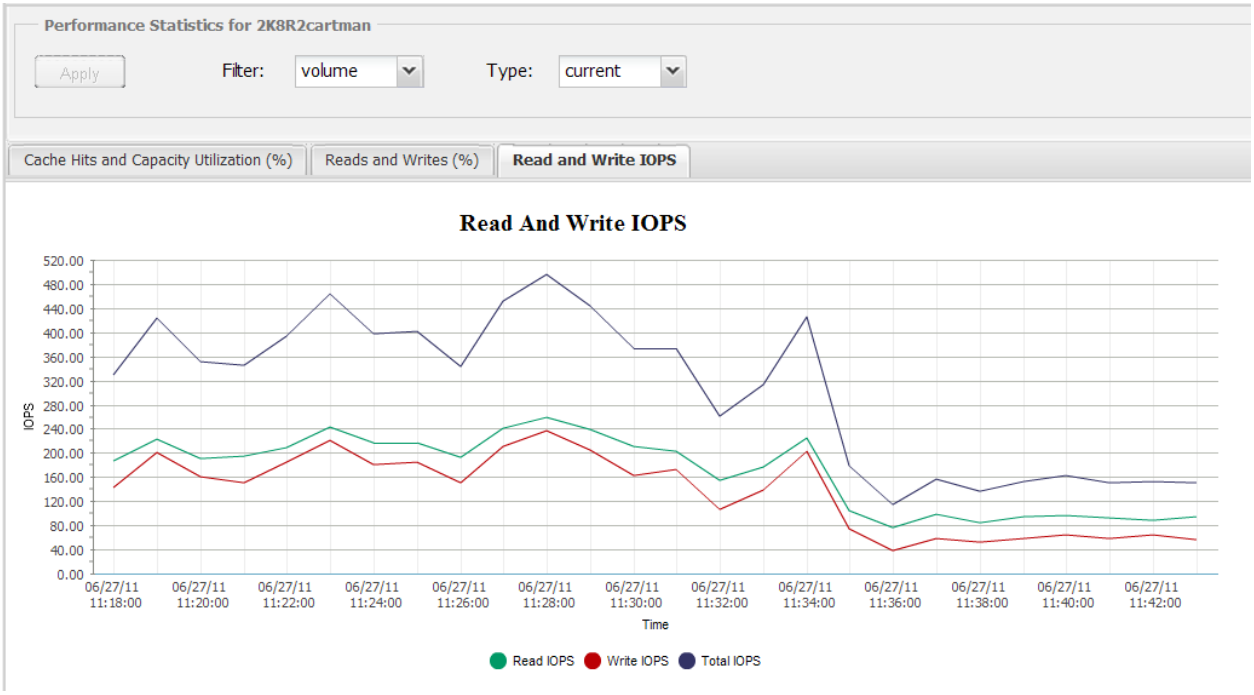
- Cache Hits and Capacity Utilization (%) tab



- Reads and Writes (%) tab



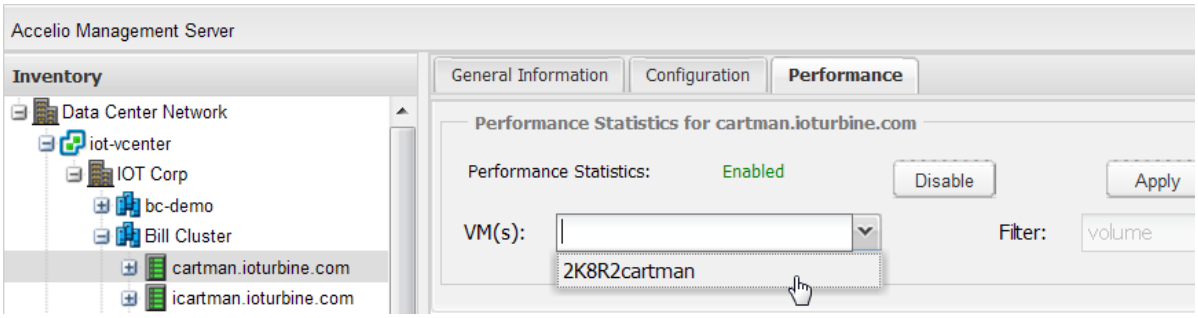
- Read and Write IOPS tab



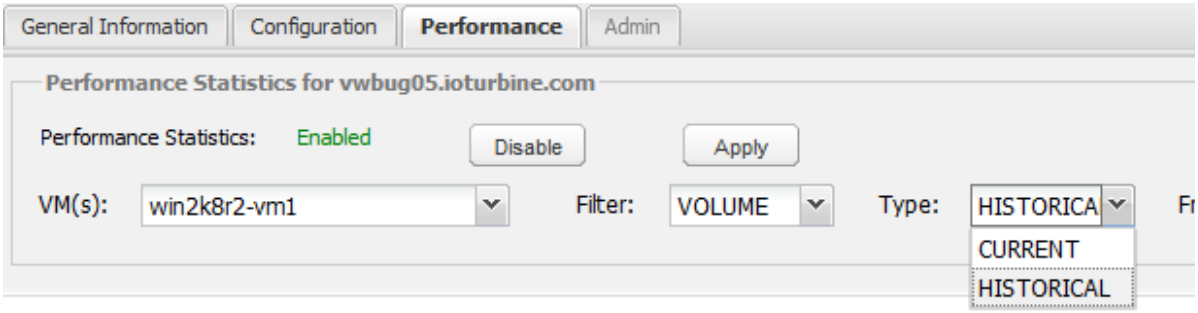
Viewing Historical Performance Statistics

You can see historical performance statistics within the last 30 days for any particular period of time that you specify. Using the calendar feature, you pick an actual date and time for the source, and an end date and time.
Follow these steps:

1. In the Inventory tree, select a Host.
2. Click the **Performance** tab.
3. In the **Performance** tab:
    a. Click the VM(s) drop-down list and select a Guest VM on the Host.



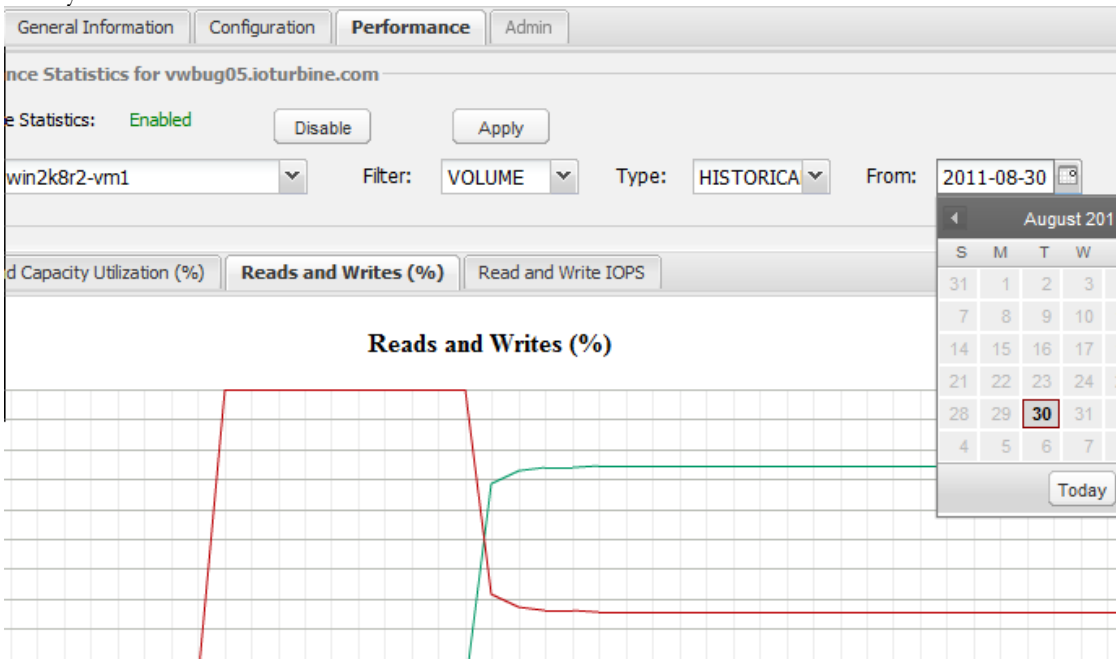
b. In the Type drop-down list, select HISTORICAL.



c. Select starting and ending dates and times.
The values are set to the widest possible range by default. You can adjust the range using the From and To drop-down lists and selecting dates from the calendar (and the available times that the system presents).
Based on your selection, the software determines whether to show you daily, hourly, or per-minute statistics. The range that you specify determines what you will see.

If you select an interval for:

- Days — you see the daily statistics
- Less than 24 hours — you see the hourly statistics
- Less than 1 hour--- you see the per-minute statistics for that particular hour of any day for the last 30 days



d. Click **Apply**.
Graphs shown using the historical setting automatically scale the display based on the time period chosen.

Using the CLI

This section provides the CLI commands to monitor performance in the ioSphere VM Edition ecosystem.

Follow these steps:

1. To use the performance monitoring features in the ioSphere VM Edition, you must first enable the collection of Guest VM statistics:

```
stats --enablehost <host> [--interval <poll interval in seconds>]
```

> If you do not use the optional --interval argument, polling defaults to every five minutes (300 seconds).

2. Display the statistics for a Guest VM at the volume level, file level, and disk level described in the subsequent sections.

Volume-Level Statistics

```
list --vmguest <guest> --volumestats [--guestuser <user> [--guestpassword
<password>]]
```

Example:

```
list --vmguest 2k8r2cartman --volumestats
RESULT:
Hits                        : 31,126
Hit Ratio                   : 10.79%
Misses                      : 257,363
Miss Ratio                  : 89.21%
Number of Reads             : 54,436
Number of Writes            : 42,756
Number of Cache Page Reads  : 288,487
Number of Cache Page Writes: 128,752
```

File-Level Statistics

```
list --vmguest <guest> --filestats [--guestuser <user> [--guestpassword
<password>]]
```

Disk-Level Statistics

```
list --vmguest <guest> --diskstats [--guestuser <user> [--guestpassword
<password>]]
```

Disable Statistics Collection

To disable statistics collection:

```
stats --disablehost <host>
```

Support Functions

If you encounter errors using the ioSphere VM Edition software, Fusion-io personnel might instruct you to send them log files from the Management Server.

There are three types of logs:

- Management Server logs
- Guest VM logs
- Host logs

Using the GUI or the CLI, this chapter describes how to:

- Create the log files
- Upload the log files using the built-in FTP function

Using the GUI

This section describes the GUI steps to create and upload Management Server, Guest VM, and Host logs.

