Managing VMware ESX Server using IBM Director

Version 2.5

December 22, 2005

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Revision History

v1.0 (October 25, 2004) Initial V	ersion
v2.0 (May 02, 2005)	Second Version
	Includes managing VMware ESX Server as a SNMP Device, as an IBM Director Agent, and using Virtual Machine Manager
v2.01 (May 10, 2005)	Includes slight modification of disclaimer
v2.5 (December 22, 2005)	Updated for IBM Director v5.10 and VMM 2.01

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Overview

VMware ESX Server is virtual infrastructure software for partitioning, consolidating and managing systems in mission-critical environments. VMware ESX Server transforms physical systems into a pool of logical computing resources. Operating systems and applications are isolated in multiple virtual machines that reside on a single physical server. System resources are dynamically allocated to virtual machines based on need and administrator set guarantees, providing mainframe-class capacity utilization and control of server resources.

VMware ESX Server uses a unique bare-metal architecture that inserts a small and highly robust virtualization layer between the x86 server hardware and the virtual machines. This approach gives VMware ESX Server complete control over the server resources allocated to each virtual machine and it avoids the performance overhead, availability concerns and costs of server virtualization architectures built on a host operating system.

VMware ESX Server simplifies server infrastructure by partitioning and isolating server resources in secure and portable virtual machines. VMware ESX Server runs directly on the system hardware to provide a secure, uniform platform for deploying, managing, and remotely controlling multiple virtual machines.

With this new infrastructure comes new management demands. The combination of the integrated service processor in the xSeries server, IBM Director Agent, and Virtual Machine Manager, working in conjunction with VirtualCenter and VMotion, provides a comprehensive systems management solution that addresses these management requirements.

This document will focus on using IBM Director v5.10, Virtual Machine Manager v2.01, and various other IBM Director Extensions to manage VMware ESX Server v2.51.

VMware ESX Server as a SNMP Device

VMware ESX Server ships with a SNMP agent that is disabled by default. This agent can be enabled, allowing VMware ESX Server to be discovered by IBM Director and managed as a SNMP device. Managing VMware ESX Server using SNMP requires no additional software to be installed on the Console O/S.

The SNMP implementation is set to Read-Only, only providing configuration and fault information. The variables available in the VMware ESX Server MIB are detailed in the *ESX Server Administration Guide* available for download from http://www.vmware.com/pdf/esx25_admin.pdf.

Enable the VMware ESX Server SNMP Agent

The SNMP agent must first be enabled on the VMware ESX Server. To do this, in the MUI (browser interface), log in as root and select the <u>Options</u> tab. This will display the VMware ESX Server Options as shown in Figure 1 – VMware Options on page 5.



Figure 1 – VMware Options

From the <u>Options</u> tab, select <u>SNMP Configuration</u>. This will display the Current SNMP Status and Configuration, as shown in Figure 2 – SNMP Configuration on page 6.

mce4500: SNMP Configuration - Microso	oft Internet Explorer	
🖞 ¥Mware ESX Server 2.5.1 build-1	3057 root@mce4500.eeinc.us	
SNMP Configuration Enable, disable and configure ye	our system monitoring agents.	
Current SNMP Status and Configura	ation	
Master SNMP Agent		
Status	Stopped	Start
Startup Type	Manual	Automatic
Startup Script	/etc/init.d/snmpd	Change
Configuration File	/etc/snmp/snmpd.conf	Change
¥Mware SNMP SubAgent		
Status	Disabled	Enable
VMware Traps	Disabled	Enable
Help	С	lose Window

Figure 2 – SNMP Configuration

Under Master SNMP Agent, set the <u>Startup Type</u> to Automatic. Under VMware SNMP SubAgent, set the <u>Status</u> to Enable. Also set <u>VMware Traps</u> to Enable.

Next, edit the SNMP Configuration File /etc/snmp/snmpd.conf. Change the line syscontact and syslocation to reflect the appropriate values. Change the rocommunity and trapcommunity to match the SNMP community names being used by IBM Director. Finally, change the trapsink line to the hostname or IP address of the IBM Director Server. Refer to Figure 3 - snmpd.conf on page 6 for an example.

🛃 root@mce4500:/etc/snmp	
syscontact root@localhost (edit /etc/snmp/snmpd.conf)	_
syslocation room1 (edit /etc/snmp/snmpd.conf)	
rocommunity public	
trapcommunity public	
trapsink localhost	
master agentx	
~	
~	
~	
~	
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~	
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	-

Figure 3 – snmpd.conf

Finally, return to the MUI interface and set the <u>Status</u> to Start. The SNMP agent is now enabled and configured to forward traps to the IBM Director server.

Configure the IBM Director Server

IBM Director needs to be configured to browse the SNMP MIBs, interpret the SNMP Traps, and to discover the VMware ESX Server as a SNMP device. These tasks are defined in the following sections.

Compiling the VMware ESX Server MIBs

The first step is to compile the VMware ESX Server MIBs into IBM Director. Copy the MIBs to the IBM Director Server. The VMware ESX Server MIBs are found in

/usr/lib/vmware/snmp/mibs. A Secure Copy client such as PuTTY's <code>PSCP.EXE</code> can be used for this.

Next, compile the MIBs using IBM Director's Compile MIB tool. To launch the tool, in the IBM Director Console, select the <u>Tasks</u> menu item, then select SNMP Browser \rightarrow Manage MIBs...Alternately, you can show the <u>Tasks</u> pane of the console, right-click on SNMP Browser, and select Manage MIBs.... Refer to Figure 4 – Compile a New MIB on page 7 for an example.

🖶 Server Configuration Manager	•	
🖉 SNMP Browser	Þ	🔗 SNMP Browser (First select a target.)
🗮 Software Distribution	►	Manage MIBs 📐
📳 System Accounts	→	1 Help for SNMP Browser
🕵 System Availability	•	

Figure 4 – Compile a New MIB

Browse to the directory where the VMware ESX Server MIBs reside, and select the MIB to compile. Refer to Figure 5 – Select MIB to Compile on page 7 for an example.

Select MIB to Compile			×
File Name VMWARE-ROOT-MIB.mib		Directories: C:\Temp\VMwareMIBs	OK Cancel
VMVVARE-ESX-MIB.mib VMWARE-RESOURCES-MIB.mib VMWARE-ROOT-MIB.mib VMWARE-SYSTEM-MIB.mib VMWARE-TRAPS-MIB.mib VMWARE-TMAPS-MIB.mib	L3	E Cil Temp WiwareMIBs	
List Files of Type		Drives:	Source:
*.mib	-	⊂ C	- Local -
Ready			

Figure 5 – Select MIB to Compile

Note that VMWARE-ROOT-MIB.mib must be compiled first, because the other MIBs reference it. Refer to Figure 6 – Compile MIB on page 7 for an example of a successful completion message.

🖉 MIB Management: VMWARE-ROOT-MIB.mib						
File Edit Help						
Status Messages						
If you want to manage MIBs, select File at the top of this panel to select options. If you are finished, close this window.						
C:\Program Files\VMware\VMware VirtualCenter\MIBS\VMVVARE-ROOT-MIB.mib selected. MIB file submitted to server.						
Starting MIB compile for C:\Program Files\VMware\VMware VirtualCenter\MIBS\VMWARE-R(MIB parsing complete Resolving MIB imports Saving MIB photos						
MIB compile completed for: C:\Program Files\VMware\VMware VirtualCenter\MIBS\VMWARE						
Ready						

Figure 6 – Compile MIB

Repeat the process for the remaining MIBs. IBM Director is now able to correctly interpret SNMP traps from VMware ESX Server, as well as browse the VMware ESX Server MIBs.

Discover and Manage SNMP Devices

VMware ESX Server must be added to IBM Director as a SNMP Device. This can be done in one of four ways. First, ensure IBM Director can discover the VMWare ESX Server's SNMP agent by configuring the discovery preferences. The discovery preferences are accessed within the IBM Director Console by selecting Options → Discovery Preferences. In the Discovery Preferences window, select the <u>SNMP Devices</u> tab, and then enter the correct IP Address and Subnet Mask for the VMware ESX Server. Refer to Figure 7 – SNMP Discovery Preferences on page 8. Also, enter the correct SNMP Community Name as specified in Figure 3 – snmpd.conf on page 6. IBM Director should now discover VMware ESX Server as a SNMP device during its discovery process. To eliminate the need to perform a discovery, ensure the item Auto-add unknown agents which contact server is selected. The next time the VMware ESX Server SNMP agent is restarted, it will send a cold-start trap to IBM Director, and will automatically be registered.

