Virtual Machine Manager 2.0

Installation and User's Guide

Note

Before using this information and the product it supports, read the general information in Appendix D, “Notices,” on page 101.

Second Edition (August 2005)

This edition applies to version 2, release 0, modification 0 of IBM Virtual Machine Manager and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Figures

Tables

About this guide

This guide describes IBM® Virtual Machine Manager (VMM) 2.0 and how to use supported virtualization applications in an IBM Director environment.

Who should read this guide

This guide is for system administrators and operators using VMM to manage virtualization components from IBM Director Console.

How this guide is organized

Chapter 1, “Introducing Virtual Machine Manager,” on page 1 contains an overview of VMM, including its components and features, and its integration with IBM Director. This chapter also describes the features of IBM Director that are relevant to VMM objects and the IBM Director command-line interface (DIRCMD) support.

Chapter 2, “Installing VMM,” on page 23 details the system requirements for VMM components and how to install and uninstall VMM.

Chapter 3, “VMM objects and their discovery,” on page 29 describes the various objects in VMM, explains their status icons, and describes discovery of these objects.

Chapter 4, “Configuring VMM objects,” on page 39 provides information about configuring VMM objects from IBM Director Console.

Chapter 5, “Running power operations on virtual machines,” on page 59 describes the power operations that you can perform on virtual machines.

Chapter 6, “Migration types and requirements,” on page 63 describes dynamic and static migration in VMM and lists the requirements that must be followed.

Chapter 7, “Viewing VMM object attributes,” on page 69 describes the VMM object attributes that VMM displays for coordinators, VMM farms, hosts, virtual machines, and guest operating systems.

Chapter 8, “Solving VMM problems,” on page 77 lists some of the problem symptoms and suggested solutions for VMM.

Appendix A, “VMM event filters and actions,” on page 83 describes the event filters and actions that you can use with IBM Director event action plans and VMM objects. This chapter also describes virtual machine task failures.

Appendix B, “Terminology summary and abbreviation list,” on page 97 contains a summary of VMM terminology and a list of abbreviations that are used in VMM documentation.

Appendix C, “Getting help and technical assistance,” on page 99 contains information about accessing IBM Support Web sites for help and technical assistance.

Appendix D, “Notices,” on page 101 contains product notices and trademarks.

The “Glossary” on page 103 provides definitions for terms that are used in VMM documentation.

Notices that are used in this document

This document contains the following notices designed to highlight key information:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or difficult situations.
- **Attention:** These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

VMM documentation

The Web site for VMM provides the following document in Adobe Acrobat Portable Document Format (PDF):

- *Virtual Machine Manager 2.0 Installation and User’s Guide*

You can also obtain this document from the IBM Support Web site at www.ibm.com/pc/support/.

VMM resources on the World Wide Web

The following Web pages provide resources for understanding, using, and troubleshooting IBM Director and systems-management tools.

IBM Virtual Machine Manager page
www.ibm.com/servers/eserver/xseries/systems_management/xseries_sm/vmm.html

This Web page presents an overview of VMM and links to download the product, release notes, and user’s guide.

IBM personal computing support page
www.ibm.com/pc/support/

This is the IBM Support Web site for IBM hardware and systems-management software. For systems-management software support, click **Systems management**.

IBM Systems Management Software: Download/Registration page
www.ibm.com/pc/us/eserver/xseries/systems_management/dwnl.html

Use this Web page to download IBM systems-management software, including IBM Director.

IBM @server® xSeries® Systems Management page
www.ibm.com/pc/ww/eserver/xseries/systems_management/index.html

This Web page presents an overview of IBM systems management and IBM Director. Click **IBM Director** for the latest information and documentation.

IBM ServerProven® page
www.ibm.com/pc/us/compat/index.html

This Web page provides information about IBM hardware compatibility with IBM systems-management software.

Summary of changes

The *IBM Virtual Machine Manager 2.0 Installation and User's Guide, Second Edition, August 2005* has been updated since the first edition that was released July 2005 to include the following information:

- Caveats about cloning guest operating systems that have IBM Director Agent installed.
- Default PowerON and PowerOFF actions for virtual machines with undoable disks.
- Clarifications and additions to all the migration information. Specifically:
  - A separate chapter for migration requirements and information about dynamic and static migration. Further, additional migration requirements have been added as has a procedure for static migration with VMware GSX Server and Microsoft Virtual Server hosts. For details, see Chapter 6, "Migration types and requirements," on page 63.
  - Clarification that migration tasks must be created and then run to migrate virtual machines.
  - New section about using event actions for migrating virtual machines.
- Clarification that only one management server should manage a coordinator object once credentials have been entered for that coordinator.
- Several miscellaneous clarifications to the procedure for creating a virtual machine.
- Procedure for deleting a virtual machine from disk. For information, see "Deleting a virtual machine from both IBM Director and disk" on page 56.
- Several miscellaneous additions and changes to Chapter 8, "Solving VMM problems," on page 77.
- Miscellaneous corrections throughout the book.

The vmm200_users_v2.pdf from August 2005 superceedes the vmm200_users.pdf that was available in July 2005.

Chapter 1. Introducing Virtual Machine Manager

IBM Virtual Machine Manager (VMM) enables the use of the following *virtualization applications* in an IBM Director environment:

- VMware VirtualCenter
- VMware ESX Server
- VMware GSX Server
- Microsoft® Virtual Server

When VMM and these virtualization applications are installed, you can perform the following functions from IBM Director Console:

- Correlate relationships between physical platforms and virtualization components
- Report status of physical platforms and their corresponding virtualization components
- Log in to the management interface of the virtualization application
- Discover virtualization components
- Perform migration and power operations on virtual machines
- Create event action plans that involve virtualization components

When VMM is installed, IBM Director can recognize systems that contain virtualization components. Next, VMM can create *VMM objects* to represent the virtualization components that were recognized.

VMM uses the application programming interface (API) of the virtualization application to perform VMM operations on the virtualization component itself. Both IBM Director and the virtualization application then are updated.

VMM environment and terminology

The hardware in a VMM environment is referred to in the following ways:

- A *management server* is a server on which both IBM Director Server and VMM Server are installed.
- A *management console* is a system on which both IBM Director Console and VMM Console are installed. This system also must be installed with the following graphical user interfaces (GUIs) as appropriate:
  - (VMware VirtualCenter only) VMware VirtualCenter client
  - (VMware GSX Server only) VMware Virtual Machine Console
- A *managed system* is a system on which IBM Director Agent and a virtualization application are installed.
- A *system* is a server, workstation, desktop computer, or mobile computer.

The software and its components in a VMM environment are referred to in the following ways:

- A *virtualization environment* is a managed system and its associated VMM objects that are using the following sets of software:
  - VMware VirtualCenter server and VMM Agent for VirtualCenter (supported hosts are ESX and GSX hosts)
  - VMware ESX Server and VMM Agent for ESX
  - VMware GSX Server and VMM Agent for GSX

  - Microsoft Virtual Server and VMM Agent for Virtual Server
- A *virtualization component* is a software element that is created by a virtualization application.
- A *VMM object* is an IBM Director managed object that represents the virtualization components in a supported virtualization environment. VMM objects include coordinators, VMM farms, hosts, virtual machines, and guest operating systems.

Each supported virtualization environment has several VMM objects: *VMM farms*, *hosts*, *virtual machines*, and *guest operating systems*. VMware VirtualCenter environments have one additional VMM object, which is *coordinator*.

For detailed explanations of VMM objects and how they are used, see Chapter 3, "VMM objects and their discovery," on page 29.

The following VMM objects are used by VMM:

- A *coordinator* is a managed object that represents a system on which all of the following software is running:
  - VMware VirtualCenter server
  - VMware VirtualCenter Web service
  - IBM Director Agent
  - VMM Agent for VirtualCenter
- A *VMM farm* is a managed object that represents a collection of hosts and their associated virtual machines. VMM farm objects can represent farms that are defined in VMware VirtualCenter. VMM farm objects can also be a collection of hosts in other supported virtualization environments.
- A *host* is a managed object that represents a system on which one of the following combinations of software are running:
  - VMware ESX Server and IBM Director Agent (VMware VirtualCenter only)
  - VMware GSX Server and IBM Director Agent (VMware VirtualCenter only)
  - VMware ESX Server, IBM Director Agent, and VMM Agent for ESX
  - VMware GSX Server, IBM Director Agent, and VMM Agent for GSX
  - Microsoft Virtual Server, IBM Director Agent, and VMM Agent for Virtual Server
- A *virtual machine* is a managed object that represents a virtual machine that is associated with a supported virtualization application.
- A *guest operating system* is a managed object that represents an operating system that is running in a virtual machine and on which IBM Director Agent is installed.

Overview of VMM integration with IBM Director

VMM includes the following software components:

- VMM Server
- VMM Console
- VMM Agent

Figure 1 shows how VMM is integrated with IBM Director and the supported virtualization applications.

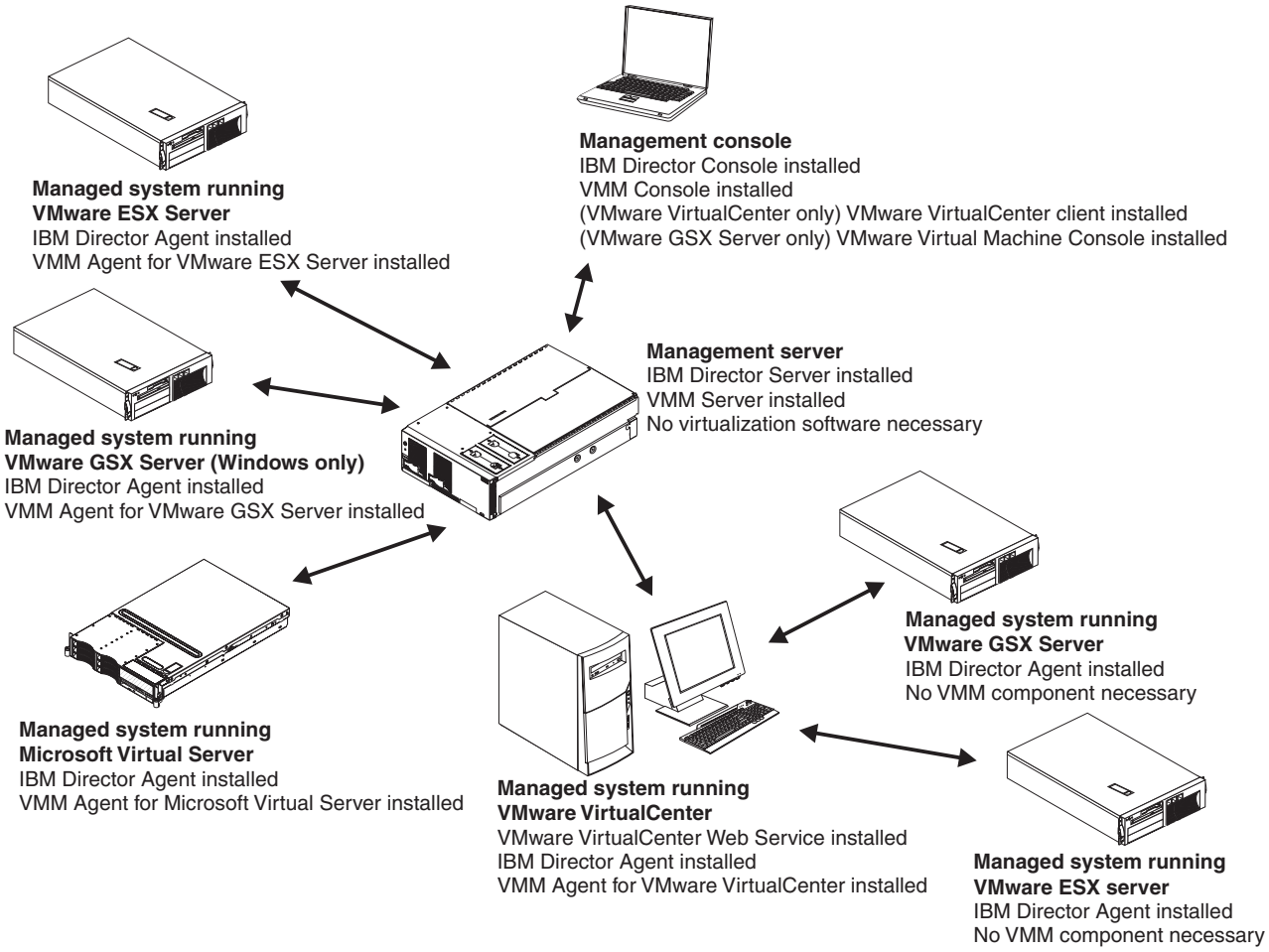

Figure 1. Overview of a VMM environment

VMM Server

VMM Server maintains the VMM environment and manages all VMM operations. VMM Server communicates with each VMM Agent and VMM Console to display status and perform operations for VMM objects. VMM Server communicates with IBM Director Server to provide event filtering and event actions that support IBM Director event action plans that involve VMM objects.

VMM Server must be installed on the management server. When you install VMM Server, VMM Console is installed automatically.

VMM Console

VMM Console provides the GUI. VMM Console must be installed on all management consoles from which a system administrator will remotely access the management server and perform VMM tasks.

Note: If you are using VMware VirtualCenter with IBM Director, the VMware VirtualCenter client must be installed on the system where IBM Director Console and VMM Console are installed. Likewise, if you are using VMware GSX Server with IBM Director, the VMware Virtual Machine Console must be installed on the system where IBM Director Console and VMM Console are installed. Otherwise, you cannot start the VMware VirtualCenter client or the VMware Virtual Machine Console with the Start Vendor Software subtask of VMM.

VMware ESX Server and Microsoft Virtual Server do not have the same requirements, because they have a Web interface.

VMM Agent

VMM provides a different version of VMM Agent for each virtualization environment that it supports. The installation program for VMM automatically detects which virtualization application is installed and displays the correct installation choice for the applicable version of VMM Agent.

Notes:

1. VMM Agent can provide support only for features that are provided by the virtualization application. For example, when VMM Agent for VMware VirtualCenter is used, you can dynamically migrate virtual machines from one VMware ESX Server host to another. When VMM Agents for VMware ESX Server, VMware GSX Server, and Microsoft Virtual Server are used, only static migration is supported.
2. Only one VMM Agent can be run on a managed system at a time.

Each VMM Agent can perform the following functions:

- Discover virtualization applications and creates VMM objects
- Relay communication between VMM Server and the virtualization application
- Translate events that are provided by the virtualization application into events that can be used in IBM Director event action plans

A virtualization environment is a managed system and its associated VMM objects that are using the following combinations of software:

- VMware VirtualCenter server and VMM Agent for VMware VirtualCenter (supported hosts are ESX and GSX hosts)
- VMware ESX Server and VMM Agent for VMware ESX Server
- VMware GSX Server and VMM Agent for VMware GSX Server
- Microsoft Virtual Server and VMM Agent for Microsoft Virtual Server

VMM Agent for VMware VirtualCenter

Install VMM Agent for VMware VirtualCenter on a system that is running IBM Director Agent, VMware VirtualCenter server, and VMware VirtualCenter Web service. These software components enable VMM and IBM Director to recognize

this managed system as a coordinator object, which you can view and manage from IBM Director Console. For more information, see “Coordinator objects” on page 29.

Note:

For brevity, VMM Agent for VMware VirtualCenter is sometimes referred to as *VMM Agent for VirtualCenter*.

VMM Agent for VMware ESX Server

Install VMM Agent on a system that is running IBM Director Agent and VMware ESX Server. VMM Agent for VMware ESX Server is not for use with hosts running VMware ESX Server that are being managed with VMware VirtualCenter.

VMM Agent for VMware ESX Server enables VMM Server and IBM Director to recognize this managed system as a host object, which you can view and manage from IBM Director Console. For more information, see “Host objects” on page 32.

For brevity, VMM Agent for VMware ESX Server is sometimes referred to as *VMM Agent for ESX*.

VMM Agent for VMware GSX Server

Install VMM Agent on a system that is running IBM Director Agent and VMware GSX Server. VMM Agent for VMware GSX Server is not for use with hosts running VMware GSX Server that are being managed with VMware VirtualCenter.

VMM Agent for VMware GSX Server enables VMM Server and IBM Director to recognize this managed system as a host object, which you can view and manage from IBM Director Console. For more information, see “Host objects” on page 32.

For brevity, VMM Agent for VMware GSX Server is sometimes referred to as *VMM Agent for GSX*.

VMM Agent for Microsoft Virtual Server

Install VMM Agent for Microsoft Virtual Server on a system that is running Microsoft Virtual Server. You also must install IBM Director Agent on this system. These software components enable VMM and IBM Director to recognize this managed system as a host object, which you can view and manage from IBM Director Console. For more information, see “Host objects” on page 32.

For brevity, VMM Agent for Microsoft Virtual Server is sometimes referred to as *VMM Agent for Virtual Server.*

Virtual Machine Manager task

When you add VMM Console to your IBM Director environment, the Virtual Machine Manager task is added to IBM Director Console. The Virtual Machine Manager task has the following subtasks:

- Create VMM Farm
- Help
- Migrate All Virtual Machine Tasks
- Migrate Single Virtual Machine Tasks
- Start Vendor Software

Figure 2 shows the IBM Director Console window with VMM and its tasks in the Tasks pane.

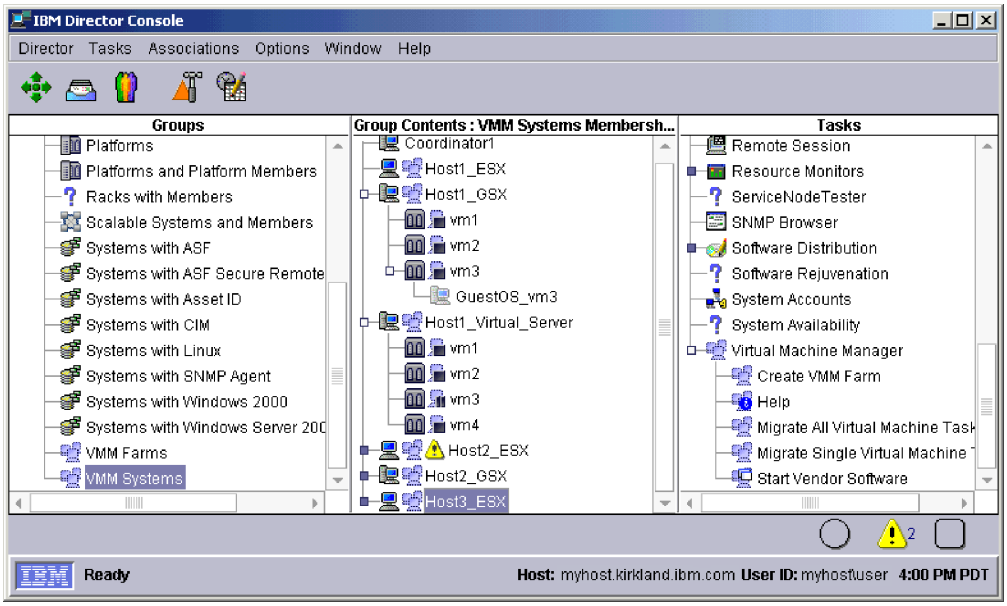

Figure 2. VMM interactive tasks that are displayed in IBM Director Console

The icon is used to identify the following VMM features:

- The Virtual Machine Manager task
- The VMM Systems group
- Windows, event actions, scheduler tasks, and help topics that are provided by VMM

Additionally, VMM adds various state icons to the VMM objects that are displayed in the Group Contents pane of IBM Director Console. For information, see the descriptions of the state icons for the various VMM object types in Chapter 3, “VMM objects and their discovery,” on page 29.

VMM also assigns attributes to VMM objects. For more information, see Chapter 7, “Viewing VMM object attributes,” on page 69.

Create VMM Farm

Use the Create VMM Farm subtask to create a VMM farm. You can start this subtask from IBM Director Console in one of the following ways:

- Drag it onto any coordinator object in the Group Contents pane. For more information, see “Creating a VMM farm for a coordinator” on page 39.
- Double-click the subtask in the Tasks pane. For more information, see “Creating a VMM farm that is not for a coordinator” on page 42.

Help

You can use the Help subtask to access and view the help pages that are provided with VMM.

To start the Help subtask, double-click the subtask.

Use the links at the bottom of each help page to navigate the help that is provided for VMM and its subtasks.

Migrate All Virtual Machine Tasks

Use the Migrate All Virtual Machine Tasks subtask to create IBM Director schedulable tasks for migrating all virtual machines from a single host to a different host. This task is available from IBM Director and VMM in these places:

- In the **Host Management** menu, which is accessed by right-clicking a host object in the Group Contents pane of IBM Director Console. The task is run when you select **Host Management → Create Migrate All Task**. The Migrate All Virtual Machine Tasks window opens.

  Note: (VMM Agent for GSX only) This task is only available when the host is running Windows® Server 2003.
- In the Tasks pane of IBM Director Console, under the Virtual Machine Manager task. The task is run when you double-click Migrate All Virtual Machine Tasks. The Migrate All Virtual Machine Tasks window opens.

For more information, see “Creating a task to migrate all virtual machines from a single host” on page 54.

After you have created IBM Director schedulable tasks for migrating all virtual machines, you can access these saved tasks from IBM Director and VMM in these places:

- In the Tasks pane of IBM Director Console, under the Migrate All Virtual Machine Tasks subtask. To run the user-defined task, right-click it and click **Execute Now**.
- In the Event Action Plan Builder, in the tasks drop-down list for the Start a Task on the ″event″ System event action template. For more information, see “Event actions for migrating virtual machines” on page 92.
- In the Scheduler, in the Task page when creating a new job.
- From the IBM Director command-line interface (DIRCMD), which provides VMM commands for noninteractive tasks. For more information, see “Using IBM Director command-line interface (DIRCMD) with VMM” on page 18.

Migrate Single Virtual Machine Tasks

Use the Migrate Single Virtual Machine Tasks subtask to create IBM Director schedulable tasks for migrating a single virtual machine from one host to a different host. This task is available from IBM Director and VMM in these places:

- In the **Virtual Machine Management** menu, which is accessed by right-clicking a virtual machine object in the Group Contents pane of IBM Director Console. The task is run when you select **Virtual Machine Management → Create Single Migrate Task**. The Migrate Single Virtual Machine Tasks window opens.

  Note: (VMM Agent for GSX only) This task is only available when the host is running Windows Server 2003.
- In the Tasks pane of IBM Director Console, under the Virtual Machine Manager task. The task is run when you double-click Migrate Single Virtual Machine Tasks. The Migrate Single Virtual Machine Tasks window opens.

For more information, see “Creating a task to migrate a single virtual machine” on page 53.

After you have created IBM Director schedulable tasks for migrating a single virtual machine, you can access these saved tasks from IBM Director and VMM in these places:

- In the Tasks pane of IBM Director Console, under the Migrate Single Virtual Machine Tasks subtask. To run the user-defined task, right-click it and click **Execute Now**.
- In the Event Action Plan Builder, in the tasks drop-down list for the Start a Task on the ″event″ System event action template. For more information, see “Event actions for migrating virtual machines” on page 92.
- In the Scheduler, in the Task page when creating a new job.
- From the IBM Director command-line interface (DIRCMD), which provides VMM commands for noninteractive tasks. For more information, see “Using IBM Director command-line interface (DIRCMD) with VMM” on page 18.

Start Vendor Software

You can use the Start Vendor Software subtask to start the virtualization application for the targeted VMM object.

To start the Start Vendor Software subtask, drag it onto any VMM object in the Group Contents Pane.

You must run this subtask on a VMM object. When you start this subtask, VMM determines the virtualization application in which the VMM object exists. Then, the applicable remote interface to that virtualization application is started.

Starting the VMware VirtualCenter client

When you drag the Start Vendor Software subtask onto a VMM object that is in a VMware VirtualCenter environment, VMM starts the VMware VirtualCenter client interface. Log in to the VMware VirtualCenter server for the VMM object that you want to manage. After you have successfully logged in, you can access and use the features of VMware VirtualCenter client, which enables administration of multiple virtual machines and VMware ESX Server instances that are associated with one VMware VirtualCenter server.

Use the VMware VirtualCenter client only when VMM does not provide equivalent functionality. Otherwise, use the features that are provided by VMM. For information about VMware VirtualCenter and its client interface, see the documentation that comes with that product.

Note: Using both the VMware VirtualCenter client and IBM Director Console at the same time can cause problems with VMM operations.

Starting the VMware Management Interface (ESX)

When you drag the Start Vendor Software subtask onto a VMM object that is under the control of VMM Agent for ESX, VMM starts the VMware Management Interface in a Web browser. Login to the VMware ESX Server host that is associated with the VMM object that you want to manage. After you have successfully logged in, you can access and use the features of VMware Management Interface.

Use the VMware Management Interface only when VMM does not provide equivalent functionality. Otherwise, use the features that are provided by VMM. For information about the VMware Management Interface, see the documentation that comes with that product.

Note: Using both the VMware Management Interface and IBM Director Console at the same time can cause problems with VMM operations.

Starting the VMware Virtual Machine Console (GSX)

When you drag the Start Vendor Software subtask onto a VMM object that is under the control of VMM Agent for GSX, VMM starts the VMware Virtual Machine Console interface. Connect to the host that is associated with the VMM object that you want to manage. After you have successfully logged in, you can access and use the features of VMware Virtual Machine Console interface.

Use the VMware Virtual Machine Console interface only when VMM does not provide equivalent functionality. Otherwise, use the features that are provided by VMM. For information about VMware Virtual Machine Console interface, see the documentation that comes with that product.