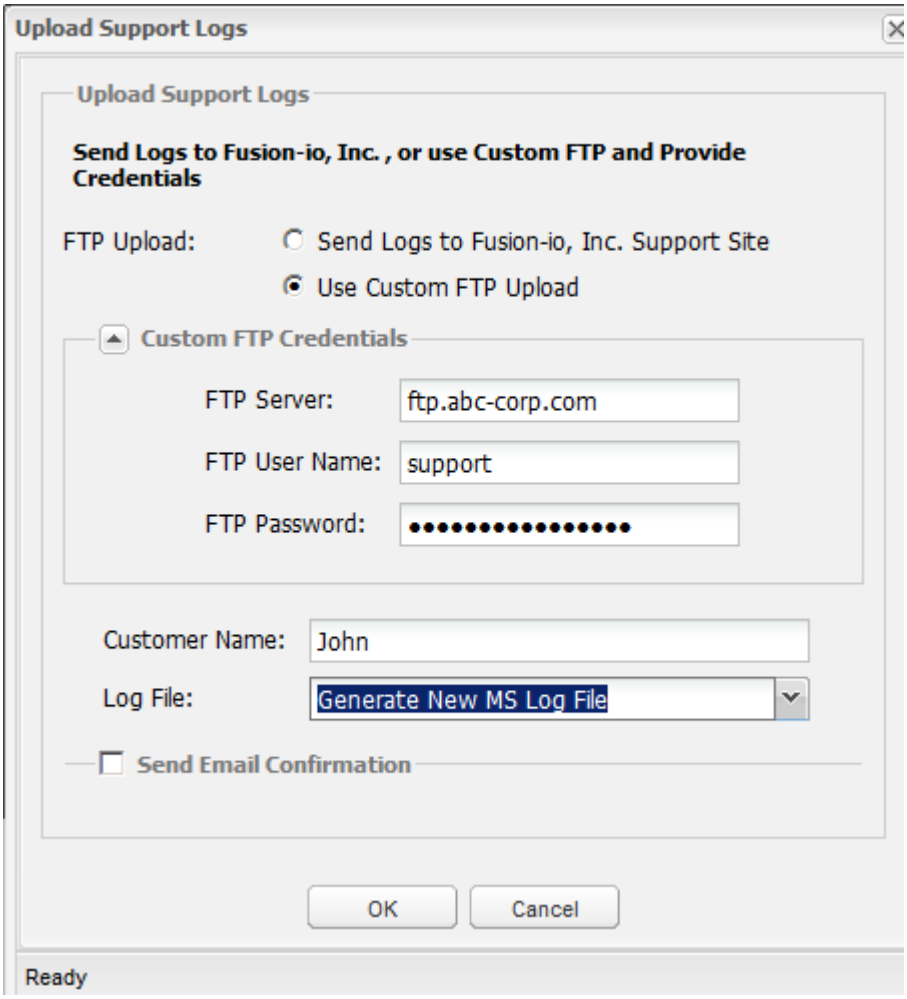
Management Server Logs

To create and upload Management Server logs, follow these steps:

1. To create ioSphere VM Edition logs, right-click the top of the Inventory tree and choose **Upload Support Logs**.

2. In the Upload Support Logs screen:
    a. In **FTP Upload**, select one of the following:
        - Send Logs to Fusion-io, Inc. Support Site — the option that you would choose most frequently.
        - Use Custom FTP Upload — the option to send the files to another FTP location. If selected, complete the Custom FTP Credentials section with the applicable information.
    b. In the **Customer Name** field, type your name.
    c. In the **Log File** drop-down list, select **Generate New MS Log File**.

> File names for the Management Server logs begin with the prefix: `YYYY-MM-DD_`



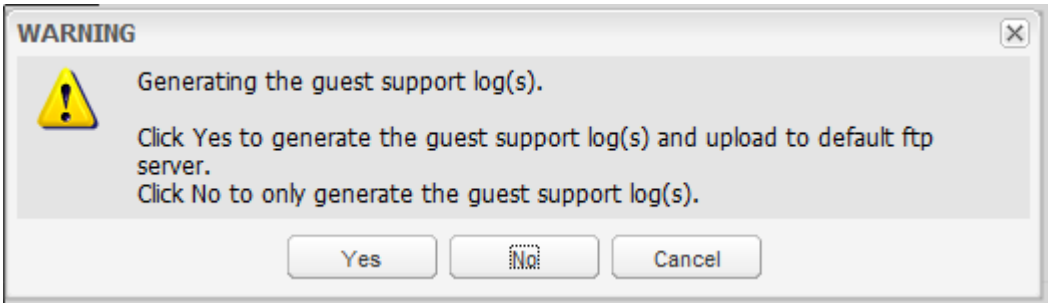
    d. Click OK to create and upload the log file.

3. Once the log files are successfully transferred, click OK to dismiss the confirmation dialog box.

Guest VM Logs

To create and upload Guest VM logs, follow these steps:

1. In the Inventory tree, right-click on the particular Guest VM that you want to generate logs for and choose Generate Guest Support Logs.
2. In the **Warning** dialog box, click one of the following:
   - **Yes** — to create the log and upload it in one step.
   - **No** — to store the file for now.



> File names for the Guest VM logs begin with the prefix: `VM_`

Host Logs

To create and upload Host logs, follow these steps:

1. In the Inventory tree, right-click on the particular Host that you want to generate logs for and choose Generate Host Support Logs.
2. In the **Warning** dialog box, click one of the following:
   - **Yes** — to create the log and upload it in one step.
   - **No** — to store the file for now.

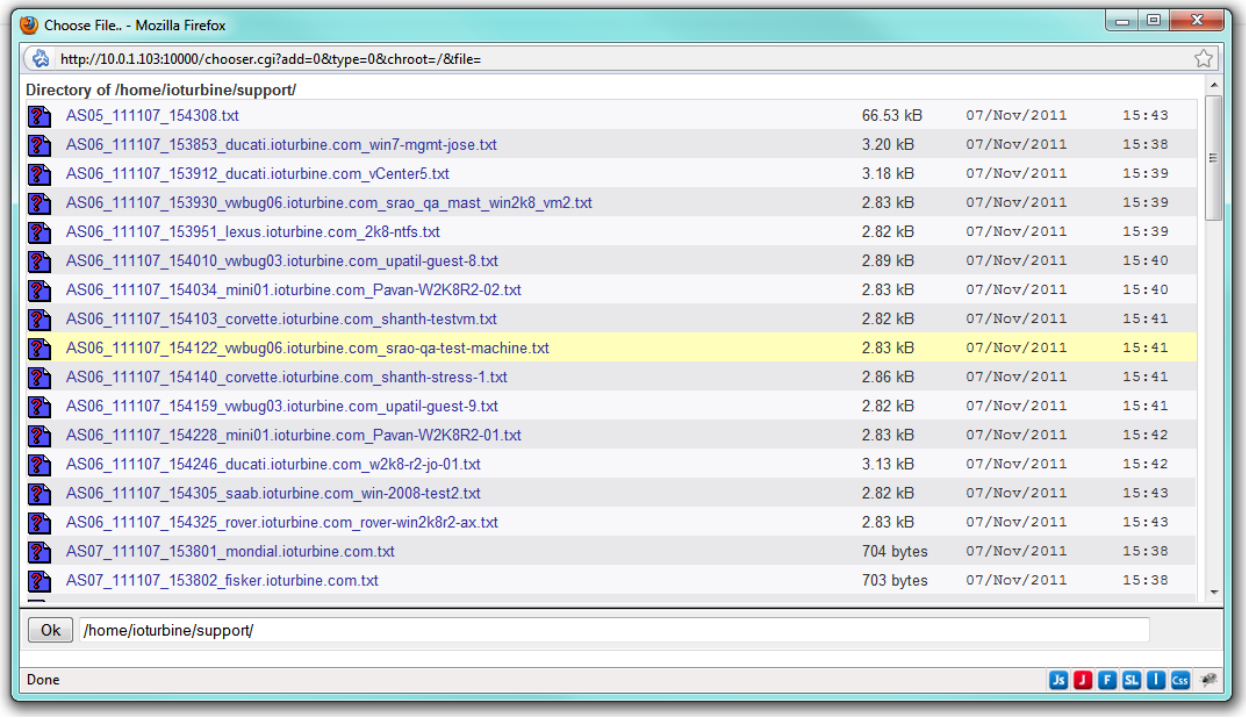
> File names for the Host logs begin with the prefix: `ESX_`

Using the Webmin for Local SUB Gathering

If you have an internal firewall that prevents the host from uploading support logs to ioTurbine directly, you can use the Webmin to download the log. You can then email it to your support representative.

1. Generate the log as described above.
2. In your web browser, navigate to `<management server ip>:10000`.

3. Log in using `iotsupport` for the user name and the password.
4. Browse to the support log and download it.



Using the CLI

This section provides the commands to create and upload logs for the Management Server, Guest VM, and Host.

Management Server Logs

1. To create logs for the Management Server, type:

```
support --ms
```

Example:

```
support --ms
```

Backup in `support/2011-07-25_12.03.17.zip`

File names for the Management Server logs begin with the prefix: `YYYY-MM-DD_`

To upload the logs for the Management Server, type:

```
support --uploadfile <file name>
```

Example:

```
support --upload 2011-07-25_12.03.17.zip
```

Guest VM Logs

To create and upload logs for the Guest VM, type:

```
support --vmguest <guest> --unblock [--upload]
```

Example:

```
VM_110725_121554_cartman.ioturbine.com_2k8r2node.cab
```

The command automatically uploads the file if you use the `--upload` option.

> File names for the Guest VM logs begin with the prefix: `VM_`

Host Logs

To create and upload logs for the Host, type:

```
support --vmhost <host> --unblock [--upload]
```

Example:

```
ESX_110722_151117_ducati.ioturbine.com.tgz
```

The command automatically uploads the file if you use the `--upload` option.