Discovery Pref	erences	Ctorogo Do	icoo	DiadaCa	ntor Choo	via V	Dhusiaal Dist	formo			
Level 2: IBN	Directo	r Agents		Level	1: IBM Dire	ector C	ore Services	Systems		Level 0: Age	ntless Systems
P Addresses	and Sul	onet Masks-						SNMP Ver	sion—		
1.							Clear	SNMPv1			
10216000	. Pochinik			265 265 26	5.0			Communit	ty Name	es	
192.100.0.0				200.200.20	5.0						Clear
								public			
Add		Import		Repla	ce	Re	emove	Add		Replace	Remove
SNMP Devices	;										
Auto-discover	period (hours)	Disa	bled 🔻							
Presence Che	ick perio	od (minutes)	15	· •							
Auto add .	nknove	agonte whi	h cont	acteorer							
Marchada a	IIIMIOWI	ragents with	in com	aciseivei							
										<u>Г</u> Г	<u> </u>
										OK Cai	ncel Help

Figure 7 – SNMP Discovery Preferences

A third option to discovering the SNMP agent is to manually add it. Right-click in the center pane of the IBM Director Console and select New \rightarrow SNMP Devices. In the Add SNMP Devices window, enter the IP Address and Community Name of the VMware ESX Server. Refer to Figure 8 – Add SNMP Device on page 9. The Community Name must match what was configured in Figure 3 – snmpd.conf on page 6.

📾 Add SNMP Devices		
Address:		
SNMP Version:	SNMPv1	*
Community Name:	public	
🗌 Use as a discovery	/ seed	
	OK	Cancel
Ready		

Figure 8 – Add SNMP Device

Finally, the SNMP Device can be added to IBM Director using the Command Line Interface. To add the VMware ESX Server as a SNMP Device using the Command Line Interface, execute the command:

```
dircli mkmo type="SNMP Device" ip=IpAddress version=n community=name
seed=yesno
```

where:

IpAddress is the IP Address of the VMware ESX Server n is the SNMP Version name is the SNMP Community Name yesno is yes or no

To see a list of IBM Director Tasks that can be executed against VMware ESX Server, right-click on the VMware ESX Server SNMP object in the Director Console. Refer to Figure 9 – IBM Director SNMP Tasks on page 9.

🖁 IBM Director Console				
Console Tasks Associations	View Options Wi	ndow Help		
🖌 • 🛆 🕅 🚸 • 👌	, .	• 🛃 • 🗗 • 📮 •	@	• 😋 •
*	🆧 All Ma	naged Objects : System Mer	nbership 🔻	
Name 🔺	TCP/IP Addresse	s TCP/IP Hosts	Operating System	
mce4500.eeinc.us	192.168.0.54	mce4500.eeinc.us	Linux 2.4	C
MCET30 Open		mcet30.eeinc.us	Microsoft Windows Serve	r 2003™ 5.2 (
Delete			Microsoft Windows Serve	r 2003™ 5.2 (
Rename	2012/01/04			
Presence C	heck			
SNMP Brow	/ser 🗟			
Collect Inve	ntory			
View Invention	ory			
Event Log				
Process Ma	anagement			
Remote Set	ssion			
Set Present	ce Check Interval			
All Available	Recordings			
All Available	e Thresholds			
Resource N	Ionitors			
Rack Manag	ger			•
Set Status	•			
Ready		Host: mcet30 U	ser ID: MCET30\DirSvc	4 objects

Figure 9 – IBM Director SNMP Tasks

Select the <u>SNMP Browser</u> Task on the VMware ESX Server to see the VMware ESX Server SNMP information. Expand the tree next to the machine_name \rightarrow iso \rightarrow org \rightarrow dod \rightarrow internet \rightarrow private \rightarrow enterprises \rightarrow vmware to see the available VMware ESX Server information. Refer to Figure 10 – SNMP Browser on page 10.



Figure 10 – SNMP Browser

The IBM Director <u>Event Log</u> Task will show the SNMP traps that have been received from VMware ESX Server. The VMware ESX Server traps are limited to the following:

- vmPoweredOn
- vmPoweredOff
- vmHBLost
- vmHBDetected
- vmSuspended

Refer to Figure 11 – Event Log on page 11.

🚏 Event Log: mce4500.eeinc.us										
File Edit View Options Help										
A. 8										
			Ev	ents (3) - Last 4 Weeks			, î			
Date	Tim	е	Event Type	Event Te>	t	System Na	Sev			
11/10/2	12:34:5	5 PM	SNMP.iso.org.dod.intern	This trap is sent when a virtual i	machine is powered	mce4500	Unkn			
11/10/2	12:23:0	6 PM	SNMP.iso.org.dod.intern	A coldStart trap signifies that the	e SNMP entity, suppo	mce4500	Unkn			
11/10/2	12:22:4	9 PM	SNMP.iso.org.dod.intern	A coldStart trap signifies that the	e SNMP entity, suppo	mce4500	Unkn			
4							•			
				Event Details			•			
Keyword	s	Valu	es							
Date		11/1	D/2005							
Time		12:3	4:55 PM		10					
Event Typ	e l	SNM	P.iso.org.dod.internet.privat	e.enterprises.vmware.vmPower	edOn Venerded er e nevvere	d off state				
System N	a Iama	mce	trap is sent when a vinual ri 4600 ooine us	nachine is powered on iron a s	uspended of a powere	u on state.				
Severity	ame	Unkr	10wn							
Category		Alert					-			
Group Na	ame 🛛									
Sender N	lame	mce	4500.eeinc.us							
				Extended Attribute	es					
Keyword	s				Values					
2920					1972					
Commun	Community Name public									
iso.org.dod.internet.private.enterprises.vmware.vmwTraps.vmID 139										
iso.org.d	Iso.org.dod.internet.ptivate.enterprises.vmware.vmwTraps.vmConfigFile //root/vmware/ws03vm1/vws03vm1.vmx									
iso.org.u	ou.mem	ei.shi	npvz.sninpwodules.sninpi	wib.simipiwibobjects.simpir	viriware (1.3.0.1.4.1.0	070)	*			
IBM	Ready						,			

Figure 11 – Event Log

The <u>Inventory</u> Task of IBM Director collects system inventory information about the VMware ESX Server Console O/S from the VMware ESX Server SNMP agent. The information can be viewed using the Inventory Query Browser. Refer to Figure 12 – Inventory on page 11. For a list of inventory data returned, refer to Table 1 – Inventory Data on page 31. The actual data returned may differ based on Machine-Type and Model.

📱 Inventory Query Browser: mce4500.eeinc.us										
File Selected Options Help										
¢										
Available Queries: All 🔻		Query	Results: Netv	vork Adapter(3)						
Custom	Name (System)	Ind	Type (Net	MAC Address (Canonical (To (
🖰 Hardware	mce4500.eeinc.us	1	ETHERNET	000629D50756	006094ABE06A					
🗅 😋 Adapter	mce4500.eeinc.us	2	UNKNOWN		N					
Fibre Channel Add	mce4500.eeinc.us	3	UNKNOWN							
RAID Controllers RAID Controllers SCSI Adapter Chassis Cluster Chassis Cluster Chassis Cluster RAID Enclosu RAID Enclosu Management F Parallel Port PCI Device SCSI Device Scsi Port	×	1000								
Ready										

Figure 12 – Inventory

The inventory information can be used to create dynamic groups of systems. For example, to create a group of all VMware ESX Servers, use the Installed Packages criteria, and select VMware-esx. Refer to Figure 13 – Dynamic Group Creation on page 12.



Figure 13 – Dynamic Group Creation

The <u>Process Management</u> Task lists the processes currently running on VMware ESX Server Console O/S. Unlike other Agent types, processes cannot be started or stopped on SNMP devices. Processes also cannot be monitored for running status. Refer to Figure 14 – Process Management on page 12.