Note: Using both the VMware Virtual Machine Console and IBM Director Console at the same time can cause problems with VMM operations.

Starting the Administration Web site (Virtual Server)

When you drag the Start Vendor Software subtask onto a VMM object that is under the control of VMM Agent for Virtual Server, VMM starts the Administration Web site, which is the user interface to Microsoft Virtual Server. Log in to the Microsoft Virtual Server that you want to manage. After you have successfully logged in, you can access and use the features of Microsoft Virtual Server, which enables administration of multiple virtual machines that are hosted on a single system.

Use the Microsoft Virtual Server user interface only when VMM does not provide equivalent functionality. Otherwise, use the features that are provided by VMM. For information about Microsoft Virtual Server and its Administration Web site, see the documentation that comes with that product.

Note: Using both the Administration Web site and IBM Director Console at the same time can cause problems with VMM operations.

IBM Director features that are relevant to VMM objects

IBM Director includes several features that are relevant to VMM objects.

- Groups for use with VMM objects
- Associations for use with VMM objects
- Scheduler tasks for use with VMM objects
- Event filters and actions for use with VMM objects
- Permissions to configure or restrict the users that can run VMM

Groups for use with VMM objects

IBM Director provides several default groups of managed objects in the Groups pane for easier management of objects. Some of these groups, like the Logical Platforms group and the Platforms group, will display some VMM objects.

VMM has additional groups just for VMM objects. Table 1 lists the groups that apply only to VMM objects.

Table 1. IBM Director groups that are used only with VMM objects

Group name	Includes these VMM objects
VMM Farms	Only VMM farms.

Table 1. IBM Director groups that are used only with VMM objects (continued)

Group name	Includes these VMM objects
VMM Systems	Only VMM objects, which includes coordinators, VMM farms, hosts, virtual machines, and guest operating systems.

Associations for use with VMM objects

You can use IBM Director associations to display the VMM objects of a group in the Group Contents pane in a logical ordering, and if applicable, in a tree structure. Both IBM Director and VMM provide associations that are relevant to VMM objects. Use the VMM Systems group with these associations to list just the VMM objects on IBM Director Server.

VMM provides one association, the VMM Systems Membership association, that applies only to VMM objects. This association orders the objects in a group by coordinator, and then all remaining hosts. For coordinators, each object is shown in a tree structure that lists the VMM farms, hosts, virtual machines, and guest operating systems that are associated with the coordinator. For each remaining VMM farm, each object is shown with a tree structure that lists the hosts, virtual machines, and guest operating systems that are associated with that VMM farm. Then, for each remaining host, each object is shown with a tree structure that lists the virtual machines and guest operating systems that are associated with that host.

Scheduler tasks for use with VMM objects

You can use IBM Director Scheduler to create jobs that perform tasks on VMM objects. For detailed procedures for creating and monitoring scheduled jobs, see the *IBM Director 4.20 Systems Management Guide*.

Note: The execution history provides details only about the start and completion of the job. It does not provide details about the success or failure of the VMM operations that are performed by the job. For that information, use the IBM Director Event Log task to view details about all operations that have been received and logged by IBM Director Server.

For information about virtual machine operations that fail, see “Virtual machine task failures” on page 92. For information about the Event Log task, see the *IBM Director 4.20 Systems Management Guide*.

VMM includes scheduler tasks for coordinators, VMM farms, hosts, and virtual machines. Figure 3 on page 11 shows all the VMM noninteractive tasks available in IBM Director Scheduler.

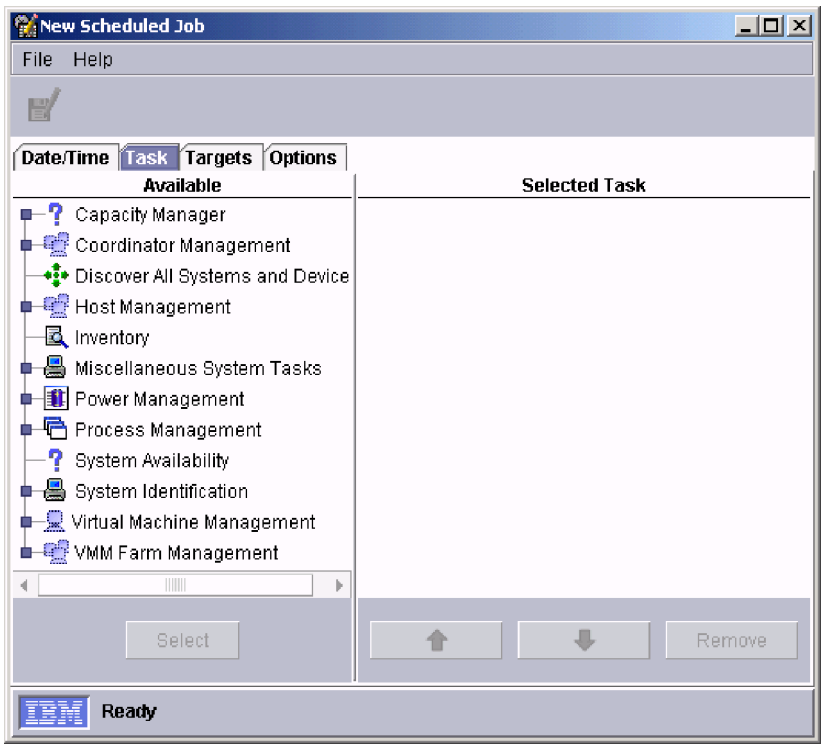

Figure 3. VMM noninteractive tasks in IBM Director Scheduler

Notes:

1. The Targets page of the New Scheduled Job window lists all managed objects that are shown in the Group Contents pane of IBM Director Console. However, you must target tasks to only the appropriate managed objects; otherwise, the task will fail. For example, you must target coordinator tasks to only coordinator objects.
2. Status icons for VMM objects are not shown on the Targets page of the New Scheduled Job window.

Tasks for a coordinator

You can use the Scheduler in IBM Director Console to create scheduled jobs that perform operations on a specific coordinator. You can discover VMM farms and revoke credentials. These Scheduler tasks for use with coordinators are under Coordinator Management on the Task page of the New Scheduled Job window.

Figure 4 on page 12 shows the coordinator management tasks available in IBM Director Scheduler.

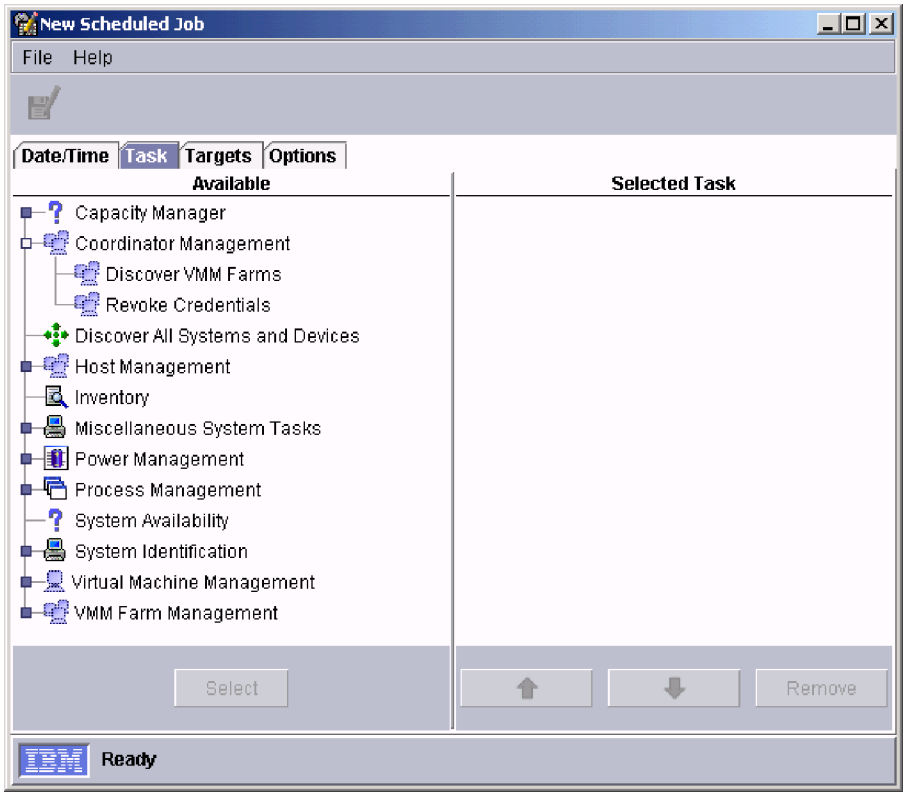

Figure 4. Coordinator management tasks in IBM Director Scheduler

The following table describes each of these coordinator management tasks.

Table 2. Scheduler tasks for coordinator objects

Scheduler task	Description
Discover VMM Farms	Discovers all farms that are defined on a system that is running VMware VirtualCenter server and creates VMM farm objects for the coordinator as necessary.
Revoke Credentials	Revokes the credentials for a coordinator.

Tasks for a VMM farm

You can use the Scheduler in IBM Director Console to create scheduled jobs that perform operations on a specific VMM farm. The Scheduler tasks for use with VMM farms are under VMM Farm Management on the Task page of the New Scheduled Job window.

Figure 5 on page 13 shows the VMM farm management tasks available in IBM Director Scheduler.

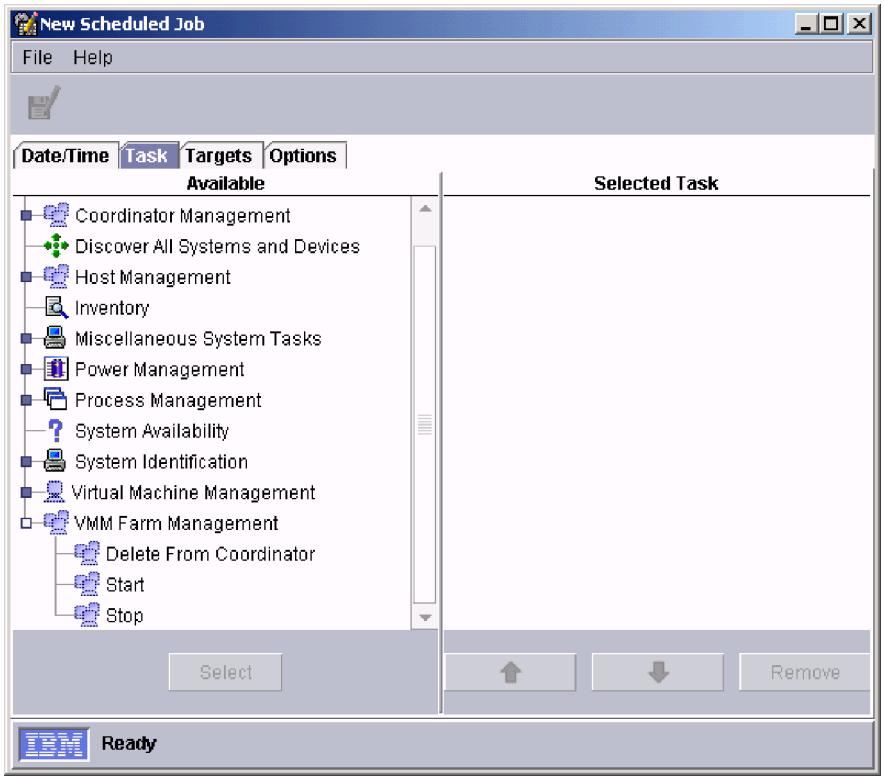

Figure 5. VMM farm management tasks in IBM Director Scheduler

The following table describes each of these VMM farm management tasks.

Table 3. Scheduler tasks for VMM farm objects

Scheduler task	Description
Delete From Coordinator (VirtualCenter only)	Deletes the farm from VMware VirtualCenter and deletes the corresponding managed object for the VMM farm from IBM Director. If you do this task, the VMM farm cannot be rediscovered and instead must be recreated.
Start	(Microsoft Virtual Server only) Starts all hosts that are associated with the targeted VMM farm.
Stop	(Microsoft Virtual Server only) Stops all hosts that are associated with the targeted VMM farm.

Tasks for a host

You can use the Scheduler in IBM Director Console to create scheduled jobs that perform operations on a specific host. You can perform operations that affect a host directly or affect all virtual machines on a host. These Scheduler tasks for use with hosts are under Host Management on the Task page of the New Scheduled Job window.

Figure 6 on page 14 shows the host management tasks available in IBM Director Scheduler.

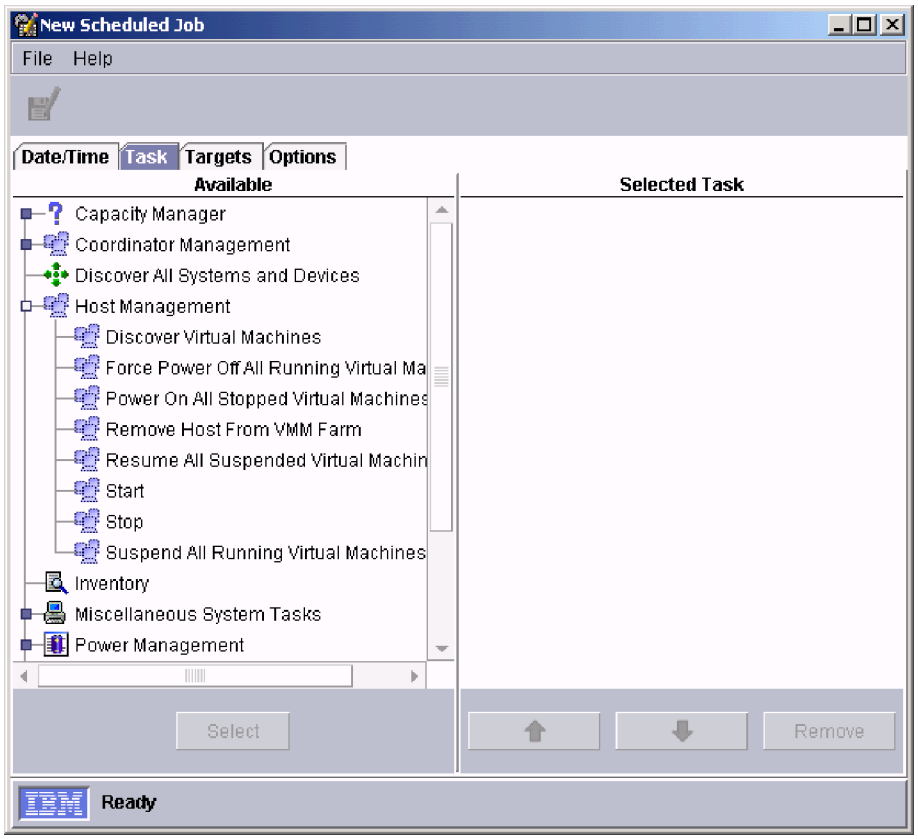

Figure 6. Host management tasks in IBM Director Scheduler

Table 4 describes each of these host management tasks.

Important: The power operations for the virtual machines on a single host apply to all virtual machines that are associated with a host, even those virtual machines that are not represented in IBM Director Console.

Table 4. Scheduler tasks for host objects

Scheduler task	Description
Discover Virtual Machines	Discovers all virtual machines that are associated with a host.
Force Power Off All Running Virtual Machines	Turns off all running virtual machines that are associated with a host without an orderly shut down of any guest operating systems.
Power On All Stopped Virtual Machines	Turns on all stopped virtual machines that are associated with a host.
Remove Host From Farm	Removes the managed object for the host from the VMM farm object in IBM Director Console.
Resume All Suspended Virtual Machines	Resumes all suspended virtual machines that are associated with a host.
Start	(Hosts that are running Microsoft Virtual Server only) Starts the host that is represented by the managed object.
Stop	(Hosts that are running Microsoft Virtual Server only) Stops the host that is represented by the managed object.

Table 4. Scheduler tasks for host objects (continued)

Scheduler task	Description
Suspend All Running Virtual Machines	Suspends all running virtual machines that are associated with a host.

If you use a task that applies to all virtual machines on a host, VMM generates a Virtual Machine, Task Failed event for each virtual machine that cannot perform the task. For example, if you use Power On All Stopped Virtual Machines and two virtual machines are already turned on, VMM generates two Virtual Machine, Task Failed events because those two virtual machines could not be turned on. For more information about virtual machine operations that fail, see “Virtual machine task failures” on page 92.

Tasks for a virtual machine

You can use the Scheduler in IBM Director Console to create scheduled jobs that perform various operations on a specific virtual machine. These Scheduler tasks for use with virtual machines are under Virtual Machine Management, Virtual Machine Manager, and Power Management on the Task page of the New Scheduled Job window.

General management tasks: These Scheduler tasks are under Virtual Machine Management on the Task page of the New Scheduled Job window. Figure 7 shows the general management tasks available in IBM Director Scheduler for a virtual machine.

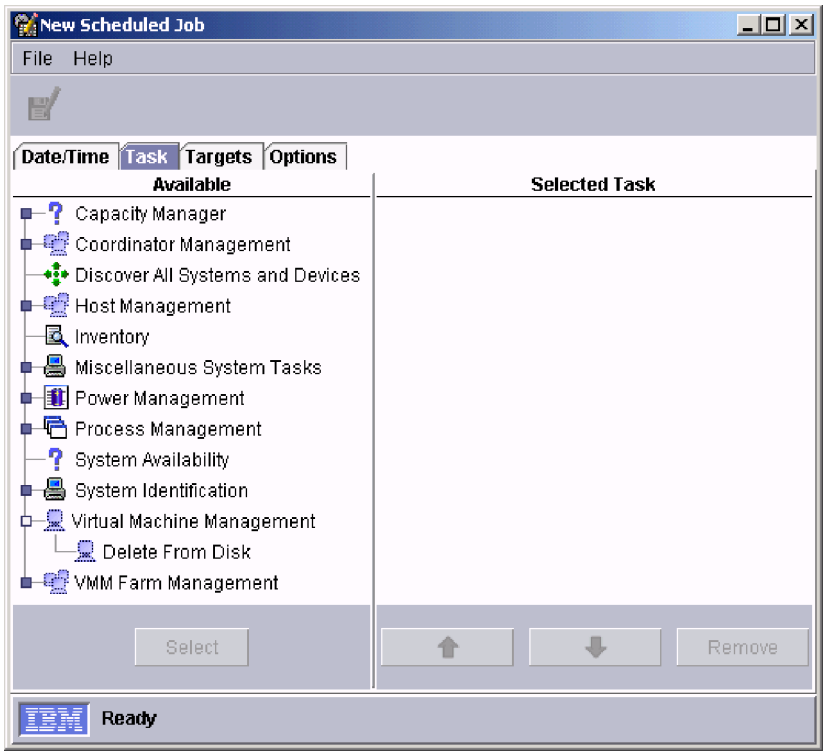

Figure 7. Virtual machine management tasks in IBM Director Scheduler

Table 5 describes general management tasks for virtual machines.

Table 5. Scheduler tasks for general management of virtual machine objects

Scheduler task	Description
Delete From Disk	Deletes the virtual machine from its virtualization application.

Migration tasks: These Scheduler tasks are under Virtual Machine Manager on the Task page of the New Scheduled Job window.

Figure 8 shows the migration task groups available in IBM Director Scheduler for a virtual machine.

Note: The Virtual Machine Manager task and the two migrate subtask groups are not always displayed on the New Scheduled Job window. They are displayed only after you have created and saved migration tasks similar to those shown in Figure 8.

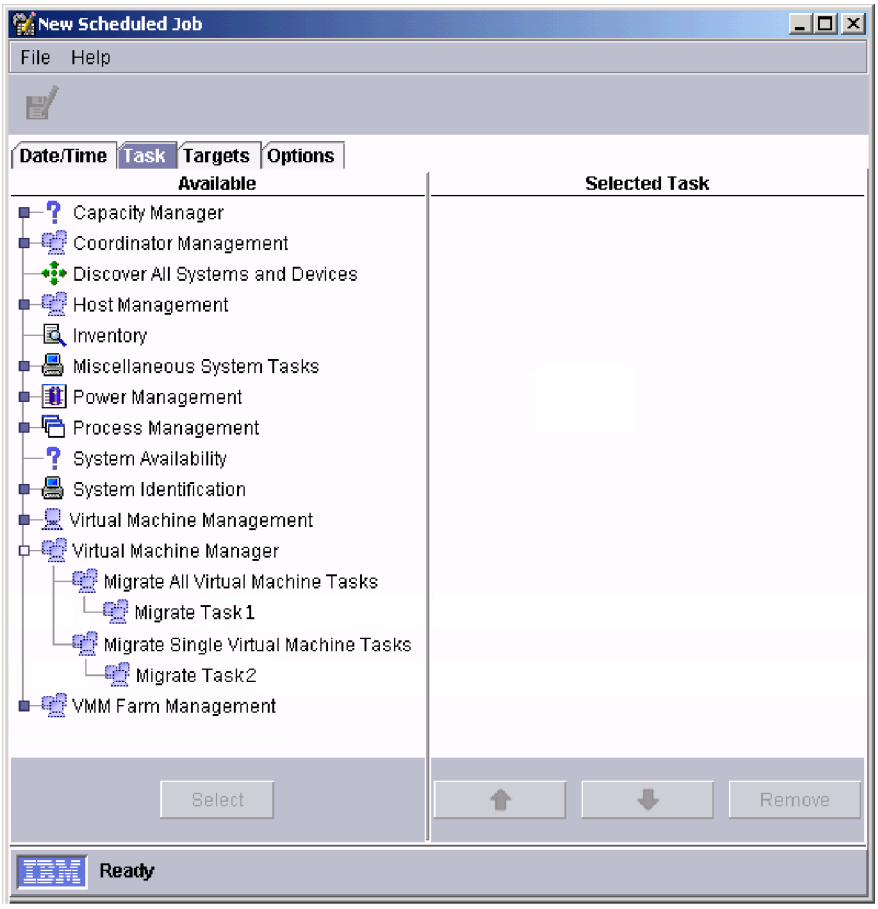

Figure 8. Virtual machine migration tasks in IBM Director Scheduler

Table 6 on page 17 describes the migration task groups for virtual machines.

Note: Before you run any tasks that migrate virtual machines, be sure you understand and observe the migration restrictions. See Chapter 6, “Migration types and requirements,” on page 63.

Table 6. Scheduler task groups for migration of virtual machine objects

Scheduler task group	Description
Migrate All Virtual Machine Tasks	Contains saved migration tasks that migrate all virtual machines on a single host to a different host. In Figure 8 on page 16, this task grouping contains the saved task called Migrate Task 1.
Migrate Single Virtual Machine Tasks	Contains saved migration tasks that migrate a single virtual machine from one host to a different host. In Figure 8 on page 16, this task grouping contains the saved task called Migrate Task 2.

Power management tasks: These Scheduler tasks are under Power Management on the Task page of the New Scheduled Job window.

Figure 9 shows the New Scheduled Job window with the power management operations that you can schedule.

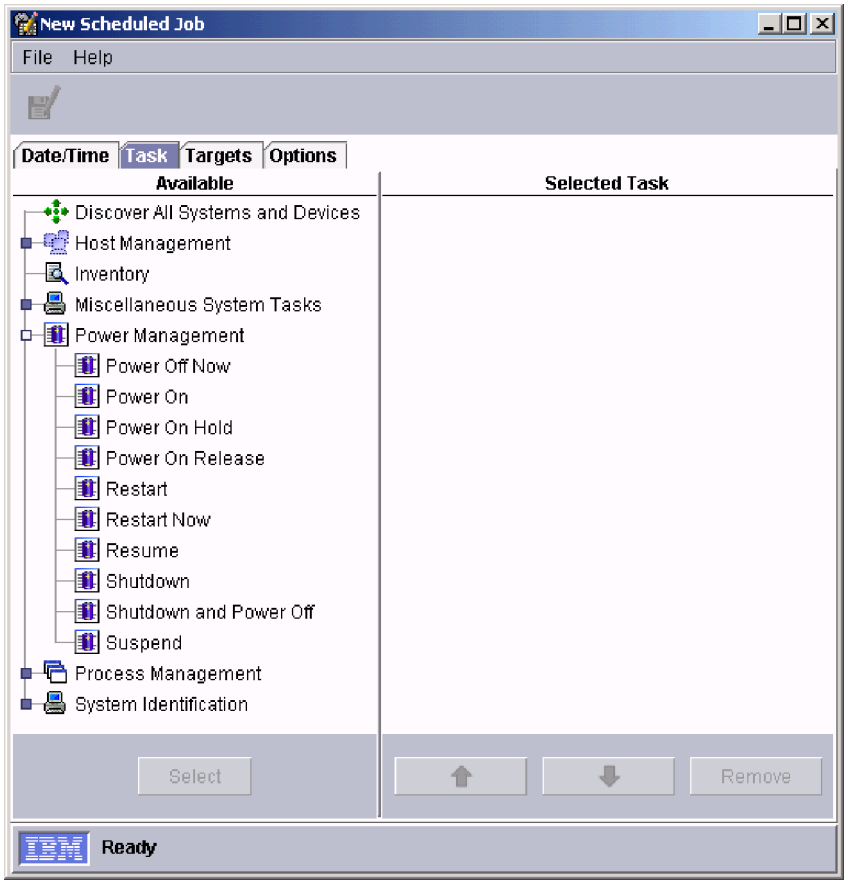

Figure 9. Power Management tasks in IBM Director Scheduler

You only can use some of these power management operations with virtual machine objects. For information about which ones are supported, see “Power operations for a single virtual machine” on page 61.

Event filters and actions for use with VMM objects

VMM provides several events and event actions for use with VMM objects. For more information about using events and event actions with VMM objects, see Appendix A, “VMM event filters and actions,” on page 83.