> File names for the Host logs begin with the prefix: `ESX_`

Uninstalling the Fusion-io Software

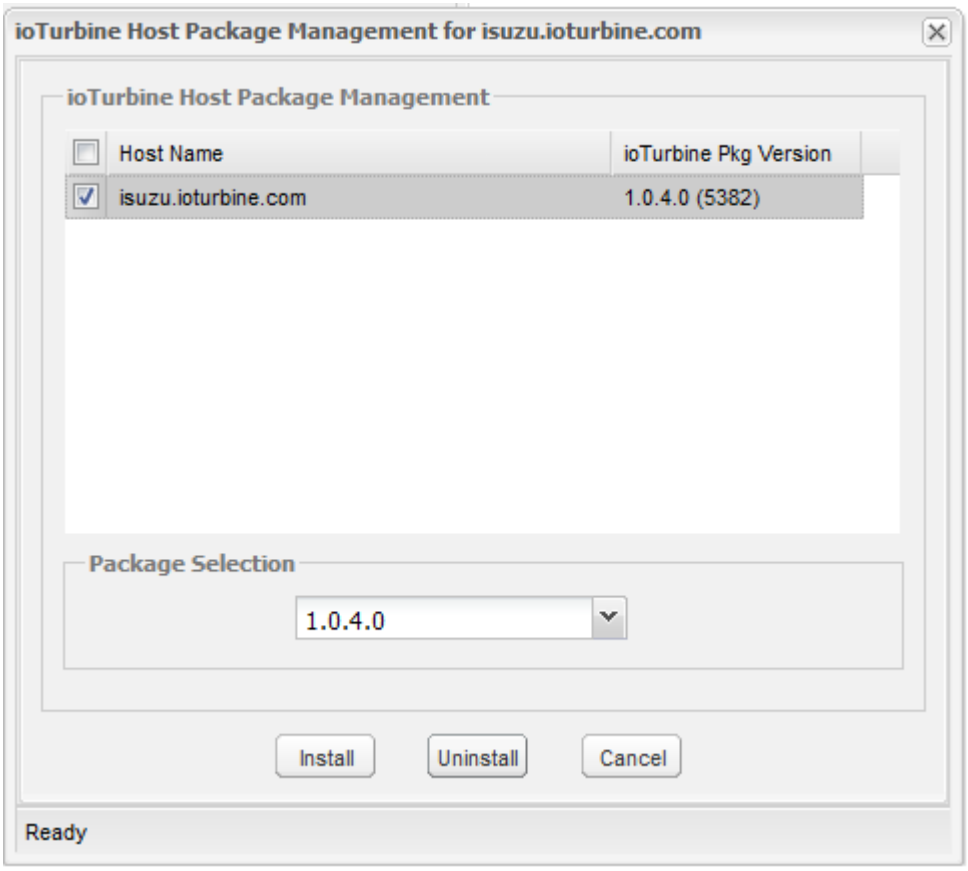
This chapter provides the instructions to remove all Fusion-io software from your Guest VMs and Hosts using the GUI or the CLI.
If the ioSphere VM Edition is installed on more than one Guest VM or Host, you should remove it from **all of the Guest VMs first**, and then remove it from all of the Hosts.

> ⚠ Before uninstalling, make sure all caching has stopped and all capacity shares have been unassigned.

Using the GUI

To remove the ioSphere VM Edition, follow these steps:

1. Remove the software from the Guest VMs:
    a. Right-click the Host that contains the Guest VMs.
    b. Choose **ioTurbine VM Package Management**.
    c. In the* ioTurbine Host Package Management* screen, click the check boxes next to each Guest VM that is running the ioSphere VM Edition.

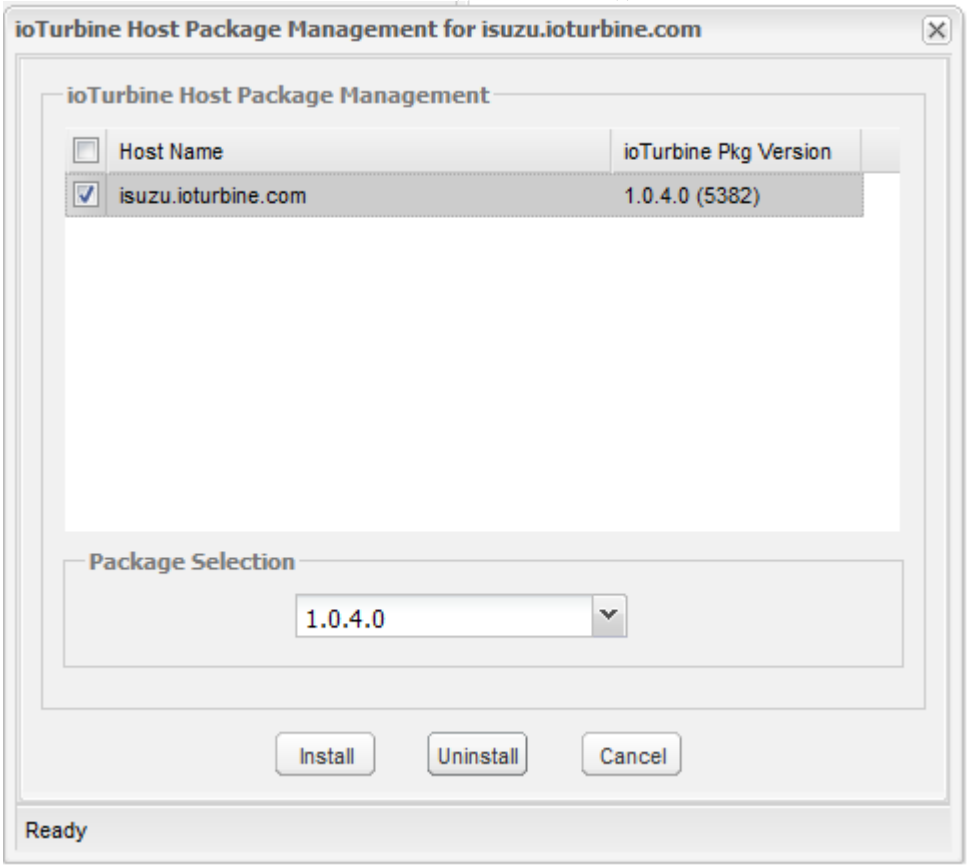


    d. Click **Uninstall**.
2. When you see the warning that states that the VM(s) will reboot, click **Yes**.
3. Allow enough time for the VM(s) that had the Fusion-io software removed to reboot.

> You can monitor the status using vCenter.

4. Right-click the cluster that you want to remove the ioSphere VM Edition from.

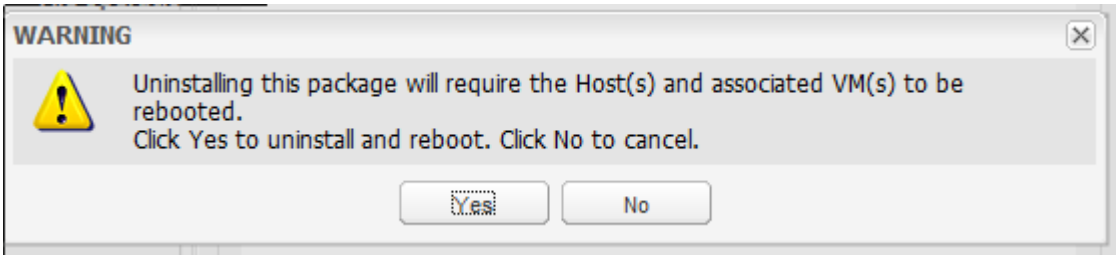
5. In the ioTurbine Host Package Management screen:
   a. Choose **ioTurbine Host Package Management**.
   b. Click the check boxes next to the name(s) of the host(s).



   c. Click **Uninstall**.

> **Reboot**:
> Only click Yes in the next step if the Host(s) are configured to automatically shut down their Guest VMs, or if you have already shut down the Guest VMs manually.

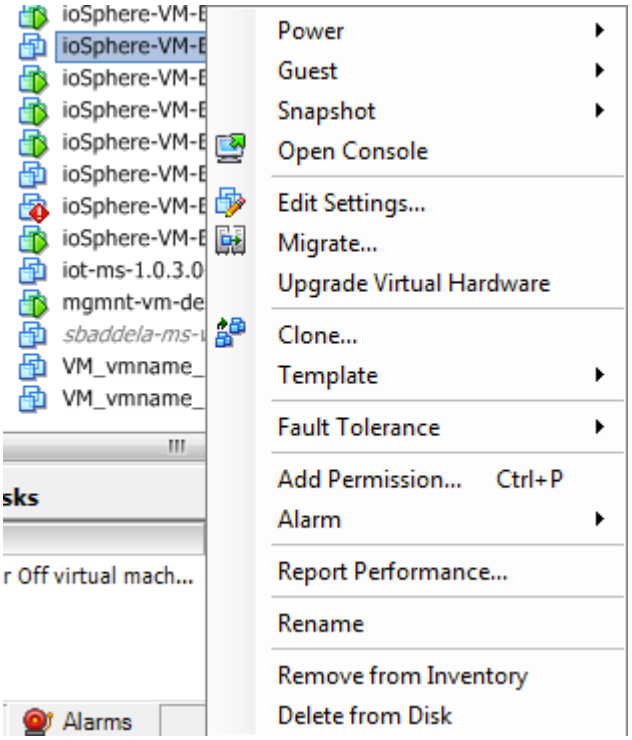
6. When you see the warning dialog box that states that a reboot is required, click **Yes**.



7. Allow enough time for the Host(s) that had the Fusion-io software removed to reboot.

> You can monitor the status using vCenter.

8. To remove the ioSphere VM Edition from the vCenter client:
   a. Shut down the Management Server VM.
   b. Right-click the Management Server VM.
   c. Choose **Delete from Disk**.



Using the CLI

If the ioSphere VM Edition is installed on more than one Guest VM or Host, you should remove it from all of the Guest VMs first, and then remove it from all of the Hosts.

To remove the ioSphere VM Edition, follow these steps:

1. To uninstall the software from the Guest VMs, type:

```
package --uninstall –-vmguest <guest> [guest user <user>
[--guestpassword <password>]]
```

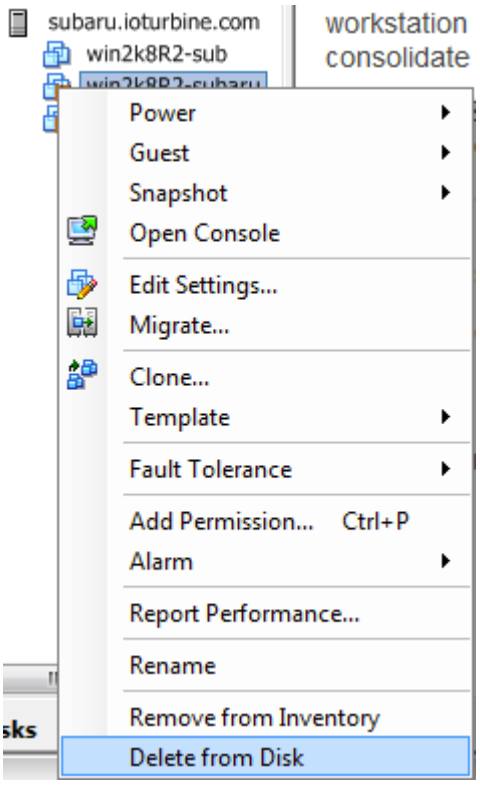
The Guest VM(s) reboot as part of the uninstall process.