Applications				
Name	Command Line	Process ID	Memory Usage	CPU Time
init	init [3]	1	508K	00:00:03
keventd	keventd	2	0K	00:00:00
ksoftirqd_CPU0	ksoftirqd_CPU0	3	0K	00:00:00
kswapd	kswapd	4	0K	00:00:00
kreclaimd	kreclaimd	5	0K	00:00:00
bdflush	bdflush	6	0K	00:00:00
kupdated	kupdated	7	0K	00:00:00
scsi_eh_0	scsi_eh_0	10	0K	00:00:00
kjournald	kjournald	11	0K	00:00:00
khubd	khubd	78	0K	00:00:00
kjournald	kjournald	171	0K	00:00:00
vmfs_flush	vmfs_flush	534	0K	00:00:00
vmklogger	/usr/sbin/vmklogger	882	488K	00:00:00
vmware-serverd	/usr/sbin/vmware-serverd -s -d	955	22684K	00:01:02
syslogd	syslogd -m 0	980	584K	00:00:00
klogd	klogd - 2	999	1080K	00:00:00
sshd	/usr/sbin/sshd	1080	1372K	00:00:00
xinetd	xinetd -stayalive -reuse -pidfile /var/run/xine	1114	936K	00:00:00
qpm	gpm -t ps/2 -m /dev/mouse	1248	500K	00:00:00

Figure 14 – Process Management

The <u>Remote Session</u> Task opens a SSH or TELNET session with the VMware ESX Server. It initially attempts SSH, and if SSH isn't available, reverts to TELNET. Once the session is established, you are prompted to log-in. Refer to Figure 15 – Remote Session on page 13.



Figure 15 – Remote Session

The <u>Resource Monitor</u> Task enables the creation of user-defined thresholds to monitor SNMP MIB variables. These variables represent resources available to the VMware ESX Server Console O/S. If the threshold is exceeded, an Event will be sent to IBM Director. Since most MIB variables are arranged in tables, care should be taken to ensure the item selected is the desired item. For example, in Figure 16 – Resource Monitors on page 13, the root partition is referenced by the first entry in the hrStorageTable. This becomes even more critical when attempting to monitor software, using the hrSWRunPerf table, since the processes are indexed by process ID, and processes may not have the same process ID each time they are executed.

Resource Monitors: mce4500.eeinc.us			_ 🗆 ×
File View Help			
Available Resources	Se	elected Resources	
Available Resources	Selected Resources ThrSWRunName.955] [hrSWRunPerfCPU.9 [hrSWRunPerfMem	elected Resources mce4500.eeinc.us vmware-serverd 7463 22684	
ArsWRunPerfCPU AnsWRunPerfMer	-		
Ready		Last updated: 1:34	:25 PM

Figure 16 – Resource Monitors

An <u>Event Action Plan</u> is the mechanism used by IBM Director to specify the Action to take when a specific Event is received. Events are specified using an Event Filter. To select an Event from VMware ESX Server, deselect the <u>Any</u> check-box, and expand SNMP \rightarrow iso \rightarrow org \rightarrow dod \rightarrow internet \rightarrow private \rightarrow enterprises \rightarrow vmware. Refer to Figure 17 – Event Filter on page 14.



Figure 17 – Event Filter

To include the contents of a MIB variable in an Event Action message, specify a"oid where oid is the OID of the desired variable. For example, to include the name of the VMware Configuration File, use

&"iso.org.dod.internet.private.enterprises.vmware.vmwTraps.vmConfigFile. Note that a " is specified prior to the OID, but not following it. Refer to Figure 18 – Event Action on page 14.

Customize Action : Send an Event Message to a Console User	_ 🗆 🗵
File Advanced Help	
E/	
Message	
nternet.private.enterprises.vmware.vmwTraps.vmConfigFile	
User(s)	
(Example: User1, Administrator)	
*	
Delivery Criteria	
Active Users Only 🔻	_

Figure 18 – Event Action

SNMP Traps From VirtualCenter

If you have Virtual Center in your environment, additional alerting is possible using VirtualCenter's Alarms. VirtualCenter can send SNMP Traps to IBM Director based on CPU Usage, Memory Usage, or Host Connection status.

Configuring VirtualCenter to Send SNMP Traps

The first step is to configure VirtualCenter to send SNMP traps. This is done from within the VirtualCenter Console. Select File \rightarrow VMware VritualCenter Settings... Within the <u>VMware</u>

<u>VirtualCenter Settings</u> window, select the <u>Advanced</u> tab. Change the value of snmp.receiver.1.name to the hostname or IP address of the IBM Director Server. Refer to Figure 19 – VirtualCenter Trap Destination on page 15.

Mware VirtualCenter Settin	igs	X
Performance Templates Ad	dvanced	1
instance.id	36	-
snmp.receiver.1.name	mcet30.eeinc.us	
snmp.receiver.1.port	162	
snmp.receiver.1.community	public	
snmp.receiver.2.name		
snmp.receiver.2.port		
snmp.receiver.2.community		
		<u> </u>
		icel

Figure 19 – VirtualCenter Trap Destination

Next, in the VirtualCenter Console, select the item Server Farms. Click on the <u>Alarms</u> tab to display the predefined alarms. To customize one of the predefined alarms, right-click on it and select properties. Within the Alarm Properties window, select the <u>Actions</u> tab. Change the action to Send a notification trap. Select all of the option check-boxes to be alerted for all changes. Repeat the process for each alarm you wish to modify. Refer to Figure 20 – VirtualCenter Alarms on page 15.

Alarm actions occur when define new actions. For ea action will fire.	the trigger changes from or ach action, use the checkt	ne color to another. Noxes to the right to r	Use the list below to determine when the
Send a notification trap	T		From green to yellow From yellow to red From red to yellow From red to yellow From yellow to green
	Add	Berroue	1

Figure 20 – VirtualCenter Alarms

Processing VirtualCenter Traps in IBM Director

Since VirtualCenter isn't running a SNMP Agent, the traps will be displayed within IBM Director with a blank System Name. This will not prevent IBM Director from processing them. However, any Event Action Plan that will process these events must be assigned to the All Managed Objects group.

To properly translate the traps, the appropriate MIBs must be loaded. The VirtualCenter MIBs can be found in the \Program Files\VMware\VMware VirutalCenter\MIBS directory on the VirtualCenter server. Copy them to the IBM Director Server and compile them using IBM

Director's MIB Management tool. Refer to Compiling the VMware ESX Server MIBs on page 7 for instructions on compiling MIBs in IBM Director.

To view the traps, double-click on the Event Log item in the Tasks pane of the IBM Director Console. Refer to Figure 21 – VirtualCenter Event on page 16.

💕 Event L	.og						×
File Edi	t View	Opti	ions Help				
el p	Î						
			Eve	nts (100) - Last 4 Weeks			1
Date	Tim	е	Event Type	Event Text		System Na	5
12/14/2	2:39:49	PM	SNMP.iso.org.dod.intern	This trap is sent when entity status	changed.		Ul 🔶
12/14/2	2:07:45	PM	SNMP.iso.org.dod.intern				U
12/14/2	2:04:50	PM	SNMP.iso.org.dod.intern				U
12/14/2	2:04:02	PM	SNMP.iso.org.dod.intern	This trap is sent when a virtual may	chine detects or r	mce4500	U
12/14/2	2:04:01	PM	SNMP.iso.org.dod.intern	This trap is sent when a virtual ma	chine detects or r	mce4500	U
17/14/2	2.01.06	PM	SNMP iso ora dod intern	This tran is sent when a virtual ma	chine is nowered	mce4500	11-
-							P
L				Event Details			
Keyword	s	Valu	es				
Date		12/1	4/2005				
Time		2:39	:49 PM ID is a sub-stantin term at universit				
Event Tex	ne	This	tran is sent when entity stat	te.enterprises.vnrware.vnrwiriaps.vp bus changed	xuilap		
System N	lame	11115	aup to oche mich charg ora	ao changea.			
Severity	5.55.5	Unkr	nown				
Category		Alert					
Group Na	ame						
Sender N	lame	192.	168.0.51				
				Extended Attributes	-		
Keyword	s				Values		
2025					1000		
Commun	ity Nami	Ξ			public		
iso.org.di	od.intern	et.priv	/ate.enterprises.vmware.vm	wiraps.vpxdirapiype wTrops.vpxdHootNome	hostCpuUsage	00 opine up	
iso ora di	nd intern	et nris	/ate.enterprises.viriware.viri /ate enterprises.vmware.vm	wTraps.vpxuHustivarite wTraps.vpxdVMName	/WCEFaill/IIICe45	oo.eemc.us	
iso.org.di	od.intern	et.priv	/ate.enterprises.vmware.vm	wTraps.vpxdOldStatus	green		
iso.org.d	od.intern	et.priv	vate.enterprises.vmware.vm	wTraps.vpxdNewStatus	yellow		
iso.org.d	od.intern	et.priv	/ate.enterprises.vmware.vm	wTraps.vpxdObjValue	CPU = 75.5%		
iso.org.d	od.intern	et.snr	mpV2.snmpModules.snmp1	MIB.snmpMIBObjects.snmpTrap	vmwTraps (1.3.6.1	.4.1.6876.50)	
4		_					•
IBM	Ready						