Configure IBM Director users for VMM

You can use the security features of IBM Director Console to configure or restrict the users that can run the Virtual Machine Manager tasks and that can perform specific operations. For example, you can create an operator user that cannot perform any migration operations in VMM.

To configure user defaults, in IBM Director Console, click **Options → User Administration**, which causes the User Administration window to open. From the User Administration window, select a user from the list and click **User → User Defaults** to open the User Defaults Editor window.

From the User Defaults Editor window in IBM Director, you can:

- Control the privileges of users as they apply to VMM. The following user default privileges are relevant to VMM:
  - Allow discovery requests
  - Allow power down of systems
  - Allow power on of systems
  - Allow shutdown of systems
  - Allow system create/modify/delete operations
- Limit user access to specific IBM Director groups, such as VMM Systems.
- Limit user access to the Virtual Machine Manager extension and its tasks.

For more information about user administration, see the *IBM Director 4.20 System Management Guide*.

Using IBM Director command-line interface (DIRCMD) with VMM

The IBM Director command-line interface (DIRCMD) can be used with VMM to perform these tasks without using IBM Director Console:

- List objects based on VMM object attributes
- Create and delete VMM farms
- Start and stop hosts in a VMM farm (Microsoft Virtual Server only)
- Create, register, unregister, and delete virtual machines
- Migrate one virtual machine or migrate all virtual machines on a host
- Change the attributes of a virtual machine

DIRCMD enables system administrators to use a command-line prompt to access, control, and gather information from IBM Director Server. Alternatively, system administrators can use DIRCMD in a script to perform a task automatically and confirm the task status through the use of exit codes.

DIRCMD provides command-line support for VMM in two ways:

- The vmm bundle
- Noninteractive VMM tasks that are available in the server-management bundle

For information about installing and using DIRCMD, see the *IBM Director 4.20 Systems Management Guide*. The remainder of this section describes the VMM commands that are available for DIRCMD when VMM is installed.

Commands in the vmm bundle

The commands in the vmm bundle are for the VMM objects listed in the following sections. The syntax and usage for each of these commands is available from DIRCMD.

General commands

The following table lists general commands:

Table 7. VMM commands in DIRCMD for all VMM objects

Command name	Description
lsvmm	Lists all VMM objects defined in IBM Director.

Coordinator commands

The following table lists commands for coordinators:

Table 8. VMM commands in DIRCMD for coordinators

Command name	Description
chvmmauth	Enters or revokes credentials for a coordinator.

VMM farm commands

The following table lists commands for VMM farms:

Table 9. VMM commands in DIRCMD for VMM farms

Command name	Description
mkvmmfarm	Creates a VMM farm.
chvmmfarm	Modifies a VMM farm by adding or removing a host.

Host commands

The VMM bundle does not include any commands for hosts. Instead, use a noninteractive VMM task from the server-management bundle to manage a host.

Virtual machine commands

The following table lists commands for virtual machines:

Table 10. VMM commands in DIRCMD for virtual machines

Command name	Description
mkvmmvm	Creates a virtual machine with the specified attributes. The name must be less than or equal to 80 characters in length.
chvmmvm	Changes the VMM object attributes of a virtual machine.
chvmmvmreg	(VMM Agent for ESX, GSX, and Virtual Server only) Registers or unregisters a virtual machine.
mkvmmmigratetask	Creates a task for migrating virtual machines. This task can migrate one virtual machine or migrate all virtual machines on a host.

VMM noninteractive tasks in server-management bundle

The server-management bundle of DIRCMD includes the VMM noninteractive tasks that the VMM extension provides. You can list all noninteractive tasks, not just those for VMM, with the ListNoninteractiveTasks command.

DIRCMD starts noninteractive tasks with the RunTask command. Use the ListTaskActivationStatus command to see the status of a noninteractive task that you run with DIRCMD.

VMM adds these noninteractive tasks to DIRCMD:

Table 11. VMM noninteractive tasks in DIRCMD

VMM object for task	Command name
coordinator	[Coordinator Management][Discover VMM Farms] [Coordinator Management][Revoke Credentials]
VMM farm	[VMM Farm Management][Start] [VMM Farm Management][Stop] [VMM Farm Management][Delete From Management] [VMM Farm Management][Delete Farm From Coordinator]
host	[Host Management][Power On All Stopped Virtual Machines] [Host Management][Force Power Off All Running Virtual Machines] [Host Management][Suspend All Running Virtual Machines] [Host Management][Resume All Suspended Virtual Machines] [Host Management][Remove Host From VMM Farm] [Host Management][Start] [Host Management][Stop] [Host Management][Discover Virtual Machines]
virtual machine	[Virtual Machine Management][Delete From Host] [Power Management][Shutdown and Power Off] [Power Management][Power On] [Power Management][Resume] [Power Management][Suspend] [Power Management][Power Off Now] [Power Management][Restart Now]

Further, after you have created and saved migration tasks, these tasks are VMM noninteractive tasks that you can run with the RunTask command. Use the ListNoninteractiveTasks command to list any migration tasks that have been saved.

Note: The Virtual Machine Manager task and the two migrate subtasks are not always displayed on the New Scheduled Job window. They are displayed only after you have created and saved migration tasks similar to those shown in Figure 8 on page 16.

Examples

In the following example, an IBM Director super-user connects to the management server with the host name Server1, using the user ID User1 and the password password1. When the user invokes the help function, the following command returns the help message for the VMM bundle:

```
dircmd -s Server1 -u User1 -p password1 vmm help
```

The following command returns the syntax and usage of the **mkvmmmvm** command:

```
dircmd -s Server1 -u User1 -p password1 vmm mkvmmvm -h
```

Chapter 2. Installing VMM

This chapter provides information about system requirements, supported systems, and instructions for installing and uninstalling VMM 2.0

System requirements

In addition to the requirements that are applicable to IBM Director 4.22, VMM has further requirements regarding the hardware and software with which it can be used.

Supported virtualization applications

VMM 2.0 supports the following virtualization applications:

- VMware VirtualCenter 1.2.x
- VMware ESX Server 2.1.x and 2.5.x
- VMware GSX Server 3.1
- Microsoft Virtual Server 2005

Notes:

1. Both VMware ESX Server hosts and VMware GSX Server hosts are supported with VMware VirtualCenter in IBM Director. In this scenario, only use VMM Agent for VirtualCenter.
2. Use VMM Agent for ESX or VMM Agent for GSX when you are using VMware ESX Server hosts and VMware GSX Server hosts that are not in a VMware VirtualCenter environment.
3. (VMware VirtualCenter only) The VMware VirtualCenter client must be installed on the system where IBM Director Console and VMM Console are installed.
4. (VMware GSX Server only) the VMware Virtual Machine Console must be installed on the system where IBM Director Console and VMM Console are installed.

Hardware requirements

This section describes the hardware requirements for VMM.

Note: Be sure to observe the hardware requirements for the virtualization applications that you are using. Disregarding them can cause performance impacts when using VMM. For information on the hardware requirements for the virtualization applications that you are using, see the documentation that comes with that product.

Management servers and management consoles

VMM has these additional hardware requirements beyond those of IBM Director 4.22:

- VMM Server needs 10 MB of additional disk space
- VMM Console needs 10 MB of additional disk space

Managed systems

You can install VMM Agent on any platform that supports IBM Director 4.22 Agent and the virtualization application that you plan to use. However, each managed system running VMM Agent needs 10 MB of additional disk space for that VMM Agent. This hardware requirement applies to all supported virtualization applications.

Supported operating systems

This section lists the operating systems upon which the components of VMM 2.0 are supported.

VMM Server

VMM Server is supported for use with IBM Director 4.22 management servers that are running any supported 32-bit Windows operating system, including Windows 2000 and Windows 2003 Editions.

Note: VMM Server is not supported on any Windows x64 Edition or Linux® operating systems.

VMM Console

VMM Console is supported for use with IBM Director 4.22 management consoles that are running any supported 32-bit Windows operating system, including Windows 2000 and Windows 2003 Editions.

Note: VMM Console is not supported on any Windows x64 Edition operating system.

VMM Agent for VirtualCenter, GSX, and Virtual Server

VMM Agents for VirtualCenter, GSX, and Virtual Server are supported for use on 32-bit Windows operating systems that are supported by both IBM Director 4.22 managed systems and virtualization applications on that managed system. This includes Windows 2000 and Windows 2003 Editions.

Notes:

1. These VMM Agents are not supported on any Windows x64 Edition operating systems.
2. The VMM Agent for Virtual Server does not support any of the Windows 2000 Edition operating systems.

VMM Agent for ESX

VMM Agent for ESX is supported for use only on IBM Director 4.22 managed systems that are running these operating systems:

- VMware ESX Server 2.1.x
- VMware ESX Server 2.5.x

Downloading VMM

Complete the following steps to download VMM from the IBM Web site:

1. Go to www.ibm.com.
2. In the menu bar at the top of the page, click **Products**.
3. Under the Servers category near the middle of the page, click **Intel processor-based**.
4. Under the Resources category and the Products subcategory, click **Systems management**.
5. Under the Download category on the right of the page, click **Systems Management Downloads**.
6. In the drop-down list, select **Virtual Machine Manager 2.0**.
7. At the bottom of the page, click **Submit**.

8. Click the file link for the executable file that you want to download.
   Table 12 lists the executable files that you can download.

Table 12. VMM files that can be downloaded

Operating system	File to download	Contains these VMM components
Windows	32R2644.exe	VMM Server VMM Console VMM Agent for VMware VirtualCenter VMM Agent for VMware GSX Server VMM Agent for Microsoft Virtual Server
VMware ESX Server	VMMESXAgent-2.0-1.i386.rpm	VMM Agent for VMware ESX Server

   You also can download the *IBM Virtual Machine Manager 2.0 Release Notes®* and the *IBM Virtual Machine Manager 2.0 Installation and User's Guide* from this Web page.
9. For systems that are running Windows, copy the downloaded file to a local drive on each management server, management console, and Windows-based managed system on which you want to install VMM. For managed systems that are running VMware ESX Server, copy the file VMMESXAgent-2.0-1.i386.rpm to a temp directory.

Installing VMM on systems running Windows

This procedure only applies to installing VMM components on systems running Windows. This means that this procedure only applies to installing these VMM components:

- VMM Server
- VMM Console
- VMM Agent for VMware VirtualCenter
- VMM Agent for VMware GSX Server
- VMM Agent for Microsoft Virtual Server

If you are installing VMM Agent for VMware ESX Server, see "Installing VMM on systems running VMware ESX Server" on page 26.

The VMM installation program detects whether IBM Director Server or IBM Director Console are installed on a system and automatically displays installation choices for the corresponding VMM components.

If IBM Director Agent is installed on a system that contains a supported virtualization application, the VMM installation program detects which virtualization application is installed and automatically displays an installation choice for the applicable version of VMM Agent. Only one VMM Agent can be run on a managed system at a time.

Note: (VMware VirtualCenter environment only) Before you use VMM, you must also install the VMware VirtualCenter Web service on the managed system that is running VMware VirtualCenter.

Complete the following steps to install VMM on systems that are running Windows:

1. If IBM Director Console is running, close it.
2. From the system on which you want to install VMM, run the executable file that you downloaded.

Note: The operating-system account that is used to install VMM must have at least local Administrator authority.

The VMM Setup program starts, and the Welcome to the InstallShield Wizard for IBM Virtual Machine Manager window opens.

3. Click **Next**. The License Agreement window opens.
4. Click **I accept the terms in the license agreement** and click **Next**. The Setup Type window opens.
5. Make sure that the check boxes for the type of installations that you want are selected. and click **Next**. The Destination Folder window opens.

   Note: You can select only those installation types that are applicable for the system on which you are installing VMM. For example, you cannot install VMM Agent for VMware VirtualCenter unless VMware VirtualCenter is installed on the system.
6. Click **Next**. The Ready to Install the Program window opens.
7. Click **Install**. If you are installing VMM Server or VMM Agent, the Question window opens, which prompts about stopping the IBM Director Service.
8. Click **Yes**. The Installing IBM Virtual Machine Manager window opens. The progress of the installation is displayed.

   When the installation is completed, the InstallShield Wizard Completed window opens.
9. Click **Finish**.

Installing VMM on systems running VMware ESX Server

This procedure only applies to installing VMM components on systems running VMware ESX Server. This means that this procedure only applies to installing VMM Agent for VMware ESX Server.

If you are installing VMM components on systems that are running Windows, see “Installing VMM on systems running Windows” on page 25.

Complete the following steps to install VMM Agent for VMware ESX Server:

1. From the system on which you want to install VMM Agent for ESX, stop the IBM Director Service by entering the following command at the command prompt:

   ```
   twgstop
   ```
2. Run the executable file that you downloaded:

   ```
   rpm -iv VMMESXAgent-2.0-1.i386.rpm
   ```

   Note: The operating-system account that is used to install VMM must have at least local Administrator authority.
3. After VMM is installed, start the IBM Director Service:

   ```
   twgstart
   ```

Installing IBM Director Agent on guest operating systems

You also must install IBM Director Agent on all guest operating systems that you want to view through IBM Director Console. When IBM Director Agent is installed on guest operating systems, VMM can recognize these objects as guest operating systems and correlate them to their virtual machines within IBM Director.

For information about installing IBM Director Agent and the operating systems that it supports, see the *IBM Director 4.22 Release Notes* and the *IBM Director 4.20 Installation and Configuration Guide*.

Note: Cloning systems that have IBM Director Agent installed is not recommended for guest operating systems as unexpected problems can result. One situation that can occur is that managed systems on the same management server will have the same unique identifier from IBM Director. This can cause duplicate managed systems to be displayed in IBM Director Console.

To resolve a situation with duplicate managed systems, see the "Solving IBM Director Problems" chapter of the *IBM Director 4.20 Systems Management Guide*. This problem is discussed with other IBM Director Console problems on managed systems and the solution involves removing a registry key and deleting an ID file.

Upgrading VMM from an earlier release

You cannot upgrade to VMM 2.0 directly from VMM 1.0. However, complete these steps to indirectly upgrade to VMM 2.0:

1. Uninstall VMM 1.0 from all management servers, management consoles, and managed systems that you plan to upgrade.
2. Upgrade these systems from IBM Director 4.20 to IBM Director 4.22.
3. Install VMM 2.0 on the management servers, management consoles, and managed systems. For details, see “Installing VMM on systems running Windows” on page 25.

Notes:

1. Be sure to upgrade VMM on the management server, any management consoles, and any managed systems that you plan to use.
2. The versions of the VMM server extension, console extension, and agent extensions must match. Otherwise, VMM will not function correctly.
3. Be sure to install VMM 2.0 and not VMM 1.0. The installation program in VMM 1.0 does not prevent you from installing VMM 1.0 on an existing VMM 2.0 installation.

Uninstalling VMM on systems running Windows

Note: This procedure only applies to uninstalling VMM components on systems running Windows. This means that this procedure only applies to uninstalling these VMM components:

- VMM Server
- VMM Console
- VMM Agent for VMware VirtualCenter
- VMM Agent for VMware GSX Server
- VMM Agent for Microsoft Virtual Server

If you are uninstalling VMM Agent for VMware ESX Server, see “Uninstalling VMM on systems running VMware ESX Server” on page 28.

You must uninstall VMM 2.0 before you uninstall IBM Director 4.22. The IBM Director 4.22 setup program does not uninstall VMM 2.0.

Complete the following steps to uninstall VMM on a system that is running Windows:

1. Click **Start** → **Settings** → **Control Panel**. The Control Panel window opens.
2. Double-click **Add/Remove Programs**. The Add/Remove Programs window opens.
3. Click **IBM Virtual Machine Manager 2.0**.
4. Click **Remove**.
5. When prompted `Are you sure you want to remove IBM Virtual Machine Manager from your computer`, click **Yes**.
6. (VMM Server and VMM Agents only) When you are prompted `The action you are about to perform will stop the IBM Director Service. Do you want to continue?`, click **Yes**.

Note: The uninstallation of VMM Server and VMM Console does not remove any VMM farm objects or virtual machine objects. The virtual machine objects remain in IBM Director Console, but they are no longer associated with a VMM Systems Group or the VMM Systems Membership association as those were removed when VMM was uninstalled. The VMM farm objects are not displayed in IBM Director Console after VMM is uninstalled. However, If you later reinstall VMM, these VMM farm objects are redisplayed in IBM Director Console.

Uninstalling VMM on systems running VMware ESX Server

Note: This procedure only applies to uninstalling VMM components on systems running VMware ESX Server. This means that this procedure only applies to uninstalling VMM Agent for VMware ESX Server.

If you are uninstalling VMM components on systems that are running Windows, see “Uninstalling VMM on systems running Windows” on page 27.

Complete the following steps to uninstall VMM Agent for VMware ESX Server:

From the system on which you want to uninstall VMM Agent for ESX, stop the IBM Director Service by entering the following command at the command prompt:

```
twgstop
```

Run the uninstallation program by entering the following command:

```
rpm -e VMMESXAgent-2.0-1
```

After VMM is uninstalled, start the IBM Director Service by entering the following command:

```
twgstart
```

Chapter 3. VMM objects and their discovery

This chapter describes VMM objects and how they are discovered. It also provides information about migration types and requirements.

VMM assigns various attributes to all VMM objects. For information, see Chapter 7, “Viewing VMM object attributes,” on page 69.

Most errors with VMM objects are reported through the IBM Director Event Log. See Appendix A, “VMM event filters and actions,” on page 83 for information about VMM events.

Coordinator objects

This information applies only to systems that are running VMware VirtualCenter server.

A coordinator object is a managed object that represents a physical system on which all of the following software is installed:

- VMware VirtualCenter server
- VMware VirtualCenter Web service
- IBM Director Agent
- VMM Agent for VirtualCenter

When IBM Director Server discovers that VMM Agent for VirtualCenter is running on a managed system, it registers services for that VMM Agent. When VMM Server detects that VMM Agent has been registered with IBM Director Server, it recognizes the managed system as a coordinator object.

IBM Director does not recognize a managed system as a coordinator until the managed system has been unlocked from IBM Director Console. (The padlock icon beside a managed system indicates that the object is secured.) To request access to the object, right-click the managed system and click **Request Access**. By providing a valid user name that has local administrative rights to that managed system and its password, you can unlock and access the system.

Note: Before you can manage a coordinator object, you must enter credentials to login to VMware VirtualCenter server. For information, see “Configuring credentials for coordinators” on page 40.

A coordinator object can manage multiple VMM farms, the hosts that they contain, and their virtual machines and guest operating systems.

For information about configuring a coordinator, see “Configuring coordinators” on page 39.

IBM Director Console displays a system icon for a managed system object. When VMM recognizes the managed system as a coordinator, it adds a second icon to depict status information about VMware VirtualCenter server. VMM obtains status information from the virtualization application. For example, a system that is running VMware VirtualCenter server and that has not yet granted permission to IBM Director to perform operations on VMM objects is represented in IBM Director Console as  .

Note: VMM does not add a status icon to a coordinator object when VMware VirtualCenter server is available for use and authenticated with IBM Director.

Table 13 describes the status icons that are used for coordinator objects.

Table 13. Status icons for coordinator objects

Icon	Description
	The VMware VirtualCenter server has not granted permission to IBM Director to perform operations on VMM objects.
	The server is no longer running one of the required services, VMware VirtualCenter server or VMware VirtualCenter Web service. VMM requires both of these services.
	The server is turned on but has an error condition. Generally this problem has two causes: • VMM Agent or IBM Director Agent is not running. • VMware VirtualCenter server or VMware VirtualCenter Web service is not installed.

VMM farm objects

A VMM farm object is a managed object that represents one of the following VMM farms:

- A farm configured on an instance of VMware VirtualCenter server.
- A VMM farm created in VMM for any other supported virtualization environment.

A VMM farm is a logical grouping of hosts and their virtual machines; it does not represent a physical system. A VMM farm can be associated with multiple hosts and their associated virtual machines. A VMM farm object is a managed object that is created specifically by VMM.

A VMM farm is only allowed to contain hosts that are being managed with the same type of VMM Agent. For example, a VMM farm that contains a host running VMM Agent for GSX can only contain other hosts that are also running VMM Agent for GSX.

For information about configuring a VMM farm, see “Configuring VMM farms” on page 42.

VMM farms in a VMware VirtualCenter environment

After IBM Director creates a coordinator object for a system that is running VMware VirtualCenter server, VMM Agent continues the discovery process to identify farms that are in a VMware VirtualCenter environment and create VMM farm objects for these farms. If necessary, you can manually request the discovery of VMM farm objects after IBM Director has discovered a coordinator object. For information, see “Manually discovering VMM farms” on page 37. Alternatively, you can create VMM farms for a coordinator.

VMM farm objects are not identical to farm objects in VMware VirtualCenter because VMM does not use the hierarchical model that VMware uses. VMware VirtualCenter supports collections of farms, which are referred to as *farm groups*. This concept enables VMware VirtualCenter to present farms in hierarchical groups within the VMware VirtualCenter client. However, VMM does not have a farm group concept and does not support this type of farm hierarchy. When VMM Agent creates

a VMM farm object for a VMware VirtualCenter farm that is a member of one or more farm groups, the name of the VMM farm object is a concatenation of the names of its farm groups and the farm itself, for example, FarmGroup1/FarmSubGroup1/Farm.

Note: If a farm that is contained within a farm group is discovered and later that farm group is renamed in VMware VirtualCenter, unexpected behavior can occur with the VMM farm object in the VMM environment. This unexpected behavior for the VMM farm object occurs for all instances of IBM Director Server that are tracking activity on that VMM farm object. After a farm group is renamed, you should revoke and enter credentials for the coordinator object that contains the VMM farm object.

The farm type of a VMM farm in a VMware VirtualCenter environment is *VMware Virtual Center*.

VMM farms in other virtualization environments

You can create VMM farms for use with other supported virtualization environments. These VMM farms are not defined in any virtualization application, but only exist in IBM Director.

The farm type of a VMM farm is undefined until you add a host to it. Then, the farm type becomes one of the following values:

- VMware ESX
- VMware GSX
- Microsoft Virtual Server

Icons for VMM farm objects

IBM Director Console displays a VMM farm icon for a VMM farm object. VMM uses a second icon to depict status information about the VMM farm. VMM obtains status information from the virtualization application.

Note: VMM does not add a status icon to a VMM farm object when the VMM farm is available for use. For example, a VMM farm that is turned on in VMware VirtualCenter is represented in IBM Director Console as  .

Table 14 describes the status icons that are used for VMM farm objects.

Table 14. Status icons for VMM farm objects

Icon	Description
	(VMM Agents for ESX, GSX, and Virtual Server only) A VMM farm that does not contain any hosts. (VMM Agent for Virtual Server only) Microsoft Virtual Server is stopped on all hosts in the VMM farm.

Table 14. Status icons for VMM farm objects (continued)

Icon	Description
	A VMM farm whose status cannot be determined. This icon can occur when VMM Agent cannot communicate with the coordinator (VMM Agent for VirtualCenter) that is associated with the VMM farm or with the VMM farm itself (VMM Agents for ESX, GSX, and Virtual Server). Communication problems will occur if the associated VMM Agent has been stopped. When using the VMM Agent for VirtualCenter, communication problems can occur for these reasons: • The coordinator does not have credentials to log in to the VMware VirtualCenter server. For more information, see “Configuring credentials for coordinators” on page 40. • VMware VirtualCenter Web service on the coordinator has been stopped. • The coordinator has some other error condition. This icon can also occur when one or more of the hosts associated with the VMM farm have an error condition.

(VMM Agent for VirtualCenter only) Sometimes IBM Director Console displays the VMM farm icon with a question mark. This icon can be displayed after this series of events: VMM is installed, VMM farm objects are discovered from a VMware VirtualCenter environment , VMM is uninstalled, and VMM is reinstalled. In this scenario, the previous VMM farm objects are displayed again, but IBM Director cannot determine their status until credentials are entered for their associated coordinator.

Host objects

A host object is a managed object that represents a physical system on which one of the following sets of software are running:

- VMware ESX Server and IBM Director Agent (VMware VirtualCenter only)
- VMware GSX Server and IBM Director Agent (VMware VirtualCenter only)
- VMware ESX Server, IBM Director Agent, and VMM Agent for ESX
- VMware GSX Server, IBM Director Agent, and VMM Agent for GSX
- Microsoft Virtual Server, IBM Director Agent, and VMM Agent for Virtual Server

After IBM Director creates a VMM farm object for a farm that is in a VMware VirtualCenter environment, VMM queries the virtualization application for the hosts that the VMM farm contains. For each host that is identified, VMM matches it with an existing IBM Director managed system. If a managed object does not already exist for the physical system, VMM does not create a managed object for it.

A host object can manage multiple virtual machines and their guest operating systems.

For information about configuring a host, see “Configuring hosts” on page 46.

Hosts that are in a VMware VirtualCenter environment

When a host object represents a system that is running VMware ESX Server or VMware GSX Server in a VMware VirtualCenter environment, you can perform VMM operations on that host whether it is locked or unlocked. VMM communicates out-of-band with this system.

VMM supports only those hosts that are connected to a system that is running VMware VirtualCenter server. If a VMware VirtualCenter host is disconnected, VMM removes the host object for that system and generates a ″VMM Farm, Host Removed″ event. VMM does not discover hosts that are connecting to or are disconnected from a system that is running VMware VirtualCenter server.

The VMware VirtualCenter client must be installed on the system where IBM Director Console and VMM Console are installed.