> ⚠ Wait until the uninstall process has completed before removing the Host package.

2. To uninstall the Host package, type:

```
package --uninstall –-vmhost <host>
```

3. To remove the ioSphere VM Edition from the vCenter client (GUI only):
   a. Shut down the Management Server VM.
   b. Right-click the Management Server VM.
   c. Choose **Delete from Disk**.



Upgrade Procedure

You can upgrade the ioSphere VM Edition server software to the latest version while preserving existing configuration settings.

> ⚠ MS is Management Server and/or ioSphere VM Edition

MS Upgrade prerequisites:

1. Make sure user closes all the browser windows accessing ioSphere
2. Close all the un-wanted SSH sessions

Follow these steps:

1. Use SSH to access the ioSphere Management Server and log in to use the CLI.
2. At the login prompt, ioSphere-VM-Edition login:, type:
   ioturbine
3. At the system prompt for a password, type:
   `IOadmin123`

   > ℹ Passwords are case-sensitive.

4. Download the software package that you will use to upgrade to.
   You should be in receipt of an e-mail that contains the URL for the package download.
   Type:

   ```
   Download --url <url of software package>
   ```

   Example:

   ```
   download –url
   http://12.197.84.195/pkg/contents/ioSphere/v1.0_Beta/downloads/ioSphere-V
   download complete.
   File validation in progress...
   Ok
   ```

5. Identify the software release that you just downloaded by listing the software packages:

```
package --list
Example:
package –list
type VMWare guest image, pkg IOH, version 1.0.2.0
[VMGUEST/IOH/1.0.2.0], 8/26/2011 19h:34m
type VMWare host image, pkg IOT, version 1.0.2.0 [VMHOST/IOT/1.0.2.0],
8/26/2011 19h:34m
type ioSphere VM Edition image, pkg MS, version 1.0.3.0
[MS/MS/1.0.3.0], 10/19/2011 3h:33m
type ioSphere VM Edition image, pkg MS, version 1.0.2.0
[MS/MS/1.0.2.0], 8/26/2011 19h:33m
```

6. When you have identified the latest software release version, perform a software upgrade by specifying the version number:

```
system –upgrade <version> [--Default | --Network | Factory | <no
option> ]
```

Option	Steps Undertaken	Effect
Default	1. Backup licensing data. 2. Backup current schema with data. 3. Delete current DB. 4. Create DB with new schema and default new initial data only. 5. Restore licensing data.	1. Hostname is preserved. Other network settings are lost. 2. Old data is lost and server needs to be discovered again. 3. Licensing is retained.
Network	1. Backup licensing data. 2. Backup of current network settings. 3. Backup current schema with data. 4. Delete current DB. 5. Create DB with new schema and default initial data only. 6. Restore licensing data.	1. Old data is lost and server needs to be discovered again. 2. Network settings are retained. 3. Licensing is retained.

Factory	1. Backup licensing data. 2. Backup current schema with data. 3. Delete current DB. 4. Create DB with new schema and default new initial data only.	1. Old data is lost and server needs to be discovered again. 2. Network settings are lost. 3. Licensing data is lost.
No Option	**Case A)** DB Upgrade id of the current release is same that of DB Upgrade id of the upgrade target release – NO CHANGE IN DB, IT IS RETAINED AS IS. No action undertaken. **Case B)** DB Upgrade id of the current release is different than that of DB Upgrade id of the upgrade target release: 1. Backup licensing data. 2. Backup current data only. 3. Delete current DB. 4. Create DB with new schema. 5. Attempt to import archived data step 2. 6. Apply any addition data transformation as needed to confirm to the new DB schema.	**Case A)** 1. No data is* lost including licensing. 2. Network settings are NOT lost. **Case B)** 1. New schema is use. 2. As much possible old data is migrated including licensing data. 3. Network settings are NOT lost.

Option	NETWORK variable value	What happens
No Options	`1` (default value)	Current settings are not disturbed
`New` (Default)	`0` (new reassigned value)	Current settings are lost & new factory settings applied
`Network`	`1` (new reassigned value)	Current settings are not disturbed
`Factory`	`0` (new reassigned value)	Current settings are lost & new factory settings applied

Example:

```
system –upgrade 1.0.3.0
** Upgrading the Management Server will require a REBOOT. **
Do you want to proceed (y/n)?y
...
```

Error Logging

This chapter provides descriptions of some of the errors that you might encounter and workarounds for issues or problems that might occur using the ioSphere VM Edition software.

Error Logging

The errors that you might encounter include:

- **NO_LICENSE_FOR_COMPRESSION_FEATURE 5007**, No license available for the Compression feature

You must purchase a license for the Compression feature to perform data compression in the cache. For more information about the feature, see the chapter, *Using Data Compression*. Contact Customer Support to learn how to purchase a license.

- **NO_LICENSE_FOR_FLK_FEATURE 5010**, No license available for the File-Level Caching feature

You must purchase a license for the File-Level Caching feature to enable caching at the file level. For more information about the feature, see the section *Configuring Guest VM Settings*, and refer to the subsection *Using the GUI*. Contact Customer Support to learn how to purchase a license.

Licensing

This chapter lists the licenses that you can purchase to access additional features in the ioSphere VM Edition software.

Available Licenses

Licenses are available for the following features:

- **Compression** feature — enables Flash capacity to be optimized by compressing the virtual workload cache data where possible. The license applies on a per Guest VM basis.
- **File-Level Caching** feature — provides the ability to cache data at the file level.

Appendix A - Command Summary

The following table contains all of the ioSphere VM Edition CLI commands and their associated arguments.

This is the notation that is used:

- All arguments in brackets [ ] are optional.
- The `[OptCreds]` argument refers to the `GuestUser` and `GuestPassword` arguments, which can be stored for reuse using the `Account` command to eliminate the need to enter them each time.

Command	Arguments
`Help or ?`	`<command topic>`

`Account`	`--Add <name> --User <user> [--Password <password>]`
	`--Modify <name> --User <user> [--Password <password>]`
	`--Delete <name>`
	`--List`

`Connect-VIServer`	`--Server <server> --User <user> [--Password <password>]`
`Disconnect-VIServer`	

`Package`	`--Install --VMHost <host> --Version <version>`
	`--Install --VMGuest <guest> --Version <version> [OptCreds]`
	`--Uninstall --VMHost <host>`
	`--Uninstall --VMGuest <guest> [OptCreds]`
	`--Delete <VMGUEST | VMHOST | MS> --Version <version>`
	`--List`

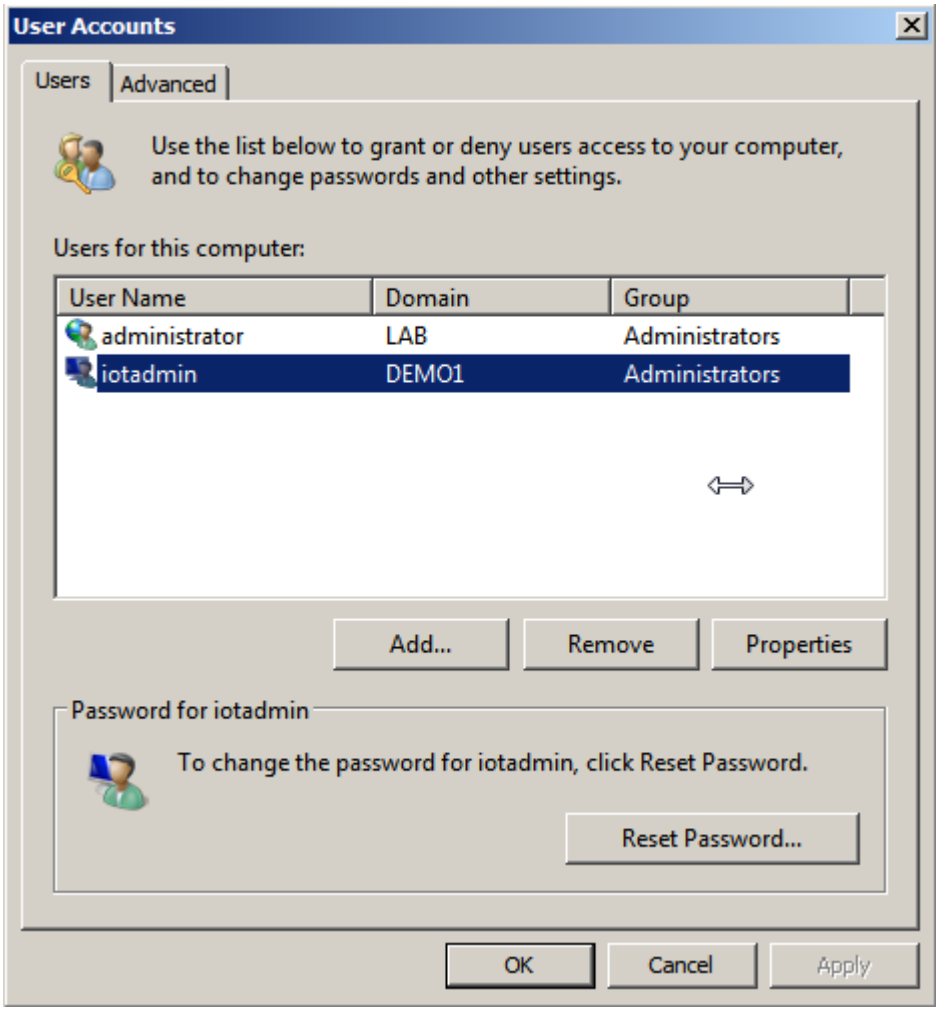
List	--VMHost <host> --ListLuns --VMHost <host> --ListVluns --VMHost <host> --ListSsds --VMGuest <guest> [OptCreds] --VMGuest <guest> --ListVolumes [OptCreds] --VMGuest <guest> --ListAllVolumes [OptCreds] --VMGuest <guest> --ListAllShares [OptCreds] --VMGuest <guest> --FileRuleFilters [OptCreds] --VMGuest <guest> --DiskStats [OptCreds] --VMGuest <guest> --FileStats [OptCreds] --VMGuest <guest> --VolumeStats [OptCreds] --VMGuest <guest> --DiskStatus [OptCreds] --VMGuest <guest> --FileStatus [OptCreds] --VMGuest <guest> --VolumeStatus [OptCreds] --VMGuest <guest> --Version [OptCreds]
Provision	--VMHost <host> --AddSsd <ssd_uid> --VMHost <host> --DeleteSsd <ssd_uid> --VMGuest <guest> --AddDisk <pri_disk_name> [OptCreds] --VMGuest <guest> --DeleteDisk <pri_disk_name> [OptCreds] --VMGuest <guest> --AddFileRule <full_path_filename> [OptCreds] --VMGuest <guest> --DeleteAllFileRules [OptCreds] --VMGuest <guest> --AddVolume <pri_vol_name> [OptCreds] --VMGuest <guest> --DeleteVolume <pri_vol_name> [OptCreds] --VMGuest <guest> --SetCapacityShares <shares> [--DisableVmotion] --VMGuest <guest> --SetAllShares <file vol disk> [OptCreds] --VMGuest <guest> --DeleteAllCapacityShares --VMGuest <guest> --StartDiskCache [OptCreds] --VMGuest <guest> --StopDiskCache [OptCreds] --VMGuest <guest> --StartFileCache [OptCreds] --VMGuest <guest> --StopFileCache [OptCreds] --VMGuest <guest> --StartVolumeCache [OptCreds] --VMGuest <guest> --StopVolumeCache [OptCreds] --VMGuest <guest> --StartVolumeLogging –-Hours <hrs> --Minutes <min> --LogDir <log_folder_path> [OptCreds] --VMGuest <guest> --StopVolumeLogging [OptCreds] --VMGuest <guest> --SetVolumeCompressionRatio <1 | 2> [OptCreds] --VMGuest <guest> --StartProfilerMode [OptCreds] --VMGuest <guest> --StopProfilerMode [OptCreds]
Stats	--EnableHost <host> [--Interval <poll interval in sec>] --DisableHost <host> --VMGuest <guest> --ResetDisk --VMGuest <guest> --ResetFile --VMGuest <guest> --ResetVolume --VMGuest <guest> --ResetAll