Figure 21 – VirtualCenter Event

Just as with the other SNMP traps, the data from the VirtualCenter traps can be passed to other applications using IBM Director's Event Data Substitution. For example, to pass the current value, use the following:

&"iso.org.dod.internet.private.enterprises.vmware.vmwTraps.vpxdObjValue

Running the IBM Director Agent on VMware

Additional management functionality can be gained by installing the IBM Director Agent in the VMware ESX Server Console O/S. This section of the document will assist with the installation of the IBM Director Agent, as well as provide information about the additional benefits of the IBM Director Agent. For a complete list of installation instructions, refer to the IBM Director *Installation and Configuration Guide* Version 5.10

(<u>ftp://ftp.software.ibm.com/pc/pccbbs/pc_servers_pdf/dir510_docs_install.pdf</u>). For a complete list of IBM Director functions, refer to the IBM Director *Systems Management Guide* Version 5.10 (<u>ftp://ftp.software.ibm.com/pc/pccbbs/pc_servers_pdf/dir510_docs_sysmgt.pdf</u>).

Installing the Agent

IBM Director Version 5.10 offers multiple Agent "levels", with each (Level 0, Level 1, and Level 2) offering increasing functionality. The following sections will address managing VMware ESX Server running each level of Agent.

Level 0 Agent

The Level 0 Agent does not require any IBM Software. The IBM Director Server manages a Level 0 Agent using industry standard protocols. For VMware ESX Server, this uses SSH.

Level 1 Agent

The IBM Director Level 1 Agent (Core Services) can be installed in one of three ways: locally from the VMware ESX Console, remotely from a SSH session, or remotely by promoting a Level 0 Agent to a Level 1 Agent. Installation instructions are contained in Chapter 3 of the *IBM Director Installation and Configuration Guide Version 5.10*.

Once the Level 1 Agent has been successfully installed, it will be started automatically.

Note: The IBM Director Level 1 Agent (Core Services) is a small footprint agent designed for hardware management only. Unfortunately, it has minimal benefit in a VMware ESX environment. This is true for two reasons. First, the service processor drivers (neither IPMI-BMC nor the RSA-II) are not supported running in the VMware ESX Server Console O/S. Without these drivers, the Level 1 Agent cannot receive in-band hardware events. Second, the standalone ServeRAID Manager is also not supported running in the VMware ESX Server Console O/S. Without this agent, the Level 1 Agent cannot receive RAID events. Therefore, the only benefit of the Level 1 Agent is enhanced inventory information over that provided by the Level 0 Agent. This includes the ability to collect inventory information such as firmware versions, FRU numbers, and serialization information.

Level 2 Agent

The IBM Director Level 2 Agent can be installed in one of three ways: locally from the VMware ESX Server Console, remotely using a SSH session, or remotely by promoting a Level 0 Agent (or Level 1 Agent) to a Level 2 Agent. Installation instructions are contained in Chapter 3 of the *IBM Director Installation and Configuration Guide Version 5.10*.

Note: The IBM Director Level 2 Agent is a full-featured agent designed for hardware management as well as system management. Unfortunately, it has limited hardware management capabilities in a VMware ESX environment. This reason for the limitation is that the service processor drivers (neither IPMI-BMC nor the RSA-II) are not supported running in the VMware ESX Server Console O/S. Without these drivers, the Level 2 Agent cannot receive inband hardware events. Unlike the Level 1 Agent, the integrated ServeRAID Manager is supported running in the VMware ESX Server Console O/S. This agent allows the Level 2 Agent to send RAID events. In addition to RAID management the Level 2 Agent collects enhanced inventory information similar to that provided by the Level 1 Agent. This includes information such as firmware versions, FRU numbers, and serialization information. The Level 2 Agent can

also be extended to include additional IBM Director Extensions such as Capacity Manager and System Availability. The functionality of these tools will be included in the sections that follow.

Once the IBM Director Level 2 Agent has been installed, it can be started using the script /opt/ibm/director/bin/twgstart. This script can be launched using a Remote Session with the Level 0 Agent. The O/S doesn't need to be restarted prior to starting the Level 2 Agent for the first time. To check the operational status of the Level 2 Agent, execute the script /opt/ibm/director/bin/twgstat. Refer to Figure 22 – Director Agent Commands on page 18 for an example of the output of these commands.



Figure 22 – Director Agent Commands

Adding the Agent to IBM Director Server

Once the Agent has been installed and started, it is able to be discovered by the IBM Director Server. IBM Director Server has discovery preferences for each of the 3 Agent levels. The discovery preferences are accessed within the IBM Director Console by selecting Options \rightarrow Discovery Preferences. Once the discovery preferences have been specified, you may initiate a system discovery by either right-clicking in the center pane of the IBM Director Console and selecting Discover, then selecting the desired Agent level, or selecting Discover \rightarrow All Managed Objects. Please note that it make take a while for Level 0 or Level 1 Agents to be discovered.

Discovery Preferences – Level 0 Agents

In the Discovery Preferences window, select the <u>Level 0: Agentless Systems</u> tab. Select the <u>Add</u> button, and enter a Unicast Address (to discover a single device) or Unicast Range (to discover all Level 0 Agents on the specified subnet. Refer to Figure 25 – Level 2 Agent Discovery Preferences on page 19.

NMP Devices SMI-S Storage	Devices	BladeCenter C	hassis Phys	ical Platforms		
Level 2: IBM Director Agents	Lev	el 1: IBM Directo	r Core Services	Systems	Level 0: Agentless Sy	ystems
Address Entries						
Start Ad	dress			End	Address	
192.168.0.1			192.168.0.2	54		
	Add	Import	Edit	Remove		
Level 0: Agentiess Systems-	Add	Import	Edit	Remove		
Level 0: Agentless Systems Auto-discover period (hours)	Add Disal	Import	Edit	Remove		
Level 0: Agentiess Systems Auto-discover period (hours) Presence Check period (minute	Add Disal	Import oled V	Edit	Remove		
Level 0: Agentiess Systems Auto-discover period (hours) Presence Check period (minute	Add Disal 95) 15	Import oled •	Edit	Remove		

Figure 23 – Level 0 Agent Discovery Preferences

Discovery Preferences – Level 1 Agents

In the Discovery Preferences window, select the <u>Level 1: IBM Director Core Services Systems</u> tab. Select the appropriate <u>Add</u> button to add either a Predefined directory agent server or a SLP Scope. Refer to Figure 24 – Level 1 Agent Discovery Preferences on page 20.

BDiscovery Preferences			
SNMP Devices SMI-S Storag	e Devices 🛛 BladeCenter C	hassis Physical Platform	S
Level 2: IBM Director Agents	Level 1: IBM Directo	or Core Services Systems	Level 0: Agentless Systems
Predefined directory agent	servers	SLP Scope	
	Add Remove		Add Remove
Discovery Maximum wait time in seco ☑ Use broadcast ☑ Use multicast	onds: 15		
Level 1: IBM Director Core Se Auto-discover period (hours)	rvices Systems Disabled ▼		OK Cancel Help

Figure 24 – Level 1 Agent Discovery Preferences

Discovery Preferences – Level 2 Agents

In the Discovery Preferences window, select the <u>Level 2: IBM Director Agents</u> tab, select the <u>System Discovery (IP)</u> radio button, then select the <u>Add</u> button to add a Broadcast, Relay, Unicast Address, or Unicast Range for the VMware ESX Server. Refer to Figure 25 – Level 2 Agent Discovery Preferences on page 21.