Hosts that are in other virtualization environments

A managed system that is running VMware ESX Server, VMware GSX Server, or Microsoft Virtual Server is not recognized as a host object when it is locked. To request access to the object, right-click the managed system and click **Request Access**. By providing a valid user name that has local administrative rights to that managed system and its password, you can access the system.

(VMware GSX Server only) The VMware Virtual Machine Console must be installed on the system where IBM Director Console and VMM Console are installed.

Icons for host objects

IBM Director Console displays a system icon for a managed system object. When VMM recognizes a managed system as a host, it adds a second icon to depict status information about the host. VMM obtains status information from the virtualization application. For example, a system that is running VMware ESX Server and IBM Director Agent is represented in IBM Director Console as  .

Table 15 describes the status icons that are used for host objects.

Table 15. Status icons for host objects

Icon	Description
	(VMM Agent for VirtualCenter only) The host is turned on and credentials have been entered for the coordinator. (VMM Agent for ESX only) The host is turned on and VMM Agent for ESX is active. (VMM Agent for GSX only) The host is turned on and VMM Agent for GSX is active. (VMM Agent for Virtual Server only) The host is turned on and Microsoft Virtual Server is started.
	(VMM Agent for Virtual Server only) Microsoft Virtual Server is stopped on the host.
	A host whose status cannot be determined. This icon can occur when VMM Agent cannot communicate with either the coordinator (VMware VirtualCenter) or the host (VMware ESX Server, VMware GSX Server, or Microsoft Virtual Server).

Table 15. Status icons for host objects (continued)

Icon	Description
	(VMM Agents for ESX, GSX, or Virtual Server only) A host that is turned on but has an error condition. Generally this problem has two causes: • VMM Agent or IBM Director Agent is not running. • VMware ESX Server, VMware GSX Server, or Microsoft Virtual Server is not installed on the server.

Virtual machine objects

A virtual machine object is a managed object that represents a virtual machine that is associated with a system (host) that is running a supported virtualization application. A virtual machine object is a logical platform managed object. It is the logical equivalent of a physical platform: it can be turned on and turned off through IBM Director Console. For information, see Chapter 5, “Running power operations on virtual machines,” on page 59.

After VMM discovers a host, it continues the discovery process to create virtual machine objects for all the virtual machines that are associated with the host. If necessary, you can request discovery of virtual machines after a host has been discovered. For information, see “Manually discovering virtual machines” on page 37.

In addition to power and discovery operations, you can also migrate a virtual machine from one host to another. For more information, see Chapter 6, “Migration types and requirements,” on page 63.

You can use VMM to manage virtual machines that are configured with one or more virtual disks. VMM provides support for several types of virtual disks, including undoable disks.

For information about configuring a virtual machine, see “Configuring virtual machines” on page 47.

(VMware VirtualCenter only) VMM does not support or display *virtual machine groups*, which are collections of virtual machines supported by VMware VirtualCenter. When VMM Agent creates a virtual machine object for a virtual machine that is a member of one or more virtual machine groups, the name of the virtual machine group is ignored and not included in the name of the virtual machine object.

(Microsoft Virtual Server only) Microsoft Virtual Server has a virtual machine status called *save state*; VMM refers to this feature as *suspending* a virtual machine. For information about the save state, see the documentation that comes with Microsoft Virtual Server.

Undoable disks

An *undoable disk* is a type of virtual disk that saves changes to a temporary file instead of to the virtual disk itself. Changes can be committed when the virtual machine is turned off.

VMM creates virtual machine objects for virtual machines that contain undoable disks. You can create and view these objects in IBM Director Console. VMM supports power operations and migration for virtual machines that contain undoable disks.

For detailed information about the undoable disk implementation for a virtualization application, see the documentation that comes with it.

In VMM, each virtual machine that has undoable disks can have PowerON and PowerOFF actions that are used to answer questions from the associated virtualization application when that virtual machine is turned on or turned off. The available actions vary depending on which VMM Agent is controlling the virtual machine.

- (VMM Agent for VirtualCenter and ESX only) By default, when a virtual machine is turned off, changes are written immediately to disk, which is the PowerOff Commit action. To change the PowerOFF action, see 5 on page 52. If you configure a PowerOFF action, but do not configure a PowerON action, then by default, when the virtual machine is turned on, changes saved in the redo log are applied to disk, which is the PowerOn Commit action. To change the PowerON action, see 4 on page 51.
- (VMM Agent for Virtual Server only) VMM only provides PowerOFF actions for virtual machines with undoable disks in Microsoft Virtual Server. To configure PowerON actions, you must use the Web interface to Microsoft Virtual Server. By default, when a virtual machine is turned off, changes to the virtual disk are saved in a redo log, which is the PowerOff Keep action. To change the PowerOFF action, see 3 on page 53.

VMware GSX Server does not have an undoable disks feature for its virtual machines.

Icons for virtual machine objects

IBM Director Console displays the logical platform icon for a virtual machine object. VMM adds a second icon to the virtual machine object to depict status information about the virtual machine. VMM obtains the status information from the virtualization application. For example, a virtual machine that is turned on is represented in IBM Director Console as  .

IBM Director updates the virtual machine icons whenever you perform power operations on a virtual machine. IBM Director also updates the virtual machine icons for power operations initiated by the virtualization application.

Table 16 describes the status icons that are used for virtual machine objects.

Table 16. Status icons for virtual machine objects

Icon	Description
	A virtual machine that is turned on.
	A virtual machine that is turned off.

Table 16. Status icons for virtual machine objects (continued)

Icon	Description
	A virtual machine that is pending, which means that the associated virtualization application requires the user to answer a question before the state change will continue. To resolve a pending state, use the Start Vendor Software task to start the virtualization application for the VMM object; then, resolve any open questions against the virtual machine state transition.
	A virtual machine that is undergoing a transition, for example, turning on, suspending, resuming, turning off, resetting, or migrating. **Note:** This icon is displayed when the virtual machine state change is initiated through VMM. This icon is not displayed when the virtualization application initiates a state change.
	A virtual machine that is turned on but suspended. When a virtual machine is suspended, all activity on the virtual machine is stopped until you explicitly resume operations on the virtual machine.
	A virtual machine that has not established communication. This icon can have one of the following meanings: **VMware VirtualCenter** • The coordinator does not have credentials to log in to the VMware VirtualCenter server. For more information, see “Configuring credentials for coordinators” on page 40. • VMware VirtualCenter Web service on the coordinator has been stopped. • The coordinator has some other error condition. **VMware ESX Server** • VMware ESX Server is not running. • VMM Agent has been stopped **VMware GSX Server** • VMware GSX Server is not running. • VMM Agent has been stopped **Microsoft Virtual Server** • Microsoft Virtual Server has been stopped. • VMM Agent has been stopped

Guest-operating-system objects

A guest-operating-system object is a managed system that represents an operating system that is running on a virtual machine and that is running IBM Director Agent. A guest-operating-system object is a particular type of managed system.

The standard IBM Director discovery process for managed systems can discover guest operating systems. However, if a guest operating system is not running IBM Director Agent, it is not recognized as a guest-operating-system object in IBM Director.

IBM Director Console displays a system icon for a guest-operating-system object. VMM does not display any status icons for guest-operating-system objects.

Manually discovering VMM objects

All the virtualization components on a system that is running a supported virtualization application are automatically discovered when the systems are discovered. However, you might want to force the discovery of virtualization components if they have been newly created on those systems since other virtualization components were initially discovered by IBM Director, or if the objects for some virtualization components were deleted from IBM Director. Once the new virtualization components are discovered, IBM Director can create VMM objects for them.

You can manually request discovery of VMM objects through the standard IBM Director discovery process. To do so, from IBM Director Console, click **Tasks → Discover Systems → All Systems and Devices**. For more information about discovering managed systems, see the *IBM Director 4.20 Installation and Configuration Guide*.

The remainder of this section describes the VMM menus that you can use to discover only VMM farms or only virtual machines.

Manually discovering VMM farms

This procedure applies only to systems that are running VMware VirtualCenter server.

Complete the following steps to discover all farms that are defined on a system that is running VMware VirtualCenter server and create VMM farm objects as necessary:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator.
2. Click **Coordinator Management → Discover VMM Farms**.

Manually discovering virtual machines

Complete the following steps to discover all virtual machines that are associated with a supported host and create virtual machine objects as necessary:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host.
2. Click **Host Management → Discover Virtual Machines**.

Chapter 4. Configuring VMM objects

This chapter provides information about configuring VMM objects and how to delete VMM objects from IBM Director Console.

Configuring coordinators

The information in this section applies only to VMware VirtualCenter environments.

You can configure coordinator objects with the following tasks:

- Displaying coordinator attributes
- Creating a VMM farm for a coordinator
- Configuring credentials by entering or revoking them

Note: Before you can manage a coordinator object, you must enter credentials to login to VMware VirtualCenter server. For information, see "Configuring credentials for coordinators" on page 40.

For information about displaying coordinator attributes, see "Displaying coordinator object attributes" on page 69.

The remaining configuration tasks are explained in the sections that follow.

Creating a VMM farm for a coordinator

This procedure applies only to VMware VirtualCenter environments.

Complete the following steps to create a VMM farm in IBM Director and VMware VirtualCenter:

1. From IBM Director Console, in the Tasks pane, drag the Create VMM Farms task onto any coordinator object in the Group Contents pane. The Create VMM Farm window opens and the VirtualCenter Farm check box is selected and the location and path fields are prefilled with information from IBM Director. Generally, the values in the location and path fields should not be changed. However, use the location field to select the coordinator and modify the path field only if you wish to add the new farm to a different farm group and you know the valid path to that farm group.

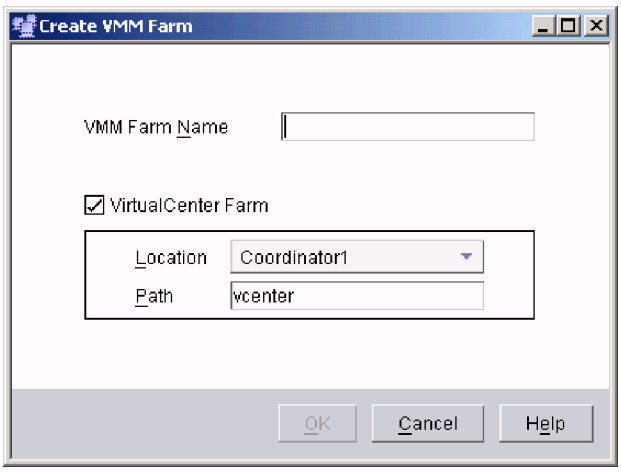

Figure 10. Create VMM Farm window when creating a VMM farm for a coordinator

2. In the VMM Farm Name field, type the name of the VMM farm that is to be added.
3. Click **OK**.

Configuring credentials for coordinators

This information applies only to systems that are running VMware VirtualCenter server.

Before you can perform operations on VMM objects, you must enter credentials for the coordinator object that represents the system on which VMware VirtualCenter server is installed. For example, you must enter credentials before you can turn on a virtual machine through IBM Director Console. *Entering credentials* logs you into the VMware management interface for that system. Logging off of the VMware management interface is referred to as *revoking credentials*.

After you have entered credentials, any instance of IBM Director Server in the environment can access that instance of VMware VirtualCenter server. You can continue to enter credentials from any instance of IBM Director Server in the environment. You can revoke credentials only from those instances of IBM Director that originally entered credentials. After credentials are revoked from the last instance of IBM Director server that previously entered credentials, no instance of IBM Director Server can access that instance of VMware VirtualCenter server.

Notes:

1. In an IBM Director environment that has multiple management servers and after credentials have been entered for a coordinator object, use only one management server to manage that coordinator object. Using multiple management servers to manage coordinator objects that have authenticated with VMware VirtualCenter causes unpredictable results.
2. Make sure that you understand that changes made to coordinators or their associated hosts outside of IBM Director and VMM cannot be reflected in IBM Director Console until credentials have been entered for a given coordinator. For more information, see the problem symptom about this scenario in “Problems with VMM Agent for VMware VirtualCenter” on page 79.

Entering credentials for a coordinator

This procedure applies only to VMware VirtualCenter environments.

Complete the following steps to enter credentials for a coordinator:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator.
2. Click **Coordinator Management → Enter Credentials**. The Enter Credentials window opens.

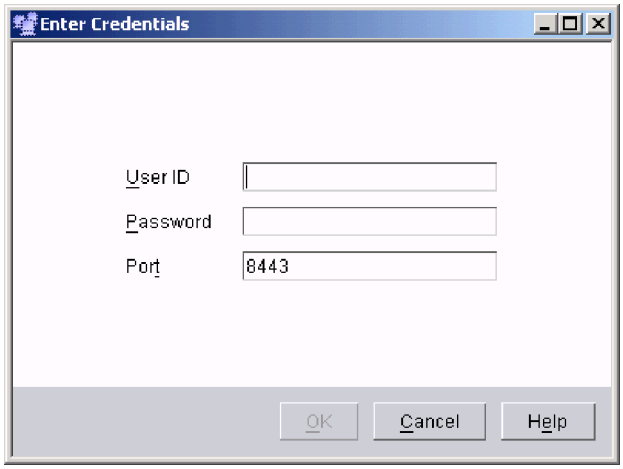

Figure 11. Enter Credentials window

3. In the **User ID** field, type the user name for the VMware VirtualCenter server. (This user name was designated when VMware VirtualCenter Server was installed.)
4. In the **Password** field, type the password for the user name that you used.
5. If necessary, in the **Port** field, type the address of the port that VMM uses for communication with the VMware VirtualCenter Web service. By default, VMM uses port 8443, which is the default port number used for VMware VirtualCenter Web service.
6. Click **OK**. VMM Agent logs on to the management interface that is provided by VMware VirtualCenter. If the login is successful, VMM displays a confirmation message that the credentials were accepted.
7. Click **OK** to close the message window.

VMM saves the entered credentials for the coordinator to IBM Director Server. VMM Agent does not save any credentials.

Revoking credentials for a coordinator

This procedure applies only to VMware VirtualCenter environments.

Complete the following steps to revoke credentials for a coordinator:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator.
2. Click **Coordinator Management → Revoke Credentials**.

Note: The **Revoke Credentials** menu option appears only when you are using an instance of IBM Director Server that previously entered credentials. This menu option is not available when using any other instance of IBM Director Server.

VMM deletes the saved credentials for the coordinator from IBM Director Server. Also, VMM Agent logs off from the management interface that is provided by VMware VirtualCenter.

Configuring VMM farms

You can configure VMM farm objects with the following tasks:

- Discovering VMM farms in IBM Director
- Displaying VMM farm object attributes
- Creating a VMM farm that is not for a coordinator
- Adding a host to a VMM farm
- Deleting a VMM farm from IBM Director and a coordinator (VMware VirtualCenter only)
- Deleting a VMM farm from IBM Director
- Starting the hosts in a VMM farm (Microsoft Virtual Server only)
- Stopping the hosts in a VMM farm (Microsoft Virtual Server only)
- Removing a host from a VMM farm

Configuration tasks differ according to the virtualization application that you are running on the host.

For information about some of these configuration tasks, see the following sections of this guide:

- “Manually discovering VMM farms” on page 37
- “Displaying VMM farm object attributes” on page 70
- “Deleting a VMM object from IBM Director” on page 57

The remaining configuration tasks are explained in the sections that follow.

Creating a VMM farm that is not for a coordinator

This procedure applies only to virtualization environments other than VMware VirtualCenter.

Complete the following steps to create a VMM farm for a host that is running VMM Agent for ESX, GSX, or Virtual Server:

1. From IBM Director Console, in the Tasks pane, double-click the Create VMM Farm subtask. The Create VMM Farm window opens and the VirtualCenter Farm check box has been cleared and the location and path fields are unavailable.

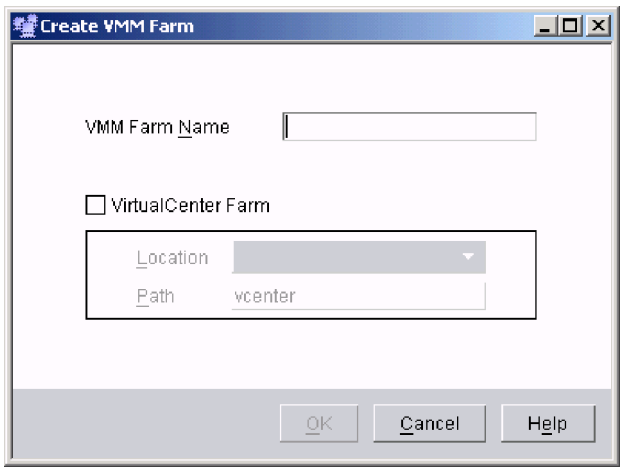

Figure 12. Create VMM Farm window when creating a VMM farm that is not for a coordinator

2. In the VMM Farm Name field, type the name of the VMM farm that is to be added.
3. Click **OK**.

Adding a host to a VMM farm

Complete the following steps to add a host to a VMM farm:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the VMM farm.
2. Click **VMM Farm Management → Add Host to a VMM Farm**. The Add Host window opens.

The Add Host window is different based on the type of VMM farm to which you are adding a host:

- If you are adding a host to a VMM farm that is defined in VMware VirtualCenter, you must designate the host, a user ID for VMware VirtualCenter, the password, and the port.
- If you are adding a host to a VMM farm that is any other type of VMM farm, you only need to select the host from a list of available hosts.

Adding a host to a VMM farm in VMware VirtualCenter

Figure 13 shows the Add Host window when adding a host to a VMM farm that is defined in VMware VirtualCenter.

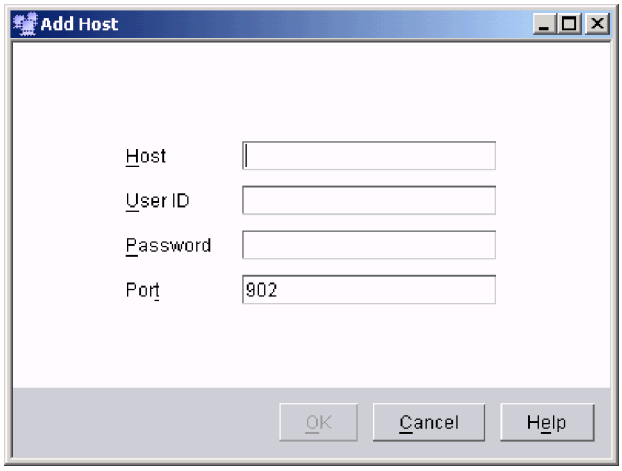

Figure 13. Add Host window when the VMM farm is in VMware VirtualCenter

When adding a host to a VMM farm that represents a farm defined in VMware VirtualCenter, complete the following steps on the Add Host window:

1. In the **Host** field, type the IP address or name of the host that is to be added to the VMM farm.

   Note: Before you type a host name, make sure that the network environment is able to determine the IP address from the host name. Otherwise, the operation to add a host will fail. If you cannot determine the IP address of a host by using the **ping** command, type the IP address instead of the host name.
2. In the **User ID** field, type the user name for the administrator of the system. Generally, this is root for hosts that are running VMware ESX Server. This user name is used by VMware VirtualCenter server to communicate with the host that is running VMware ESX Server or VMware GSX Server.
3. In the **Password** field, type the password for the user name that you used.
4. If necessary, in the **Port** field, type the address of the port that VMware VirtualCenter server will use for communication with VMware ESX Server. By default, VMM uses port 902 for this communication. If the system that is running VMware ESX Server is configured to use a port address other than 902, type that port address in this field. Hosts that are running VMware GSX Server do not use the port number.
5. Click **OK**.

Note: VMM Agent does not enable VMware VirtualCenter VMotion for a newly added VMware ESX Server host. If you want to dynamically migrate virtual machines to or from this host, you must use VMware VirtualCenter to enable VMotion for the host. For information about VMware VirtualCenter VMotion requirements, see the documentation that comes with VMware VirtualCenter.

Adding a host to a VMM farm not in VMware VirtualCenter

Figure 14 shows the Add Host window when adding a host to a VMM farm that is not defined in VMware VirtualCenter.

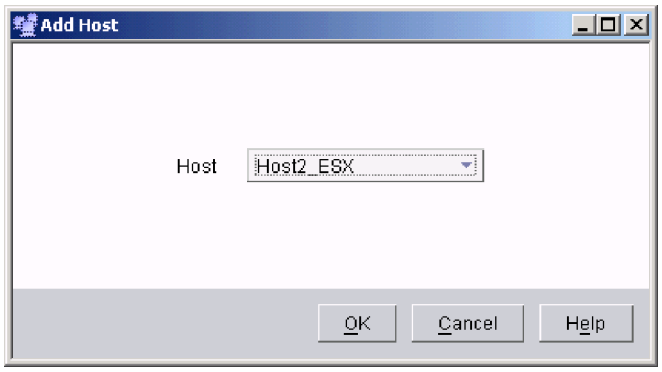

Figure 14. Add Host window when the VMM farm is not in VMware VirtualCenter

Complete the following steps to add a host to a VMM farm that is not defined in VMware VirtualCenter:

1. Select an available host from the list in the Add Host window.
2. Click **OK**.

The attributes of the VMM farm are updated according to the type of host that you added.

Deleting a VMM farm from IBM Director and VMware VirtualCenter

This task applies only to VMM farms in VMware VirtualCenter.

If you no longer require a VMM farm object, you can use VMM to delete the corresponding farm from VMware VirtualCenter. This action also deletes the corresponding managed object for the VMM farm from IBM Director. If you do this task, the VMM farm cannot be rediscovered and instead must be recreated. Alternatively, you can delete a VMM farm only from IBM Director. To do so, see “Deleting a VMM object from IBM Director” on page 57.

Complete the following steps to delete a VMM farm object from a coordinator and delete its corresponding virtualization component from VMware VirtualCenter:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the VMM farm.
2. Click **VMM Farm Management → Delete from coordinator**.

   Note: This menu option is only available when the coordinator that contains the VMM farm to be deleted is online and authenticated.
3. Click **OK**.

Starting Microsoft Virtual Server services on a VMM farm

Complete the following steps to start Microsoft Virtual Server services on all hosts that are associated with one VMM farm:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the VMM farm that contains the hosts where you want to start Microsoft Virtual Server services.

2. Click **VMM Farm Management → Start**.

Stopping Microsoft Virtual Server services on a VMM farm

Complete the following steps to stop Microsoft Virtual Server services on all hosts that are associated with one VMM farm:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the VMM farm that contains the hosts where you want to stop Microsoft Virtual Server services.
2. Click **VMM Farm Management → Stop**.

Removing a host from a VMM farm

Complete the following steps to remove a host from a VMM farm:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host.
2. Click **Host Management → Remove Host From VMM Farm**.

   Note: This menu option is only available when the coordinator that contains the VMM farm is online and authenticated.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Configuring hosts

You can configure host objects with the following tasks:

- Discover virtual machines that are associated with a host
- Display host object attributes
- Add a host to a VMM farm
- Remove a host from a VMM farm
- Start Microsoft Virtual Server services
- Stopping Microsoft Virtual Server services
- Migrating a single or all virtual machines to another host
- Performing power operations for all virtual machines that are associated with a host

Configuration tasks differ according to the virtualization application that you are running on the host.

For information about some of these configuration tasks, see the following sections of this guide:

- “Manually discovering virtual machines” on page 37
- “Displaying host object attributes” on page 71
- “Adding a host to a VMM farm” on page 43 under “Configuring VMM farms” on page 42
- “Removing a host from a VMM farm” under “Configuring VMM farms” on page 42
- “Power operations for all virtual machines on a host” on page 60

The remaining configuration tasks are explained in the sections that follow.

Starting Microsoft Virtual Server services on a host

You can use VMM to start Microsoft Virtual Server services. These features can be useful when you want to use Microsoft Virtual Server to preconfigure individual virtual machines. VMM does not provide these configuration features. For information about Microsoft Virtual Server services, see the documentation.

Complete the following steps to start Microsoft Virtual Server services on a host:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host where you want to start Microsoft Virtual Server services.
2. Click **Host Management → Start Host**.

Stopping Microsoft Virtual Server services on a host

Complete the following steps to stop Microsoft Virtual Server services on a host:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host where you want to stop Microsoft Virtual Server services.
2. Click **Host Management → Stop Host**.

Migrating a single or all virtual machines to another host

You can migrate virtual machines between hosts in one of the following ways:

- Create a task to migrate a single virtual machine from one host to another host. For information, see “Migrate Single Virtual Machine Tasks” on page 7.
- Create a task to migrate all virtual machines on one host to another host. For information, see “Migrate All Virtual Machine Tasks” on page 7.

Configuring virtual machines

You can configure virtual machine objects with the following tasks:

- Discovering virtual machines in IBM Director
- Displaying virtual machine object attributes
- Creating a virtual machine
- Registering a virtual machine
- Setting attributes for virtual machines
- Running power operations on virtual machines
- Creating a task to migrate a single virtual machine
- Creating a task to migrate all virtual machines from a single host
- Unregistering a virtual machine
- Deleting a virtual machine from both IBM Director and disk
- Deleting a virtual machine only from IBM Director

Configuration tasks differ according to the virtualization application that you are running on the host.

For information about some of these configuration tasks, see the following sections of this guide:

- “Manually discovering virtual machines” on page 37
- “Displaying virtual machine object attributes” on page 73
- Chapter 5, “Running power operations on virtual machines,” on page 59

- “Deleting a VMM object from IBM Director” on page 57

The remaining configuration tasks are explained in the sections that follow.

Creating a virtual machine

Complete the following steps to create a virtual machine for a host:

Note: You cannot migrate virtual machines that are created within the system or boot partitions in a Windows environment.

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host.
2. Click **Host Management → Create Virtual Machine**. The Create Virtual Machine window opens. Figure 15 shows the Create Virtual Machine window when creating a virtual machine on a host running VMware ESX Server.