System	--Upgrade <version> [--Default --Factory] [--Halt] --SetHostname <hostname> --GetHostname --SetNameserver <nameserver1,nameserver2> --GetNameserver --SetDomainname <domain1,domain2> --GetDomainname --GetDate
Interface	--List --DhcpEnable --IpAddress <IP address> --Mask <Subnet Mask> --Gateway <Default Gateway>
JobSched	--Status <task-id>
Ping	--Host <hostname or IP address>
Halt	
Reboot	
Version	
Wizard	
Download	--Url <HTTP URL>
AutoSupport	--Interval <time in hours> --Upload [Enable | Disable]
Support	--BugReport --VMHost <host> [--Upload] --VMGuest <guest> [--Upload] --UploadFile <file name>

Appendix B - Configuring Active Directory

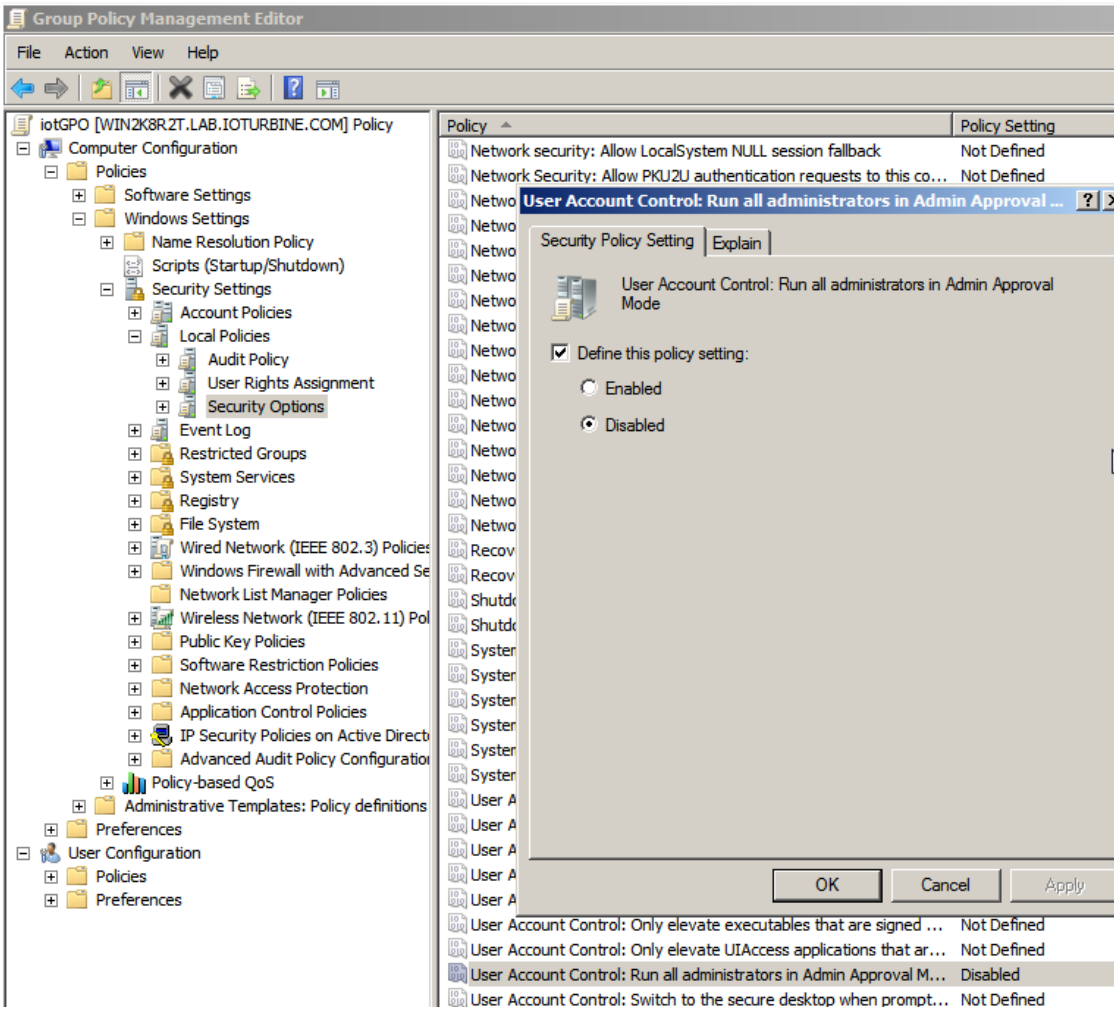
This Appendix provides the steps to configure Windows Active Directory to work with ioSphere VM Edition. To configure Windows Active Directory, follow these steps:

1. Add a local user to the Guest VM and make them part of the local Administrators group.



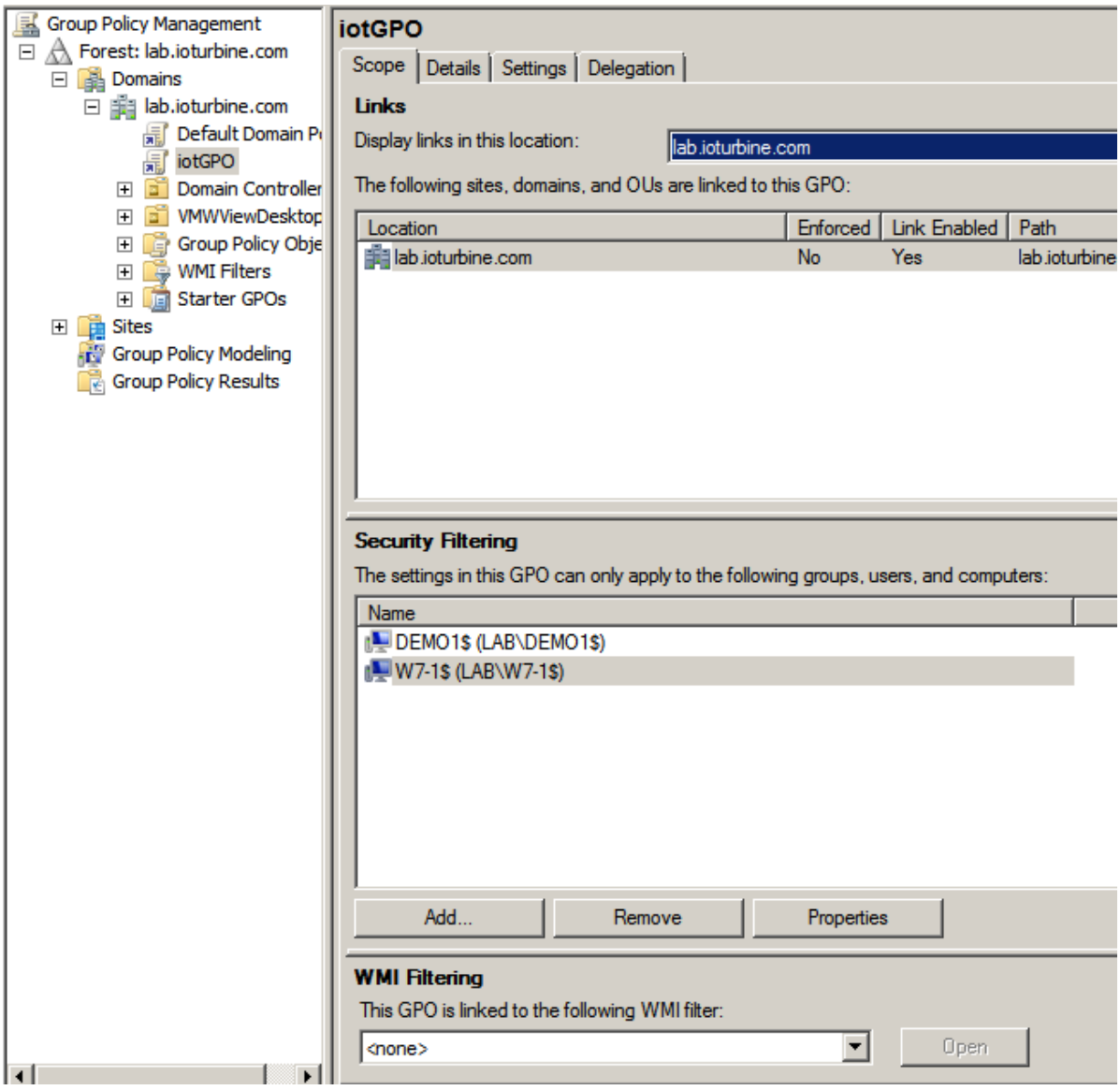
Use the same name and password combination for every VM that is running the ioSphere VM Edition client software.