⊖ General ●	System Discovery (IF	2)	
rstem Discovery (IP)	- Addrass Entrice -		
Broadcast	Address	Mask (or Addre	Type
☑ Use TCP/IP general broadcasts	192.168.0.1	255.255.255.0	Broadcast
	192.168.0.51	255.255.255.0	Relay
Multicast	192.168.0.54		Unicast
Use TCP/IP multicasts Multicast Group: 224 . 0 . 1 . 118 Multicast TTL: 32 -	192.168.0.1	192.168.0.154	Unicast
	Add	Edit	Remove

Figure 25 – Level 2 Agent Discovery Preferences

Alternately, you may manually add the Level 0, 1, or 2 Agents. To manually add the Agent, rightclick in the center pane of the IBM Director Console and select New \rightarrow Systems. In the Add Systems window, type the System Name and Network Address, and select the OK button. Refer to Figure 26 – Add System on page 21.

📇 Add Systems	
System Name	MCE4500
Network Protocol *	TCPIP -
Network Address *	192.168.0.54
* denotes required fi	elds
	OK Cancel
IEM Ready	

Figure 26 – Add System

Finally, you may add Agents to IBM Director using the Command Line Interface. To use the Command Line Interface to add the Agent, execute the command:

dircli mkmo type=Systems name=ComputerName ip=IpAddress

where:

ComputerName is the label for the object in the IBM Director Console *IpAddress* is the IP Address of the VMware ESX Server to be added

Note: You must be logged in locally on the IBM Director Server system using a DirSuper ID in order to run the IBM Director Command Line Interface.

Requesting Access to an Agent

Once discovered, the Agent will be "locked" or "secured to itself". Access to the Agent must be gained by right-clicking on the Agent icon and selecting Request Access. Refer to Figure 27 – Request Access on page 22.

🔒 IBM Director Console		_ 🗆 🗙
Console Tasks Associations View	Options Window Help	
🖋 • 🗠 🥡 🚸 • 👼 •	Q · 💼 · 🗮 · 🚽 · 📮 · 📦 ·	<u>_</u> • <u>∎</u> • <u>□</u> • ⊲ •
Groups	🍋 🦧 All Managed Objects : System Members	Tasks
🗖 🧟 All Groups	Name TCP/IP Addres	Asset ID
All Managed Objects	Open	📮 🛄 BladeCenter Management
— 🛄 Chassis and Chassis Mer	mce4500 Delete	🗖 🗕 📊 Capacity Manager
Clusters and Cluster Mem	Rename	
	MCEX22 Presence Check	Configure Alert Standard For
- 1 Hardware Status Informati	Collect Inventory	Configure SNMP Agent
-A Hardware Status Warning	View Inventory	🗖 👾 Event Action Plans
🚽 🦉 Level 0: Agentless System	Event Log	🗖 🗗 Event Log
🚽 🥰 Level 1: IBM Director Core	Set Presence Check Interval	External Application Launch
🚽 🖳 Level 2: IBM Director Agent	Rack Manager	File Transfer
Physical Platforms	Request Access	Hardware Status
- 📴 Platforms	Set Status 😽 🔸	- A Inventory
Platforms and Platform Me		🚽 👘 Microsoft Cluster Browser
- Racks with Members		- 📲 Network Configuration
—🎇 Scalable Systems and Me		🗖 🗣 Process Management
SNMP Devices		- Rack Manager
		Remote Control
Ready	Host: mcet30 User ID: MCI	ET30\DirSvc 5 objects

Figure 27 – Request Access

Selecting Request Access will open a dialog box requiring a User ID and Password to proceed. The User ID **must** be root. Refer to Figure 28 – User Credentials on page 22.

Request Access to S	5ystems	×
Liser ID	root	
Password	*******	
	OK Cancel Help	

Figure 28 – User Credentials

Once valid log-on credentials are specified, the Request Access will display a success message. Refer to Figure 29 – Access Request Succeeded on page 22.

Access Request Suc	cceeded	×
I	Access was successfully granted.	
	OK	

Figure 29 – Access Request Succeeded

When access is granted, the IBM Director Server will immediately initiate an Inventory collection against the IBM Director Agent. VMware ESX Server can now be managed as an IBM Director Agent.

You may also request access to the Agents using the Command Line Interface. To use the Command Line Interface to request access to the Agent, execute the command:

dircli accessmo -n ComputerName -t Type -u UserId -p Password

where:

ComputerName is the label for the object in the IBM Director Console Type is the managed object type (Run the command dircli lsmo -i for a list of object types) UserId is the root user ID Password is the password for the root user ID

Note: You must be logged in locally on the IBM Director Server system using a DirSuper ID in order to run the IBM Director Command Line Interface.

Managing the Agent

To see a list of IBM Director Tasks that can be executed against VMware ESX Server, right-click on the VMware ESX Server's object in the IBM Director Console. Refer to Figure 30 – IBM Director Agent Tasks on page 23. Note that the available tasks and their behavior may differ depending on the Agent level.



Figure 30 – IBM Director Agent Tasks

Level 0 Management Tasks

The <u>Power Management</u> task will enable you to restart the VMware ESX Server. This effectively executes the command shutdown <u>-r</u> now on the VMware ESX Server's Console O/S. It is up to the VMware ESX Server to cleanly shutdown any virtual machines prior to it restarting.

The <u>Inventory</u> Task of IBM Director collects system inventory information about the VMware ESX Server Console O/S. For a list of inventory data returned, refer to Table 1 – Inventory Data on page 31. The actual data returned may vary based on Machine-Type and Model. Note that more inventory information is available from a Level 0 Agent than is available from a SNMP Agent.

Just as when managing a VMware ESX Server as a SNMP device, the inventory collected from a Level 0 Agent can be used to create a dynamic group that contains all VMware ESX Servers. In

fact, the dynamic group example in Figure 13 – Dynamic Group Creation on page 12 will work the same for Level 0 Agents as it does for SNMP devices.

The IBM Director Event Log Task will show the events that have been received from VMware ESX Server. These events are typically limited to topology events for Level 0 Agents.

The Remote Session Task opens a SSH session with the VMware ESX Server. Unlike the Remote Session to a SNMP device, opening a Remote Session on a Level 0 Agent will not prompt you for logon credentials - it uses the persisted credentials entered when requesting access to the Level 0 Agent.

Level 1 Management Tasks

The Power Management task will enable you to restart the VMware ESX Server. This effectively executes the command shutdown -r now on the VMware ESX Server's Console O/S. It is up to the VMware ESX Server to cleanly shutdown any virtual machines prior to it restarting.

The Inventory Task of IBM Director collects system inventory information about the VMware ESX Server Console O/S. For a list of inventory data returned, refer to Table 1 – Inventory Data on page 31. The actual data returned may vary based on Machine-Type and Model. Note that more inventory information is available from a Level 1 Agent than is available from a Level 0 Agent.

Just as when managing a VMware ESX Server as a SNMP device or Level 0 Agent, the inventory collected from a Level 1 Agent can be used to create a dynamic group that contains all VMware ESX Servers. In fact, the dynamic group example in Figure 13 – Dynamic Group Creation on page 12 will work the same for Level 1 Agents as it does for SNMP devices or Level 0 Agents.

The IBM Director Event Log Task will show the events that have been received from VMware ESX Server. Since the Level 1 Agent is unable to receive in-band hardware or RAID events. these events are typically limited to topology events.

The Remote Session Task opens a SSH session with the VMware ESX Server. Similar to opening a Remote Session on a Level 0 Agent, opening a Remote Session on a Level 1 Agent will not prompt you for logon credentials - it uses the persisted credentials entered when requesting access to the Level 1 Agent.

The Hardware Status Task notifies you whenever a system or device has a hardware status change. However, since the Level 1 Agent is unable to receive in-band hardware or RAID events, it will typically be unable to display any hardware status information.

Level 2 Management Tasks

The Power Management task will enable you to restart the VMware ESX Server. This effectively executes the command shutdown -r now on the VMware ESX Server's Console O/S. It is up to the VMware ESX Server to cleanly shutdown any virtual machines prior to it restarting.

The Inventory Task of IBM Director collects system inventory information about the VMware ESX Server Console O/S. For a list of inventory data returned, refer to Table 1 – Inventory Data on page 31. The actual data returned may vary based on Machine-Type and Model. Note that more inventory information is available from a Level 2 Agent than is available from a Level 0 or Level 1 Agent.

Just as when managing a VMware ESX Server as a SNMP device, the inventory collected from a Level 2 Agent can be used to create a dynamic group that contains all VMware ESX Servers. In fact, the dynamic group example in Figure 13 – Dynamic Group Creation on page 12 will work the same for Level 2 Agents as it does for SNMP devices.