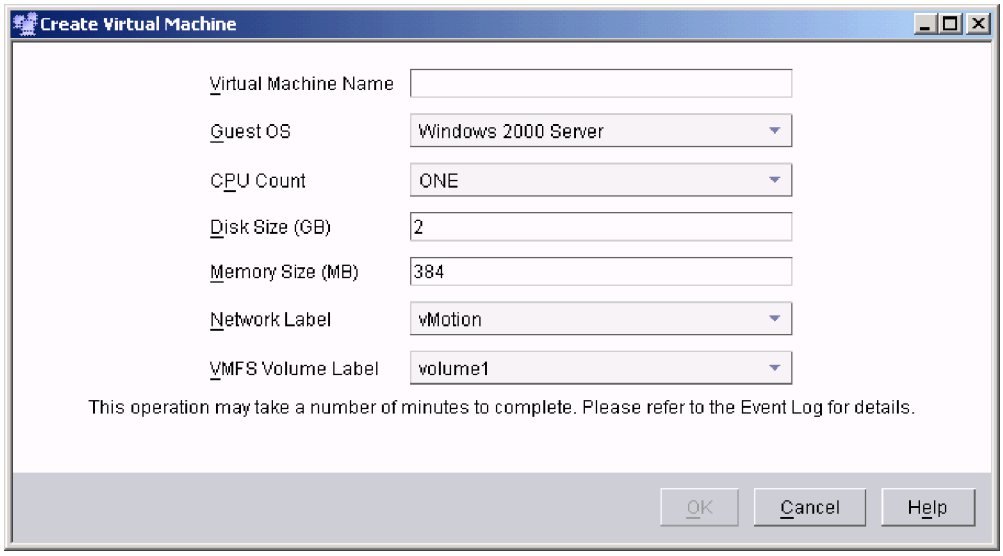

Figure 15. Create Virtual Machine window for a host running VMware ESX Server

3. In the **Virtual Machine Name** or **VM Name** field, type the name of the virtual machine that is to be added to the host. The name must be less than or equal to 80 characters in length.

   (VMM Agents for GSX and Virtual Server only) The virtual machine is created in the default location of the C drive unless you designate a full path name in this field. For VMware GSX hosts, the default is `C:\Virtual Machines\`. For Microsoft Virtual Server hosts, the default is `C:\Documents and Settings\All Users\Shared Documents\Shared Virtual Machines\`.
4. (VMM Agents for VirtualCenter, ESX, and GSX only) In the **Guest OS** field, select the guest-operating system that will run on this virtual machine from the drop-down list.
5. (VMM Agents for VirtualCenter and ESX only) In the **CPU Count** field, select the number of processors for this virtual machine from the drop-down list.
6. In the **Disk Size (GB)** field, type the size of the virtual disk to be used by the virtual machine. The minimum amount that you can allocate is 1 GB and the maximum is 8 GB.

7. In the **Memory Size (MB)** field, type the amount of memory to be used by the virtual machine. The minimum amount that you can allocate is 256 MB and the maximum is 768 MB. The value you enter must be evenly divisible by four. If you want to configure the virtual machine with more memory than 768 MB, you must use the virtualization application to do so.
8. (VMM Agents for VirtualCenter, ESX and Virtual Server only) In the **Network Label** field, select the network label that you want for this virtual machine from the drop-down list.
9. (VMM Agents for VirtualCenter and ESX only) In the **VMFS Volume Label** field, select the Virtual Machine File System (VMFS) volumes on which you can create virtual machines from the drop-down list.
10. Click **OK**.

This operation can take several minutes to complete. View the IBM Director Event Log for details during the operation.

(VMM Agent for ESX, GSX, and Virtual Server only) During the creation operation, the virtual machine is registered to the host. You do not need to manually register the virtual machine unless you are manually moving it to a different host.

The default disk type for a virtual machine created by VMM depends on the VMM Agent that was used to create the virtual machine:

- (VMM Agent for VirtualCenter, ESX, and GSX only) Virtual machines are created with a disk type of persistent. To change the disk type on a virtual machine, see the section ""“Setting attribute values for virtual machines” on page 50" later in this chapter.
- (VMM Agent for Virtual Server only) Virtual machines are created with a disk type of persistent and dynamically expanding. To create virtual machines with differencing or linked disks, use the Web interface to Microsoft Virtual Server.

Registering a virtual machine

This procedure applies only to virtual machines under the control of VMM Agent for ESX, GSX, or Virtual Server.

Complete the following steps to register a virtual machine for a host:

1. Make sure that the virtual machine to be registered is turned off or suspended. For more information, see “Power operations for a single virtual machine” on page 61.
2. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host where you want to register a virtual machine.
3. Click **Host Management → Register Virtual Machine**. The Register Virtual Machine window opens.

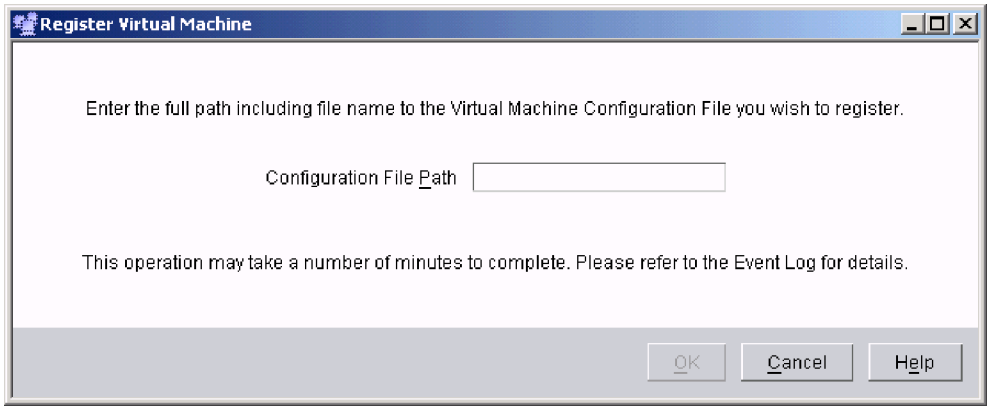

Figure 16. Register Virtual Machine window

4. In the **Configuration File Path** field, type the full path name to the configuration file of the virtual machine that you want to register. This is the full path name that you noted previously when you unregistered the virtual machine from a different host. For example, type `C:\Virtual Machines\Windows 2000 Server 2\win2000Serv.vmx`.
5. Click **OK**.

This operation can take several minutes to complete. Refer to the IBM Director event log for details.

Note: (VMM Agent for Virtual Server only) Sometimes a virtual machine that was previously unregistered from a Microsoft Virtual Server host does not reregister. When this happens, restart the Microsoft Virtual Server service then complete the VMM registration steps again. This problem was corrected in Microsoft Virtual Server Service Pack 1.

Setting attribute values for virtual machines

Complete the following steps to set attribute values for a virtual machine:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the virtual machine.
2. Click **Virtual Machine Management → Set Resources**. The VMM Object Attributes window opens with the values that you can set.

The VMM Object Attributes window has different fields based on the type of virtual machine on which you are setting attribute values:

- In a VMware VirtualCenter or VMware ESX Server environment, you can set the memory size, the number of central processing units (CPUs), the virtual disk type, and the PowerON and PowerOFF action for undoable disks.
- In a VMware GSX Server environment, you can set the memory size and virtual disk type.
- In a Microsoft Virtual Server environment, you can set the memory size, the virtual disk mode, and the PowerOFF action for undoable disks.

Figure 17 on page 51 shows the VMM Object Attributes window when setting attribute values for a virtual machine on a host running VMware ESX Server.

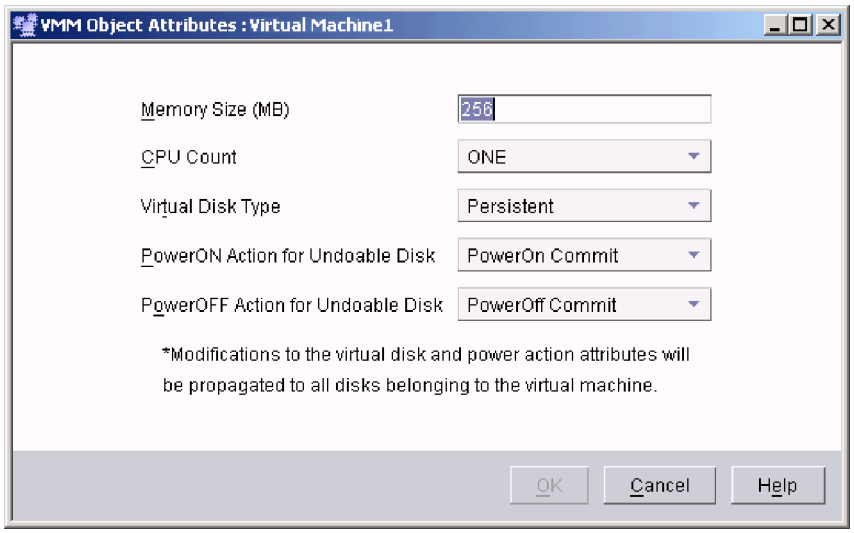

Figure 17. VMM Object Attributes window when setting attribute values for a virtual machine on a host running VMware ESX Server

Setting virtual machine attributes through VMM Agents for VirtualCenter or ESX

Complete the following steps to set attributes for virtual machines through VMM Agents for VirtualCenter or ESX:

1. In the **Memory Size (MB)** field, type the amount of memory to be allocated to the virtual machine. The minimum amount that you can allocate is 256 MB and the maximum is 768 MB. The value you enter must be evenly divisible by four. If you want to configure the virtual machine with more memory than 768 MB, you must use the virtualization application to do so.
2. In the **CPU Count** field, type the number of CPUs to be allocated to the virtual machine.
3. In the **Virtual Disk Type** field, select the type of disks used by this virtual machine. This setting applies to all disks belonging to this virtual machine. If the virtual machine does not have any disks defined for it, then this field is ignored. Table 17 describes the disk types that you can select.

Table 17. Virtual disk types for a virtual machine (VirtualCenter or ESX)

Virtual Disk Type	Description
Persistent	The changed data on the virtual disk is immediately written to disk.
Non-Persistent	The changed data on the virtual disk is discarded when you turn off the virtual machine or revert to the snapshot.
Undoable	The changed data on the virtual disk is not saved until the virtual machine is turned off and you confirm to save the changes.
Append	The changed data on the virtual disk is appended to the redo log only when you turn off the virtual machine.

4. In the **PowerON Action for Undoable Disk** field, select the action you want VMM to take when the virtual machine is turned on. The virtual machine must be using one or more undoable virtual disks. The action you select applies to all undoable virtual disks in the virtual machine. Table 18 on page 52 describes the

actions that you can select.

Table 18. PowerON actions for virtual machines with undoable disks (VirtualCenter or ESX)

Action name	Description
PowerOn Commit	Applies the changes saved in the redo log.
PowerOn Discard	Deletes the changes in the redo log.
PowerOn Append	Does not apply or delete the changes in the redo log. Instead, the changes are kept and new changes are appended to the end of the redo log.

5. In the **PowerOFF Action for Undoable Disk** field, select the action you want VMM to take when the virtual machine is turned off. The virtual machine must be using one or more undoable virtual disks. The action you select applies to all undoable virtual disks in the virtual machine.Table 19 describes the actions that you can select.

Table 19. PowerOFF actions for virtual machines with undoable disks (VirtualCenter or ESX)

Action name	Description
PowerOff Commit	Writes the changes immediately to disk.
PowerOff Discard	Does not save any changes to disk.
PowerOff Keep	Saves the changes to the virtual disk in a redo log.

6. Click **OK**.

Setting virtual machine attributes through VMM Agent for GSX

Complete the following steps to set attributes for virtual machines through VMM Agent for GSX:

1. In the **Memory Size (MB)** field, type the amount of memory to be allocated to the virtual machine. The minimum amount you can allocate is 256 MB.
2. In the **Virtual Disk Type** field, select the type of disks used by this virtual machine. This setting applies to all disks belonging to this virtual machine. If the virtual machine does not have any disks defined for it, then this field is ignored. Table 20 describes the disk types that you can select.

Table 20. Virtual disk types for a virtual machine (GSX)

Virtual disk type	Description
Persistent	The changed data on the virtual disk is recorded when you take a snapshot of the virtual machine. Further, all changes to the data on the virtual disks are saved to the disk file immediately.
Independent Persistent	The changed data on the virtual disk is not recorded when you take a snapshot of the virtual machine. Further, all changes to the data on the virtual disks are saved to the disk file immediately.
Independent Non-persistent	The changed data on the virtual disk is not recorded when you take a snapshot of the virtual machine. Further, changes to the virtual disk are not saved to the disk file. When the virtual machine is turned off or reset, all changes are discarded.

3. Click **OK**.

Setting virtual machine attributes through VMM Agent for Virtual Server

Complete the following steps to set attributes for virtual machines through VMM Agent for Virtual Server:

1. In the **Memory Size (MB)** field, type the amount of memory to be allocated to the virtual machine. The minimum amount you can allocate is 256 MB.
2. In the **Virtual Disk Mode** field, select the mode (undoable or not undoable) for the virtual disk from the drop-down list. This setting applies to all disks belonging to this virtual machine.
3. In the **PowerOFF Action for Undoable Disk** field, select the action you want VMM to take when the virtual machine is turned off. The virtual machine must be using one or more undoable virtual disks. The action you select applies to all undoable virtual disks in the virtual machine. Table 21 describes the actions that you can select.

Table 21. PowerOFF actions for virtual machines with undoable disks (Virtual Server)

Action name	Description
PowerOff Commit	Writes the changes immediately to disk.
PowerOff Discard	Does not save any changes to disk.
PowerOff Keep	Saves the changes to the virtual disk in a redo log.

4. Click **OK**.

Creating a task to migrate a single virtual machine

Complete the following steps to create a schedulable task for migrating a single virtual machine from one host to a different host:

Note: Before migrating virtual machines, you should understand the migration requirements that are involved. For information, see Chapter 6, “Migration types and requirements,” on page 63

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the virtual machine that you want to migrate to another host.
2. Click **Virtual Machine Management → Create Single Migrate Task**. The Migrate Single Virtual Machine Tasks window opens. If no hosts are listed, the VMM farm that contains the host for this virtual machine does not contain another host to which you can migrate the virtual machine.

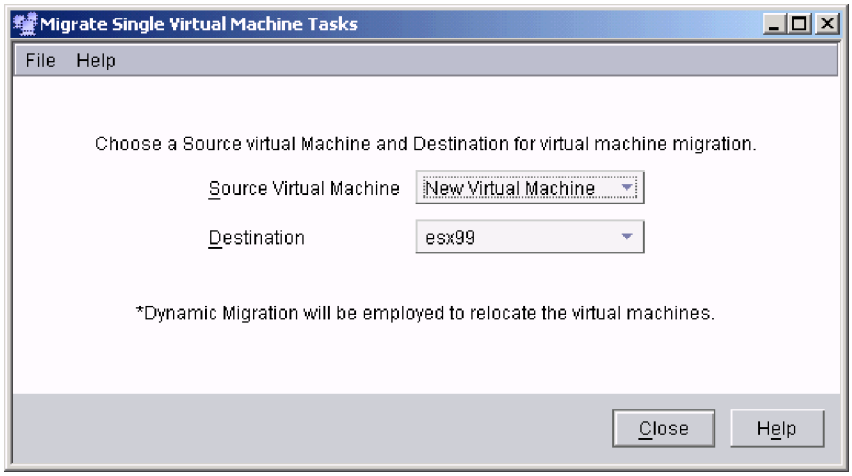

Figure 18. Migrate Single Virtual Machine Tasks window

Note: Although the fields on this window are usually prefilled, you must explicitly select a value for at least one field. Do so by selecting a value from the drop-down list on one of the fields. Otherwise, after you click **Close**, IBM Director Console will not prompt you to save the task that you are creating.

3. In the **Source Virtual Machine** field, select a virtual machine from the drop-down list that you want to migrate in a task.

   A virtual machine is relocated with one of these migration types:

   - When using the VMM Agent for VirtualCenter, VMM uses dynamic migration.
   - When using the VMM Agents for ESX, GSX, or Virtual Server, VMM uses static migration.

4. In the **Destination** field, select the host to become associated with the migrated virtual machine when this task is run.
5. Click **Close**. A window opens that asks if you want to save changes.
6. Type a name for the saved task.
7. Click **OK**.

The newly created schedulable task is displayed in the Tasks pane of IBM Director Console under the Migrate Single Virtual Machine Tasks subtask, which is under the Virtual Machine Manager task. To run the task, right-click it and click **Execute Now**.

For a list of other places in IBM Director Console from which this saved task is available, see “Migrate Single Virtual Machine Tasks” on page 7.

Creating a task to migrate all virtual machines from a single host

Complete the following steps to create a schedulable task for migrating all virtual machines from a single host to a different host:

Note: Before migrating virtual machines, you should understand the migration requirements that are involved. For information, see Chapter 6, “Migration types and requirements,” on page 63.

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host that contains the virtual machines that you want to migrate to another host.

2. Click **Host Management → Create All Migrate Task**. The Migrate All Virtual Machine Tasks window opens.

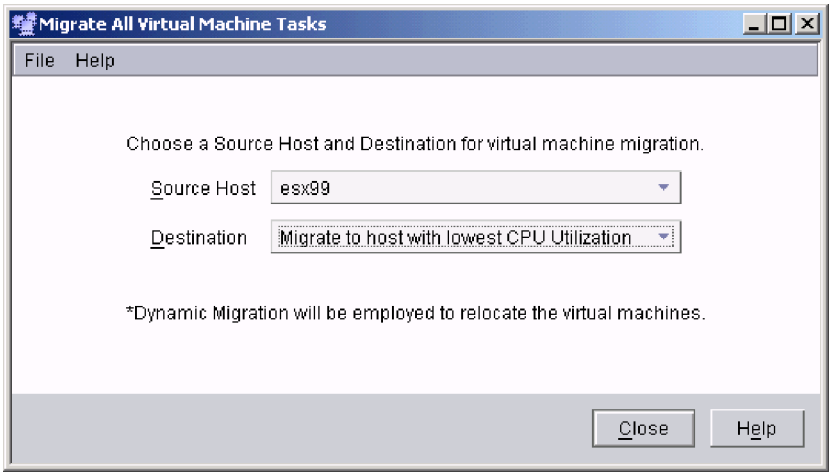

Figure 19. Migrate All Virtual Machine Tasks window

Note: Although the fields on this window are usually prefilled, you must explicitly select a value for at least one field. Do so by selecting a value from the drop-down list on one of the fields. Otherwise, after you click **Close**, IBM Director Console will not prompt you to save the task that you are creating.

3. In the **Source Host** field, select a host that is associated with the virtual machines that you want to migrate. If no source or destination hosts are listed, the VMM farm that contains the host that you right-clicked does not contain another host to which you can migrate the virtual machines.

   The virtual machines are relocated with one of these migration types:

   - When using the VMM Agent for VirtualCenter, VMM uses dynamic migration.
   - When using the VMM Agents for ESX, GSX, or Virtual Server, VMM uses static migration.

4. In the Destination field, select the host to become associated with the migrated virtual machines when this task is run. Only hosts that are in the same VMM farm are available as destination choices.

   Alternatively, you can also select the host with the lowest CPU utilization over the last 10 minutes.

5. Click **Close**. A window opens that asks if you want to save changes.
6. Type a name for the saved task.
7. Click **OK**.

The newly created schedulable task is displayed in the Tasks pane of IBM Director Console under the Migrate All Virtual Machine Tasks subtask, which is under the Virtual Machine Manager task. To run the task, right-click it and click **Execute Now**.

For a list of other places in IBM Director Console from which this saved task is available, see 8.

Unregistering a virtual machine

This procedure applies only to virtual machines under the control of VMM Agent for ESX, GSX, or Virtual Server.

Complete the following steps to unregister a virtual machine for a host:

1. Make sure that the virtual machine to be unregistered is turned off or suspended. For more information, see “Power operations for a single virtual machine” on page 61.
2. From IBM Director Console, in the Group Contents pane, right-click the managed object for the virtual machine.
3. Click **Virtual Machine Management → Unregister From Host**. The Unregister From Host window opens.

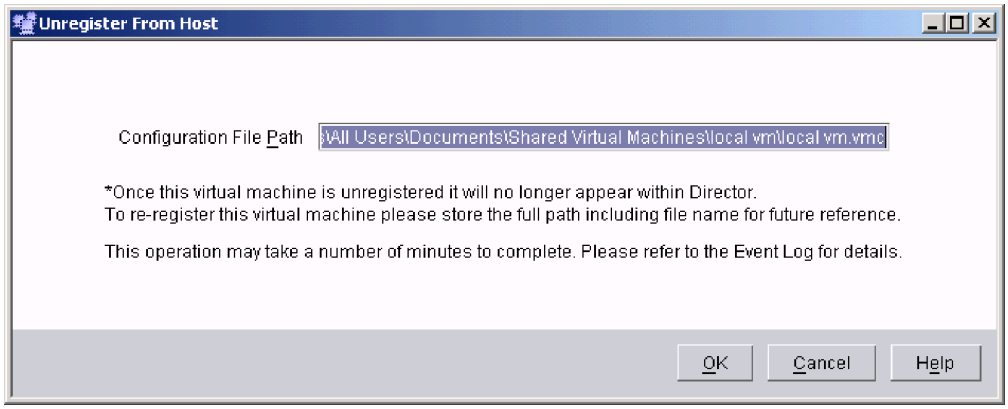

Figure 20. Unregister From Host window

4. The **Configuration File Path** field contains the full path name to the configuration file of the virtual machine that you want to unregister. For example, `C:\Virtual Machines\Windows 2000 Server 2\win2000Serv.vmx`.
5. Click **OK**.

Notes:

1. After a virtual machine is unregistered, the managed object for the virtual machine is no longer displayed in IBM Director Console. You should record the full path and file name for future reference should you decide to reregister this virtual machine.
2. This operation can take several minutes to complete. Refer to the IBM Director event log for details.

Deleting a virtual machine from both IBM Director and disk

If you no longer require a virtual machine, you can use VMM to delete it from the disk of its associated host. This action also deletes the corresponding managed object for the virtual machine from IBM Director. If you do this task, the virtual machine cannot be rediscovered and instead must be recreated. Alternatively, you can delete a virtual machine only from IBM Director. To do so, see “Deleting a VMM object from IBM Director” on page 57.

You can delete a virtual machine from disk only when it has been turned off. For information about turning off a virtual machine, see “Power operations for a single virtual machine” on page 61.

Complete the following steps to delete a virtual machine object from IBM Director and delete its corresponding virtualization component from disk on its associated host:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the virtual machine.
2. Click **Virtual Machine Management → Delete From Disk**.
3. Click **OK**.

Deleting a VMM object from IBM Director

If you no longer require a VMM object, you can delete the managed object from IBM Director.

Important: Do not delete managed objects for coordinators, hosts, and guest operating systems. These managed objects represent real hardware on your network. After you uninstall VMM, these VMM objects are displayed as managed systems.

Notes:

1. When a VMM farm that represents a virtualization component in VMware VirtualCenter is deleted from IBM Director, VMM does not delete the corresponding farm from VMware VirtualCenter. Later, if you decide that you want to manage the VMM farm in IBM Director, you can rediscover it. Alternatively, you can delete a VMM farm from VMware VirtualCenter as well as IBM Director. To do so, see "Deleting a VMM farm from IBM Director and VMware VirtualCenter" on page 45.
2. For VMM farms that are associated with hosts that are running VMM Agents for ESX, GSX, or Virtual Server and for VMM farms that are undefined, you cannot rediscover these VMM farms in IBM Director as there is no corresponding virtualization component.
3. You can delete the managed object for a VMM farm in VMware VirtualCenter even when it contains one or more hosts. You cannot delete a VMM farm that is not in VMware VirtualCenter if it contains one or more hosts.
4. When a virtual machine object is deleted from IBM Director, VMM does not delete the corresponding virtualization component from its associated virtualization application. Later, if you decide that you want a to manage that virtual machine in IBM Director, you can rediscover it. Alternatively, you can delete a virtual machine from disk as well as from IBM Director. To do so, see "Deleting a virtual machine from both IBM Director and disk" on page 56.

Complete the following steps to delete a VMM object from IBM Director:

1. From IBM Director Console, in the Group Contents pane, right-click a VMM object.
2. Click **Delete**.

Chapter 5. Running power operations on virtual machines

VMM supports a subset of the power operations that you can perform on virtual machines. See the documentation that comes with the virtualization application for information about these types of operations.

You can perform power operations in several different ways:

- Use the **Host Management** menu to perform a power operation for all virtual machines that are associated with a selected host.
- Use the **Power Management** menu to perform a power operation for a single virtual machine.

When you use either of these methods, IBM Director Console prompts you to run the operation immediately or to create a scheduled job for the operation. For information about the Scheduler, see the *IBM Director 4.20 Systems Management Guide*. Alternatively, you can use the Scheduler to create scheduled jobs for these power operations. For more information, see "Scheduler tasks for use with VMM objects" on page 10.

When you run a power operation immediately, the Execution History window is displayed and shows that the job is in progress.

Note: The execution history provides details only about start and completion of the job. It does not provide details about the success or failure of the VMM operations that are performed by the job. For that information, use the IBM Director Event Log task to view details about all operations that have been received and logged by IBM Director Server.

For information about the Event Log task, see the *IBM Director 4.20 Systems Management Guide*. For information about virtual machine operations that fail, see "Virtual machine task failures" on page 92.