2. Create a Group Policy Object for your Domain:
    a. Navigate to the Local Policies section.
    b. Choose* Security Options*.
    c. Scroll down the list to locate and double-click the policy called **User Account Control: Run all administrators in Admin Approval Mode**.
    d. In User Account Control: Run all administrators in Admin Approval Mode screen > **Security Policy Setting tab:**
        i. Click the check box for **Define this policy setting**.
        ii. Select **Disabled**.



        iii. Click **OK**.

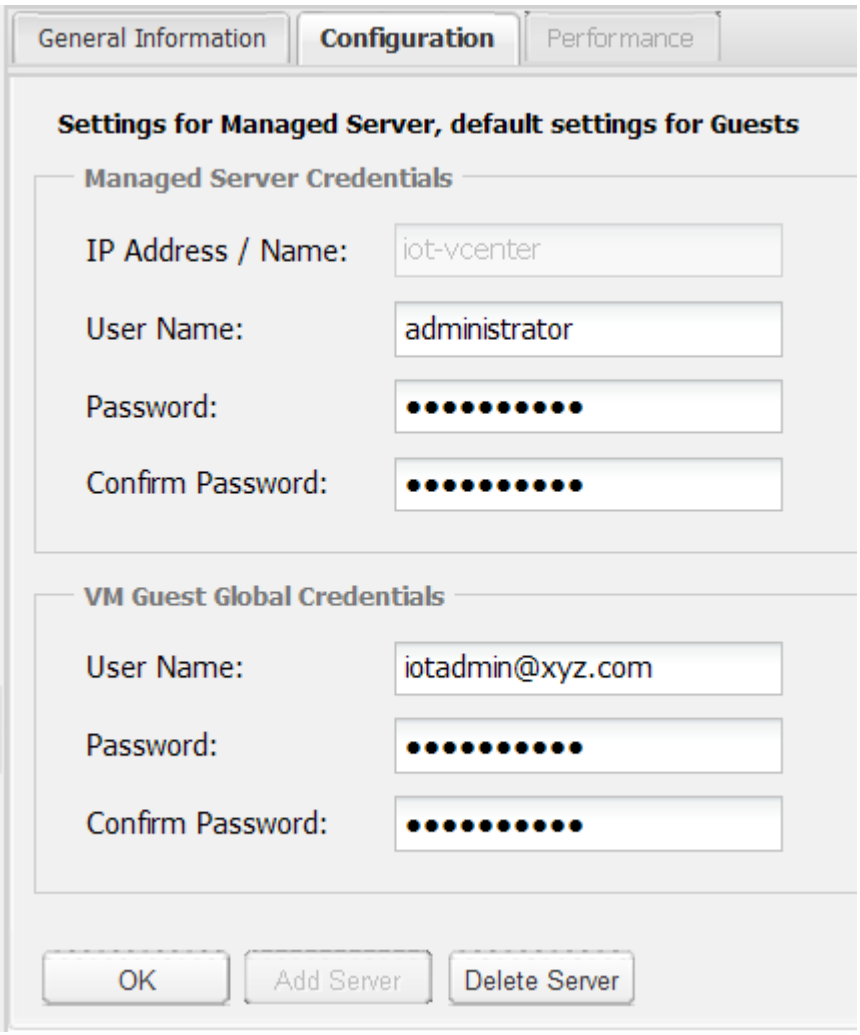
3. If you only want this Group Policy Object to apply to a subset of your machines, you can define a scope for it:
    a. Select the **Group Policy Object**.
    b. In the Scope tab, supply the applicable information.



    c. Click **Add**.

4. In the Management Server GUI, right-click the top of the tree and choose **Configuration**.

5. In the Configuration tab:
    a. In the Guest VM Global Credentials section, enter the user name (using the name@domain naming convention) and password that you defined in Step 1 of this appendix.



    b. Click **OK**.
    You should now be able to deploy, configure, and manage the ioSphere VM Edition software from the Management Server.

Appendix C - Installing ioSphere VM Edition in a VMware Workstation

This Appendix provides the steps to import the ioSphere VM Edition OVF into a VMware Workstation for Windows or Linux.

Importing into a VMware Workstation for Windows

The system requirements are VMware Workstation for Windows 7.x
Follow these steps:

1. Start a command box (`cmd.exe`).
2. Change the current directory to the location on the disk where the `ioTurbine-OVF.zip` is unzipped.
3. Run the following command:

   ```
   "c:\Program Files (x86)\VMware\VMware Workstation\OVFTool\ovftool.exe"
   -tt=vmx ioSphere-VM-Edition.ovf <Destination Dir>
   ```

   where `<Destination Dir>` is the location on the disk where you want the ioSphere VM Edition VM to be created.

   Example:

   ```
   "c:\Program Files (x86)\VMware\VMware Workstation\OVFTool\ovftool.exe"
   -tt=vmx ioSphere-VM-Edition.ovf C:\VMs
   ```

4. Accept the Fusion-io License Agreement.
   The `OVFtool` will convert the VM from OVF format to the normal VM format to use with the VMware Workstation.
5. Once the OVFtool completes the conversion, go to the VMware Workstation main GUI.
6. Select **File** > **Open** (or press **Ctrl+O**) and go to the folder, `ioSphere-VM-Edition` inside the `<Destination Dir>` that you specified earlier (in Step 3).
7. Select the `ioSphere-VM-Edition.vmx` file to open the ioSphere VM Edition VM.

Importing into a VMware Workstation for Linux

The system requirements are:

- VMware Workstation for Linux 7.x
- OVFTool for Linux (*http://communities.vmware.com/community/vmtn/server/vsphere/automationtools/ovf*)
  Follow these steps:

1. Start a command box (`cmd.exe`).
2. Change the current directory to the location on the disk where the `ioTurbine-OVF.zip` is unzipped.
3. Run the following command:

   ```
   ovftool -tt=vmx ioSphere-VM-Edition.ovf <Destination Dir>
   ```

   where <Destination Dir> is the location on the disk where you want the ioSphere VM Edition VM to be created.

   Example:

   ```
   ovftool -tt=vmx ioSphere-VM-Edition.ovf
   ```

4. Accept the Fusion-io License Agreement.
   The OVFtool will convert the VM from OVF format to the normal VM format to use with the VMware Workstation.
5. Once the OVFtool completes the conversion, go to the VMware Workstation main GUI.
6. Select **File** > **Open** (or press **Ctrl+O**) and go to the folder, `ioSphere-VM-Edition` inside the `<Destination Dir>` that you specified earlier (in Step 3).
7. Select the `ioSphere-VM-Edition.vmx` file to open the ioSphere VM Edition VM.

Appendix D - Enabling Clipboard Copy and Paste in vSphere Client 4.1 and Later

This Appendix provides the instructions to copy-and-paste between the Guest VM operating system and the remote console.

If the Clipboard Copy and Paste options do not work in vSphere 4.1, you will find:

- You cannot copy-and-paste from the VM remote console to the system in which the vSphere client is installed.
- The Copy and Paste options are disabled.
  Beginning with vSphere 4.1, the Copy and Paste options are disabled for security reasons by default.

Enabling the Copy and Paste Options

To be able to copy-and-paste between the Guest VM operating system and the remote console, you must enable the Copy and Paste options using the vSphere Client. Alternatively, you can use the Remote Desktop Protocol (RDP) to connect to the Windows VMs.

Enabling Copy and Paste for a Specific Guest VM

To enable the Copy and Paste options for a specific Guest VM, follow these steps:

1. Log in to a Vcenter Server system using the vSphere Client and power-off the Guest VM.
2. Select the Guest VM and click the Summary tab.
3. Click **Edit Settings**.
4. Navigate to **Options > Advanced > General** and click **Configuration Parameters**.
5. Click **Add Row**.
6. In the Name and Value columns, type the following values:

```
isolation.tools.copy.disable - false
isolation.tools.paste.disable - false
```


These options override any settings made in the Guest VM OS's VMware Tools control panel.

7. Click OK to close the Configuration Parameters dialog box.
8. Click OK to close the Virtual Machine Properties dialog box.
9. Power-on the VM.

> If you vMotion a Guest VM to a Host in which the isolation.tools.*= "FALSE" is already set, the Copy and Paste options are automatically activated for that Guest VM.

Enabling Copy and Paste for all Guest VMs in an ESX/ESXi Host

To enable the Copy and Paste options for all Guest VMs in the ESX/ESXi Host, follow these steps:

1. Log in to an ESX/ESXi Host as a root user.
2. Use a text editor to open the /etc/vmware/config file.
3. Add the following entries to the config file:

```
isolation.tools.copy.disable = "FALSE"
isolation.tools.paste.disable = "FALSE"
```

4. Save and close the config file.

The Copy and Paste options are only enabled when the Guest VMs restart or resume the next time.