The Event Log Task will show all Events that have been sent from the IBM Director Agent. For a list of all possible Events the IBM Director Agent can send, please refer to the IBM Director Events Reference Version 5.10

(ftp://ftp.software.ibm.com/pc/pccbbs/pc servers pdf/dir510 events ref.pdf).

The <u>Process Management</u> Task lists the processes currently running on VMware ESX Server Console O/S, just as it did when managing VMware ESX Server as a SNMP device. However, unlike the limitations of managing a SNMP device, Process Management can start or stop processes on an IBM Director Level 2 Agent system. It can also monitor processes for running state – Start, Stop, or Fail.

Just as when managing VMware ESX Server as a SNMP device, the <u>Remote Session</u> Task opens a SSH or TELNET session with the VMware ESX Server when managed as an IBM Director Level 2 Agent.

The <u>File Transfer</u> Task allows the copying of files and / or directories between the IBM Director Console and VMware ESX Server or between the IBM Director Server and VMware ESX Server. The drag-and-drop interface provides a convenient method of copying the files, without requiring FTP, NFS, or Secure Copy to be enabled on VMware ESX Server. Refer to Figure 31 – File Transfer on page 25.

🗊 File Transfer	
File Actions View Options Help	
Source File System	Target File System
Local 🗸	mce4500 - Other
Name	Name
P-⊕ C).	
Documents and Settings	📭 💼 bin
🗖 🧰 Downloads	🛑 🛑 🧰 boot
🗖 🧰 Inetpub	🛑 🧰 dev
🗣 🧰 Peri	📭 💼 etc
🗖 🧰 Program Files	📭 💼 home
	📭 💼 initrd
🛑 🧰 System Volume Information	🛑 💼 lib
🗖 🧰 Temp	📭 💼 lost+found
📭 🚘 Utils	📭 🛅 mnt
	📭 💼 opt
🛑 🧰 wmpub	🛑 🧰 proc
💶 🧰 WUTemp	📭 💼 root
🗌 🗕 .rnd	🛑 💼 sbin
- Average - NavCClt.Log	🛑 💼 tmp
- AUTOEXEC.BAT	📭 🧰 usr
🗌 🔚 boot.ini	📭 💼 var
CONFIG.SYS	💶 💼 vmfs
ImEanth VMI	
Name: [*.*	Name: *
Ready	

Figure 31 – File Transfer

The <u>Resource Monitor</u> Task enables the creation of user-defined thresholds to monitor key indicators of system performance. These Available Resources represent resources available to the VMware ESX Server Console O/S. Unlike monitoring a SNMP device, the IBM Director Level 2 Agent allows the monitoring of VMware ESX Server by selecting easy to understand labels rather than table entries. Refer to Figure 32 – Resource Monitors on page 26.



Figure 32 – Resource Monitors

IBM Director's <u>Asset ID</u> task allows you to view serialization information, as well as record personalization, lease, and warranty information for the server. This information is collected during an inventory collection and stored in the inventory database. Refer to Figure 33 – Asset ID on page 26.

Name	Serial Number	Information	
System	23B0413	IBM -[86562RY]-	
3aseBoard0	1J0C9977533	IBM	
SystemEnclosure0		IBM	
Processor0		GenuineIntel Pentium III (Coppermine)	
DEDevice0	2000/01/07	CRN-8241B	
3CSIDevice0		IBM SERVERAID	

Figure 33 – Asset ID

The <u>Configure SNMP Agent</u> task is a convenient method of modifying the trap destination of the SNMP Agent configuration on VMware ESX Server. This is equivalent to editing the file /etc/snmpd.conf on VMware ESX Server. Refer to Figure 34 – Configure SNMP on page 27.

🐉 Configure	e SNMP Agent: n	ice4500.eein	c.us	
File Help				
	Community N	lame		
	public		-	
	Add	Remove		
	Tran Doctination			
	192 168 0 51	°		
	102.100.0.01			
	Add E	idit R	emove	
				Apply
R	eady			

Figure 34 – Configure SNMP

For network changes, the <u>Network Configuration</u> task can be used to change the IP address of the Console O/S. You can also change the DNS settings as well as the hostname. Refer to Figure 35 – Network Configuration on page 27.

🗿 Network Configuration:	mce4500.eeinc.us	_ 🗆 🗵	
File Help			
IP Address DNS V	VINS Domain/Workgroup		
Adapter			
AMD PCnet32 [eth0]		*	
 Use DHCP for autom Configure manually 	atic configuration		
IP Address 192.168. 0. 54			
Subnet Mask	255.255.255. 0		
Default Gateway	192.168. 0. 1		
MAC Address	00:06:29:D5:07:56		
		Apply	
Ready			

Figure 35 – Network Configuration

The <u>System Accounts</u> task allows you to perform user and group management for the Console O/S. This includes creating users, changing user settings, and modifying group membership. Refer to Figure 36 – System Accounts on page 28.

📲 System Accounts: mce4500.eeinc.us	
File Help	
Configure the User Accounts for accessing this Operating System	
Users Groups	
😰 root	
Properties	
Add	
Delete	
	Apply
Ready	

Figure 36 – System Accounts

The <u>ServeRAID Manager</u> task allows you to perform complete RAID management, including receiving events, creating/deleting arrays, and initialize/synchronize logical drives. Refer to Figure 37 – ServeRAID Manager on page 28.

👼 ServeRAID Manager			_ 🗆 ×
<u>File View Actions H</u> elp			
D Add 🎢 Create 🔺 Silence	🕽 Properties 🔲 Events 🔌	Configure <i> Help</i>	IEM.
Enterprise view	Physical devices		Logical devices
Direct attached storage mce4500.eeinc.us	Controller 1 (IBM Serve	RAID-4L)	
Controller 1 (IBM Ser	Channel 1 160 MB/s (8 dev	rices found)	Arrays (1)
-1 Networked storage	🗢 💼 ID 0 - Online (16.9	5 GB)	🗢 🚍 Array A (1
	🖮 ID 1 - Online (16.9	5 GB)	
	🚞 ID 2 - Online (16.9	5 GB)	Logical drives (1)
	ID 8 - Enclosure m	ianagement devi	🔍 🧊 Logical d
	ID 9 - Enclosure m	ianagement devi	
	🚞 ID 12 - Online (16.	95 GB)	
	🚞 ID 13 - Online (16.	95 GB)	<u></u>
	🚞 ID 14 - Online (16.	95 GB)	-
	•		•
•	Connection status: Connection	ected	
Date Time	Source	Desc	ription
12:58:36 PM C	3T mce4500.eeinc.us	ServeRAID Manager sta	arted.
mce4500.eeinc.us/Controller 1			

Figure 37 – ServeRAID Manager

The <u>Capacity Manager</u> Task, one of the IBM Director Extensions, enables capacity planning through trending, forecasting, and bottleneck identification. Performance data from the VMware ESX Server Console O/S is recorded on each VMware ESX Server. When a Capacity Manager report is executed, this data is gathered, analyzed, and displayed in a table and associated graphs. Refer to Figure 38 – Capacity Manager on page 29.



Figure 38 – Capacity Manager

The <u>System Availability</u> Task, another of the IBM Director extensions, tracks server up-time and downtime. Using VMware ESX Server Console O/S data from /var/logs, it produces an availability report, detailing all of the availability records and the system availability as a percentage. It also produces graphs to show uptime, downtime, and outages based on hour of the day and day of the week. Refer to Figure 39 – System Availability on page 29.



Figure 39 – System Availability

<u>Event Action Plans</u> can be created for IBM Director Agents similar to those created for SNMP devices. Rather than drilling-down thru the SNMP tree, the Events from the IBM Director Agent are dynamically published in the Director \rightarrow Director Agent tree. This tree will be empty until a threshold has been configured, or an Event has been received from an IBM Director Agent.

Event details can also be included in Event Action messages. However, rather than using the OID, IBM Director Agent Events support variables available through Event Data Substitution. Refer to Table 2 — Event Data Substitution on page 31.

The <u>Update Assistant</u> Task provides an easy mechanism to update system software (i.e. BIOS, Diagnostics, Hard Drive Firmware) on a VMware ESX Server. These updates are imported from the UpdateXpress CD, and appear as Software Distribution subtasks. To apply the update, simply drag it to the VMware ESX Server. Refer to Figure 40 – Update Assistant on page 30. UpdateXpress is available for download from the IBM web site at <u>http://www-</u>307.ibm.com/pc/support/site.wss/document.do?Indocid=MIGR-53046.