Because VMM performs its operations in the background, IBM Director Console remains available for use when you perform power operations for virtual machines. You can determine that the power operation is completed by checking the job history or by watching the icons for the virtual machines.

When a virtual machine is undergoing a state transition that is initiated from IBM Director Console, the  icon is displayed for the virtual machine. After the state transition is completed, the applicable state icon is displayed for the virtual machine; for example, the  icon is displayed for the virtual machine when the virtual machine is turned on. For more information about the icons that are used for a virtual machine object in IBM Director Console, see "Icons for virtual machine objects" on page 35.

Note: (VMM Agent for VirtualCenter only) Even though a power operation for a virtual machine is initiated through VMware VirtualCenter, if the virtual machine contains undoable disks, VMM answers questions about the power operation. This can be confusing since VMware VirtualCenter reports that there are questions to answer, but VMM has already answered the questions. This situation does not occur when using the VMM Agents for ESX or GSX.

Power operations for all virtual machines on a host

Use the **Host Management** menu to perform power operations for all virtual machines that are associated with a single host. The **Host Management** menu is available when you right-click a host object in the Group Contents pane of IBM Director Console.

You can use the **Host Management** menu to perform the following power operations:

- Turn on all stopped virtual machines
- Suspend all running virtual machines
- Resume all suspended virtual machines
- Turn off all running virtual machines

Important: The power operations on the **Host Management** menu apply to all virtual machines that are associated with a host, even those virtual machines that are not represented in IBM Director Console.

The selected power operation applies only to the virtual machines in the specified state. For example, a turn on operation applies only to virtual machines that are turned off. It does not affect virtual machines that are already turned on or suspended. This aspect is important to consider when you create IBM Director scheduled jobs for host management power operations that involve virtual machines.

Turning on all stopped virtual machines

Complete the following steps to turn on all stopped virtual machines that are associated with a single host:

1. From IBM Director Console, in the Group Contents pane, right-click the host.
2. Click **Host Management → Power On All Stopped Virtual Machines**.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Suspending all running virtual machines

Complete the following steps to suspend all running virtual machines that are associated with a single host:

1. From IBM Director Console, in the Group Contents pane, right-click the host.
2. Click **Host Management → Suspend All Running Virtual Machines**.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Resuming all suspended virtual machines

Complete the following steps to resume all suspended virtual machines that are associated with a single host:

1. From IBM Director Console, in the Group Contents pane, right-click the host.
2. Click **Host Management → Resume All Suspended Virtual Machines**.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Turning off all running virtual machines

Complete the following steps to turn off all running virtual machines that are associated with a single host:

Important: This operation forces a virtual machine to turn off without an orderly shut down of its guest operating system. This immediately stops all applications that are in use on that guest operating system.

1. From IBM Director Console, in the Group Contents pane, right-click the host.
2. Click **Host Management → Force Power Off All Running Virtual Machines**.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Power operations for a single virtual machine

Use the **Power Management** menu to perform a power operation on a single virtual machine. The **Power Management** menu is available when you right-click a virtual machine object in the Group Contents pane of IBM Director Console. For more information about the **Power Management** menu, see the *IBM Director 4.20 Systems Management Guide*.

You can use the **Power Management** menu to perform the power operations that are listed in Table 22.

Table 22. Power Management menu options for virtual machines

Menu option	Description
Power Off Now	The virtual machine is turned off without an orderly shut down of its guest operating system. This immediately stops all applications that are in use on that guest operating system.
Power On	The virtual machine is turned on.
Restart Now	The virtual machine is restarted immediately, which means that it is restarted without an orderly shut down of its guest operating system. This immediately stops all applications that are in use on that guest operating system.
Resume	The virtual machine resumes operation and is no longer suspended.
Shutdown and Power Off	(VMM Agent for VirtualCenter only) If VMware Tools are installed on the guest operating system, this menu option performs an orderly shut down of the guest operating system and then turns off the virtual machine. However, if VMware Tools are not installed on the guest operating system, the virtual machine is turned off without an orderly shut down of its guest operating system. (VMM Agent for ESX and GSX only) If VMware Tools are installed on the guest operating system, this menu option performs an orderly shut down of the guest operating system and then turns off the virtual machine. However, if VMware Tools are not installed, this menu option will fail. (VMM Agent for Virtual Server only) If the guest operating system is a Windows operating system and if Microsoft Virtual Machine Additions is installed on the guest operating system, this menu option performs an orderly shut down of the guest operating system and then turns off the virtual machine.
Suspend	The virtual machine remains turned on but is suspended from use.

Only those operations that are applicable to the selected virtual machine are available on the **Power Management** menu. For example, if a virtual machine is suspended, the **Power Management** menu contains only the **Resume** menu option.

Complete the following steps to perform a power-management operation for a virtual machine:

1. From IBM Director Console, in the Group Contents pane, right-click the virtual machine.
2. Click **Power Management**; then, click the power operation that you want to perform. For example, click **Power Management → Power On**.
3. Click **Execute Now** to perform the operation immediately or click **Schedule** to create a new scheduled job.

Chapter 6. Migration types and requirements

VMM supports two types of migration based on the VMM Agent associated with the virtual machines that are being migrated:

- When using the VMM Agent for VirtualCenter with ESX hosts, VMM uses dynamic migration.

  Note: The VMM Agent for VirtualCenter does not support dynamic or static migration for GSX hosts.
- When using the VMM Agents for ESX, GSX, or Virtual Server, VMM uses static migration.

Additionally, there are several migration requirements that apply to both types of migration.

General migration requirements

Irrespective of the migration type involved, these cautions must be observed when migrating virtual machines:

- Migration of virtual machines is only possible between hosts within the same VMM farm.
- Both the source and destination host must have access to a shared storage area network (SAN).
- Both the source and destination host must have access to a shared communications network.
- The destination host must have enough memory to support the virtual machine.
- The destination host must support the configuration version of the virtual machine.
- Migration of clustered virtual machines is not supported.
- Migration of virtual machines that are suspended or in a transition state is not supported.
- Source and destination hosts must have a virtual network device with the same label.
- Virtual machines to be migrated cannot be connected to a removable device such as a CD or diskette drive.
- The version of a configuration file for a virtual machine must be supported by the virtualization application that VMM Agent communicates with. Otherwise, the virtual machine cannot be migrated.

For further information about virtual machine migration for a specific virtualization application, see the documentation that comes with it.

Dynamic migration

VMM supports dynamic migration (sometimes referred to as *live migration*) of virtual machines when using the VMM Agent for VirtualCenter with VMware ESX Server hosts. The guest operating systems on migrated virtual machines remains available for use; it is not shut down.

Dynamic migration is supported only for hosts that are running VMware ESX Server in a VMware VirtualCenter environment. It is not supported for hosts that are running VMware GSX Server in a VMware VirtualCenter environment.

VMware VirtualCenter VMotion must be enabled on both the source host and destination host between which you want to dynamically migrate virtual machines. Use VMware VirtualCenter client to enable VMotion for the applicable hosts. For information about VMware VirtualCenter VMotion requirements, see the documentation that comes with VMware VirtualCenter.

Dynamic migration is not supported for virtual machines that contain undoable disks that are turned off with the PowerOFF action to keep (save the changes in a redo log).

During a dynamic migration, VMware VirtualCenter is sometimes unable to dynamically migrate a virtual machine as requested from IBM Director Console. For more information, see “Problems with VMM Agent for VMware VirtualCenter” on page 79.

In the VMware VirtualCenter documentation, dynamic migration is referred to as *migration with VMotion*.

Static migration

VMM supports static migration of virtual machines when using the VMM Agents for ESX, GSX, or Virtual Server.

Note: (VMM Agent for GSX only) Migration is only supported when VMware GSX Server is installed on host that is running Windows Server 2003.

In addition to the general cautions, static migration requires that these additional cautions are observed when migrating virtual machines:

- Virtual machines to be migrated are either turned on or turned off. If a virtual machine is turned on at the start of a static migration, VMM turns off the virtual machine, completes the migration, and then turns on the virtual machine when the migration completes.

  Before any virtual machines are turned off, the guest operating systems on migrated virtual machines are shut down in an orderly way. After the migration when the virtual machines are turned on, the guest operating systems are restarted.
- (VMM Agent for ESX only) Secure copy (scp) must be enabled on all VMware ESX Server hosts that are using VMM Agent for ESX. For more information, see “Static migration with VMM Agent for ESX requires secure copy (scp)” on page 65.
- (VMM Agent for ESX only) The access mode of the shared Virtual Machine File System (VMFS) volume should be public.
- (VMM Agent for ESX only) Make sure that all VMFS volumes on your managed hosts use volume names, and that the virtual machines use the volume names for specifying the virtual disks.
- (VMM Agent for ESX only) The virtual machine configuration file should not reside on a VMFS partition.
- (VMM Agents for GSX and Virtual Server only) Extra steps must be completed to account for volumes in these environments. For more information, see “Static migration with VMM Agents for GSX and Virtual Server” on page 66.

- (VMM Agents for GSX and Virtual Server only) Any saved files (from a suspend operation) and undo disk files must be on shared storage.
- (VMM Agent for Virtual Server only) Migration of a virtual machine that has the same display name as a virtual machine on the destination host is not supported.
- (VMM Agent for Virtual Server only) Migration of a virtual machine that contains one or more differencing or linked disks is not supported.

During a static migration, loss of network connectivity during virtual machine migration can cause the virtual machine to be inaccessible. For more information, see Chapter 8, “Solving VMM problems,” on page 77.

In the VMware VirtualCenter documentation, static migration is referred to as *migration*.

Static migration with VMM Agent for ESX requires secure copy (scp)

To enable static migration for VMware ESX Server hosts, you must enable secure copy (scp) on all VMware ESX Server hosts. Secure copy must be enabled using RSA certificates, which provides secure transfer of files without requiring the user ID and password for each file transfer operation.

Static migration through VMM will fail for a destination host unless you can copy (pull) a file at the destination host from a source host by using the scp command without entering a password.

If the hosts are moved to a different network, the steps in this procedure must be repeated.

Complete the following steps to enable secure copy (scp) on a destination host that is running VMM Agent for ESX:

1. Create a RSA public key:
   a. At the command prompt of the source host, enter ssh-keygen -t rsa.
   b. Store the generated key in a default location and do not use a passphrase.

   Note: If you specify a different location other than /root/.ssh/, you must adjust any other steps that use the default path.
2. Add the public key to the authorized_keys file for any ESX host that you would like to use as a destination host for migration:
   a. On the source host where you created the RSA public key, copy the .pub file to a directory that is accessible through File Transfer Protocol (FTP).
   b. Use FTP to log in to both ESX hosts (source and destination) and copy the .pub file from the source host to the destination host.
   c. From the console of the destination host, copy the .pub file to /root/.ssh/authorized_keys.

      Note: If this file already exists, do not overwrite it. Instead, add the information in the .pub file to the existing /root/.ssh/authorized_keys file.
3. Change the permissions on the authorized_keys file and the ssh subdirectory:
   a. On the console of the destination host, type cd
   b. Type chmod go-w . .ssh .ssh/authorized_keys
4. On all ESX hosts that will be destination hosts, add the ESX host to the known_host list:

a. On the console of the destination host, type ssh *source_IPaddress*.
b. When you are asked if you would like to add the host to the known_host list, answer yes.
c. Exit the secure shell.
d. Repeat steps a through c for all destination hosts until they have added the source hosts to the known_host list.
e. Repeat steps a through c for all source hosts until each has added the destination hosts to the known_host list.

5. Copy the required Perl scripts onto each host:
   a. From the Comprehensive Perl Archive Network (CPAN), download the ShellQuote.pm, SCP.pm and SSH.pm scripts.
   b. Copy SCP.pm and SSH.pm into /usr/lib/vmware/perl5/site_perl/*perl_version*/Net/ directory. You will probably have to create the Net subdirectory.
   c. Copy the ShellQuote.pm file into /usr/lib/vmware/perl5/site_perl/*perl_version*/String/ Directory. You will probably have to create the String folder.

Static migration with VMM Agents for GSX and Virtual Server

To perform static migration for virtual machines that are associated with VMware GSX Server hosts or Microsoft Virtual Server hosts, extra steps must be completed to account for volumes in these environments. A volume is an area on a storage device that is managed by the filesystem as a discrete logical storage unit.

Complete the following steps to perform static migration for virtual machines that are associated with VMM Agent for GSX or VMM Agent for Virtual Server:

Notes:

1. A volume should be mounted only at one mount point on the source host. A volume mounted at multiple mount points is not supported.
2. Make sure that the volume that contains the virtual machine to be migrated does not contain non-virtual machine-related files. Everything in the volume will be inaccessible as soon as it is dismounted.
3. When migrating multiple virtual machines on one volume, the migration operation succeeds only when all virtual machines on the same volume are successfully migrated. The operation fails when any of the virtual machines on the same volume fail to be migrated. In that case, all virtual machines on the volume are registered back to the source host.

1. Create a volume on the SAN whose size is big enough to hold the virtual machine.
2. Mount the volume at the source host.
3. Make sure that the destination host can access the volume as initialized or formatted. If not, the destination host may need to be restarted. However, do not mount the volume at the destination host.
4. Create a virtual machine on the source host and put it on this volume.
5. Use VMM to create migration tasks for the virtual machine. For more information, see “Creating migration tasks” on page 67.

Creating migration tasks

Irrespective of the migration type involved, you can create tasks to migrate virtual machines in one of the following ways:

- Create a task to migrate a single virtual machine. For information, see “Migrate Single Virtual Machine Tasks” on page 7.
- Create a task to migrate all virtual machines on a host. For information, see “Migrate All Virtual Machine Tasks” on page 7.

Chapter 7. Viewing VMM object attributes

VMM creates attributes for the following VMM objects:

- Coordinators
- VMM farms
- Hosts
- Virtual machines
- Guest operating systems

Displaying coordinator object attributes

Complete the following steps to display VMM object attributes for a coordinator:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator.
2. Click **Coordinator Management → VMM Object Attributes**. The VMM Object Attributes window opens.

Figure 21 shows the VMM Object Attributes window for a coordinator.

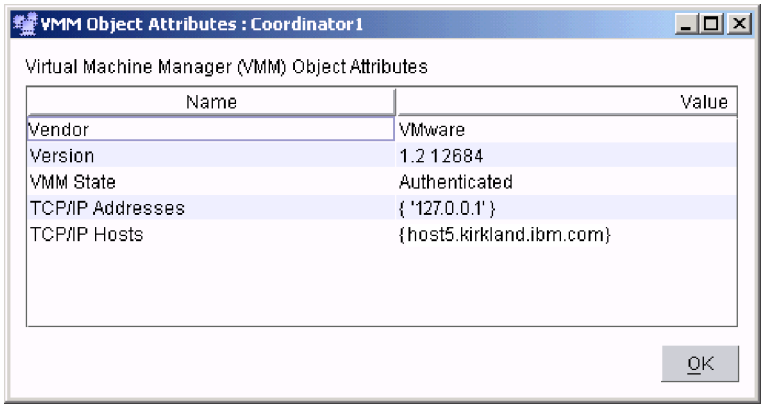

Figure 21. VMM object attributes for a coordinator

Table 23 describes the VMM object attributes for a coordinator.

Table 23. VMM object attributes for a coordinator

Attribute name	**Description**
Vendor	The name of the virtualization vendor that provides the API for the VMM object. For this release, the value is always VMware.
Version	The version of the vendor library that VMM is using.
VMM State	The state of the coordinator. Values can be Authenticated, Not Authenticated, Communication Not Established, and Virtualization not supported.
TCP/IP Addresses	The IP address of the server.
TCP/IP Hosts	The name of the server.

Displaying VMM farm object attributes

Complete the following steps to display VMM object attributes for a VMM farm:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the VMM farm.
2. Click **VMM Farm Management → VMM Object Attributes**. The VMM Object Attributes window opens.

This window displays different attributes depending on which VMM Agent is being used.

Figure 22 shows the VMM Object Attributes window when the VMM farm object represents a farm in a VMware VirtualCenter environment.

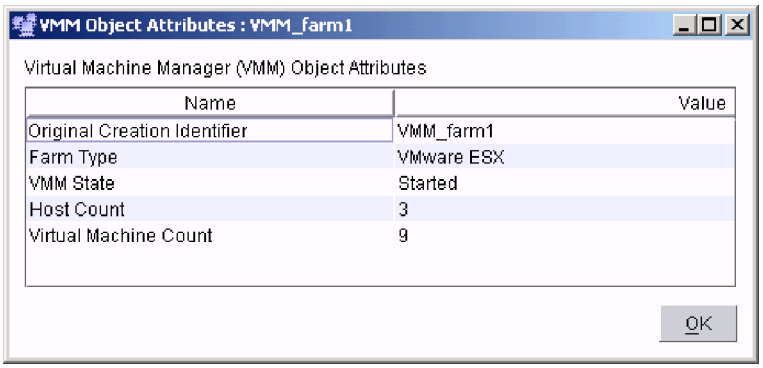

Figure 22. VMM object attributes for a VMM farm object representing a farm in VMware VirtualCenter

Table 24 describes the VMM object attributes for a VMM farm. Some of these attributes only apply to VMM farms in specific virtualization environments.

Table 24. VMM object attributes for a VMM farm

Attribute name	**Description**
Vendor Display Name	(VMM Agent for VirtualCenter only) The name of the VMM farm as it is known by the virtualization application. This name can be the same as, or different from, the name that is shown for the VMM farm object in IBM Director Console.
Original Creation Identifier	(VMM Agents for ESX, GSX, and Virtual Server only) The name of the VMM farm as it is known in VMM. This identifier is unique per management server and is maintained even after the name of a VMM farm is changed in IBM Director. This identifier is not known to the virtualization application.
Farm Type	The type of VMM farm. Values can be VMware VirtualCenter, VMware ESX, VMware GSX, Microsoft Virtual Server, or Undefined.
VMM Parent	(VMM Agent for VirtualCenter only) Identifies the coordinator on which this VMM farm is configured.
VMM State	The state of the VMM farm. Values can be Started, Stopped, or Unknown.
Host Count	The number of hosts that are in the VMM farm.
Virtual Machine Count	The number of virtual machines that are associated with the hosts in the VMM farm.

Displaying host object attributes

Complete the following steps to display VMM object attributes for a host:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the host.
2. Click **Host Management → VMM Object Attributes**. The VMM Object Attributes window opens.

This window displays different attributes depending on which VMM Agent is being used.

Figure 23 shows the VMM Object Attributes window when the host object represents a server that is running VMware ESX Server in a VMware VirtualCenter environment.

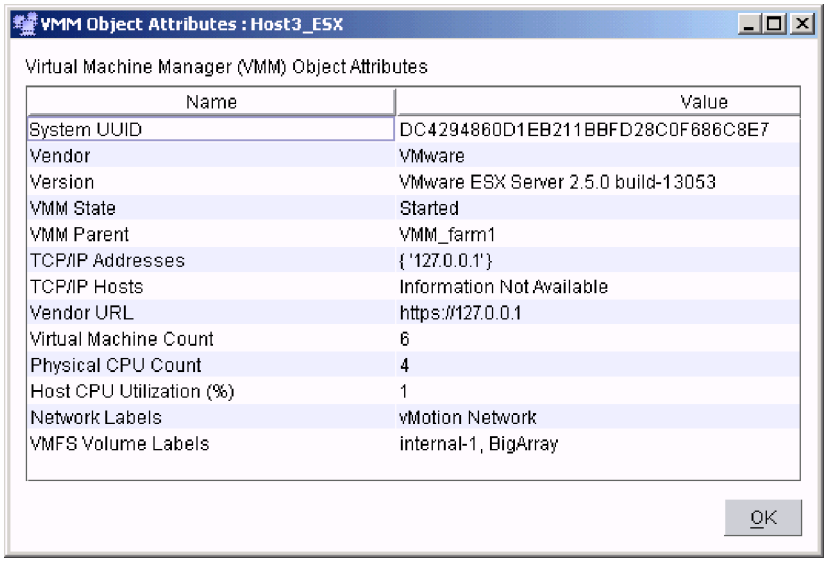

Figure 23. VMM object attributes for a host in a VMware VirtualCenter environment

Table 25 describes the VMM object attributes for a host object. Some of these attributes only apply to virtual machines in specific virtualization environments.

Table 25. VMM object attributes for a host

Attribute name	**Description**
System UUID	The universal unique identifier (UUID) of the server. This attribute is the same as the IBM Director system attribute of the same name.
Vendor	The name of the virtualization vendor that provides the API for the VMM object. For this release, the value is either VMware ESX, VMware GSX, or Virtual Server.
Version	The version of the vendor library that VMM is using.
VMM Parent	The VMM farm that is associated with this host. This field is always listed for hosts defined in VMware VirtualCenter. However, for hosts that are running VMM Agent for ESX, GSX, or Virtual Server, it is only listed if the host is in a VMM farm.
TCP/IP Addresses	The IP address of the server.

Table 25. VMM object attributes for a host (continued)

Attribute name	Description
TCP/IP Hosts	The name of the server.
Vendor URL	(VMM Agents for Virtual Server and ESX only) The Web address of the management interface for the host as provided by the virtualization application.
Virtual Machine Count	The number of virtual machines that are associated with the host.
Physical CPU Count	The number of CPUs that are in the server.
Host CPU Utilization (%)	The percentage of CPUs that are being used by the host averaged over the most recent ten-minute period.
Dynamic Migration Enabled	(VMM Agent for VirtualCenter only) Whether this host is configured for dynamic migration, also known as *migration with VMotion*. Values are True or False. Use VMware VirtualCenter client to enable VMotion for specific hosts. For information about VMware VirtualCenter VMotion requirements, see the documentation that comes with VMware VirtualCenter.
Network Labels	(VMM Agents for VirtualCenter, ESX and Virtual Server only) The labels that are assigned to each network interface on a host.
VMFS Volume Labels	(VMM Agents for VirtualCenter and ESX only) The Virtual Machine File System (VMFS) volumes on which you can create virtual machines.

Displaying virtual machine object attributes

Complete the following steps to display VMM object attributes for a virtual machine:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the virtual machine.
2. Click **Virtual Machine Management → VMM Object Attributes**. The VMM Object Attributes window opens.

This window displays different attributes depending on which VMM Agent is being used.

Figure 24 shows the VMM Object Attributes window when the virtual machine object represents a virtual machine that is associated with a host in a VMware VirtualCenter environment.

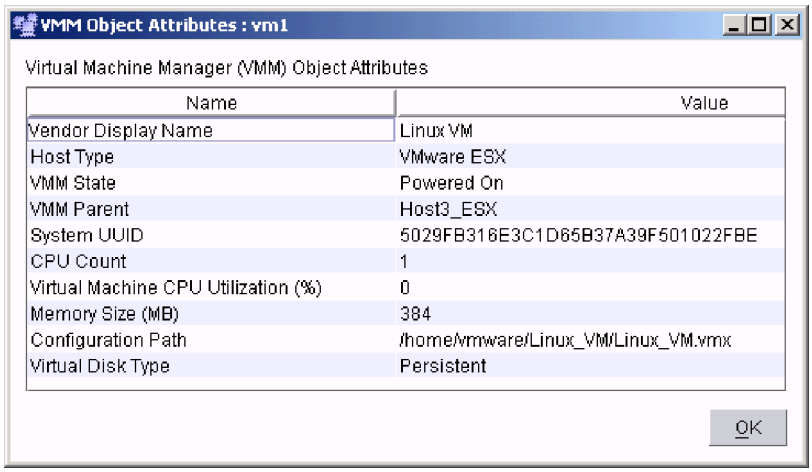

Figure 24. VMM object attributes for a virtual machine in a VMware VirtualCenter environment

Table 26 describes the VMM object attributes for all virtual machines. Some of these attributes only apply to virtual machines in specific virtualization environments.

Table 26. VMM object attributes for a virtual machine

Attribute name	**Description**
Vendor Display Name	The name of the virtual machine as it is known by the virtualization application. This name can be the same as, or different from, the name that is shown for the virtual machine object in IBM Director Console.
Host Type	The type of host to which the virtual machine is associated. Values can be VMware ESX Server, VMware GSX Server, or Microsoft Virtual Server.
VMM State	The state of the virtual machine. Values can be Powered Off, Suspended, Pending, Powered On, Transition, or Communication Not Established.
VMM Parent	The host to which the virtual machine is associated.
System UUID	The UUID of the virtual machine. This attribute is the same as the IBM Director system attribute of the same name.

