VM Orchestration Reference

Cloud Manager 2.1

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Contents

About This Guide

In addition to managing virtual machines (VMs) and host servers by using the NetIQ Cloud Manager VM Client, you can do other VM management work with the Orchestration Console. This *guide* provides instructions on the management tasks that you can do in the Orchestration Console.

The guide is organized as follows:

- Chapter 1, "Managing Virtual Machine Hosts," on page 7
- Chapter 2, "Managing Virtual Machines," on page 13
- Chapter 3, "Managing VM Repositories," on page 27
- Chapter 4, "Orchestration Provisioning Adapter Information," on page 31
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For documentation about using Cloud Manager Orchestration jobs to further manage VMs, host machines, and physical machines, see "Virtual Machine Job Development" in the *NetIQ Cloud Manager 2.1 Orchestration Developer Reference*.

Audience

This book is for data center administrators. It assumes that users of the product have the following background:

- General understanding of network operating environments and systems architecture
- Knowledge of basic Linux shell commands, the Windows command prompt, and text editors

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation, or go to www.novell.com/documentation/feedback.html (http://www.novell.com/documentation/feedback.html) and enter your comments there.

Additional Documentation

For other NetIQ Cloud Manager 2.1 documentation, see the NetIQ Cloud Manager 2.1 documentation site (http://www.novell.com/documentation/cloudmanager2).

1 Managing Virtual Machine Hosts

After you install the Cloud Manager Orchestration Agent on a physical resource, the Xen and Hyper-V hypervisor technologies running on that resource are determined by the Discover VM hosts job. You can then discover and manage VMs residing on the VM hosts.

For the VMware vsphere hypervisor, however, you need to associate the `vsphere_client` policy to a vSphere resource before the discovery works.

1.1 Discovering VM Hosts and Repositories

1. Ensure that the policies appropriate to the VM technology are configured. For more information, see Chapter 4, "Orchestration Provisioning Adapter Information," on page 31.

   For vSphere, the default number of slots is 4. We recommend that you increase this number to 10, depending on the hardware and available computing resources (RAM/CPU) of the server where the agent is running (this is also the server associated with the `vsphere_client` policy). Each joblet slot causes a separate Java instance on this resource. Each Java instance uses 50-60 MB of RAM and is quite CPU-intensive.

   For Xen, we recommend that you accept the default slot number of 1. No more than one provision operation should happen concurrently on the Xen host, particularly any operation that is disk-related.

   For more information on the policies, see Chapter 4, "Orchestration Provisioning Adapter Information," on page 31.

2. Ensure that you have set the correct number of joblet slots for the VM hosts in the policies appropriate to the VM technology. For more information, see *Joblet Slots* in the *NetIQ Cloud Manager 2.1 Orchestration Console Reference*.

3. In the Orchestration Console, click *Provision > Discover VM Hosts and Repositories*.

   The Discover VM Hosts and Repositories dialog box is displayed.

4 Select your provisioning adapter from the drop-down list.

5 Click *OK*.

6 Click *Jobs* to view the *Jobs* section in the Orchestration Console and verify that the job has started.

After your VM host machines are discovered, you can refresh your tree view or wait for the automatic tree refresh to see the VM host machine listed under the provisioning adapter, although no VMs are listed.

This also discovers:

  - Local repositories for all types of hypervisors.
  - SAN and NAS repositories for Xen and vSphere.

    To view the discovered repositories, click *Repositories*, then click *xen30* or *esx*.

For a list of the VM technologies and supported host and guest operating systems, see "Requirements and Cloud Manager Support for the Virtual Environment" in the *NetIQ Cloud Manager 2.1 Installation Planning Guide*.

1.2 Discovering VM Images

To discover the VM images on a specific repository:

1 In the Orchestration Console, click *Provision > Discover VM Images*.

The Discover VM Images dialog box is displayed.
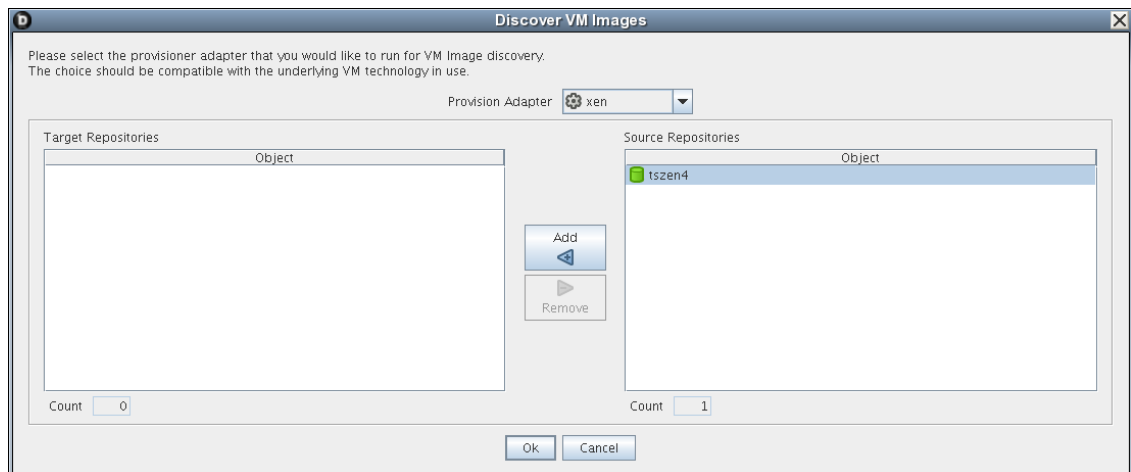
2 In the *Provisioning Adapter* drop-down list, select the provisioning adapter for which you want to discover the VM images.

The source repositories for the selected provisioning adapter are displayed.

For information on provisioning adapters, see Section 2.1, "Provisioning a Virtual Machine," on page 13.

3 Select the source repositories, then click *Add*.

The selected repositories are added to the *Target Repositories* pane.

4 Click *OK*.

The VM images are discovered: a separate job is launched for each repository that the user selected. After all jobs are complete, you can refresh the Explorer tree in the Orchestration Console to see the discovered VMs.

1.3 Resynchronizing the VM Host's State

To manually verify and ensure that the state of a VM host displayed in the Orchestration Console is accurate:

1 In the Orchestration Console, right-click the VM host, then click *Discover*.

To manually verify and ensure that the state of multiple VM hosts displayed in the Orchestration Console is accurate:

1 In the Orchestration Console, click *Provision > Resync VM Host's State*.

The Resync VM Host's State dialog box is displayed.
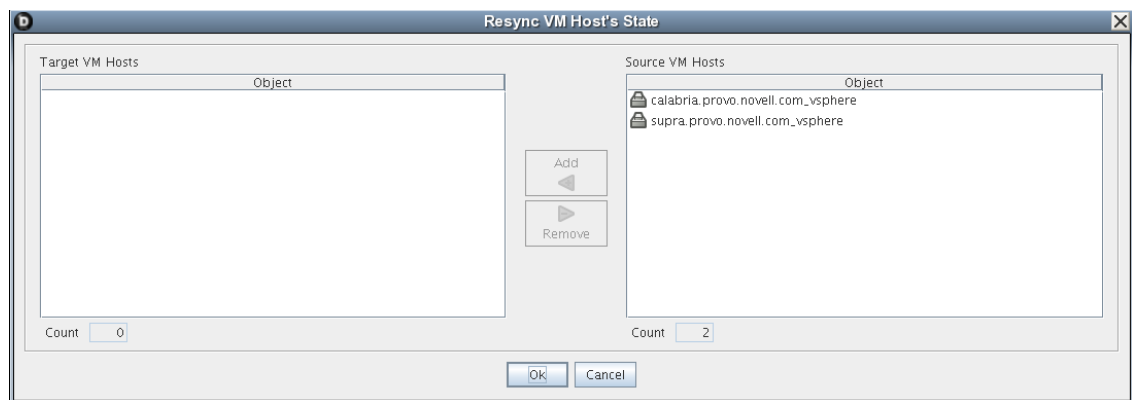
2 In the *Source VM Hosts* pane, select the VM hosts to be resynchronized, then click *Add*.

The selected VM hosts are added to the *Target VM Hosts* pane.

3 Click *OK*.

1.4 Shutting Down VM Hosts

To shut down a single VM host:

1 In the Orchestration Console, right-click the VM host you want to shut down, then click *Shutdown*.

To shut down multiple VM hosts:

1 In the Orchestration Console, click *Provision > Shutdown Hosts*.

The Shut Down VM Hosts dialog box is displayed.
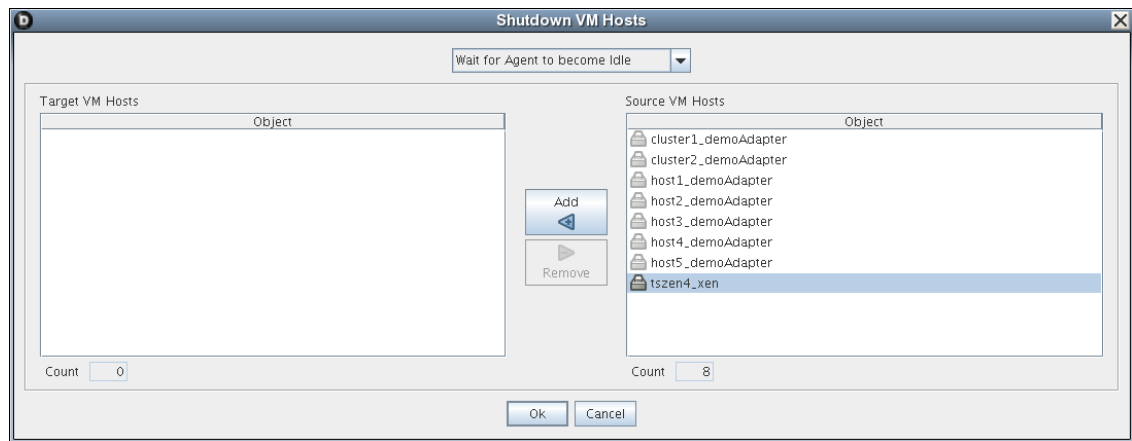
2 Choose when to shut down the VM hosts.

You can choose to shut down the VM hosts after the Orchestration Agent becomes idle or to immediately shut down the VM hosts. By default, the *Wait for Agent to become Idle option* is selected.

3 In the *Source VM Hosts* pane, select the VM hosts you want to shut down, then click *Add*.

The selected VM hosts are added to the *Target VM Hosts* pane.

4 Click *OK*.

The VMs running on the host are automatically shut down and the VM host is moved to the Shutting Down state, where will not accept any Provisioning actions.