Figure 40 – Update Assistant

Managing VMware ESX Server with Virtual Machine Manager

IBM Virtual Machine Manager (VMM) is an extension to IBM Director that allows you to manage both physical and virtual machines from a single console. Virtual Machine Manager can manage VMware GSX Server, VMware ESX Server and Microsoft® Virtual Server environments using IBM Director. Virtual Machine Manager also integrates VMware VirtualCenter and IBM Director for advanced virtual machine management.

Virtual Machine Manager is comprised of several components – VMM Server, VMM Console, and VMM Agent. The VMM Server is installed on a system running the IBM Director Server. The VMM Console is installed on any IBM Director Console systems. If VirtualCenter is not being used, the IBM Director Agent and the VMM Agent are installed each ESX Server. If VirtualCenter is being used, the IBM Director Agent and the VMM Agent are installed on your VirtualCenter server, and the IBM Director Agent is installed on each ESX Server. Refer to Figure 41 – VMM Environment on page 31 for an example of the possible VMM deployment options.



Figure 41 – VMM Environment

The following management tasks are provided by Virtual Machine management. The available management tasks differ depending on whether VirtualCenter is deployed or not.

Discovery

IBM Director can now discover systems running VMware and classify them as a VMM objects, displaying an additional icon to signify this classification. This icon will change depending on the object state. Additionally, IBM Director will discover all virtual machines on the VMware ESX Servers, also displaying the additional icon to signify the classification. Like the VMware ESX Server, this icon will also change depending on the state of the virtual machine. Virtual Machine Manager shows relationships between physical and virtual objects using the VMM Systems Membership association within the IBM Director Console. For example:

VirtualCenter management server¹

¹ With VirtualCenter

- Farm grouping of Physical Hosts ¹
 - Physical Host ²
 - Virtual Machine²
 - Operating System/Agent²

Refer to Figure 42 – VMM Agent Discovery on page 31 for an example of the hierarchical view.

*	🏠 🦉 VMM Systems : VMM Systems Membership 🔻			
Name (arra	nged by Status) 🔺	TCP/IP Addresses	TCP/IP Hosts	
D- 🖳 MCE	Т30	192.168.0.51	mcet30.eeinc.us	
— 🕂 🛒 м	ICEFarm			
þ- <u>9</u>	🛛 🐏 mce4500.eeinc.us	192.168.0.54	mce4500.eeinc.us	
	🗕 🔟 篃 RHEL40VM1	{ '192.168.0.116' }		
	2-000 🔍 RHEL40VM2	{ '192.168.0.112' }		
	- 📙 rhel30vm2.eei	192.168.0.112		
	- 📶 🖵 SLES9VM1	{ '192.168.0.103' }		
	- 📶 🚰 SLES9VM2			
	- 📶 🔍 WS03VM1			
0	- 🔟 篃 WS03VM2	{ '192.168.0.115' }		
	└─ <u>/</u> ∰ VVS03VM2	192.168.0.115	W803VM2	
<u> </u>	🖳 🐏 mcex220.eeinc.us	192.168.0.52	mcex220.eeinc.us	
c d	⊐- <u>000 </u> ₩S03VM3			
	- 🖳 WS03VM3	192.168.0.108	WS03VM3	

Figure 42 – VMM Agent Discovery

When discovering the VirtualCenter host running the IBM Director Agent and VMM Agent, credentials must be specified to allow IBM Director to access VirtualCenter. This is accomplished by right-clicking on the VirtualCenter host, and selecting Coordinator Management \rightarrow Enter Credentials. The credentials specified are a User ID, Password, and Port used to access the VMware VirtualCenter Web Service. Refer to Figure 43 – VMM Credentials on page 31.

nter Credentials		_ 🗆 ×
<u>U</u> ser ID <u>P</u> assword Por <u>t</u>	8443	
	<u>O</u> K <u>C</u> ancel	H <u>e</u> lp

Figure 43 – VMM Credentials

Power Management

Virtual Machine Manager enhances the ability of the Power Management task, enabling you to perform power control of virtual machines. This includes:

- Power On
- Shutdown and Power Off
- Restart Now

¹ With VirtualCenter

² With or Without VirtualCenter

- Power Off Now
- Suspend
- Resume

Power Management tasks can be scheduled using the Job Scheduler to run at a specific time against any virtual machine. Note that the Shutdown and Power Off task requires a supported Operating System HAL/kernel.

Coordinator Management

These are tasks launched against the system running VirtualCenter, the IBM Director Agent, and the VMM Agent.

- Revoke Credentials
- Create VMM Farm
- Discover VMM Farms
- VMM Object Attributes

VMM Farm Management

These are tasks launched against the VMware Farms.

- Add Host to a VMM Farm
- Delete From Coordinator
- VMM Object Attributes

Host Management

These are tasks launched against the VMware hosts.

- Remove Host From VMM Farm¹
- Discover Virtual Machines²
- Create Virtual Machine²
- Register Virtual Machine ³
- Create Migrate All Task¹
- Power On All Stopped Virtual Machines²
- Force Power Off All Running Virtual Machines²
- Suspend All Running Virtual Machines²
- Resume All Running Virtual Machines²
- VMM Object Attributes²

Virtual Machine Management

These are tasks launched against the virtual machines.

- Delete From Disk²
- Create Single Migrate Task ¹
- Unregister From Host ³
- VMM Object Attributes²
- Set Resources²

¹ With VirtualCenter

² With or without VirtualCenter

³ Without VirtualCenter

Additional management tasks are available from the Tasks pane of the IBM Director Console. This includes the following:

Virtual Machine Manager Tasks

- Create VMM Farm ¹
- Help
- Migrate All Virtual Machine Tasks ¹

This task can be customized, allowing you to specify which host to migrate from and which host to migrate to. Additionally, you can specify to migrate to the host with the lowest CPU utilization. Refer to Figure 44 – Migrate All Virtual Machine Tasks on page 31.

- Migrate Single Virtual Machine Tasks¹
 This task can be customized, allowing you to specify which host to migrate a specific virtual machine to.
- Start Vendor Software ¹

🏥 Miç	grate All Virtual Machine Tasks		
File	Help Choose a Source Source Host	e Host and Destination for virtual machine migration.	
	Destination *Dynamic Migrati	Migrate to host with lowest CPU Utilization	
		Close	H <u>e</u> lp

Figure 44 – Migrate All Virtual Machine Tasks

Event Processing

Events from Virtual Machine Manager are published to the Event Action Plan Filter Builder. These events can be used as part of an Event Action Plan, to provide notification or initiate management of VMware ESX Servers or Virtual Machines. The following events are published automatically:

- Agent Extension
 - Status Change The VMM Agent is not running, it is not communicating with VirtualCenter, or it requires credentials to communicate with VirtualCenter
- Host
 - Started
 - Stopped
- Virtual Machine
 - Attribute Changed
 - Created
 - Deleted
 - Migration
 - Completed

¹ With VirtualCenter

- Started
- State
 - Pending
 - Powered Off
 - Powered On
 - Reset
 - Resumed
 - Suspended
 - Task Failed
- VMM Farm
 - Created
 - Deleted
 - Host Added
 - Host Removed
 - Renamed

Refer to Figure 45 – Published Events on page 31 for an example.

Simple Event Filter Builder: N	łew		
File Help			
Ľ			
Sender Name Event Text	Extended Attributes Syst	tem Variables	
Event Type	Severity	Day/Time	Category
specific event types, clear the Any check box.	VMM Agent Extension Agent Extension Host Oreated Orea	1	

Figure 45 – Published Events

Virtual Machine Manager also adds new Actions to the Event Action Plan Builder. These Actions can be used as part of an Event Action Plan to automate management tasks in response to an Event. This includes the following Actions:

- Add a Host to a VMM Farm
- Add a Host to Virtual Center
- Manage a Host
 - Start (VirtualCenter only)
 - Stop (VirtualCenter only)
 - Power off all virtual machines
 - Power on all virtual machines
 - Resume all virtual machines
 - Suspend all virtual machines
- Manage a Virtual Machine

- Power on
- Shutdown and power off
- Power off now
- Suspend
- Resume
- Restart now
- Remove a Host from a Farm

Refer to Figure 46 – Event Actions on page 31 for an example.