Table 26. VMM object attributes for a virtual machine (continued)

Attribute name	Description
ID	(VMM Agent for Virtual Server only) The unique ID that identifies the virtual machine to Microsoft Virtual Server. This ID is assigned by Microsoft Virtual Server. You can use this ID to identify the virtual machine when you create scripts that use the Microsoft Virtual Server COM interface.
CPU Count	The number of central processing units (CPUs) that are assigned to the virtual machine. You can set this value for virtual machines that are in a VMware VirtualCenter or VMware ESX Server environment. For more information, see “Setting virtual machine attributes through VMM Agents for VirtualCenter or ESX” on page 51.
Virtual Machine CPU Utilization (%)	(VMM Agent for VirtualCenter, ESX, and Virtual Server only) The percentage of CPUs that are being used by the virtual machine averaged over the most recent ten-minute period.
Memory Size (MB)	The amount of memory that is assigned to the virtual machine. You can set this value for virtual machines that are in any supported virtualization environment. For more information, see “Setting attribute values for virtual machines” on page 50.
Configuration Path	The full path name to the configuration file of the virtual machine.
Virtual Disk Type	The type of virtual disk used by this virtual machine. (VMM Agent for VirtualCenter and ESX only) Values can be Persistent, Non-Persistent, Undoable, Append, or Mixed. The Mixed value means that the virtual machine is using multiple disks of different types. For information about the other values, see “Setting virtual machine attributes through VMM Agents for VirtualCenter or ESX” on page 51. (VMM Agent for GSX only) Values can be Persistent, Independent Persistent, Independent Non-persistent, or Mixed. The Mixed value means that the virtual machine is using multiple disks of different types. For information about the other values, see “Setting virtual machine attributes through VMM Agent for GSX” on page 52. (VMM Agent for Virtual Server only) Values can be Persistent, Linked, Differencing, and Mixed. These values cannot be modified with VMM. The Mixed value means that the virtual machine is using multiple disks of different types. For information about the other values, see the documentation for Microsoft Virtual Server.
PowerOn Action	(VMM Agents for VirtualCenter and ESX only) The action that is performed when a virtual machine with undoable disks is turned on. Values can be PowerOn Commit, PowerOn Discard, or PowerOn Append. For information about these values, see “Setting virtual machine attributes through VMM Agents for VirtualCenter or ESX” on page 51.
PowerOff Action	(VMM Agents for VirtualCenter, ESX, and Virtual Server only) The action that is performed when a virtual machine with undoable disks is turned off. Values can be PowerOff Commit, PowerOff Discard, or PowerOff Keep. For information about these values, see “Setting virtual machine attributes through VMM Agents for VirtualCenter or ESX” on page 51 or “Setting virtual machine attributes through VMM Agent for Virtual Server” on page 53.

Table 26. VMM object attributes for a virtual machine (continued)

Attribute name	Description
Virtual Disk Mode	(VMM Agent for Virtual Server only) The mode of the virtual disks that are associated with this virtual machine. Values can be Undoable or Not Undoable. This setting applies to all disks belonging to this virtual machine. You can use VMM to set this value. For more information, see “Setting virtual machine attributes through VMM Agent for Virtual Server” on page 53.

Displaying guest-operating-system object attributes

Complete the following steps to display VMM object attributes for a guest operating system:

1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the guest operating system.
2. Click **Guest Operating System Management → VMM Object Attributes**. The VMM Object Attributes window opens.

Figure 25 shows the VMM Object Attributes window for a guest-operating-system object.

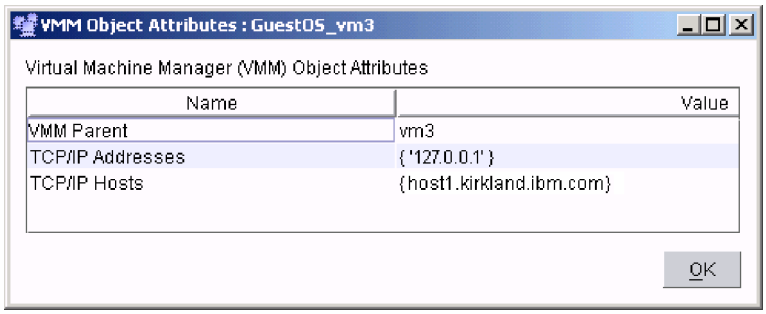

Figure 25. VMM object attributes for a guest operating system

Table 27 describes the VMM object attributes for all guest operating systems.

Table 27. VMM object attributes for a guest operating system

Attribute name	Description
VMM Parent	The virtual machine to which the guest operating system is associated.
TCP/IP Addresses	The IP address of the server.
TCP/IP Hosts	The name of the server.

Chapter 8. Solving VMM problems

This chapter describes some of the problem symptoms and suggested solutions for VMM. Multiple sections are used to list the problem symptoms depending on whether the symptom occurs with any supported virtualization environment or occurs only with a specific VMM Agent.

Any supported virtualization environment

Table 28 describes some of the problem symptoms and suggested solutions for VMM when used in any supported virtualization environment. In some cases, the problem symptom only applies to a few of the VMM Agents and not all VMM Agents.

Table 28. VMM problems in any supported virtualization environment

Symptom	Suggested action
Creation of virtual machine objects	
(VMM Agents for ESX, GSX, and Virtual Server only) A virtual machine is created with VMM, but a corresponding virtual machine object is not created in IBM Director.	Use the associated virtualization application to make sure that a newly-created virtual machine can be turned on successfully. If it cannot, use the virtualization application to resolve the problems. Virtual machines can fail to turn on for several reasons including lack of memory, disk failures, (VMware GSX Server only) no serial number, and so forth. Until the virtual machine can be turned on, it will not be represented as a virtual machine object in IBM Director Console. When VMM is used to create a virtual machine, VMM Agent requests that the associated virtualization application turn on and off the virtual machine. This is so that it's corresponding virtual machine object can obtain a UUID, which is required by IBM Director Console before the virtual machine object is displayed. When this type of failure occurs, VMM Agent sends a virtual machine, task failed event. Although IBM Director Console cannot display a virtual machine object for a virtual machine that failed to turn on, you can check the IBM Director event log for a virtual machine, task failed event.
Deletion of VMM Farms	
(VMM Agents for ESX, GSX, and Virtual Server only) A host has VMM farm related operations in the Host Management menu even though the host does not appear to be in a VMM farm.	This symptom can occur after VMM has been uninstalled and reinstalled and a VMM farm is deleted before a host that was previously in that VMM farm is discovered. Complete the following steps to delete and rediscover the host object: 1. From IBM Director Console, in the Group Contents pane, right-click the affected host object; then click **Delete**. 2. From IBM Director Console, click **Tasks → Discover Systems → All Systems and Devices** to rediscover the deleted host.
Event action plans	
An event action in an event action plan does not occur when an event occurs.	Make sure that the event action plan is targeting the correct managed object; for example, if an event is for a virtual machine, the event action plan must be applied to a virtual machine and not any other VMM objects.
Event filters that use extended attributes to monitor the creation of a virtual machine with a specific name are ignored.	Event filters for virtual machines that use extended attributes must designate the virtual machine ID and not the virtual machine name in the Values (String) field.. Since a virtual machine ID is not assigned until after the creation of a virtual machine, you cannot create an event filter to monitor the creation of virtual machines.

Table 28. VMM problems in any supported virtualization environment (continued)

Symptom	Suggested action
Network connectivity is lost during virtual machine migration	
(VMM Agents for ESX, GSX, and Virtual Server only) A virtual machine that is being statically migrated with VMM can become inaccessible when network connectivity is lost to any of the involved systems. This could be the source host, destination host, or IBM Director Server that is managing the hosts involved in the migration.	When this situation happens, the virtual machine stays in a transition state on the source host, but is not accessible. The recovery steps differ based on the VMM Agent that you are using. (VMM Agent for Virtual Server only) Further, all the virtual machines that are on the same partition as the virtual machine that was being migrated are also inaccessible. These virtual machines are not destroyed but are not visible to VMM or to the host system. The files that define the virtual machines are still available on the source or destination host depending on what phase of migration was occurring when the network failure occurred. The affected virtual machines must be recovered following a manual procedure. **VMM Agent for ESX:** Complete some or all of the following steps to manually recover the virtual machines on an ESX host that are affected by this problem. In some cases, not all steps are needed. As soon as the affected virtual machines are accessible again, you can stop completing the steps. 1. From IBM Director Console, in the Group Contents pane, delete the affected virtual machine object. 2. From the source host system, right-click the host object that corresponds to the source host. 3. Click **Host Management → Discover Virtual Machines**. If the affected virtual machines are still not accessible, proceed to the next step. 4. From the destination host system, right-click the host object that corresponds to the source host. 5. Click **Host Management → Discover Virtual Machines**. If the affected virtual machines are still not accessible, proceed to the next step. 6. Find the configuration file of the virtual machine that was being migrated when the network connectivity was lost. This configuration file is generally at /home/vmware or /root/vmware. Most likely, the configuration file is on the source host, but it could be on the destination host. 7. After you have the full path to the configuration file of the virtual machine, register the virtual machine with the host that contained the file. To do so, right-click the host object where you want to register the virtual machine and click **Host Management → Register Virtual Machine**. For more information, see “Registering a virtual machine” on page 49. **VMM Agents for GSX and Virtual Server:** Complete the following steps to manually recover the virtual machines affected by this problem on GSX hosts and Virtual Server hosts: 1. From IBM Director Console, in the Group Contents pane, delete the affected virtual machine object. 2. From the source host system, find the unmounted partition that the virtual machine was using. 3. From the source host system, mount the partition. 4. From the mounted partition, find the configuration file of the virtual machine that was being migrated when the network connectivity was lost. 5. From the source host system, register the virtual machine with the source host. Do not use IBM Director Console. 6. From IBM Director Console, in the Group Contents pane, right click the host object that corresponds to the source host. 7. Click **Host Management → Discover Virtual Machines**.

Symptom	Suggested action
VMM Agent for VirtualCenter takes precedence over VMM Agent for ESX or GSX	
(VMM Agents for ESX and GSX only) Virtual machines that are associated with a host that contains VMM Agent for ESX or GSX are deleted when the associated host is removed from a VMM farm in VMware VirtualCenter.	Make sure that you understand that VMM Agent for ESX and VMM Agent for GSX is not for use with hosts that are being managed with VMware VirtualCenter. For more information on the various VMM Agents, see “VMM Agent” on page 4 in Chapter 1. Also, make sure that you understand that should this scenario occur that the VMM Agent for VirtualCenter always takes precedence over either VMM Agent for ESX or VMM Agent for GSX. This symptom can occur when a host is being managed with VMware VirtualCenter and it is also running VMM Agent for ESX or GSX, which is not a supported configuration. Further, the host was added to a VMM farm in VMware VirtualCenter, but is later removed from the VMM farm, which in turn deletes all associated virtual machines. Although you can rediscover the virtual machines that are associated with the host that is running VMM Agent for ESX or GSX, this action causes all event action plans that contain references to the deleted virtual machines to become invalid. This happens because the rediscovered virtual machines have different object IDs than the virtual machines that were deleted.

Problems with VMM Agent for VMware VirtualCenter

Table 29 describes some of the problem symptoms and suggested solutions for VMM when used in a VMware VirtualCenter environment.

Table 29. VMM problems with VMM Agent for VMware VirtualCenter

Symptom	Suggested action
Communication with VMware VirtualCenter	
An application exception error, an insufficient permission error, or a connection error occurs when you use the Start Vendor Software task to run the VMware VirtualCenter client from IBM Director.	Make sure that VMware VirtualCenter server is installed by a user that has administrator privileges on the installing system. If it was installed by a user that does not have administrator privileges, you either must assign administrator privileges to that user or reinstall VMware VirtualCenter server with a user that does have administrator privileges.
A login failure occurs when you try to enter credentials for a coordinator.	Make sure that the user that is running VMware VirtualCenter server has administrator privileges in VMware VirtualCenter. If it does not, log in to the VMware VirtualCenter client as a user with administrator privileges. Then, add administrator privileges to the user that does not have administrator privileges.
VMM objects in IBM Director Console sometimes do not match those configured in VMware VirtualCenter. For example, IBM Director Console can display host objects under a coordinator object after those hosts have been removed from VMware VirtualCenter control.	Make sure that you understand that changes made to coordinators or their associated hosts outside of IBM Director and VMM cannot be reflected in IBM Director Console until credentials have been entered for a given coordinator. For information about entering credentials, see “Configuring credentials for coordinators” on page 40. In the example scenario, from IBM Director, a coordinator object and its host objects were discovered. Later, access to that coordinator was revoked and IBM Director Server was shut down. Then, using VMware VirtualCenter, the hosts associated with that coordinator were removed from VMware VirtualCenter control. However, when IBM Director Server is turned back on, IBM Director Console continues to display the hosts associated with the coordinator. Once access to that coordinator is requested through VMware VirtualCenter, IBM Director can update the display to reflect reality, which is that the hosts are no longer associated with that coordinator.

Table 29. VMM problems with VMM Agent for VMware VirtualCenter (continued)

Symptom	Suggested action
Coordinator object is locked, but unable to enter credentials	
A coordinator object is locked, but Enter Credentials is not available in the right-click menu for the coordinator.	This problem occurs when VMware VirtualCenter server has granted permission to IBM Director to perform operations on VMM objects, but later, someone changes the user ID and password of the VMware VirtualCenter server so access to the coordinator is no longer available. Complete the following steps to resolve this problem: 1. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator; then, click **Coordinator Management → Revoke Credentials**. 2. From IBM Director Console, in the Group Contents pane, right-click the managed object for the coordinator; then, click **Coordinator Management → Enter Credentials**. 3. Type the new credentials for the coordinator in the Enter Credentials window. For information, see “Entering credentials for a coordinator” on page 41. 4. Click **OK**.
Renaming farm groups	
Unexpected behavior occurs for a VMM farm object in any instance of IBM Director Server that is tracking activity on that farm object.	This symptom can occur when a farm that is contained within a farm group is discovered in IBM Director and later that farm group is renamed in VMware VirtualCenter. After a farm group is renamed, you should revoke and enter credentials for the coordinator object that contains the VMM farm object. For information, see “Configuring credentials for coordinators” on page 40.
Virtual machine migration	
Failure codes 66 and 67 are returned even though migration is enabled on the system that is running VMware ESX Server in a VMware VirtualCenter environment. Migration menu options are available for virtual machine objects even though VMotion is not enabled in VMware VirtualCenter.	These failure codes can be returned and the migration menu options can be available when VMM does not have the most up-to-date information about migration properties from the virtualization application. This situation occurs more frequently when multiple users are making changes to the properties. For example, migration failure codes can be returned when migration properties have been modified in VMware VirtualCenter while IBM Director Server is running. Use one of the following methods to refresh these properties in VMM Server: • From the Group Contents pane of IBM Director Console, right-click the host object for the virtual machine and click **Host Management → Discover Virtual Machines**. • From the Group Contents pane of IBM Director console, right-click the virtual machine object and click **Virtual Machine Management → VMM Object Attributes**.

Symptom	Suggested action
Virtual machine power operations	
(Windows NT® 4.0 only) Virtual machines do not shut down and turn off as expected; instead, they turn off without an orderly shut down of their operating system or they remain in a transition state.	Install VMware Tools in the virtual machine so that shut down and turn off operations do not immediately turn off a virtual machine without an orderly shut down. For information about installing VMware Tools, see the VMware VirtualCenter documentation. However, even when VMware Tools are installed, shut down and turn off operations are not completed as expected from VMM. The guest operating system is shut down in an orderly way, but the virtual machine is not turned off. You must perform an additional operation to turn off the virtual machine. Complete the following steps to perform a shut down and turn off of a virtual machine running Windows NT 4.0: 1. Perform a shut down and turn off operation for the virtual machine. For information, see “Power operations for a single virtual machine” on page 61. This action shuts down the operating system in an orderly way, but does not turn off the virtual machine. 2. Perform a second operation to turn off the virtual machine. This second operation can be either another shut down and turn off operation or a turn off now operation. **Note:** Before performing a turn off now operation, make sure that the operating system has completely shut down on the virtual machine. One way to check this from IBM Director is to use the Remote Session task on the virtual machine.
Power operations on virtual machines that have multiple undoable disks sometimes fail.	This symptom occurs infrequently, but happens when the VMM Agent for VirtualCenter fails to answer all the questions from VMware VirtualCenter about the power operation. If this symptom occurs, use the VMware VirtualCenter client application to answer any pending questions.

Appendix A. VMM event filters and actions

VMM provides several events and event actions for use with VMM objects.

For more general information about event filters, event actions, and the Event Filter Builder, see the IBM Director help, the *IBM Director 4.20 Systems Management Guide*, and the *IBM Director 4.20 Events Reference*.

Events provided by VMM

The events that are provided by VMM are for VMM objects. These events are in the **VMM** event type in the Event Filter Builder.

Note: Make sure that any event action plans that use these events are actually targeted to the applicable VMM object; otherwise, the intended actions will not occur.

Use the IBM Director Event Log task to view details about all VMM event types that have been received and logged by IBM Director Server.

Simple event filters can be created with or without specifying extended attributes for the event filter. The target object for an event filter is different depending on which method was used to create the event filter:

- If an event filter is created without specifying any extended attributes, the event action plan that contains this event filter should be applied directly to the VMM object identified as the target object in the tables that follow.
- If an event filter is created and it specifies values for extended attributes, the event action plan that contains this event filter can be applied directly to the VMM object identified as the target object or to any higher-level VMM objects that are associated with the target object.

  For example, if you create an event filter with extended attributes that identifies a specific virtual machine, you can apply the event action plan that contains this event filter directly to the virtual machine itself or to its associated host, VMM farm, or coordinator.

  In this scenario, all VMM objects that are associated with the target object listed in the following tables will receive the event notification, which means that the IBM Director Event Log will contain one event for each associated VMM object, each with the same detail. To continue the example, there would be four log entries, one each for the coordinator, VMM farm, host, and virtual machine.

Virtual machine events

The virtual machine events are in the **Virtual Machine** subcategory of the **VMM** event type category.

Figure 26 shows the events for a virtual machine in the Simple Event Filter Builder window.

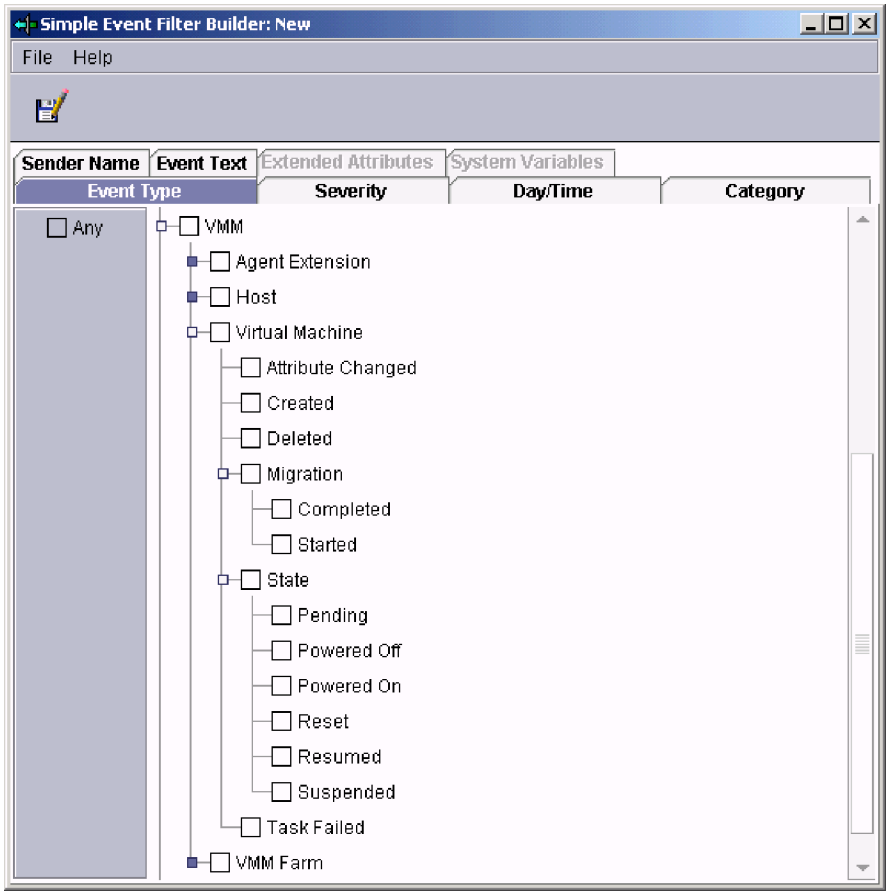

Figure 26. Virtual machine events in the Simple Event Filter Builder window

Table 30 defines the virtual machine events that are provided by VMM.

Table 30. Virtual machine events

Event subcategory	Additional event subcategory	Target object for event action plan	Event trigger	Description
Attribute Changed		Virtual machine	The value of one or more attributes for a virtual machine object is changed.	VMM has changed one or more attributes for a virtual machine. VMM updates the attribute information in both IBM Director and the associated virtualization application.
Created		Virtual machine	A virtual machine object is created.	IBM Director Console displays a virtual machine object for a virtual machine.

Table 30. Virtual machine events (continued)

Event subcategory	Additional event subcategory	Target object for event action plan	Event trigger	Description
Deleted		Virtual machine	A virtual machine object is deleted.	IBM Director Console no longer displays a virtual machine object for a virtual machine.
Migration	Started	Virtual machine	A virtual machine has started migration from one host to another.	VMM has started the migration of a virtual machine from one host to another.
	Completed	Virtual machine	A virtual machine has completed migration from one host to another.	VMM has completed the migration of a virtual machine from one host to another.
State	Pending	Virtual machine	The state of a virtual machine has changed to pending.	The associated virtualization application requires the user to answer a question before the state change will continue. To resolve a pending state, use the Start Vendor Software task to start the management interface for the virtual machine; then, resolve any open questions.
	Powered off	Virtual machine	The state of a virtual machine has changed to turned off.	A virtual machine is turned off.
	Powered on	Virtual machine	The state of a virtual machine has changed to turned on.	A virtual machine is turned on.
	Reset	Virtual machine	The state of a virtual machine has changed to restarted.	A virtual machine is restarted.
	Resumed	Virtual machine	The state of a virtual machine has changed from suspended to turned on.	A virtual machine resumes operations after being in the suspended state.
	Suspended	Virtual machine	The state of a virtual machine has changed to suspended.	A virtual machine is suspended.

Table 30. Virtual machine events (continued)

Event subcategory	Additional event subcategory	Target object for event action plan	Event trigger	Description
Task Failed		Virtual machine	An operation on a virtual machine has failed to be completed successfully.	A power or migration operation failed for a virtual machine. For more information, see “Virtual machine task failures” on page 92.

Coordinator, VMM farm, and host events

VMM also provides events for coordinators, VMM farms and hosts. These events are in the **VMM** event type category.

Figure 27 shows the coordinator, VMM farm, and host events for VMM objects in the Simple Event Filter Builder window.

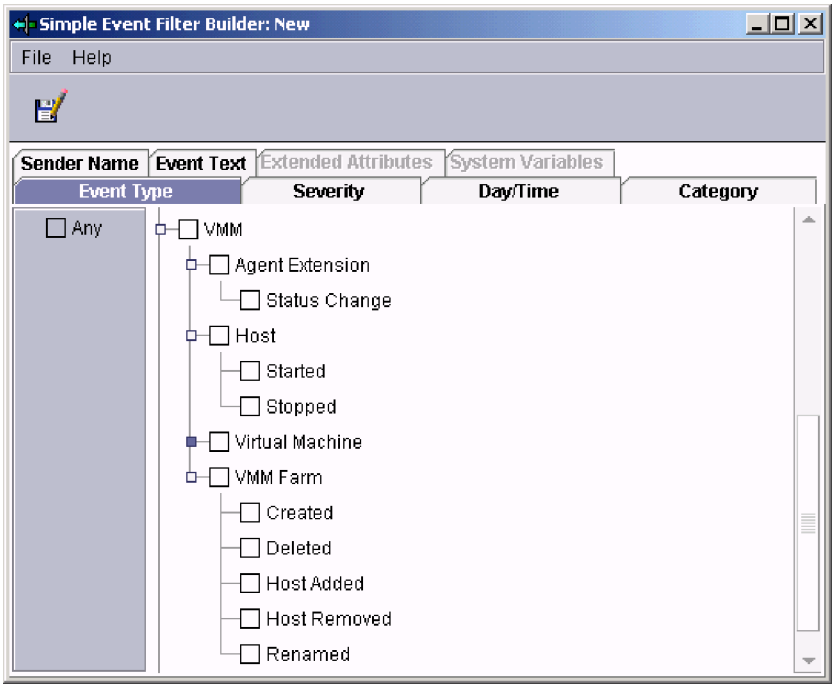

Figure 27. Coordinator, VMM farm, and host events in the Simple Event Filter Builder window

Table 31 on page 87 defines the coordinator, VMM farm, and host events that are provided by VMM.

Table 31. Coordinator, VMM farm, and host events

Event subcategory	Additional event subcategory	Target object for event action plan	Event trigger	Description
Agent Extension	Status Change	Depends on the VMM Agent: • Coordinator (VMM Agent for VirtualCenter) • Host (VMM Agents for ESX, GSX, and Virtual Server)	VMM Agent detects a status change for the coordinator or the host.	The following scenarios are examples of such events: • VMM Agent is not running or the virtualization application is not installed. • VMM Agent and the virtualization application are installed, but they are not communicating properly with each other. • The coordinator or host is ready for use. For coordinators, this means that IBM Director has authenticated with VMware VirtualCenter server. For hosts, this means that Microsoft Virtual Server services are started. • (VMware VirtualCenter only) The coordinator requires credentials. For more information, see “Configuring credentials for coordinators” on page 40.
Host	Started	Host	VMM Agent detects that Microsoft Virtual Server has started on a host.	(Microsoft Virtual Server only) Microsoft Virtual Server services are started on a host.
	Stopped	Host	VMM Agent detects that Microsoft Virtual Server has been stopped on a host.	(Microsoft Virtual Server only) Microsoft Virtual Server services are stopped on a host.
VMM Farm	Created	VMM Farm	VMM Agent for VirtualCenter detects that a VMM farm is created.	(VMware VirtualCenter only) IBM Director Console displays a VMM farm object.
	Deleted	VMM Farm	VMM Agent for VirtualCenter detects that a VMM farm is deleted.	(VMware VirtualCenter only) IBM Director Console no longer displays a VMM farm object.
	Host Added	VMM Farm	VMM Agent detects that a host is added to a VMM farm.	IBM Director Console displays a host object under a VMM farm object. **Note:** (VMware VirtualCenter only) When this event occurs, a host object is displayed only when the managed system that represents the host has already been discovered by IBM Director.