1.5   Restarting VM Hosts

To restart a single VM host:

1 In the Orchestration Console, right-click the VM host you want to start, then click *Start*.

To restart multiple VM hosts:

1 In the Orchestration Console, click *Provision > Start VM Hosts*.

The Start VM Hosts dialog box is displayed.
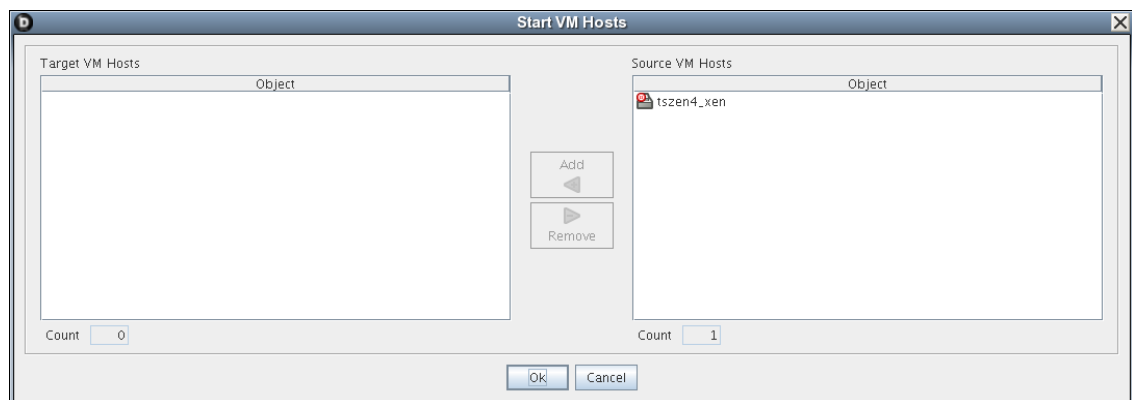
2 In the *Source VM Hosts* pane, select the VM hosts you want to restart, then click Add.

The selected VM hosts are added to the *Target VM Hosts* pane.

3 Click *OK*.

1.6 Understanding VM Host Failover

When the Orchestration Server comes back online after being offline, it rediscovers the state of all resources, including VM hosts and the VMs running on those hosts. This section provides more information about how the Orchestration Server behaves when the VM Host loses its agent connection.

There are two possible scenarios that can occur when a VM Host fails while running VMs. The failover behavior depends on where the VM image is stored and whether the VM has the agent installed.

The following table shows possible failover scenarios with the VM Host and the expected server behavior when it occurs.

Table 1-1 *Orchestration Server Behavior when the VM Host Loses Its Agent Connection*

Scenario	Failover Behavior
Scenario 1: The VM image is: • Stored on a non-local repository (for example, the zos repository) • Accessible by other VM hosts • Successfully provisioned **Situation:** The VM host fails.	The VMs that had been running on the failed VM host are reprovisioned to other available VM hosts. • If the VM was provisioned from a template, there is now another instance of the VM. For example, if the template name is `sles10template`, the original VM provisioned from the template is then named `sles10template-1`. If the host running `sles10template-1` goes down, or if it loses its agent connection, a new instance of the template named `sles10template-2` is reprovisioned to an available host. • If the original VM was a standalone VM, it is reprovisioned to an available host.
Scenario 2: The VM image is stored on a local repository. **Situation:** The VM host loses its agent connection.	• Because the VM image is stored locally, it cannot be reprovisioned to another VM host. • When the VM host comes back online, it is reprovisioned to the host where it is stored.

In either of these scenarios, if the Orchestration Agent is installed on the VM and if the VM host loses its agent connection but the VMs retain their agent connection (for example, if someone kills the agent process on the VM host), no reprovisioning occurs.

If the VM host loses its agent connection, and if the Orchestration Agent is not installed on the running VMs, the VMs can continue running indefinitely. However, if the location of the VM image warrants it, the VMs are reprovisioned to other available hosts. When there are two (or more) of the same VM instance running on different VM hosts, the Orchestration Server is aware only of the VMs running on a VM host with an active agent connection, so the administrator must stop the VMs on the host that has lost its agent connection.

NOTE: If you are interested in failover in a high availability environment, see the *NetIQ Cloud Manager 2.1 Orchestration Server High Availability Configuration Guide* or the *NetIQ Cloud Manager 2.1 Xen VM High Availability Configuration Guide*.

2 Managing Virtual Machines

Review the following sections for specific information about the VM management functions in Cloud Manager Orchestration:

2.1 Provisioning a Virtual Machine

Provisioning is the first step in a VM's life cycle. The Orchestration Server determines the best VM host machine for running the VM, unless you select a specific host server, datastore, or network to run the VM.

By default, you can run eight VMs at one time on a VM host. If you want to provision additional VMs, you must proportionately increase the vmhost.maxvmslots fact value for a particular VM host in the Orchestration Console.

Provisioning VMs that have only an NPIV disk is not supported. You can provision a VM that has a hard disk and an NPIV disk (that is, a SAN repository). The OS image of the VM is stored on the local hard disk and the data resides in the SAN repository.

The Orchestration Server uses provisioning adapters to perform life cycle functions. Provisioning adapters are programs that control (start, stop, snapshot, migrate, or pause) a VM. They run as regular jobs on the Orchestration Server.

The system can discover SAN repositories for Xen and vSphere hosts.

The constraints used to determine a suitable VM host evaluate the following criteria to provide heterogeneous VM management:

- Machine architectures
- CPU
- Bit width
- Available virtual memory
- Other administrator-configured constraints, such as the number of virtual machine slots

For procedures and more information on provisioning VMs, see Section 2.3, "Managing a Running Virtual Machine," on page 17.

2.2 Provisioning Actions and History

The following information is included in this section:

2.2.1 What are Provisioning Actions?

The provisioning operations you perform in Cloud Manager Orchestration are recorded as "actions." For example, in the Orchestration Console main menu:

- A VM Host Discovery action is initiated if you select *Provision > Discover VM Hosts and Repositories* and then you select a provisioning adapter in the Discover VM Hosts and Repositories dialog box.
- A VM Discovery action is initiated if you select *Provision > Discover VM Images* and then you select a provisioning adapter in the Discover VM Images dialog box. An action is specified for each Repository you specify.
- A Migrate action is initiated when you perform the migration of a Virtual Machine (VM).

For a comprehensive list of the provisioning operations supported by each Cloud Manager Orchestration provisioning adapter, see Chapter 4, "Orchestration Provisioning Adapter Information," on page 31.

2.2.2 How Actions Are Displayed in the Orchestration Console

Depending on the Grid object you select, an Action History tab is displayed in several views of the Orchestration Console.

Action History in Monitor Views of the Orchestration Console

You can see the Action History tab in the VM Hosts monitor view if you select a migrating VM:

Figure 2-1 *VM Hosts Actions*
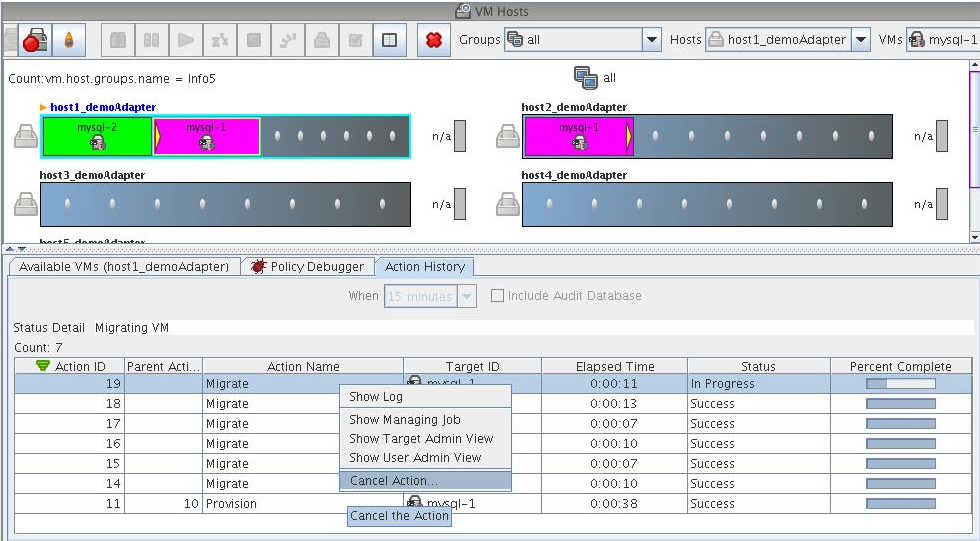
Two action-specific menu selections are available if you right-click an action in the action history table:

- *Show Log* opens the provision log for the VM
- *Cancel Action* cancels the selected active action

The action history table is updated at the same time the polling view is updated.

NOTE: The format of action history table is similar in the Provisioner monitor view and in the Users monitor view.

If the *Include Audit Database* check box is selected in this view, the action status is not polled. Click the refresh icon to fetch and display fresh data.

NOTE: The Orchestration Server must be connected to an audit database for the *Include Audit Database* check box to be available. This behavior is the same in the Job monitor view.

Action History in Admin Views of the Orchestration Console

Action history is displayed in other Grid object admin views of the Orchestration Console:

- User object
- Resource object
- Repository object

The following illustration shows an example of action history in the Repository admin view:

Figure 2-2   *Repository Action History*
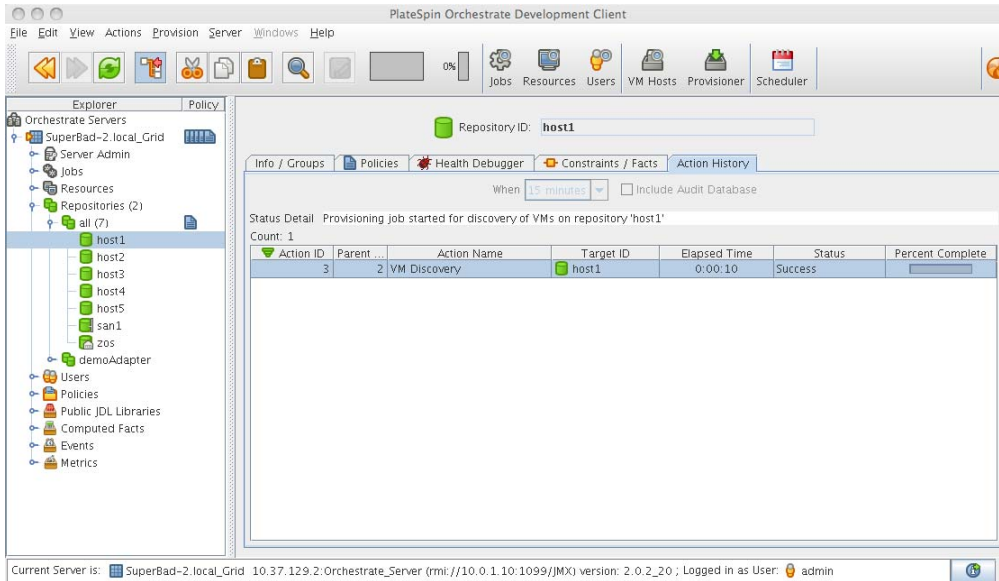
The table below defines some of the column names and the values that can populate those columns in the action history table:

Table 2-1   *Action History Table Columns*

Column Name	Purpose
Action ID	A unique integer value used to identify the action.
Parent Action ID	If a value is displayed, the action is a child of this parent, identified with a unique integer value.
Action Name	Specific to the action being invoked.
Target ID	The identifying string of the object where the action is to occur.
Status	Displays the status of this action (specific to the action being invoked). Possible values in this column include: ◆ Started ◆ In Progress ◆ Success ◆ Failed ◆ Canceled

2.2.3 Prioritized Provisioning Actions

Because the Orchestration Server must efficiently manage many resources and jobs while providing acceptable response times, short-running, user-facing jobs, such as stopping a running VM instance are prioritized above long-running background tasks such as building a VM image.