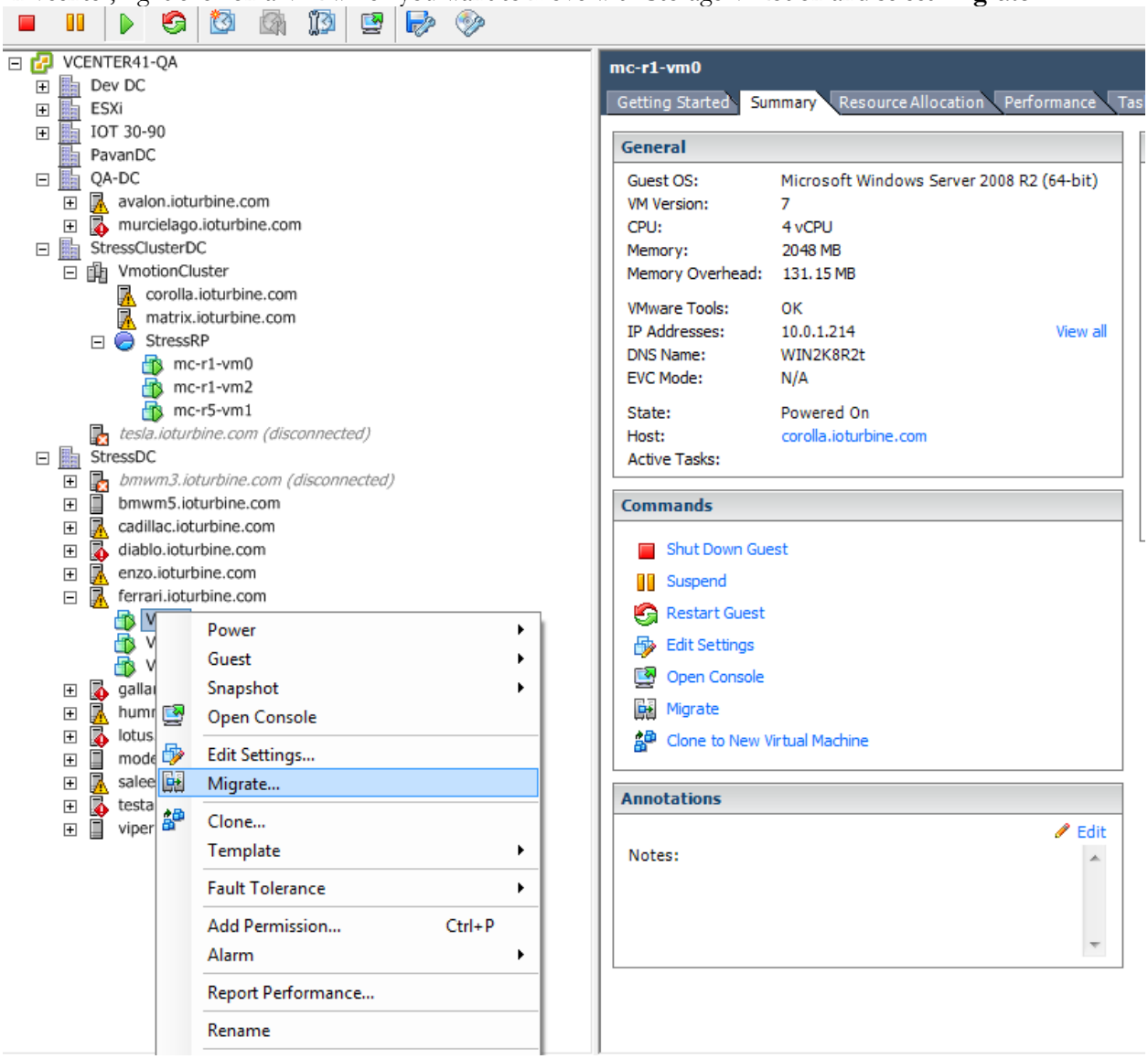
> The Copy and Paste options do not persist after an upgrade. If you upgrade to a newer version after enabling these options, the changes are lost and you might have to re-enable the options.

For more information, refer to the VMware guide, ESX Configuration Guide (ESX 4.1, vCenter Server 4.1) and see the section, "Limiting Exposure of Sensitive Data Copied to the Clipboard."

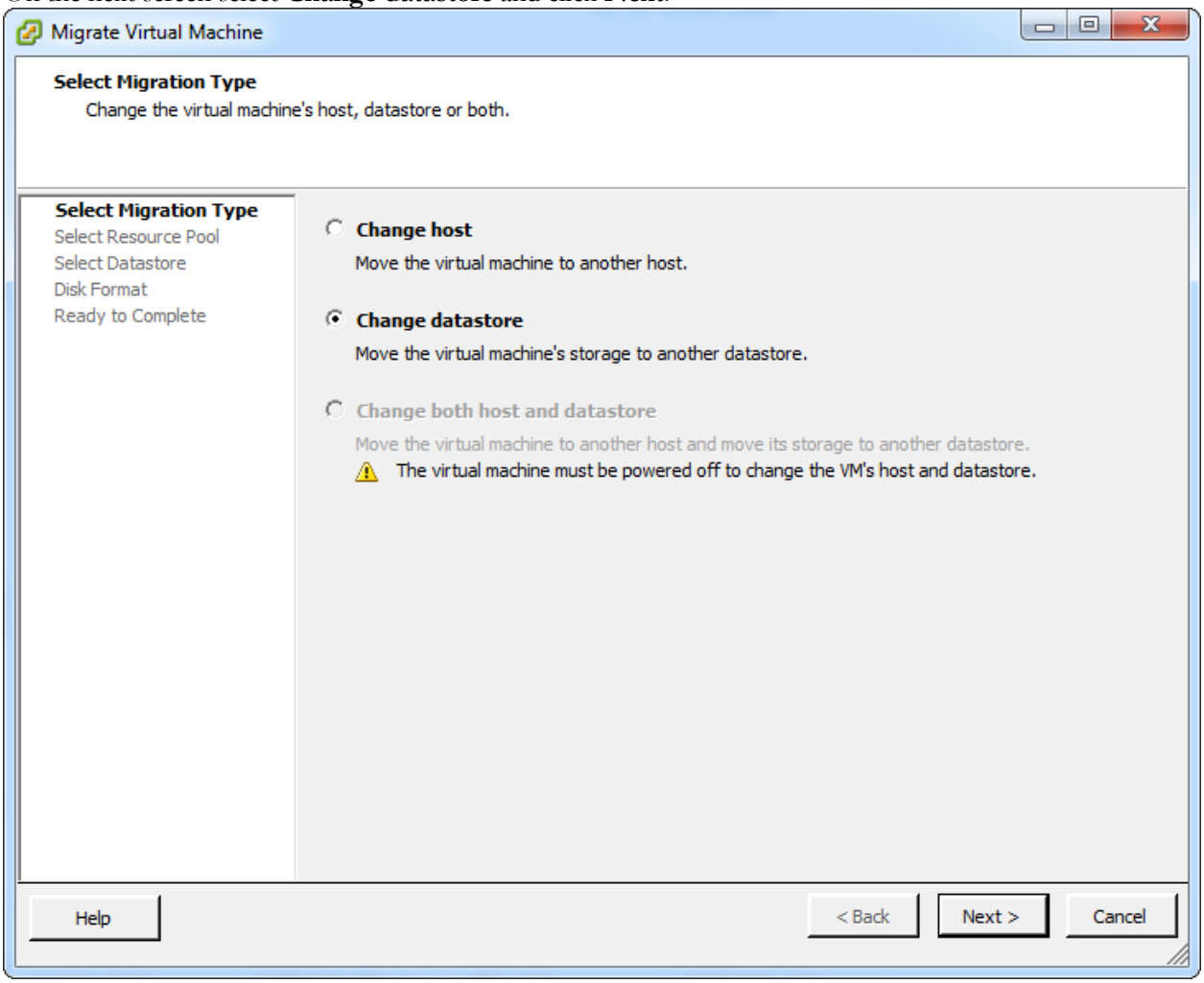
Appendix E - Storage VMotion

To move primary virtual disks, but not VLUN virtual disks:

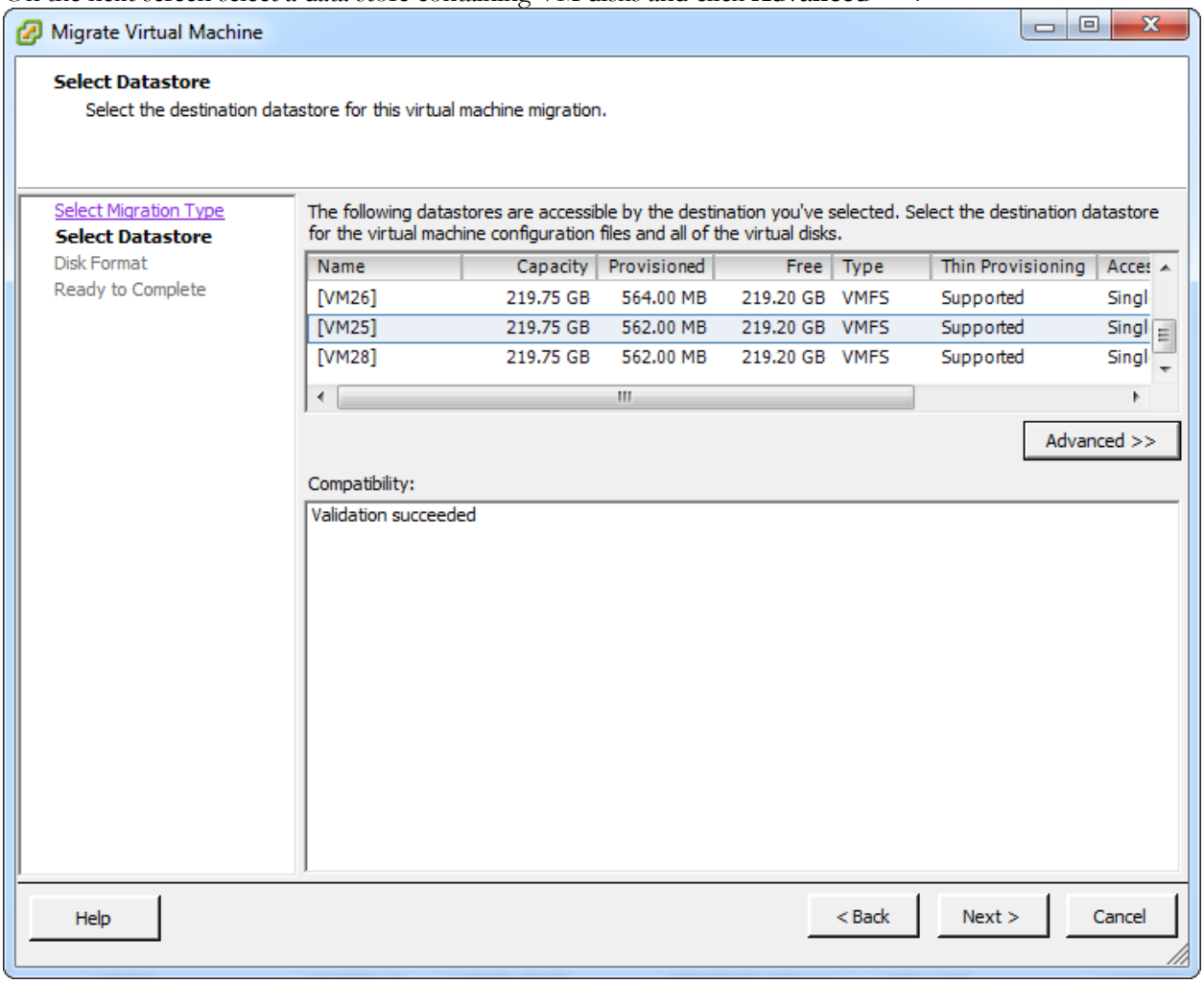
1. In vcenter, right click on a VM which you want to move with Storage VMotion and select **Migrate**.