Actions	
ACUONS	
Add/Remove 'event' system to Static Group	
🕂 📑 Add/Remove source group members to target static group	
🕂 🐣 Add a Message to the Console Ticker Tape	
-BAdd to the Event Log	
🗕 强 Define a Timed Alarm to Generate an Event	
— 🖀 Define a Timed Alarm to Start a Program on the Server	
🗕 🕂 🗄 Log to Textual Log File	
—🖳 Manage a Host	
—🚅 Manage a Virtual Machine	
🚽 Post to a News Group (NNTP)	
—🚅 Remove a Host from a VMM Farm	

Figure 46 – Event Actions

Additional actions are available by using the action Start a Task on the "event" System to launch a migration task created from Host or Virtual Machine Management. Refer to Figure 47 – Start A Task Action on page 31.

🖳 Customize Action : Start a Task on the "event" System	- 🗆 ×
File Advanced Help	
1	
_ Task	
[Miscellaneous System Tasks][Shutdown]	•
Virtual Machine Manager][Migrate All Virtual Machine Tasks][MCE4500 to MCEx220][Execute] [VMM Farm Management][Start] [Software Distribution][IBM Director Capacity Manager Agent 5.10 (Windows)] [VMM Farm Management][Stop] [System Availability] [Remote Deployment Manager][Secure Data Disposal][Level-2: 1-Overwrite Security] [Prower Management][Restart]	
[Virtual Machine Manager][Migrate Single Virtual Machine Tasks][V/S03VM2 to MCEx220][Execute]	-

Figure 47 – Start A Task Action

Scheduled Tasks

Virtual Machine Manager Tasks can be executed on a reoccurring basis using the Scheduler. This includes the following:

- Coordinator Management
 - Discover VMM Farms
 - Revoke Credentials
 - Host Management
 - Discover Virtual Machines
 - Force Power Off All Running Virtual Machines
 - Power On All Stopped Virtual Machines
 - Remove Host From VMM Farm
 - Resume All Suspended Virtual Machines
 - Start
 - Stop
 - Suspend All Running Virtual Machines
- Virtual Machine Management
 - Delete From Disk
- Virtual Machine Manager
 - Migrate All Virtual Machine Tasks
 - Migrate Single Virtual Machine Tasks
- VMM Farm Management
 - Delete From Coordinator
 - Start
 - Stop

Refer to Figure 48 – Virtual Machine Manager Jobs on page 31 for an example.



Figure 48 – Virtual Machine Manager Jobs

For more information on Virtual Machine Manager, refer to <u>http://www-</u> 03.ibm.com/servers/eserver/xseries/systems management/ibm director/extensions/vmm.html.

Appendix

Inventory Data

Inventory Data	SNMP Agent	IBM Director	IBM Director	IBM Director
	5	Agent Level 0	Agent Level 1	Agent Level 2
Hardware				
Adapter				
Fibre Channel Adapter				
IDE Adapter				
Network Adapter	Х	Х	Х	Х
RAID Controllers				Х
SCSI Adapter				
Chassis				
BladeCenter Chassis VPD				
Chassis Members				
Chassis Mempership				
Device				
External				
- Keyboard				
- Pointing Device				
- Printer				
- RAID Enclosure				Х
Internal				
- IDE Device				
- Management Processor				
- Parallel Port				
- PCI Device			Х	Х
- SCSI Device				
- Serial Port				
- System Slots				
Memory				
Cache			Х	Х
Installed Memory	Х	Х	Х	Х
Logical Memory				
Memory Modules		Х	Х	Х
Network				
IP Address	Х	Х	Х	Х
IPX Address				
Management Processor Network Settings				
Network Adapter	Χ	X	X	Х
Operating System Specific				
Geographic			X	Х
LAN Network ID				
Lease			X	Х
Operating System	Х	Х	X	X
Regional			X	Х
Settings				
Alert On LAN Settings				
Alert Standard Format Settings				
ASP				

Inventory Data	SNMP	IBM	IBM	IBM
	Agent	Director	Director	Director
		Agent	Agent	Agent
AssettD		Level 0	Level 1	Level 2
AssetID Regio System Information	V	V	X	X
Basic System Information	X	X	X	X
CIM Device Drivers			X	X
Device Drivers			V	V
Director Agent		V		
		~		
FILL Service Numbers				
ID Address	×	~		
		^		
IPA Address	^			
Bereandized Date				~
Personalized Data			×	
Port Connectors				
Senai Number	×	V		
System Leastion	^	^		
System Location				
System Lloor				~
	×		~	
	^			
				^
Warranty			~	~
SMRIOS			^	^
Basabaard		Y	Y	Y
			X	X
On Board Device		X	X	X
Physical Enclosure		X	X	X
Processor	×	X	X	X
System BIOS	X	X	X	X
System Board Configuration		X	X	X
SNIMP		~		
SNMP Agent	X			
SNMP Agent Configuration			X	X
SNMP Trap Destinations	X			
SNMP Users				
Storage				
Disk		Х	Х	Х
Logical Drive		X	X	X
Partition		X	X	X
RAID Disk Drives	1			X
RAID Logical Drives				X
SMI-S Storage Device	1			
Software				I
Device Drivers				
Installed Packages	Х	Х	Х	Х
Installed Patches				
Software	1			

Table 1 – Inventory Data

Event Data Substitution

Some event actions allow the inclusion of event-specific information as part of the text message. Including event information is referred to as event data substitution. Refer to the help associated with a specific event action template for information on where event data substitution can be used.

The text of an event message is divided into keywords. When used in a message, a keyword must be preceded by the ampersand symbol (&). The keywords are:

&date	Specifies the date the event occurred.	
&time	Specifies the time the event occurred.	
&text	Specifies the event text, if supplied by the	
	event.	
&type	Specifies the event type criteria used to trigger	
	the event.	
&severity	Specifies the severity level of the event.	
&system	Specifies the name of the system for which the event was generated	
&sender	Specifies the name of the system from which	
	the event was sent. This keyword returns null if	
	unavailable.	
&group	Specifies the group to which the target system	
	belongs and is being monitored. This keyword	
	returns null if unavailable.	
&category	Specifies the category of the event.	
&pgmtype	Specifies a dotted representation of the event	
	type using internal type strings.	
×tamp	Specifies the coordinated time of the event	
	(milliseconds since 1/1 /1 970 12:00 AM GMT).	
&rawsev	Specifies the non-localized string of event	
	severity (FATAL, CRITICAL, MINOR,	
9 revuest	WARNING, HARMLESS, UNKNOWN).	
arawcal	Specifies the non-localized string of event	
2 oorr	Calegoly (ALENT, NESOLVE).	
	Belated events, such as those from the same	
	monitor threshold activation will match this	
&snduid	Specifies the unique ID of the event sender	
&svs uid	Specifies the unique ID of the system	
	associated with the event.	
∝:filename#propname	Specifies the value of the property string	
	propname from property file filename (relative to	
	\tivoliWg\classes).	
&sysvar:varname	Specifies the event system variable varname.	
	This keyword returns null if a value is	
	unavailable.	
&slotid:slot-id	Specifies the value of the event detail slot with	
	the non-localized ID slot Id.	
amabhash	Specifies the MD5 hash code (CRC) of the	
9 hoshtut	event data (good event specific unique ID).	
Anasnixi	Specifies a full replacement for the field with an	
&bashtyt16	Specifies a full replacement for the field with a	

	short MD5 hashcode (16-character hexcode) of the event text.	
&otherstring	Specifies the value of the detail slot with the localized label that matches otherstring. This ke.word returns OTHERSTRING if unavailable.	
Table 0 Event Data Outpatitutian		

Table 2 — Event Data Substitution

Note: When you specify an event data substitution keyword containing more than one word, substitute the underscore character ("_") for each space between words. For example, to use the keyword "User Login" you must enter "User_Logon" in the text of the event message. A sample entry containing this keyword might be: "User &User_Logon just logged on to the system."

Example of message text with event data substitutions:

Please respond to the event generated for &system, which occurred &date. The text of the event was &text with a severity of &severity.

References

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VMware ESX Server Administration Guide http://www.vmware.com/pdf/esx25_admin.pdf

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IBM Virtual Machine Manager <u>http://www-</u> <u>03.ibm.com/servers/eserver/xseries/systems_management/ibm_director/extensions/vmm.html</u>

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