The Orchestration Server increases the priority for the *Start*, *Stop*, *Pause*, *Suspend, CheckStatus* and *Resume* provisioning actions so that they are run before the *Clone*, *Build*, or *Save Config* provisioning actions. These prioritized provisioning actions run as "privileged provisioning actions," which means that they can run in a resource's extra system joblet slots. This is done so that customer-initiated provisioning actions can be run immediately, even when resource joblet slots are filled by lower priority actions, congesting the grid.

NOTE: A prioritized provisioning action runs with a new "mediumlow" priority in the Orchestration Console rather than the traditional "low" priority.

For more information about adding joblet slots, see Joblet Slots in the "The Resource Object"section of the *NetIQ Cloud Manager 2.1 Orchestration Console Reference*.

2.3 Managing a Running Virtual Machine

There are many ways you can control a VM after it has been deployed. All actions from provisioning to shutting down the VM can be managed directly from the Orchestration Console, through provisioning adapter jobs, and through custom jobs written by the user.

Review the following sections for ways to manage running VMs:

- Section 2.3.1, "Using the Right-Click Menu for Provisioning Actions," on page 17
- Section 2.3.2, "Prerequisites for Creating or Deleting vNIC and vDisk Objects on Hyper-V Managed Linux VMs," on page 22
- Section 2.3.3, "Releasing a Virtual Machine from Usage," on page 22
- Section 2.3.4, "Managing Virtual Machine Templates," on page 22
- Section 2.3.5, "Managed Virtual Machine Actions," on page 24
- Section 2.3.6, "Virtual Machine Technology-Specific Actions," on page 25

2.3.1 Using the Right-Click Menu for Provisioning Actions

You can perform provisioning actions by right-clicking a VM in the Explorer tree of the Orchestration Console.

For information on provisioning adapters, see Section 2.1, "Provisioning a Virtual Machine," on page 13.

The provisioning actions available from the right-click menu are as follows:

Table 2-2 *Right-Click VM Commands*

Action	Description
Provision	Starts a VM to a running state. The Orchestration Server automatically looks for the best VM host machine to run the VM on, unless you have specifically designated another server to run the VM. If a VM has snapshots, you cannot start the VM on a different host. If a VM that has snapshots is on a shared repository, you can register the VM to a different host and start the VM if the host is also connected to the shared repository.
Pause	Prevents the VM from gaining access to the processor of the host machine, although it is still resident in the memory of the host machine.
Resume	Allows a paused VM to access the processor of the host machine again.
Suspend	Pauses the VM and takes a snapshot of its disk and memory status. In the suspended state, a VM can be moved or migrated to another host machine. **NOTE**: A suspended VM must be provisioned to make it active again. The *Resume* action does not perform this function.
Shutdown	Stops a VM from running, just like shutting down a physical machine. The operating system stops and acts as if it is shut down.
Restart	Shuts down and restarts a running VM.
Migrate	**vSphere:** Migrates the VM from one host machine to another only if both the source and destination host machines have VMotion enabled. VM migrations can be of the following types: ◆ A "warm migrate" is the migration of a suspended VM to another host. From a user's perspective, if a VM is suspended, it is effectively "down." This function requires shared storage. ◆ A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This function requires shared storage. For more information, see the VMware VMotion documentation (http://www.vmware.com/products/vmotion/). **Hyper-V:** VM migration is not supported by Cloud Manager Orchestration. **Xen:** VM migrations can be of the following types: ◆ A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This function requires shared storage. **NOTE**: Migration of a Xen VM on Fibre Channel SAN disks is not supported.

Action	Description
Resync State	Ensures that the state of the VM displayed in the Orchestration Console is accurate.
Rediscover VM	If changes have been made to a virtual machine in the hypervisor's native management console, that new configuration might not be reflected in Orchestration fact values. The *Rediscover VM* action triggers an Orchestration event that rediscovers the fact configuration of a single VM in the hypervisor and then updates the facts of the counterpart VM Grid Object represented in the Orchestration Server. **NOTE**: This action is supported only for VMs managed by the KVM hypervisor.
Save Config	Requests that the runtime VM configuration be persisted on the VM image for future use. **NOTE**: If you add a vNIC or a vDisk to a VM, you must initiate the *Save Config* action. Clicking the *Save* icon on the Orchestration Console toolbar does not save the change.
Apply Config	Updates the VM transient configuration. The VM must be running.
Create Template (VM only)	Creates a new template object based on the VM. Other versions of the VM can be cloned from this template. This menu item is replaced by the *Clone* menu item when you right-click a template VM.
Clone (VM template only)	Creates a standalone VM instance from the template but does not power on that instance. This action is unlike the *Provision* action from a template, which performs a *Clone* action, powers on the instance, then destroys the VM instance when it is powered off.
Delete/Destroy Resource	Removes a VM from the *Resources* list in the Orchestration Console. If you want to delete the VM from the host machine, select the *Destroy VM Instance* option. **NOTE**: If you previously added a vDisk to the VM, it is not deleted with the VM unless the vDisk is marked moveable.
Move Disk Images	A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (including VMs that are suspended with a checkpoint file). This function does not require shared storage; the move is between separate repositories. Select the storage location from the drop-down menu. You can also move a VM from one VM host machine to another. This is a "cold" migration. VMware Server VMs must be migrated in this manner. If you want to move a VM of considerable size, appropriately increase the timeout fact value in the VM policy. The default value is 2400. For more information on editing the policy, see Chapter 4, "Orchestration Provisioning Adapter Information," on page 31. If a VM has snapshots, you cannot move the VM but you can register it to a different host if the VM and the host are connected to a shared repository.

Action	Description
Checkpoint	Creates a named snapshot of a VM image. This image is stored on the disk of the repository machine. Xen VMs cannot have a checkpoint applied to them.
	All the snapshots of a VM are chronologically listed in the resoruce.vm.snapshots fact, and the latest snapshot is listed in the resource.vm.current_snapshot fact.
	If the vSphere VM or the Hyper-V VM already has snapshots taken through other management consoles, the snapshots are synchronized with the latest snapshot taken through the Orchestration Console, and are listed in the `resource.vm.snapshots` fact.
Restore	Starts a Checkpoint VM (that is, resumes the operations of a VM made into a stored checkpoint from the moment of storage).
	If the vSphere VM already has snapshots taken through other management consoles, the snapshots are synchronized with the latest snapshot taken through the Orchestration Console, and are listed in the `resource.vm.snapshots` fact.
Remove Template Dependency	Changes a cloned instance of a VM into a VM instance.
Install Agent	Launches a job that automatically installs the Orchestration Agent on a Xen-managed VM the next time you provision the VM.
	IMPORTANT: If you stop or cancel a running Install Agent job, the VM is locked and you cannot provision the VM. The VM is automatically released after a period of time.
Personalize	Allows you to customize the VM. This includes changing elements like the DNS server. The changes are made to a VM that is shut down.
	This action relates to all guest OS-level changes, not hardware changes. With vSphere, guest customization occurs the next time the VM is powered on. The vSphere administrator must have properly configured the vCenter server to handle sysprep and the VMware tools must be installed to the VM.
	IMPORTANT: If you stop or cancel a running Personalize job, the VM is locked and you cannot provision the VM. The VM is automatically released after a period of time.
Shutdown Agent	Shuts down the Orchestration Agent and makes the VM unavailable as a resource.
Create Virtual NIC	Manually creates a vNIC on the VM to configure its network interface configuration by way of a vBridge connection.
	For more information, see "Creating or Deleting a vNIC in the Orchestration Console" in the *NetIQ Cloud Manager 2.1 Orchestration Console Reference*.
	NOTE: You can manually delete the new vNIC after it is created by right-clicking the vNIC object in the Explorer tree, then selecting *Delete.*

Action	Description
Create Virtual Disk	Manually creates a vDisk image of a specified size (measured in Mb) to associate to the VM. For more information, see "Creating or Deleting a vDisk in the Orchestration Console" in the *NetIQ Cloud Manager 2.1 Orchestration Console Reference*. **NOTE**: You can manually delete the new vDisk after it is created by right-clicking the vDisk object in the Explorer tree, then selecting *Delete.*
Cancel Action	Stops an action that has been requested.
Check Host Assignment	Opens a window so you can compare the VM hosts capable of hosting the VM.
Launch Remote Desktop	Launches a VNC terminal in which you can view and control the VM. Specify the credentials configured for the Web service in the appropriate VM policy. Some provisioning adapters require additional setup before you can launch a remote desktop. For more information about this setup for the *vsphere* provisioning adapter, see "Setting Up Orchestration VNC for a VM Managed by vSphere" in the *NetIQ Cloud Manager 2.1 Orchestration Installation Guide*. For more information about this setup for the *xenserv* provisioning adapter, see "Preparing the Citrix XenServer for Orchestration Provisioning Operations" in the *NetIQ Cloud Manager 2.1 Orchestration Installation Guide*

Authorization Constraint Messages Are Not Readily Visible in the Orchestration Console

If you unsuccessfully attempt to provision a VM whose Host/Repository selection has been designated as Automatic, it is possible that a policy with an authorization constraint has been associated to that VM. In this scenario, no message explaining the restriction is displayed.

To confirm that the provisioning has an authorization constraint:

1 In the Explorer tree of the Orchestration Console, select the VM that you want to provision.

2 In the Orchestration Console toolbar, select *Provisioner* to open the provisioning monitor view for that VM.

3 Select the *Show Log* tab to open the provisioning log.

Scan the log to find errors indicating that the VM could not be provisioned because of authorization constraints in its policy.

2.3.2 Prerequisites for Creating or Deleting vNIC and vDisk Objects on Hyper-V Managed Linux VMs

Although you can create vNICs and vDisks on Windows VMs managed by the Microsoft Hyper-V hypervisor, there is a prerequisite for creating or deleting these objects on a Linux VM managed by Hyper-V.