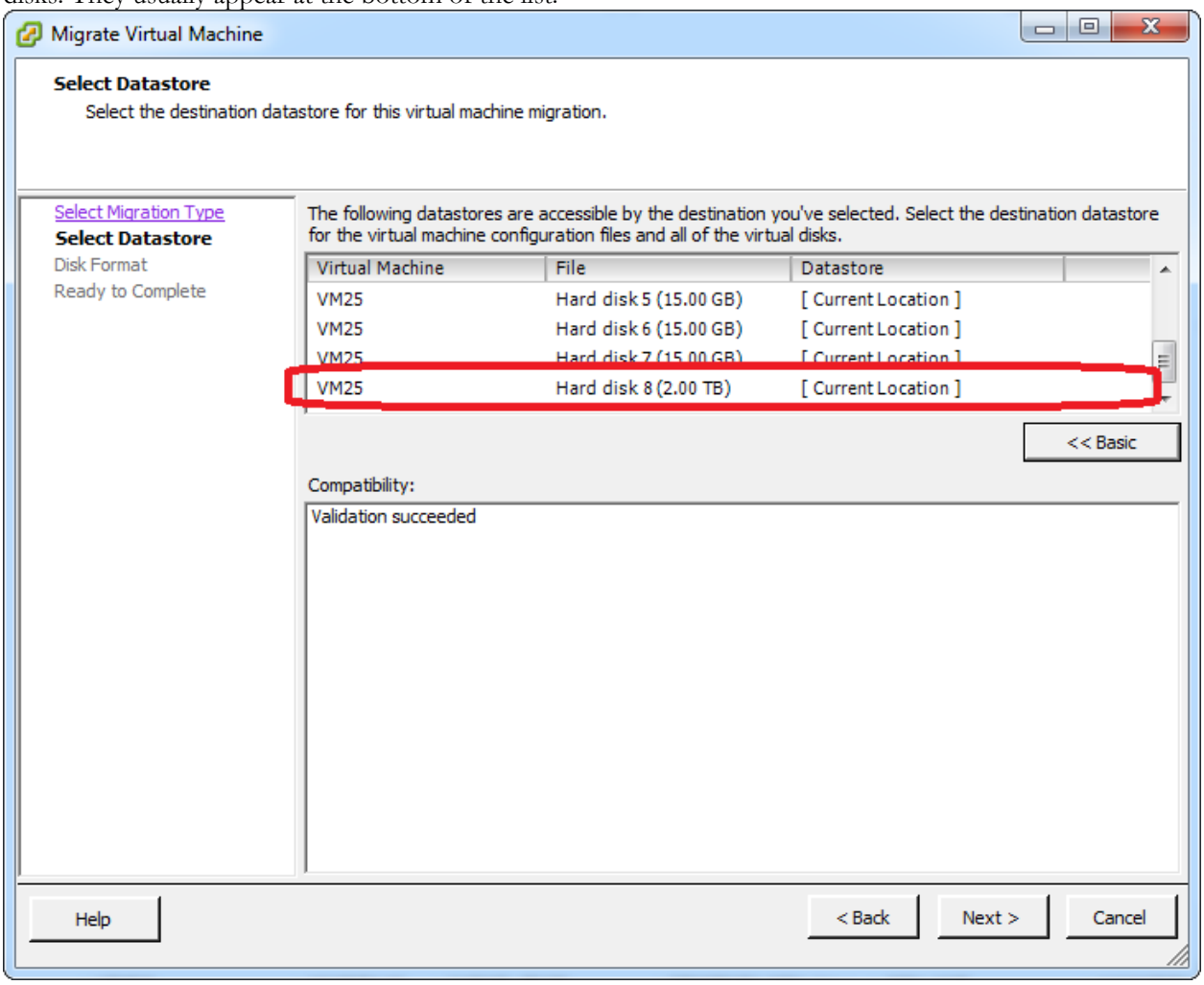
1. On the next screen select **Change datastore** and click **Next**.



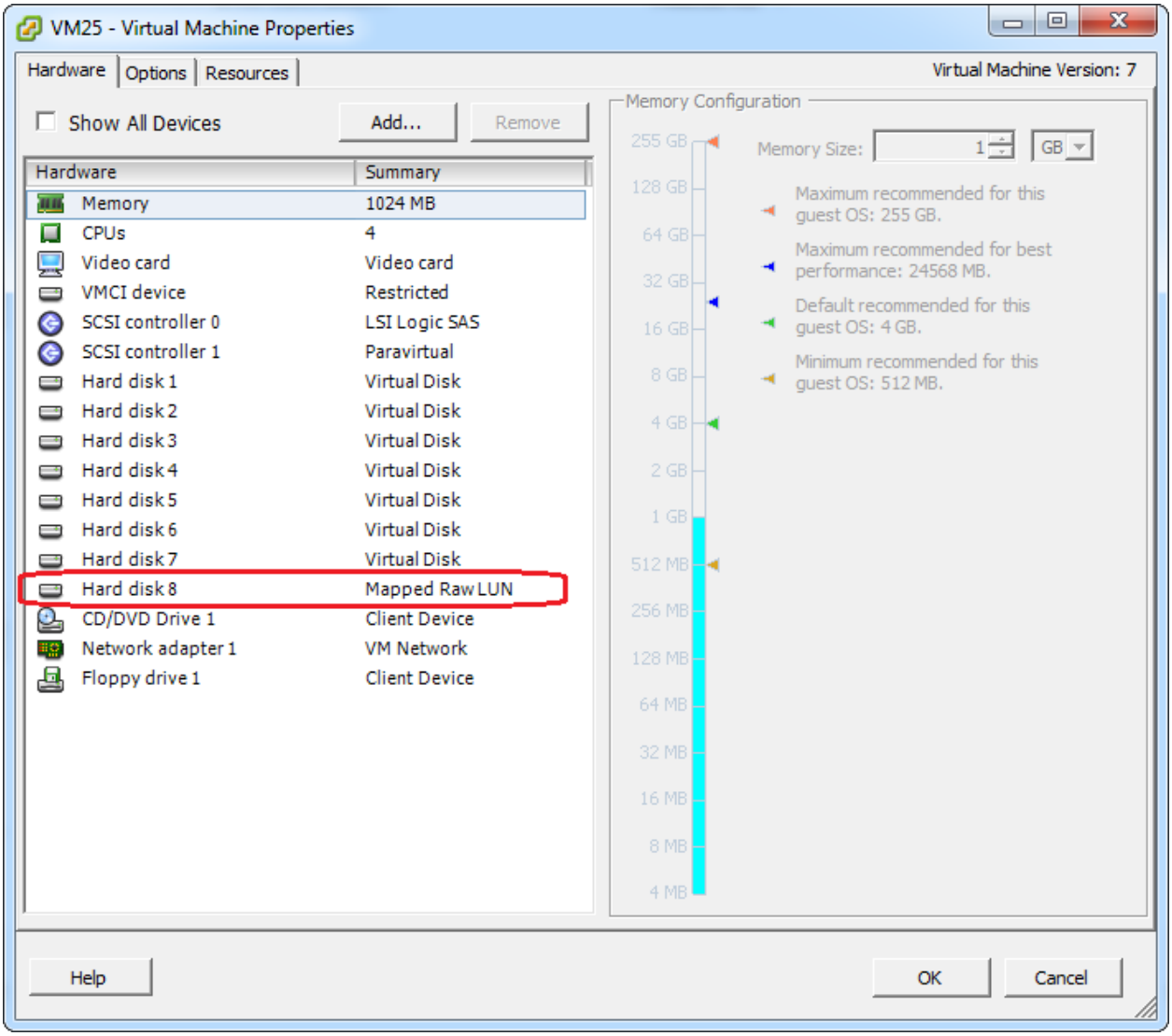
1. On the next screen select a data store containing VM disks and click **Advanced >>**.



1. On the next screen, while selecting disks to vmotion, don't select disks with a size of 2 TB; they are vlun virtual disks. They usually appear at the bottom of the list.



If you are not sure which disks are VLUNs, go to vcenter, right click on a VM and select **Edit Settings**. VLUN disks look like this:


VM25 - Virtual Machine Properties
Hardware
Options
Resources
Virtual Machine Version: 7
Show All Devices
Add...
Remove
Hardware
Summary
Memory 1024 MB
CPUs 4
Video card Video card
VMCI device Restricted
SCSI controller 0 LSI Logic SAS
SCSI controller 1 Paravirtual
Hard disk 1 Virtual Disk
Hard disk 2 Virtual Disk
Hard disk 3 Virtual Disk
Hard disk 4 Virtual Disk
Hard disk 5 Virtual Disk
Hard disk 6 Virtual Disk
Hard disk 7 Virtual Disk
Hard disk 8 Mapped Raw LUN
CD/DVD Drive 1 Client Device
Network adapter 1 VM Network
Floppy drive 1 Client Device
Memory Configuration
255 GB
128 GB
64 GB
32 GB
16 GB
8 GB
4 GB
2 GB
1 GB
512 MB
256 MB
128 MB
64 MB
32 MB
16 MB
8 MB
4 MB
Memory Size:
1
GB
Maximum recommended for this guest OS: 255 GB.
Maximum recommended for best performance: 24568 MB.
Default recommended for this guest OS: 4 GB.
Minimum recommended for this guest OS: 512 MB.
Help
OK
Cancel

Fusion-Powered Support

We offer ioTurbine Customer Support by phone, fax, e-mail and on the Web.

Telephone Support

Our customer support phone number in North America is: (877) 816-5740.

Our international support phone number is: +001-1-888-468-5303.

Our Support Staff is available from 6:00 A.M. to 6:00 P.M. Mountain Time, Monday through Friday.

(If no one answers, please leave a message, and we will get back with you shortly.)

Fax Support

Our support fax number is: (801) 293-3054

Please FAX your technical questions and we will get back to you in a timely manner.

E-Mail

Our support e-mail address is: support@fusionio.com

E-mail is the fastest way to get simple questions answered, and it is imperative for making bug reports. Please give as detailed a description of your problem as you can and include your complete contact information.

Web

Go online to find tips, FAQs, and troubleshooting help, or download the latest ioTurbine guides, driver and support packages at: *http://support.fusionio.com*.

Warranty

The ioTurbine software comes with a standard limited 90-day Fusion-io warranty as specified in the End-User License Agreement. Please visit *http://support.fusionio.com* for details.