Table 31. Coordinator, VMM farm, and host events (continued)

Event subcategory	Additional event subcategory	Target object for event action plan	Event trigger	Description
	Host Removed	VMM Farm	VMM Agent detects that a host is removed from a VMM farm.	IBM Director Console no longer displays a host object under a VMM farm object.
	Renamed	VMM Farm	VMM Agent for VirtualCenter detects that a VMM farm is renamed.	(VMware VirtualCenter only) IBM Director Console displays the new name for the VMM farm object.

Event actions provided by VMM

VMM adds several event action templates to IBM Director Event Action Plan Builder. To use these templates, from the Event Action Plan Builder window, right-click the template name; then, click **Customize** to create a custom event action.

By creating custom event actions, you can specify which action you want IBM Director to take as a result of the occurrence of an event that is triggered by an event filter. To create event filters for VMM objects, you can use VMM events. After you have created custom event actions and event filters, you can create an event action plan that contains specific filters and their associated actions. For example, you can create an event action plan that adds a host to a VMM farm after it has turned on.

Each event action plan must target the applicable VMM object; otherwise the action that is defined in the plan will not occur. For example, if you have an event filter for the Virtual Machine, Task Failed event, it must be included in an event action plan that targets a virtual machine for it to trigger an action.

To use a custom event action, you must add it to an event filter that is already in an event action plan.

Figure 28 on page 89 shows the event actions for VMM objects in the Event Action Plan Builder window.

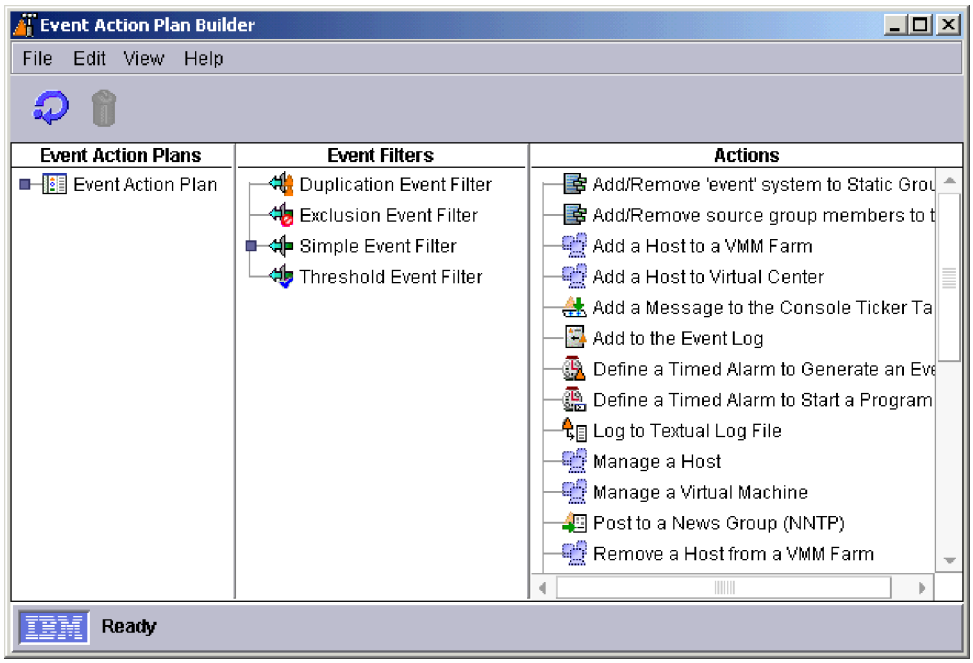

Figure 28. Virtual machine event actions in the Event Action Plan Builder window

Event actions for adding hosts to or removing hosts from VMM farms

VMM provides the following event actions for adding hosts to or removing hosts from VMM farms:

- Add a Host to a VMM Farm
- Add a Host to Virtual Center
- Remove a Host from a VMM Farm

Add a Host to a VMM Farm event action

The Add a Host to a VMM Farm event action template has the following fields:

Host Designates the IP address or the name of the host that is to be added to the VMM farm.

Note: Before you type a host name, make sure that the network environment is able to determine the IP address from the host name. Otherwise, the operation to add a host will fail. If you cannot determine the IP address of a host by using the **ping** command, type the IP address instead of the host name.

VMM Farm
Identifies the VMM farm to which the host is added.

Add a Host to Virtual Center event action

The Add a Host to Virtual Center event action template has the following fields:

Host Designates the IP address or the name of the host that is to be added to the VMM farm.

Note: Before you type a host name, make sure that the network environment is able to determine the IP address from the host name. Otherwise, the operation to add a host will fail. If you cannot

determine the IP address of a host by using the **ping** command, type the IP address instead of the host name.

User ID
Designates the user name for the administrator of the system. Generally, this is root for hosts that are running VMware ESX Server. This user name is used by VMware VirtualCenter server to communicate with the host that is running VMware ESX Server or VMware GSX Server.

Password
Designates the password for the user name that you used.

Port Designates the address of the port that VMware VirtualCenter server will use for communication with VMware ESX Server. By default, VMM uses port 902 for this communication. If the system that is running VMware ESX Server is configured to use a port address other than 902, type that port address in this field. Hosts that are running VMware GSX Server do not use the port number.

VirtualCenter Farm
Identifies the farm in VMware VirtualCenter to which the host is added.

Note: VMM Agent does not enable VMware VirtualCenter VMotion for the newly added host. If you want to migrate virtual machines to or from this host, you must use VMware VirtualCenter to enable VMotion for the host. For information about VMware VirtualCenter VMotion requirements, see the documentation that comes with VMware VirtualCenter.

Remove a Host from a VMM Farm event action

The Remove a Host from a VMM Farm event action template has the following fields:

VMM Farm
Identifies the VMM farm from which you want to remove a host.

Host Identifies the host to remove from the VMM farm.

When you customize an event action to remove a host from a VMM farm in VMware VirtualCenter and then test this customized event action, IBM Director displays the following error message:

```
Error communicating with server. If the problem persists, you may need to
restart the server.
```

You can ignore this message. It is displayed when a test action takes longer than 15 seconds to complete. Additionally, you do not need to restart the server.

Instead, check the event log and IBM Director Console to confirm that the test action was performed as expected.

To permanently prevent this error message from occurring, increase the network timeout value for IBM Director:

- Windows: Run twgipccf.exe.
- Linux: Using an ASCII text editor, open the ServiceNodeLocal.properties file (located in the /opt/IBM/director/data directory), and modify the value of ipc.timeouts

By default, the network timeout value is set to 15 seconds.

Stop and restart IBM Director Server to ensure that the new timeout value takes effect. To do so, enter the following commands from the management server:

```
net stop twgipc
net start twgipc
```

Note: Increasing the network timeout can have performance implications. You should reset the timeout value to the default 15 seconds after testing this action.

Event actions for performing power operations on virtual machines

VMM provides the following event actions for performing power operations on virtual machines:

- Manage a Host
- Manage a Virtual Machine

Manage a Host event action

The Manage a Host event action template has the following fields:

Host Identifies the host that you want to manage.

Action

Identifies the function that you want to perform on the host.

Table 32 describes the available functions.

Table 32. Actions available for Manage a Host event action

Action	Description
Start (Virtual Server only)	(Microsoft Virtual Server only) Starts Microsoft Virtual Server services on the host. You can use this event action only for hosts that are currently stopped.
Stop (Virtual Server only)	(Microsoft Virtual Server only) Stops Microsoft Virtual Server services on the host. You can use this event action only for hosts that are currently started.
Power off all virtual machines	Turns off all running virtual machines that are associated with a single host without an orderly shut down of any guest operating systems.
Power on all virtual machines	Turns on all stopped virtual machines that are associated with a single host.
Resume all virtual machines	Resumes all suspended virtual machines that are associated with a single host.
Suspend all virtual machines	Suspends all running virtual machines that are associated with a single host.

Manage a Virtual Machine event action

The Manage a Virtual Machine event action template has the following fields:

Virtual Machine

Identifies the virtual machine that you want to manage.

Action

Identifies the function that you want to perform on the virtual machine. Table 33 on page 92 describes the available functions.

Table 33. Actions available for Manage a Virtual Machine event action

Action	Description
Power on	The virtual machine is turned on.
Shut down and power off	(VMware VirtualCenter only) The guest operating system on the virtual machine is shut down in an orderly way, and then the virtual machine is turned off. (Microsoft Virtual Server only) If the guest operating system is a Windows operating system and if Microsoft Virtual Machine Additions is installed on the guest operating system, this menu option performs an orderly shut down of the guest operating system and then turns off the virtual machine.
Power off now	The virtual machine is turned off without an orderly shut down of its guest operating system. This will immediately stop all applications that are in use on that guest operating system.
Suspend	The virtual machine remains turned on but is suspended from use.
Resume	The virtual machine resumes operation and is no longer suspended.
Restart now	The virtual machine is restarted immediately, which means that it is restarted without an orderly shut down of its guest operating system. This will immediately stop all applications that are in use on that guest operating system.

Event actions for migrating virtual machines

The migration tasks that you create with VMM are available in the Event Action Plan Builder window, under the Start a Task on the "event" System event action template. Complete the following steps to access the saved migration tasks under this event action template:

1. In IBM Director Console, click **Tasks → Event Action Plan Builder**. The Event Action Plan Builder window opens.
2. In the Actions pane, double-click the Start a Task on the "event" System event action. The Customize Action window opens.

The drop-down list on the Customize Action window contains several noninteractive IBM Director tasks that can be performed on the system for which the event is generated. Any saved migration tasks are in the following formats:

```
[Migrate All Virtual Machine Tasks][Virtual Machine Manager][saved_task][Execute]
[Migrate Single Virtual Machine Tasks][Virtual Machine Manager][saved_task][Execute]
```

where *saved_task* is the name of the saved migration task.

Virtual machine task failures

When an operation on a virtual machine fails, the Virtual Machine, Task Failed event occurs. Use the IBM Director Event Log task to view details about this failed event. Click **VMM.Virtual Machine.TaskFailed**; then, in the Extended Attributes pane of the Event Log window, locate the command code and the failure code for this event. These extended attributes are defined in the following way:

Command codes
The virtual machine task that failed.

Failure codes
The cause of the failure.

Command codes for virtual machine task failures

Table 34 lists the command codes and describes their meanings.

Table 34. Command codes that are returned by Virtual Machine, Task Failed events

Command code	Task description
126	Add a host to a VMM farm.
131	Turn on all virtual machines that are associated with a host
132	Force turn off for all virtual machines that are associated with a host
137	Suspend all virtual machines that are associated with a host
138	(VMM Agent for VirtualCenter only) Migrate all virtual machines that are associated with a host
139	Resume all virtual machines that are associated with a host
141	(VMM Agent for Virtual Server only) Start a host.
142	(VMM Agent for Virtual Server only) Stop a host.
151	Turn on a single virtual machine
152	Force turn off to a single virtual machine
153	Orderly shut down and turn off a single virtual machine
154	Force a reset on a single virtual machine
157	Suspend a single virtual machine
159	Resume a single virtual machine
161	(VMM Agent for VirtualCenter only) Migrate a single virtual machine
170	(VMM Agent for ESX, GSX, or Virtual Server only) Unregister a virtual machine from a host.
171	Delete a virtual machine from a host.
172	Create a virtual machine on a host.
173	(VMM Agent for ESX, GSX, or Virtual Server only) Register a virtual machine on a host.
176	Set attribute values for a virtual machine.
178	(VMM Agent for VirtualCenter only) Create a VMM farm that represents a farm in VMware VirtualCenter server.
181	Start the first phase of migration, which includes turning off the virtual machine if it is turned on and unregistering the virtual machine from its host. For virtual machines in VMware GSX Server or Microsoft Virtual Server environments, the configuration file is unmounted from the source host during phase one of migration.
182	Start the second phase of migration, which includes moving the configuration file for the virtual machine from the source host to the destination host: • (VMware ESX Server hosts only) The configuration file is copied from the source host to the destination host. • (VMware GSX Server or Microsoft Virtual Server hosts only) The configuration file is mounted on the destination host. Phase 2 migration then includes registering the virtual machine on the destination host and turning it on if it was turned on before the migration.
183	(VMware ESX Server hosts only) Start the third and last phase of migration, which includes any cleanup needed on the source host.

Table 34. Command codes that are returned by Virtual Machine, Task Failed events (continued)

Command code	Task description
184	Restore virtual machines as they existed before a migration was attempted.

Failure codes for virtual machine task failures

Table 35 lists the failure codes and describes their meanings.

Table 35. Failure codes that are returned by Virtual Machine, Task Failed events

Failure code	Failure description
1	The host cannot be added to a VMM farm because it is already in the VMM farm.
14	(VMM Agent for ESX, GSX, or Virtual Server only) The virtual machine is already registered with the host.
15	An error occurred with the operation, but VMM Agent cannot determine the cause of the error.
60	A power operation timed out because it was not completed in the time that was expected by the virtualization application.
61	The host that is associated with this virtual machine is out of memory to perform the operation. This failure code generally occurs when you try to turn on or resume a virtual machine, which indicates that the host might need more memory to run the virtual machine.
62	The host that is associated with this virtual machine received a disk-related error. This failure code generally occurs when a power operation tries to write to or read from a disk.
63	(VMM Agent for Virtual Server only) The operation was cancelled by a script that was run from Microsoft Virtual Server.
64	(VMM Agent for VirtualCenter only) The host to which you are migrating a virtual machine could not be found. This failure code generally occurs when an event action plan is created to migrate virtual machines. Make sure that the host will be online when the event action plan is applied.
65	(VMM Agent for VirtualCenter only) The host from which you are migrating a virtual machine could not be found. This failure code generally occurs when an event action plan is created to migrate virtual machines. Make sure that the host will be online when the event action plan is applied.
66	(VMM Agent for VirtualCenter only) The host from which you are migrating a virtual machine is not enabled for virtual machine migration. Use VMware VirtualCenter to enable VMware VirtualCenter VMotion for the applicable VMware ESX Server host.
67	(VMM Agent for VirtualCenter only) The host to which you are migrating a virtual machine is not enabled for virtual machine migration. Use VMware VirtualCenter to enable VMware VirtualCenter VMotion for the applicable VMware ESX Server host.
68	(VMM Agent for VirtualCenter only) A virtual machine was not migrated as it was not in the correct state for a migration operation. Virtual machines must be turned on or turned off to be migrated. This failure code generally occurs when an event action plan is created to migrate virtual machines. Make sure that the virtual machine can be turned on or turned off when the event action plan is applied.

Table 35. Failure codes that are returned by Virtual Machine, Task Failed events (continued)

Failure code	Failure description
69	(VMM Agent for VirtualCenter only) A virtual machine is not found. This failure code generally occurs when an event action plan is created to migrate virtual machines. Make sure that the virtual machine will be available when the event action plan is applied.
85	The VMM farm was not deleted because it contains one or more hosts.
89	A virtual machine was not migrated because VMM could not copy it's configuration file from the source host to the destination host. Check secure copy (scp) enablement on the source and destination hosts.
91	A virtual machine was not migrated because it is in a cluster.
92	A virtual machine was not migrated because other virtual machines on the same volume could not be migrated.
93	A virtual machine was not migrated because the volume on the destination host could not be mounted as it was already mounted by some other host.
95	A virtual machine was not created because the name is too long. The name must be less than or equal to 80 characters in length.
96	The specified operating system is not supported. This failure code can occur when any VMM Agent encounters a virtual machine that has an unsupported guest operating system.
97	A virtual machine was not migrated because of a failure to dismount a volume that contained boot or system files.
98	A virtual machine was not migrated because files on that virtual machine are in use.

Note: Failure codes 66 and 67 can be returned when VMM does not have the most up-to-date information about migration properties from the virtualization application. This situation occurs more frequently when multiple users are making changes to the properties. For example, migration failure codes can be returned when migration properties have been modified in VMware VirtualCenter while IBM Director Server is running. For details, see Chapter 8, "Solving VMM problems," on page 77.

Appendix B. Terminology summary and abbreviation list

This appendix provides a summary of VMM terminology and a list of abbreviations that are used in this document.

VMM terminology summary

The hardware in a VMM environment is referred to in the following ways:

- A *system* is a server, workstation, desktop computer, or mobile computer.
- A *management server* is a server on which IBM Director Server and VMM Server are installed.
- A *management console* is a system on which both IBM Director Console and VMM Console are installed. This system also must be installed with the following graphical user interfaces (GUIs) as appropriate:
  - (VMware VirtualCenter only) VMware VirtualCenter client
  - (VMware GSX Server only) VMware Virtual Machine Console
- A *managed system* is a system on which IBM Director Agent and a virtualization application are installed.

The software and its components in a VMM environment are referred to in the following ways:

- A *virtualization environment* is a managed system and its associated VMM objects that are using the following sets of software:
  - VMware VirtualCenter server and VMM Agent for VirtualCenter (supported hosts are ESX and GSX hosts)
  - VMware ESX Server and VMM Agent for ESX
  - VMware GSX Server and VMM Agent for GSX
  - Microsoft Virtual Server and VMM Agent for Virtual Server
- A *virtualization component* is a software element that is created by a virtualization application.
- A *VMM object* is an IBM Director managed object that represents the virtualization components in a supported virtualization environment. VMM objects include coordinators, VMM farms, hosts, virtual machines, and guest operating systems.

The following VMM objects are used by VMM:

- A *coordinator* is a managed object that represents a system on which all of the following software is running:
  - VMware VirtualCenter server
  - VMware VirtualCenter Web service
  - IBM Director Agent
  - VMM Agent for VirtualCenter
- A *VMM farm* is a managed object that represents a collection of hosts and their associated virtual machines. VMM farm objects can represent farms that are defined in VMware VirtualCenter. VMM farm objects can also be a collection of hosts in other supported virtualization environments.
- A *host* is a managed object that represents a system on which one of the following combinations of software are running:
  - VMware ESX Server and IBM Director Agent (VMware VirtualCenter only)

  - VMware GSX Server and IBM Director Agent (VMware VirtualCenter only)
  - VMware ESX Server, IBM Director Agent, and VMM Agent for ESX
  - VMware GSX Server, IBM Director Agent, and VMM Agent for GSX
  - Microsoft Virtual Server, IBM Director Agent, and VMM Agent for Virtual Server
- A *virtual machine* is a managed object that represents a virtual machine that is associated with a supported virtualization application.
- A *guest operating system* is a managed object that represents an operating system that is running in a virtual machine and on which IBM Director Agent is installed.

Abbreviation list

The following table lists abbreviations that are used in the VMM document.

Table 36. Abbreviations used in the VMM document

Abbreviation	Definition
API	application programming interface
CPU	central processing unit, or microprocessor
GUI	graphical user interface
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
MB	megabyte
PDF	Portable Document Format
TCP/IP	Transmission Control Protocol/Internet Protocol
UUID	universal unique identifier
VMM	IBM Virtual Machine Manager

Appendix C. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This appendix contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your xSeries or IntelliStation® system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your VMM documentation (see Chapter 8, “Solving VMM problems,” on page 77) and other system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the *Hardware Maintenance Manual and Troubleshooting Guide* on the IBM *xSeries Documentation* CD or in the IBM IntelliStation *Hardware Maintenance Manual* at the IBM Support Web site.
- Go to the IBM Support Web site at www.ibm.com/pc/support/ to check for technical information, hints, tips, and new device drivers.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the publications that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

Using the documentation

Information about your IBM xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to www.ibm.com/pc/support/ and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is www.ibm.com/eserver/xseries/. The address for IBM IntelliStation information is www.ibm.com/pc/intellistation/.

You can find service information for your IBM products, including supported options, at www.ibm.com/pc/support/.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to www.ibm.com/services/sl/products/.

For more information about Support Line and other IBM services, go to www.ibm.com/services/, or go to www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to www.ibm.com/planetwide/ for support telephone numbers, or in the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

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Glossary

association. (1) A way of displaying the members of a group in a logical ordering. For example, the Object Type association displays the managed objects in a group in folders based on their type. (2) A way to display additional information about the members of the group. For example, the Event Action Plans association displays any event action plans applied to the managed objects in the group in an Event Action Plan folder.

coordinator. A managed object that represents a physical system on which all of the following software is running: VMware VirtualCenter server, VMware VirtualCenter Web service, IBM Director Agent, and VMM Agent for VMware VirtualCenter.

credentials. A security feature of VMM that enables you to log in to and log off from the VMware management interface for a system that is running VMware VirtualCenter server (coordinator).

event. An occurrence of a predefined (in IBM Director) condition relating to a specific managed object that identifies a change in a system process or a device. The notification of that change can be generated and tracked, for example, notification that a managed system is offline.

event action. The action that IBM Director takes in response to a specific event or events. In the Event Action Plan Builder, you can customize an event action type by specifying certain parameters and saving the event action. You must assign the customized event action (and an event filter) to an event action plan before IBM Director can execute the event action.

event action plan. A user-defined plan that determines how IBM Director will manage certain events. An event action plan comprises one or more event filters and one or more customized event actions. The event filters specify which events are managed, and the event actions specify what happens when the events occur.

Event Action Plan wizard. An IBM Director Console wizard that can be used to create simple event action plans.

event filter. A filter that specifies the event criteria for an event action plan. Events must meet the criteria specified in the event filter in order to be processed by the event action plan that the filter is assigned to.

extension. See IBM Director extension.

farm. See VMM farm.

group. A logical set of managed objects. Groups can be dynamic, static, or task-based.

guest operating system. An managed object that represents an operating system that is running on a virtual machine and on which IBM Director Agent is installed.

host. A managed object that represents a system on which one of the following combinations of software are running:

- VMware ESX Server and IBM Director Agent (VMware VirtualCenter environment only)
- VMware GSX Server and IBM Director Agent (VMware VirtualCenter environment only)
- VMware ESX Server, IBM Director Agent, and VMM Agent for ESX
- VMware GSX Server, IBM Director Agent, and VMM Agent for GSX
- Microsoft Virtual Server, IBM Director Agent, and VMM Agent for Virtual Server

IBM Director Agent. A component of IBM Director software. When IBM Director Agent is installed on a system, the system can be managed by IBM Director. IBM Director Agent transfers data to the management server using several network protocols, including TCP/IP, NetBIOS, IPX, and SNA.

IBM Director Console. A component of IBM Director software. When installed on a system, it provides a graphical user interface (GUI) that you can use to access IBM Director Server. IBM Director Console transfers data to and from the management server using TCP/IP.

IBM Director extension. A tool that extends the functionality of IBM Director. IBM Director extensions include the IBM Server Plus Pack, Remote Deployment Manager, Software Distribution, VMM, and others.

IBM Director Server. The main component of IBM Director software. When installed on the management server, it provides basic functions such as discovery of the managed systems, persistent storage of configuration and management data, an inventory database, event listening, security and authentication, management console support, and administrative tasks.

managed group. A group of systems or objects managed by IBM Director.

managed object. An item managed by IBM Director. Managed objects include managed systems, Windows NT clusters, IBM BladeCenter® chassis, management processors, SNMP devices, multi-node servers (scalable systems), scalable partitions, physical platforms, scalable nodes, and remote I/O enclosures. In IBM Director Console, a managed object is represented by

an icon that shows its type (such as chassis, cluster, system, or scalable system, for example represents a managed object).

managed system. A system (server, desktop computer, workstation, or mobile computer) on which IBM Director Agent is installed. Such a system is managed by IBM Director. In VMM, a managed system is installed with IBM Director Agent and one of the following virtualization applications:

- VMware VirtualCenter server
- VMware ESX Server
- VMware GSX Server
- Microsoft Virtual Server

management console. A system (server, desktop computer, workstation, or mobile computer) on which IBM Director Console and VMM Console is installed. This system must also include any remote console applications for the virtualization applications that are used in the IBM Director environment.

management server. The server on which IBM Director Server and VMM Server is installed.

pause. See suspend.

resume. A power operation on a suspended virtual machine that returns the virtual machine to normal operation.

suspend. A virtual machine state where the virtual machine remains turned on but all activity is stopped and the virtual machine does not consume microprocessor resources. Applications that were active when the virtual machine was suspended remain suspended until operations are resumed on the virtual machine.

undoable disk. A type of virtual disk on a virtual machine that saves changes to a temporary file instead of to the virtual disk itself. Changes can be committed when the virtual machine is turned off.

universal unique identifier (UUID). A 128-bit character string guaranteed to be globally unique and used to identify components under management. The UUID enables inventory-level functionality and event tracking of VMM objects.

UUID. See universal unique identifier.

virtual machine. A managed object that represents a virtual machine that is associated with a supported virtualization application.

virtualization application. One of the following applications:

- VMware VirtualCenter server
- VMware ESX Server
- VMware GSX Server
- Microsoft Virtual Server

virtualization component. A software element that is created by a virtualization application.

virtualization environment. A managed system and its associated VMM objects that are using the following sets of software:

- VMware VirtualCenter server and VMM Agent for VirtualCenter (supported hosts are ESX and GSX hosts)
- VMware ESX Server and VMM Agent for ESX
- VMware GSX Server and VMM Agent for GSX
- Microsoft Virtual Server and VMM Agent for Virtual Server

VMM farm. A managed object that represents a collection of hosts and their associated virtual machines. VMM farm objects can represent farms that are defined in VMware VirtualCenter. VMM farm objects can also be a collection of hosts in other supported virtualization environments.

VMM object. A managed object that represents the virtualization components in a supported virtualization environment. VMM objects include coordinators, VMM farms, hosts, virtual machines, and guest operating systems.

Index

I

M

O

P

R

S

T

U

V

W

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