To make these actions work, it is necessary to install Linux Integration Components from Microsoft. For download and installation information, see the Linux Integration Components page (http://www.microsoft.com/downloads/details.aspx?FamilyID=c299d675-bb9f-41cf-b5eb-74d0595ccc5c&displaylang=en) at the Microsoft downloads Web site.

2.3.3 Releasing a Virtual Machine from Usage

When the demand and load on your data center decreases, the Orchestration Server analyzes the remaining resources and releases the most appropriate resource. If a VM meets the requirements of the remaining job demands better than a physical machine, the physical machine is released before the VM is released. This dynamic analysis allows you to make sure that the needs of your data center are met.

2.3.4 Managing Virtual Machine Templates

A VM template is a special kind of VM that is not deployed separately.

Review the following tasks to manage VM templates:

This section also includes some information about support for the provisioning actions of a VM template created from a Hyper-V VM. See "Hyper-V VM Template Actions" on page 23.

Making a Virtual Machine Instance into a Template

1 In the Orchestration Console, right-click the VM.
2 Select *Create Template*.
3 Name the template.
4 Specify a repository.
5 Specify a visible VM host.
6 Select a recommended host for the VMs to be launched on, if any are present.
7 Click *OK*.

When the instance of the template VM is provisioned, it appears as a sub-branch of the template's location in the resources tree.

This clone functions as an instance of a VM and runs as though it were its own version with its own MAC address and other unique identifiers. The UUID is the only new information that is automatically generated for the clone. All the rest of the new information comes from autoprep, including the MAC address if an asterisk (*) is placed in the *Mac Address* field in the *Autoprep Network*

Adapter section of the *Info/Groups* tab for the template (the default is a blank field, meaning no MAC address is created), and if the *Use Autoprep* check box is enabled in the Create VM from *Template* dialog box.

Changing a Virtual Machine Template Clone to an Instance

1 If you decide to keep a clone VM, go to the Cloud Manager Orchestration Console, right-click it, and select *Remove Template Dependency*.

The Remove Template Dependency dialog box is displayed.

2 Click *OK*.

NOTE: This procedure works only when a VM instance has been cloned from a template. It does not work when a VM instance is provisioned from a template.

Hyper-V VM Template Actions

VM templates created in the Cloud Manager Orchestration Server from discovered Hyper-V VMs have limited functionality. The following actions are supported in a Hyper-V VM template:

- Provision
- Move Disk Images
- Clone
- Delete/Destroy Resource
- Resync State

IMPORTANT: Even though the *Create Virtual NIC* and *Create Virtual Disk* actions appear to be legitimate actions on the right-click menu of a Hyper-V VM template (that is, they are not dimmed), these are not supported actions.

The following actions are not supported in a Hyper-V VM template:

- Save Config
- Checkpoint
- Restore
- Install Agent
- Personalize
- Create Virtual NIC
- Create Virtual Disk

2.3.5 Managed Virtual Machine Actions

You can perform many actions on the VM through the Orchestration Console, from Cloud Manager itself, or you can write jobs to have actions performed on the VMs in your data center. The following table lists the managed VM actions that you can perform or use in a written job.

Table 2-3 *Managed VM Actions*

Action	Description
Provision	Starts a VM. This action clones and start a cloned VM template.
Clone	Creates a new, unique instance of a VM template.
Cold Migrate	Moves the storage location of the configuration and first disk files to another physical storage host. This might allow the VM to start faster.
Shutdown	Stops an active VM instance (including a started template VM).
	NOTE: If you manually shut down a running VM (either by logging in to the VM and shutting it down manually or by using any hypervisor-specific tool to shut down the VM), that VM is still displayed in the Orchestration Console as running. If you then choose the *Shutdown* action rather than the *Resync State* action for that VM, the Orchestration Server job log shows that the shutdown job fails. This condition always exists unless a Resync operation occurs on the VM or when an Orchestration Agent on the VM relays its current state to the Orchestration Server.
Delete/Destroy	Removes a VM from the *Resources* list in the Orchestration Console. If you want to delete the VM from the host machine, select the *Destroy VM Instance* option.
Suspend	Takes a snapshot of an active VM and pauses it in order to move it to another VM host.
Pause	Prevents the VM from obtaining CPU cycles, but it stays resident.
Resume	Allows a paused VM to access the CPU again.
Create Template	Creates a VM template from a VM instance.
Hot Migrate	Changes the association of the VM, which is residing in a shared storage location, from one host machine to another.
Checkpoint	Create a named snapshot of a moment that can later be accessed to restart from the same point
Restore	Resumes a VM at a previously stored checkpoint.
Install Orchestrator Agent	Opens a VM image and installs the Orchestration Agent.
Make Standalone	Removes the association of a template and makes the active VM into its own instance.
Check Status	Checks the current state of the VM to verify if the VM is provisioned or shut down.
Personalize	Modifies the Orchestration Agent properties and disk image that are currently part of a clone.
Save Config	Transfers changes made to a VM to its permanent image storage.

2.3.6 Virtual Machine Technology-Specific Actions

For a detailed breakdown of the actions you can perform on and with a VM, see the appropriate VM technology and configuration section in Chapter 4, "Orchestration Provisioning Adapter Information," on page 31.

2.4 Resynchronizing the State of All VMs

To manually verify and ensure that the state of the VMs of all VM hosts displayed in the Orchestration Console is accurate:

1 In the Orchestration Console, click *Provision > Resync VM's State*.

The Resync VMs' State dialog box is displayed.
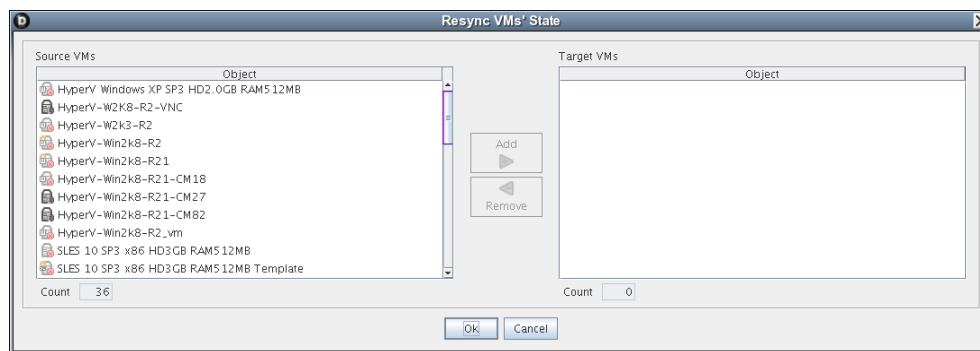
2 In the *Source VMs* pane, select the VMs to be resynchronized, then click *Add*.

The selected VMs are added to the *Target VMs* pane.

3 Click *OK*.

2.5 Resynchronizing the State of All VMs of a Specific VM Host

To manually verify and ensure that the state of the VMs of a specific VM host displayed in the Orchestration Console is accurate:

1 In the Orchestration Console, click *Provision > Reset State of All VMs*.

The Reset State of All VMs dialog box is displayed.

2 Select the VM host whose VMs you want to resynchronize.

3 Click *OK*.

2.6   Shutting Down Multiple VMs

1 In the Orchestration Console, click *Provision > Shutdown VMs*.

The Shutdown VMs dialog box is displayed.

2 You can choose to shut down the VMs after the Orchestration Agent becomes idle or to immediately shut down the VMs. By default, the *Wait for Agent to become Idle* option is selected.

3 In the *Source VMs* pane, select the VMs you want to shut down, then click *Add*.
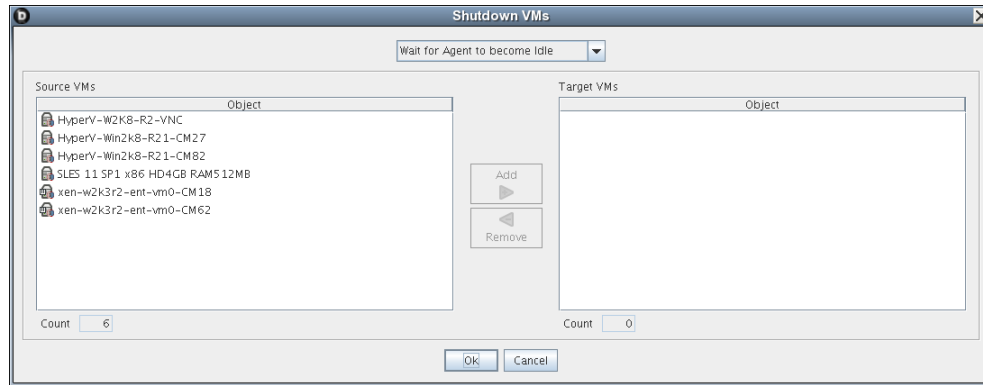
The selected VMs are added to the *Target VMs* pane.

4 Click *OK*.

2.7   Destroying and Deleting a Virtual Machine

1 In the Orchestration Console, right-click the VM in the tree and select *Delete/Destroy Resource*.

The Delete Resource dialog box is displayed.
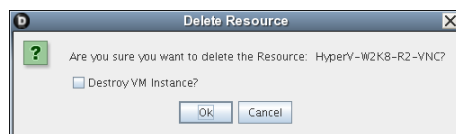
2 (Optional) To delete a VM from the VM host, select the *Destroy VM Instance* option.

This completely deletes the VM and all its versions from your data center. You cannot restore any version of the VM after you delete it.

If you do not choose this option, the VM is removed from the resource list. However, the actual image of the VM is still stored in its directory.

3 Click *OK*.

If you choose only to delete a VM from your resource tree, you can rediscover the VM by running a discovery job (click *Provision > Discover VM Images*).

3 Managing VM Repositories

The Cloud Manager Orchestration Server uses the Repository object to represent where VMs are stored. VMs can be stored on local disks, the datagrid, a network attached storage (NAS), or a storage area network (SAN, Fibre Channel, or iSCSI).

Before VMs can be used by Cloud Manager Orchestration, you must create or discover Repository objects and then discover the VM images within the Repository:

3.1 Provisioning a VM from a Local Repository

By default, the Xen and vSphere provisioning adapters create a local Repository object for local VM images (or datastores) on a VM host when the Orchestration Server performs the Discover VM Hosts action.

NOTE: For vSphere, the Orchestration Server models all repositories the Virtual Center server is aware of. There is not necessarily a local repository for each ESX host, although that is the default.

A local repository represents VMs residing in a VM Host's local storage where the VMs are only visible to the VM Host. VMs are searched for in the default paths for each adapter.

IMPORTANT: Do not use local repositories for shared directories visible to more than one VM Host. Instead, create a new NAS or SAN repository.

For information on NAS storage, see "Provisioning a VM from a NAS Repository" on page 28. For information on SAN storage, see "The SAN Repository" on page 29.

When discovering VM Images, the adapters use the `location`, `searchpath` and `preferredpath` facts for searching. The `repository.location` is usually the root path, such as `/`. For Xen, the adapter creates a local repository with search paths of `/etc/xen/vm` and a preferred search path of `/var/lib/xen/images`.

When the Discover VM Images action is run, the provisioning adapter follows these steps:

- Concatenates the `repository.location` and every element of `repository.searchpath` and searches for VMs in those directories.
- Concatenates the `repository.location` and `repository.preferredpath` and searches for VMs in that directory.

These steps are also followed when searching in NAS and SAN repositories when representing auto-mounted file systems, and when the location, search path, and preferred path are set.

For more information on facts, see "Understanding Grid Object Facts, Computed Facts, and Custom Facts" in the *NetIQ Cloud Manager 2.1 Orchestration Developer Reference*.

3.2 The Datagrid Repository

By default, a datagrid repository named `zos` is automatically created when the Orchestration Server is initialized. The datagrid repository represents VMs residing in the Orchestration datagrid, which is a storage area on the Orchestration Server.

The `zos` datagrid repository has a location of `grid:///vms`, which points to an area in the datagrid reserved for VM archival storage.

The datagrid repository storage is archival because VMs cannot be run from the datagrid repository. You must move VMs out of the datagrid to a VM Host in order to run them.

3.3 Provisioning a VM from a NAS Repository

The Network Attached Storage (NAS) repository represents VMs stored on a NAS. This is a storage area where VMs are visible to multiple VM hosts, so they can be run by any one of the connected hosts.

The following procedure shows an example of setting up a NAS repository. For the example, assume you have a Xen setup where the `/vms` directory is auto-mounted on multiple VM hosts as the shared storage location for your VMs.

1 To create a new Repository object, go to the Orchestration Console, then click *Actions > Create Repository*.

2 Specify a new name and choose which adapter group this repository is used for.

   This example is for Xen VMs, so choose the xen30 adapter.

3 Close the dialog box to display the *Info/Groups* tab for the new repository.

4 Set the location path.

   This is the root path for the repository. It is usually `/`.

5 Set the search path and preferred path.

   In this example, the VMs are all in `/vms`, so leave `searchpath` empty and set the `preferredpath == "vms"`.

6 Select the VM Host objects that have visibility to the shared directory and add the new repository to the VM hosts list of available repositories.

   To find a VM host, either select *VM Hosts* to open the VM Hosts admin view or open the *Physical* tree under *Resources* and open the physical host representing the VM host.

7 Run *Provision > Discover VM Images* on the new repository.

3.4 The SAN Repository

The Storage Area Network (SAN) repository is a single storage server that can be accessed by multiple machines. The Cloud Manager Orchestration Server does not support booting a VM from a SAN repository. SAN repositories can only be used as data disks for VMs.

4 Orchestration Provisioning Adapter Information

This section includes the following information:

- Section 4.1, "The VMware vSphere Provisioning Adapter," on page 31
- Section 4.2, "The Citrix XenServer Provisioning Adapter," on page 33
- Section 4.3, "The Hyper-V Provisioning Adapter," on page 35
- Section 4.4, "The Xen Provisioning Adapter," on page 37
- Section 4.5, "The KVM Provisioning Adapter," on page 41

4.1 The VMware vSphere Provisioning Adapter

Because you probably want to get your Cloud Manager Orchestration environment configured for use in your vCenter hypervisor environment at installation time, detailed configuration information you need for the vSphere provisioning adapter is included in the "Configuring the vsphere Provisioning Adapter" in the *NetIQ Cloud Manager 2.1 Orchestration Installation Guide*.

This section includes the following supplementary information about the provisioning adapter:

- Section 4.1.1, "Provisioning Actions Supported by the vSphere Provisioning Adapter," on page 31
- Section 4.1.2, "Known Configuration Limitations for Virtual Center VMs," on page 33

4.1.1 Provisioning Actions Supported by the vSphere Provisioning Adapter

The following table lists the VM provisioning actions supported by the Orchestration Console for the vsphere provisioning adapter job.

Table 4-1 *Provisioning Actions Supported by the vSphere Provisioning Adapter on Guest Operating Systems*

Orchestration Server Managed VM Action	SLES 10	SLES 11	RHEL 4	RHEL 5	RHEL 6	Other Linux	Windows 2003 R2	Windows 2008 R2
Provision	X	X	X	X	X	X	X	X
Clone	X	X	X	X	X	X	X	X
Shutdown	X	X	X	X	X	X	X	X
Destroy	X	X	X	X	X	X	X	X
Suspend	X	X	X	X	X	X	X	X

Orchestration Server Managed VM Action	SLES 10	SLES 11	RHEL 4	RHEL 5	RHEL 6	Other Linux	Windows 2003 R2	Windows 2008 R2
Pause								
Resume								
Create Template	X	X	X	X	X	X	X	X
Move Disk Image[1]	X	X	X	X	X	X	X	X
Hot Migrate[2]	X	X	X	X	X	X	X	X
Warm Migrate[3]	X	X	X	X	X	X	X	X
Checkpoint	X	X	X	X	X	X	X	X
Restore	X	X	X	X	X	X	X	X
Install Orchestration Agent	X	X	X	X	X	X	X	X
Make Standalone	X	X	X	X	X	X	X	X
Check Status	X	X	X	X	X	X	X	X
Save Config	X	X	X	X	X	X	X	X
Cancel Action	X	X	X	X	X	X	X	X
Check Host Assignment	X	X	X	X	X	X	X	X
Launch Remote Desktop	X	X	X	X	X	X	X	X

NOTE: Host operating systems are dependent on the VMware vSphere support matrix.

The VMware vsphere provisioning adapter supports only VMware Virtual Center 2.*x*. Virtual Center 1.*x* is not supported.

[1] A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (including VMs that are suspended with a checkpoint file). This action does not require shared storage; the move is between separate repositories.

[2] A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This action requires shared storage.

[3] A "warm migrate" is the migration of a suspended VM to another host and starting it there with brief resulting downtime (measured in seconds). This action requires shared storage.

4.1.2 Known Configuration Limitations for Virtual Center VMs

When a vSphere VM is deleted by the vSphere client, it can leave behind a VM template in a "defined" state that can be subsequently discovered and registered as a resource in the Orchestration Server.

If you attempt to remove this VM template in the Orchestration Console, the Orchestration Server attempts to remove the VM's files from the file system, but because the VM has no files to delete, the provisioning job fails with the following error:

```
Error: Delete : Failed delete of Managed Entity :
```

For identified vCenter VM issues slated for eventual correction, see the "vSphere VM Issues in the Orchestration Console" section of the *NetIQ Cloud Manager 2.0 Readme*. For ongoing vCenter VM issues, see "Troubleshooting vSphere VM Provisioning Actions" in the *NetIQ Cloud Manager 2.1 Orchestration Troubleshooting Reference*.

4.2 The Citrix XenServer Provisioning Adapter

Because you probably want to get your Cloud Manager Orchestration environment configured for use in your Citrix XenServer hypervisor environment at installation time, detailed configuration information you need for the xenserv provisioning adapter job is included in the "Configuring the Citrix XenServer Provisioning Adapter" in the *NetIQ Cloud Manager 2.1 Orchestration Installation Guide*.

This section includes the following information:

4.2.1 The xenserv.policy File

The xenserv.policy file contains the policy settings for the xenserv provisioning adapter job. The policy is deployed automatically when the Orchestration Server starts. By default, the optimal values are preset for the configuration of the job and joblets in the policy.

The policy settings are made on the following facts:

* `job.vdisk_creation_pattern`
* `job.joblet.copyMaxRetry`
* `job.multicast`
* `job.multicastWait`
* `job.multicastQuorum`
* `job.multicastRate`
* `job.multicastMinReceivers`
* `job.vmagentPeriod`
* `job.vmagentRetry`
* `job.vmagentTimeout`

- ◆ `job.vmagentFallback`
- ◆ `job.vmagentSocketPath`

4.2.2 Provisioning Actions Supported by the XenServ Provisioning Adapter

The following table lists the VM provisioning actions supported by the Orchestration Console for the xenserv provisioning adapter job for Citrix XenServer 5.6.0.

Table 4-2 *Provisioning Actions Supported by the Xen Provisioning Adapter*

Cloud Manager Orchestration Managed VM Action	SLES 10 Guest	SLES 11 Guest	RHEL 4 Guest	RHEL 5 Guest	Other Linux Guest	Windows Guest
Discover VM Hosts and Repositories	X	X	X	X	X	X
Discover VM Images	X	X	X	X	X	X
Discover Disks[1]	X	X	X	X	X	X
Provision	X	X	X	X	X	X
Clone	X	X	X	X	X	X
Shutdown	X	X	X	X	X	X
Destroy	X	X	X	X	X	X
Suspend[2]	X	X	X	X	X	X
Pause	X	X	X	X	X	X
Resume[2]	X	X	X	X	X	X
Create Template	X	X	X	X	X	X
Move Disk Image[3]	X	X	X	X	X	X
Hot Migrate[4]	X	X	X	X	X	X
Checkpoint	X	X	X	X	X	X
Restore Checkpoint	X	X	X	X	X	X
Install Orchestration Agent	X	X	X	X		X
Make Standalone (Remove Template Dependency)	X	X	X	X	X	X
Check Status (Resync State)	X	X	X	X	X	X
Personalize	X	X	X	X		
Save Config[5]	X	X	X	X	X	X
Apply Config[6]	X	X	X	X	X	X
Cancel Action	X	X	X	X	X	X
Check Host Assignment	X	X	X	X	X	X

Cloud Manager Orchestration Managed VM Action	SLES 10 Guest	SLES 11 Guest	RHEL 4 Guest	RHEL 5 Guest	Other Linux Guest	Windows Guest
Build						
Launch Remote Desktop	X	X	X	X	X	X

For more information about guest platform support, see the Xenserver 5.6 Administrator's Guide (http://support.citrix.com/servlet/KbServlet/download/23735-102-646135/Administrators_Guide.pdf).

[1] Currently, only an ISO disk discovery is supported.

[2] Suspend/Resume of Windows VMs is not supported until the PV drivers are upgraded/installed. You can install these drivers using XenServer Tools available from the XenCenter VM menu.

[3] A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (this includes VMs that are suspended with a checkpoint file). This function does not require shared storage; the move is between separate repositories.

Before you move a disk image, make sure that you allow enough free space (total VM disk size) in the local repository of the destination server to allow storage of the exported .xva files.

Moving a snapshot associated with a VM is not supported.

[4] A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This action requires shared storage.

[5] Modifying CPU number and VM memory supported. Add/Modify/Remove of vDisk and vNIC are supported. When modifying a vDisk, only increasing disk size is supported.

[6] Add/Modify/Remove of vNIC are supported. Add vDisk and Detach ISO disk are supported.

4.3 The Hyper-V Provisioning Adapter

This section includes the following information:

⬥ Section 4.3.1, "Provisioning Actions Supported by the Hyper-V Provisioning Adapter," on page 36

For known Hyper-V provisioning adapter issues, see "Troubleshooting Hyper-V VM Provisioning Operations" in the *NetIQ Cloud Manager 2.1 Orchestration Troubleshooting Reference*.

4.3.1 Provisioning Actions Supported by the Hyper-V Provisioning Adapter

The following table lists the VM provisioning actions supported by the Orchestration Console for the hyperv provisioning adapter job.

Table 4-3 *Provisioning Actions Supported by the Hyper-V Provisioning Adapter*

Orchestration Server Managed VM Action	SLES 10	Windows 2000	Windows Server 2003	Windows Server 2008
Provision	X	X	X	X
Pause	X	X	X	X
Resume	X	X	X	X
Suspend	X	X	X	X
Shutdown	(X)[1]	X	X	X
Shutdown Agent	X	X	X	X
Restart	X	X	X	X
Hot Migrate[2]	X	X	X	X
Warm Migrate[3]				
Move Disk Images[4]	X	X	X	X
Resync State[5]	X	X	X	X
Save Config	X	X	X	X
Apply Config		X	X	X
Create Template		X	X	X
Delete / Destroy Resource[6]	X	X	X	X
Checkpoint	X	X	X	X
Restore	X	X	X	X
Remove Template Dependency		X	X	X
Install Agent		X	X	X
Personalize		X	X	X
Cancel Action	X	X	X	X
Check Host Assignment	X	X	X	X
Launch Remote Desktop		X	X	X
Create Virtual Disk	X	X	X	X
Create Virtual NIC	X	X	X	X
Delete Virtual Disk	X	X	X	X
Delete Virtual NIC	X	X	X	X

1 Shutting down the Orchestration Agent on a SLES 10 VM (guest OS) is possible if the agent is installed manually in the VM.

2 A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This action requires shared storage.

3 A "warm migrate" is the migration of a suspended VM to another host and starting it there with brief resulting downtime (measured in seconds). This action requires shared storage.

4 A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (including VMs that are suspended with a checkpoint file). This action does not require shared storage; the move is between separate repositories.

5 In addition to updating the VM's status, Resync State collects information about the present VM host, even if the VM is migrated to some other host by an external action executed in a Hyper-V clustered environment. It also discovers the `osfamily` and `ostype` fact values.

6 The Delete/Destroy Resource action deletes all VM files (including snapshot files) except ISOs that are attached to the image. The action might not destroy the VM file folders if the VM was created in a non-default location.

4.4   The Xen Provisioning Adapter

This section includes the following information:

4.4.1 Configuration Policies Used by the Xen Provisioning Adapter

The following table provides information about the policies associated with the xen provisioning adapter job that manage the Xen hosts and VMs in the grid. The policy settings are applied to all the VMs in the grid.

Table 4-4 *Virtual Machine Management Policies for Xen*

Policy Name	Explanation	Additional Details
xen	Contains the policy settings for the xen provisioning adapter.	By default, the optimal values are configured for the job and joblets in the policy.
xenDiscovery	Contains the settings required to discover the Xen host machines. It also contains the default installation path of the Xen server.	If the Xen server is not installed in the default path, edit this policy to provide the correct information.
xenPA	Contains the constraints used to check whether the Xen host is registered to the Orchestration Server, and the host is up and running.	Do not edit the policy.

4.4.2 Provisioning Actions Supported by the Xen Provisioning Adapter

The following table lists the VM provisioning actions supported by the Orchestration Console for the xen provisioning adapter job.

Table 4-5 *Provisioning Actions Supported by the Xen Provisioning Adapter*

Cloud Manager Orchestration Managed VM Action	SLES 9 Guest	SLES 10 Guest	RHEL 4 Guest	RHEL 5 Guest	Other Linux Guest	Windows Guest
Provision	X	X	X	X	X	X
Clone	X	X	X	X	X	X
Shutdown	X	X	X	X	X	X
Destroy	X	X	X	X	X	X
Suspend	X	X	X	X	X	X
Pause	X	X	X	X	X	X
Resume	X	X	X	X	X	X
Create Template	X	X	X	X	X	X
Move Disk Image[1]	X	X	X	X	X	X
Hot Migrate [2]	X	X	X	X	X	X
Checkpoint	X	X	X	X	X	X
Restore	X	X	X	X	X	X

Cloud Manager Orchestration Managed VM Action	SLES 9 Guest	SLES 10 Guest	RHEL 4 Guest	RHEL 5 Guest	Other Linux Guest	Windows Guest
Install Orchestration Agent	X	X	X	X		X
Make Standalone	X	X	X	X	X	X
Check Status	X	X	X	X	X	X
Personalize	X	X	X	X		
Save Config	X	X	X	X	X	X
Cancel Action	X	X	X	X	X	X
Check Host Assignment	X	X	X	X	X	X
Build	?	?	?	?	?	?
Launch Remote Desktop	X	X	X	?	X	X

[1] A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (this includes VMs that are suspended with a checkpoint file). This function does not require shared storage; the move is between separate repositories.

[2] A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This action requires shared storage.

4.4.3 Additional Xen Provisioning Adapter Information

Other behaviors of the xen provisioning adapter that you should be aware of include the following:

- The VM Builder running on a SLES 11 VM host now supports three additional VM OS types:
  - openSUSE 11
  - SLED 11
  - SLES 11

  These OS types are not available for build when you use the VM Builder running on a SLES 10 SP2 VM host. These OS types can only be built and provisioned to a SLES 11 VM host.
- VMs that were supported on SLES 10 SP2 are supported on SLES 11; that is, if the VM was built on SLES 10 SP2, the provisioning adapter supported for that VM on SLES 10 SP2 can also be supported when the VM runs on SLES 11.
- Although VM migration from a SLES 11 VM host to a SLES 10 SP2 VM host is not supported, VM migration is supported in the following scenarios:
  - VM on a SLES 10 SP2 VM host migrating to a SLES 11 VM host
  - VM on a SLES 10 SP2 VM host migrating to a SLES 10 SP2 VM host
  - VM on a SLES 11 VM host migrating to a SLES 11 VM host
- Virtual machines built on SLES 10 SP2 can be provisioned on either SLES 10 SP2 or SLES 11 VM hosts.
- Virtual machines (regardless of OS type) built on SLES 11 cannot be provisioned on a SLES 10 SP2 VM host.

- RHEL 5 VMs managed by the xen provisioning adapter must have the following characteristics:
  - They must not use LVM

    or
  - If LVM is used on the VM, its volume groups (VGs) must have unique (that is, non-default) names.

  To illustrate what can happen when you use a default LVM configuration, consider the following example:

  You create two RHEL 5 VMs. During this process, the default disk configuration (which incorporates LVM) is utilized, so the two VMs have identical VG names. If these VMs are located on the same Xen host, a naming conflict occurs when those VMs are concurrently discovered by the Orchestration Server. This results in one of the VMs not being properly discovered.

  TIP: As a general rule, we do not recommend using LVM for VM disks.

For information about the VMs provisioned by this provisioning adapter, see Section 4.4.1, "Configuration Policies Used by the Xen Provisioning Adapter," on page 38.

4.4.4 Known Configuration Limitations for Xen VMs

The following list describes the known limitations you can encounter when configuring Xen VMs in the Orchestration Server.

- The checkpoint and restore features on the xen provisioning adapter only suspend and resume the specified VM. Xen does not support taking normal snapshots as other hypervisors do.

- The Cloud Manager Orchestration Server configures the "netfront" paravirtualized driver in paravirtualized and fully virtualized guest VMs.

  Previous releases of the Orchestration Server allows for 16 disks on both paravirtualized and fully virtualized VMs. However, if the paravirtualized drivers have not been installed within a fully virtualized VM, you can configure only 4 disks. In this scenario, if the number of disks exceeds 4, Xen fails to start the VM.

- If you use virt-manager to create a VM in the default repository and then copy its config file from /etc/xen/vm/<*VM_name*> to a new location on a different repository, both of these config files point to the same physical disk image. If you do not remember to use the xm delete command on the original VM, the Discovery action on both the original repository and the new repository results in the same VM being discovered in both repositories. This can cause the provisioning adapter to become confused as to which repository holds the VM image you want to use. To avoid this issue, we recommend that you use the Orchestration Console to move any VMs you happen to create manually. The client takes care of properly deleting and re-creating the configuration for the VM.

- When the xendConfig job is used during the discovery of a very large number of Xen VM hosts (that is, Xen resources where you have installed the Orchestration Agent), the completion of the xendConfig job can take an unnecessary amount of time to complete. This happens because, by default, an instance of the xendConfig job is started for every VM host discovered, possibly resulting in a very large number of queued xendConfig jobs.

  By default, the xendConfig job is constrained to allow only one instance of the job to run at a time, causing all the other xendConfig job instances to queue.

  The following constraint from the xendConfg.policy file causes all the xendConfig job instances to run one at a time, rather than concurrently.

```
<constraint type="start" >
  <lt fact="job.instances.active"
          value="1"
          reason="Only 1 instance of this job can run at a time" />
</constraint>
```

If you need to work around this issue to accommodate a large Xen environment, you can temporarily remove or comment out this constraint from the xendConfig policy, but you must ensure that no other the Orchestration Server administrator runs this job at the same time. Doing so might result in corruption of the `/etc/xen/xend-config.sxp` file because two xendConfig job instances could attempt to concurrently modify this config file.

4.5 The KVM Provisioning Adapter

Because you probably want to get your Cloud Manager Orchestration environment configured for use in your KVM hypervisor environment at installation time, detailed configuration information you need for the kvm provisioning adapter job is included in the "Configuring the KVM Provisioning Adapter" in the *NetIQ Cloud Manager 2.1 Orchestration Installation Guide*.

This section includes the following information:

4.5.1 Understanding the Functionality of the KVM Provisioning Adapter

The Orchestration KVM provisioning adapter does not use a command line tool, nor does it communicate with the KVM daemon directly. The Orchestration Server manages KVM virtual machines using the libvirt API set, which communicates with the KVM daemon.

The KVM hypervisor runs on SUSE Linux Enterprise Server (SLES) 11 SP1 host machines where the Cloud Manager KVM provisioning adapter can discover its guest virtual machines. For information about configuring the KVM provisioning adapter, see Section 4.5, "The KVM Provisioning Adapter," on page 41.

The KVM provisioning adapter does not store a copy of the VM's configuration file on disk with the VM's disk files. Instead, the Orchestration Server searches for VM configuration files during discovery and requests the configuration from the libvirt daemon for other provisioning actions. Because the configuration can exist on any host, the kvm provisioning adapter uses a custom fact (`resource.vm.registered.vmhost`) to store the ID of the host with which the VM is currently associated. Additionally, the Orchestration Server keeps a backup copy of the VM's configuration file on the VM Resource object (using the `resource.vm.libvirt.xml fact`) as a backup if the registered host becomes unavailable through a hardware failure or similar malfunction.

4.5.2 The kvm.policy File

The kvm.policy file contains the policy settings for the kvm provisioning adapter job. The policy is deployed automatically when the Orchestration Server starts. By default, the optimal values are preset for the configuration of the job and joblets in the policy.

Those settings are made on the following facts:

- `job.vdisk_creation_pattern`

- ◆ `job.multicastRate`
- ◆ `job.joblet.copyMaxRetry`
- ◆ `job.multicast`
- ◆ `job.multicastWait`
- ◆ `job.multicastQuorum`
- ◆ `job.multicastMinReceivers`
- ◆ `job.vmagentPeriod`
- ◆ `job.vmagentRetry`
- ◆ `job.vmagentTimeout`
- ◆ `job.vmagentFallback`
- ◆ `job.vmagentSocketPath`

We strongly recommend that you do not edit these facts.

4.5.3 Provisioning Actions Supported by the KVM Provisioning Adapter

The following table lists the VM provisioning actions supported by the Orchestration Console for the kvm provisioning adapter job.

Table 4-6 *Provisioning Actions Supported by the KVM Provisioning Adapter*

Orchestration Server Managed VM Action	SLES 9 Guest	SLES 10 Guest	RHEL 5 Guest	RHEL 6 Guest[3]	Other Linux Guest	Windows Guest
Discover VM Hosts & Repositories	X	X	X	X	X	X
Discover VM Images	X	X	X	X	X	X
Discover Disks	X	X	X	X	X	X
Provision	X	X	X	X	X	X
Clone	X	X	X	X	X	X
Shutdown	X	X	X	X	X	X
Destroy	X	X	X	X	X	X
Suspend	X	X	X	X	X	X
Pause	X	X	X	X	X	X
Resume	X	X	X	X	X	X
Create Template	X	X	X	X	X	X
Move Disk Image[1]	X	X	X	X	X	X
Hot Migrate [2]	X	X	X	X	X	X
Checkpoint						
Restore Checkpoint						

Orchestration Server Managed VM Action	SLES 9 Guest	SLES 10 Guest	RHEL 5 Guest	RHEL 6 Guest[3]	Other Linux Guest	Windows Guest
Install Orchestration Agent						
Make Standalone	X	X	X	X	X	X
Check Status (Resync State)	X	X	X	X	X	X
Personalize	X	X	X	X		X
Save Config	X	X	X	X	X	X
Apply Config	X	X	X	X	X	X
Cancel Action	X	X	X	X	X	X
Check Host Assignment	X	X	X	X	X	X
Build						
Launch Remote Desktop	X	X	X	X	X	X

[1] A "move" is the relocation of VM disk images between two storage devices when the VM is in a not running state (this includes VMs that are suspended with a checkpoint file). This function does not require shared storage; the move is between separate repositories.

[2] A "hot migrate" (also called a "live migrate") is the migration of a running VM to another host and starting it there with minimal resulting downtime (measured in milliseconds). This action requires shared storage. SSH or TLS authentication must be configured for this action to work.

[3] For more information about RHEL 6 VM support, see "RHEL 6 VM Support" in the *NetIQ Cloud Manager 2.1 Installation Planning Guide*.

A Discovering or Dynamically Creating vSphere Port Groups

If you manage a vSphere hypervisor environment, you can configure virtual switches (vSwitches) and distributed virtual switches (dvSwitches) with virtual ports to allow virtual machines on the same ESX Server host to communicate on the network. Your VMware environment also requires port groups, which, according to the VMware Infrastructure Library (http://pubs.vmware.com/vi3/serverconfig/wwhelp/wwhimpl/common/html/wwhelp.htm?context=serverconfig&file=sc_networking.5.3.html) "define how a connection is made through the vSwitch to the (physical) network construct."

You can use the Orchestration Server to monitor the discovered VMs in your vSphere environment (provided that you have configured the vSwitches or dvSwitches on those VMs), dynamically deleting unused port groups from the virtual switches to free up resources on the vSwitch or dvSwitch so that it can be used elsewhere in the virtual network. Then, if you later decide to provision a VM that requires the port group, the Orchestration Server can be configured to automatically re-create the required port group. This allows VMs to be moved or migrated from one host to another without reconfiguring the networking information on either the VM or the host.

This section includes the following information:

- Section A.1, "How the Orchestration Server Models a vSphere Port Group and Exposes vSwitch Settings," on page 45
- Section A.2, "Dynamically Creating Port Groups," on page 45

A.1 How the Orchestration Server Models a vSphere Port Group and Exposes vSwitch Settings

When the Orchestration Server discovers a vSphere VM, it maps port group configuration settings (including its associated vSwitch or dvSwitch configuration settings) to a virtual bridge (vBridge) grid object in the Orchestration Server. As the virtual networking settings (including the VLAN ID) of these resources are determined during VM and VM host discovery, the Orchestration Server also automatically creates a Network group object to group similarly associated vBridge objects. All necessary information required for re-creating a port group is preserved on the Network object and the vBridge object.

A.2 Dynamically Creating Port Groups

You can instruct the Orchestration Server to dynamically create a port group in the vSphere environment if a VM that you are provisioning requires it or you can delete and existing port group when the last VM utilizing that port group is shut down. Port groups are dynamically created on the host/dvSwitch only when a VM requiring a port group is provisioned. A port group is deleted only

when there are no active VMs utilizing it and if it is not configured as a management network interface. In order for dynamic creation or deletion to function properly, you need to configure the dvSwitches/vSwitches in the vSphere environment.

The vsphere provisioning adapter utilizes information it gathers during discovery and stores on the Network objects to determine how to correctly create a required port group and to attach it to the correct dvSwitches or vSwitches. You can modify this information on the discovered Network objects, or you can add it to Network objects that you customize in the Orchestration Console.

This section includes the following information:

- Section A.2.1, "Network Configuration Facts," on page 46
- Section A.2.2, "Enabling Dynamic Creation of Port Groups," on page 46

A.2.1 Network Configuration Facts

The Orchestration Server uses the following facts when it creates a port group:

- `group.dvswitch:` A Boolean fact that specifies if the port group is to be attached to a dvSwitch or to a standard host vSwitch. The value is set to true for a dvSwitch or false if set for a vSwitch.
- `group.switch:` The name of the dvSwitch or vSwitch that the port group is to be attached to. This fact can be a regular expression to match against different dvSwitches or vSwitches on different hosts
- `group.vsphere.portgroupsettings:` An XML string that describes the settings on the port group (for example, Security, Traffic Shaping, or Teaming policies). Use the vSphere tools to configure these settings, so that the Orchestration Server can properly populate the fact upon discovery.
- `group.vlanid:` The vLAN ID that is associated with the port group. A value of zero (0) is equivalent to no vLAN.

The Orchestration Server also uses the `group.vbridge.matchname`.fact. This is a regular expression used during discovery of Networks to correlate port groups that are functionally identical (and should therefore be grouped in the same Network object in the Orchestration Server) but are not named the same. So, if Host A contains a port group named HostA-InternetConnection and Host B contains a port group named HostB-InternetConnection, modifying the `group.vBridge.matchname` fact to Host?-InternetConnection" results in creating a vBridge object for each host under a single Network object.

A.2.2 Enabling Dynamic Creation of Port Groups

Complete the following steps to enable the dynamic creation of port groups described in Section A.2, "Dynamically Creating Port Groups," on page 45.

1. Assign the vsphere_ignoreNetwork.policy to all vSphere hosts where you want to enable port group creation. This lets the host be considered as a provisioning target, even if the port groups do not currently exist on the host's dvSwitches or vSwitches.

2. Associate the vsphere_ignoreNetwork.policy with all VMs where you want to enable port group creation. This enables the computed facts that are necessary to provide proper ordering of provisioning plans.

3. In the vsphere.policy, update the `vsphere.vcenters` fact by setting the *auto_portgroups_creation* setting to true.

Modifying the *auto_portgroups_deletion* and *auto_portgroups_disconnection* settings is not necessary to enable dynamic creation of port groups, but is necessary for automatically reclaiming the port group resources when they are not in use.

B

Using Reflinks and Sparse Copying of vDisks in the Xen Provisioning Adapter

This section includes the following information:

B.1 Configuring Reflinks for Use by the xen Provisioning Adapter

OCFS2 in SUSE Linux High Availability (SLE HA) SP1 (and newer) supports reflinks (also referred to as refcounted links), providing significant performance advantages over a standard filesystem-level copy (cp) when you clone Xen VM images on SUSE Linux Enterprise Servers acting as VM Hosts. As a Cloud Manager Orchestration Server administrator, you might need control over whether the xen provisioning adapter should copy disk image files using reflinks or normal cp.

The Orchestration Server includes two Boolean facts that control the reflinks tuning for VMs and repositories. By default, these facts are marked true and accommodate the reflinks feature when it is available:

- `resource.vm.useReflinks`
- `repository.useReflinks`

If specified, the `resource.vm.useReflinks` fact takes precedence over the corresponding `repository.useReflinks` fact.

B.2   Sparse Copy

When reflinks are disabled or unavailable for use, the standard filesystem-level copy (cp) can optionally perform a sparse copy of Xen disks. A sparse copy operation designates unallocated blocks within the source vDisk file as not pre-allocated in the cloned copy. It is useful if you want to overcommit a disk for space efficiency or performance-related reasons. A non-sparse copy pre-allocates all disk blocks prior to usage.

By default, the decision to perform either a sparse or a normal copy is left to the cp(1) command, which uses a "crude heuristic" to determine whether the source file is sparse. However this heuristic can be overridden per-VM using the resource.vm.sparseCopy fact, or per-repository, using the repository.sparseCopy fact. If you decide to set either of these String facts, they must have one of the following values, as documented in the cp(1) man page:

*   auto (For example, --sparse=auto. Use this value to have the crude heuristic detect sparse SOURCE files and make the corresponding DEST file. This is the default value for sparse copy.)
*   always (For example, --sparse=always. Use this value to create a sparse DEST file whenever the SOURCE file contains a long enough sequence of zero bytes.)
*   never (For example, --sparse=never. Use this value to inhibit creation of sparse files.)

C
 Supported Functionality of KVM Linux VMs Following Apply Config or Save Config Actions

This section provides information to help you anticipate the behavior of KVM VMs of various supported Linux platforms when the Apply Config action or the Save Config action is applied.

C.1 Expected Results of the Apply Config Action

Some paravirtualized drivers are required for the kvm provisioning adapter to function correctly when the Apply Config action is applied:

- `virtio_net`: A device driver required for supporting the virtual network.
- `virtio_blk`: A virtual block device driver required for supporting paravirtualized block devices.
- `virtio_balloon`: A memory driver for dynamic memory allocation required for supporting the dynamic change of the amount of memory allocated to a VM.
- `acpiphp`: A device driver used for attaching and detaching disks.

The table below lists the supported VM functionality when the Apply Config action is applied. An "x" in the table indicates support for the function. Required drivers for each platform are noted below the table.

Table C-1   *Supported Disk, NIC, and Memory Setting Functionality on KVM VMs after Apply Config Action Applied*

Function	SLES 11 SP1 VM[1]	SLES 10 SP3 VM[2]	RHEL 5 VM[3]
Attach IDE disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
	Disk bus IDE cannot be hotplugged.	Disk bus IDE cannot be hotplugged.	Disk bus IDE cannot be hotplugged.
Detach IDE disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Insert DVD / CD-ROM media into IDE disk	x	x	x
Eject DVD / CD-ROM media from IDE disk	x	x	x

Function	SLES 11 SP1 VM[1]	SLES 10 SP3 VM[2]	RHEL 5 VM[3]
Attach USB disk	x	x	x
Detach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
	This type of device cannot be hot unplugged.	This type of device cannot be hot unplugged.	This type of device cannot be hot unplugged.
Attach SCSI disk.	Disk is shown in the configuration filoe, but not in the VM object.	Not displayed in the VM.	x
Detach SCSI disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
	This type of device cannot be hot unplugged.	This type of device cannot be hot unplugged.	This type of device cannot be hot unplugged.
Attach Virtio disk	x	x	x
Detach Virtio disk	x	x	x
Attach Virtual NIC	The vNIC is displayed in the Orchestration Console, but does not operate correctly.	The vNIC is displayed in the Orchestration Console, but does not operate correctly.	The vNIC is displayed in the Orchestration Console, but does not operate correctly.
Detach Virtual NIC	x	x	x
Set current memory	x	x	x
Set max memory	Not supported.	Not supported.	Not supported.

[1] Paravirtualized virtio drivers (including `acpiphp`) are included in the kernel of SUSE Linux Enterprise Server 11 SP1 and newer.

[2] SUSE Linux Enterprise Server 10 SP3 does not support para-virtualized devices out of the box, because the `virtio_*` drivers are not included. In order to use such devices, add the missing virtio drivers during the installation. For more information, see Section 5.3.1, "*Adding para-virtualized Drivers During the Installation*" (http://www.novell.com/documentation/sles11/book_sles_kvm/data/sec_libvirt_inst_advanced.html#sec_libvirt_inst_advanced_virtio) in the "*Managing Virtual Machines with libvirt*" section of the "*SLES 11 Virtualization with KVM Administration Guide* (http://www.novell.com/documentation/sles11/book_sles_kvm/data/cha_kvm_intro.html)."

These drivers are available at the Novell virtio Drivers Download Web site (http://drivers.suse.com/novell/Novell-virtio-drivers-2.6.27/sles10-sp3/novell-virtio-drivers-2.6.27-sle10sp3.iso).

[3] Paravirtualized virtio drivers (including `acpiphp`) are included in the kernel of Red Hat Enterprise Linux 5.4 and newer.

C.2 Expected Results of the Save Config Action

Some paravirtualized drivers are required for the kvm provisioning adapter to function correctly when the Save Config action is applied:

- `virtio_net`: A device driver required to support the virtual network.

- `virtio_blk`: A virtual block device driver required for supporting paravirtualized block devices.
- `virtio_balloon`: A memory driver for dynamic memory allocation required for supporting the dynamic change of the amount of memory allocated to a VM.

The table below lists the supported VM functionality when the Save Config action is applied. An "x" in the table indicates support for the function. Required drivers for each platform are noted below the table.

Table C-2 *Supported Disk, NIC, and Memory Setting Functionality on KVM VMs after Save Config Action Applied*

Function	SLES 11 SP1 VM[1]	SLES 10 SP3 VM[2]	RHEL 5 VM[3]
Attach IDE disk	x	x	x
Detach IDE disk	x	x	x
Insert DVD / CD-ROM media into IDE disk	x	x	x
Eject DVD / CD-ROM media from IDE disk	x	x	x
Attach USB disk	x	x	x
Detach USB disk	x	x	x
Attach SCSI disk	x	x	x
Detach SCSI disk	x	x	x
Attach Virtio disk	x	x	x
Detach Virtio disk	x	x	x
Attach virtual NIC	x	x	x
Detach virtual NIC	x	x	x
Set current memory	x	x	x
Set max memory	x	x	x

[1] Paravirtualized virtio drivers are included in the kernel of SUSE Linux Enterprise Server 11 SP1 and newer.

[2] SUSE Linux Enterprise Server 10 SP3 does not support para-virtualized devices out of the box, because the `virtio_*` drivers are not included. In order to use such devices, add the missing virtio drivers during the installation. For more information, see Section 5.3.1, "*Adding para-virtualized Drivers During the Installation*" (http://www.novell.com/documentation/sles11/book_sles_kvm/data/sec_libvirt_inst_advanced.html#sec_libvirt_inst_advanced_virtio) in the "*Managing Virtual Machines with libvirt*" section of the "*SLES 11 Virtualization with KVM Administration Guide* (http://www.novell.com/documentation/sles11/book_sles_kvm/data/cha_kvm_intro.html)."

These drivers are available at the Novell virtio Drivers Download Web site (http://drivers.suse.com/novell/Novell-virtio-drivers-2.6.27/sles10-sp3/novell-virtio-drivers-2.6.27-sle10sp3.iso).

[3] Paravirtualized virtio drivers are included in the kernel of Red Hat Enterprise Linux 5.4 and newer.

D Apply Config and Save Config Actions on vSphere VMs

This section provides information to help you anticipate the behavior of vsphere VMs of various supported platforms when the Apply Config action or the Save Config action is applied.

D.1 Expected Results of the Apply Config Action on Windows VMs

The table below lists the supported Windows VM functionality when the Apply Config action is applied while the VM is running. An "x" in the table indicates support for the function.

Table D-1   *Supported Disk, NIC, and Memory Setting Functionality on vSphere Windows VMs after the Apply Config Action Applied*

Function	Windows 2003 R2 VM	Windows 2008 R2 VM
Attach IDE disk	x Effective on reboot.	x Effective on reboot.
Detach IDE disk	x Effective on reboot.	x Effective on reboot.
Modify IDE disk	x Effective on reboot.	x Effective on reboot.
Insert DVD / CD-ROM media into IDE disk	Does not work.	Does not work.
Eject DVD / CD-ROM media from IDE disk	Does not work.	Does not work.
Attach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.
Detach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.
Attach SCSI disk.	x Effective on reboot.	x Effective on reboot.

Function	Windows 2003 R2 VM	Windows 2008 R2 VM
Detach SCSI disk	x Effective on reboot.	x Effective on reboot.
Detach Fibre Channel disk	x Effective on reboot.	x Effective on reboot.
Attach Fibre Channel disk	x Effective on reboot.	x Effective on reboot.
Attach Virtual NIC	x Effective on reboot.	The vNIC is displayed in the Orchestration Console, but does not operate correctly.
Detach Virtual NIC	x Effective on reboot.	x Effective on reboot.
Set required VM memory	Not supported by the hypervisor.	Not supported by the hypervisor.
Set host CPU number	Not supported by the hypervisor.	Not supported by the hypervisor.
Set VNC port	x	x

D.2 Expected Results of the Save Config Action on Windows VMs

The table below lists the supported Windows VM functionality when the Save Config action is applied while Windows VMs are shut down. An "x" in the table indicates support for the function. Required drivers for each platform are noted below the table.

Table D-2 *Supported Disk, NIC, and Memory Setting Functionality on vSphere Windows VMs after the Save Config Action is Applied*

Function	Windows 2003 R2 VM	Windows 2008 R2 VM
Attach IDE disk	x	x
Detach IDE disk	x	x
Modify IDE disk	x	x
Insert DVD / CD-ROM media into IDE disk	Does not work.	Does not work.
Eject DVD / CD-ROM media from IDE disk	Does not work.	Does not work.
Attach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.
Detach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.
Attach SCSI disk.	x	x
Detach SCSI disk	x	x
Detach Fibre Channel disk	x	x
Attach Fibre Channel disk	x	x
Attach Virtual NIC	x	x
Detach Virtual NIC	x	x
Set required VM memory	x	x
Set host CPU number	x	x
Set VNC port	x	x

D.3   Expected Results of the Apply Config Action on Linux VMs

The table below lists the supported VM functionality when the Apply Config action is applied on running Linux VMs. An "x" in the table indicates support for the function. Required drivers for each platform are noted below the table.

Table D-3 *Supported Disk, NIC, and Memory Setting Functionality on vSphere Linux VMs after the Apply Config Action is Applied*

Function	SLES 11 SP1 VM	SLES 10 SP3 VM	RHEL 5 VM	RHEL 6 VM
Attach IDE disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Detach IDE disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Modify IDE disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.

Function	SLES 11 SP1 VM	SLES 10 SP3 VM	RHEL 5 VM	RHEL 6 VM
Insert DVD / CD-ROM media into IDE disk	Does not work.	Does not work.	Does not work.	Does not work.
Eject DVD / CD-ROM media from IDE disk	Does not work.	Does not work.	Does not work.	Does not work.
Attach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Detach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Attach SCSI disk.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Detach SCSI disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Detach Fibre Channel disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Attach Fibre Channel disk	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Attach Virtual NIC	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Detach Virtual NIC	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.	x Effective on reboot.
Set required VM memory	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Set host CPU number	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Set VNC port	x	x	x	x

D.4 Expected Results of the Save Config Action on Linux VMs

The table below lists the supported VM functionality when the Save Config action is applied while Linux VMs are shut down. An "x" in the table indicates support for the function. Required drivers for each platform are noted below the table.

Table D-4 *Supported Disk, NIC, and Memory Setting Functionality on vSphere Linux VMs after the Save Config Action is Applied*

Function	SLES 11 SP1 VM	SLES 10 SP3 VM	RHEL 5 VM	RHEL 6 VM
Attach IDE disk	x	x	x	x
Detach IDE disk	x	x	x	x

Function	SLES 11 SP1 VM	SLES 10 SP3 VM	RHEL 5 VM	RHEL 6 VM
Modify IDE disk	x	x	x	x
Insert DVD / CD-ROM media into IDE disk	Does not work.	Does not work.	Does not work.	Does not work.
Eject DVD / CD-ROM media from IDE disk	Does not work.	Does not work.	Does not work.	Does not work.
Attach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Detach USB disk	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.	Not supported by the hypervisor.
Attach SCSI disk.	x	x	x	x
Detach SCSI disk	x	x	x	x
Detach Fibre Channel disk	x	x	x	x
Attach Fibre Channel disk	x	x	x	x
Attach Virtual NIC	x	x	x	x
Detach Virtual NIC	x	x	x	x
Set required VM memory	x	x	x	x
Set host CPU number	x	x	x	x
Set VNC port	x	x	x	x