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Abstract

VMware virtualization technology has changed the computing landscape, transforming IT infrastructure with market-leading virtual machine products. More and more enterprises are compelled to use resources more efficiently, respond quickly to business needs, and increase consistency of IT operations to reduce costs and deliver quality service at times of uncertainty. VMware vSphere™ is the industry’s first cloud operating system. It contains VMware® ESXi/ESX – a next-generation thin architecture hypervisor that provides an efficient foundation for building a dynamic and automated data center. VMware ESXi/ESX tightly integrates into HP ProLiant platforms for building next-generation data centers, simplifying virtualization deployments, and providing reliable management platforms. This document will clarify how adopting HP ProLiant with VMware provides organizations greater control, efficiency, and scalability.

Introduction

VMware vSphere takes advantage of the power of virtualization to transform data centers into simplified cloud computing infrastructures. It allows IT organizations to deliver the next generation of flexible and reliable IT services. With VMware vSphere providing the foundation for internal and external clouds, organizations of all sizes can achieve the full benefits of cloud computing:

- Reduced costs and maximum IT efficiency.
- Increased IT control through service level automation.
- Empower IT departments with choice.

VMware ESXi is the next-generation hypervisor, providing a new foundation for cloud infrastructures. This innovative architecture operates independently from any general-purpose operating system and offers improved security, increased reliability, and simplified management. The compact architecture is designed for integration directly into virtualization-optimized server hardware, enabling rapid installation, configuration, and deployment.

Functionally, ESXi 4 is equivalent to ESX 4, offering the same levels of performance and scalability, while reducing the footprint to less than 70MB of memory. ESXi 4 provides remote command line interfaces vSphere command line interface (vCLI), APIs for hypervisor and virtual machine management, and adherence to system management standards. Administrators can use the vCLI for storage, network, and host configuration, as well as for maintenance, patches, and updates. The automatic configuration capabilities in VMware ESXi provide detection, discovery, and intelligent-default configuration. Because ESXi is functionally equivalent to ESX, it supports the entire vSphere 4 suite of products and features.

Customers have the choice of deploying ESXi on HP ProLiant Servers either with select flash media devices or onto the local hard drive of a server. ESXi 4 also introduces support for PXE boot installation, which allows truly stateless compute nodes to be used. It takes just minutes to implement a virtualized environment. This innovative way of distributing virtualization technology removes time-consuming installation steps and simplifies host configuration.

HP VMware ESXi provides seamless, out-of-the-box integration with HP Systems Insight Manager (HP SIM), the industry’s only unified storage and server management platform. HP Systems Insight Manager 5.3.2, and later, software incorporates user-friendly features and an improved installation process, and it supports association and discovery for VMware ESXi. Customers can actively receive information about the health of their ProLiant servers with enhanced hardware alerting and inventory management. Companies can eliminate risk, lower potential costs, and resolve server problems before they result in actual downtime.
Operating systems and virtualization software support for ProLiant servers

HP delivers and supports a wide range of VMware products certified on ProLiant server platforms. For a complete and up-to-date listing of supported operating systems and versions, visit the ProLiant OS Support Matrix at http://h71028.www7.hp.com/enterprise/us/en/servers/4x-servers.html.

VMware ESXi integration with HP Systems Insight Manager

On its own, VMware ESXi provides a simplified approach to managing server compute nodes with a robust set of standards-based management capabilities, freeing the administrator from day-to-day tasks. Administrators can also use the vCLI for storage, network, and host configuration, as well as for patch maintenance and updates. HP enhances VMware ESXi manageability with HP Systems Insight Manager (HP SIM) integration, the industry’s only unified storage and server management platform.

ESX users typically use the service console to run hardware agents for performance and health monitoring. However, ESXi enables an agent-less approach to monitoring through industry-standard protocols like Common Information Model (CIM). VMware ESXi Embedded incorporates HP Insight Management Web-based Enterprise Management (WBEM) providers, which use the CIM standard to represent systems, networks, applications, devices, and other managed components in an object-oriented fashion. HP bases its providers on the SMASH and SMI-S standards, extending those data models as necessary to support features specific to ProLiant platforms. These providers are also bundled with VMware ESXi Installable to provide seamless, out-of-the-box integration with a large variety of HP systems.

Figure 1 shows the Systems Management software included with the VMware ESXi. HP SIM and vCenter Server are available separately.

---

1More information about CIM, Systems Management Architecture for Server Hardware (SMASH), and Storage Management Initiative Specification (SMI-S) is available in Appendix A.
Hardware monitoring with HP Systems Insight Manager

Insight Providers collect data from sources such as drivers and system firmware to populate the CIM data model. HP SIM receives the system hardware inventory and hardware health monitoring data. Table B-1 in Appendix B lists the component information provided by the environment by data source.

The Insight Providers for ESXi collect management data from the ProLiant base server system and its processor, fan, power supply, memory, network, storage, and network subsystems. Additionally, the Insight Providers for ESXi 4.0 collect management data from the following sources:

- Smart Array Providers - Smart Array controller, external storage enclosure, internal drive cage, data and spare drive and logical volume information.
- Networking Providers - Ethernet ports, statistics, port link status, IP and MAC addresses.
- PCI Providers - PCI device, adapter card and slot information.
- Sensor Providers - Temperature sensors information (for CPU, chassis, memory), temperature sensors threshold values and current readings.
- Software Inventory - Ethernet adapter driver versions, CIM provider version and Server Active ROM and redundant ROM versions.

Information provided includes properties and health status for all individual devices and redundant sets per subsystem, plus real-time event notifications. The Insight Providers deliver in-depth hardware management, inventory data, system state, and event notifications through HP SIM. The providers will report a range of server information such as server model, name, serial number, IP address, OS, and universal unique identifier (UUID), including overall server or consolidated health status through the HP SIM systems page. Each subsystem provider will report individual configuration and status information through HP SIM property pages. Figure 2 shows an example of physical memory information, such as the socket number on the processor board, size, and status.

![Figure 2. HP SIM Physical Memory status](https://10.1.1.249:50000/macpropertypages.jsp?system=16.84.198.130&dsnname=1b. - Win)

<table>
<thead>
<tr>
<th>Properties: 16.84.198.130</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Memory</strong></td>
</tr>
<tr>
<td>Status</td>
</tr>
<tr>
<td>OK</td>
</tr>
<tr>
<td>OK</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fans</th>
<th>Network</th>
<th>Physical Memory</th>
<th>Power</th>
<th>Processor(s)</th>
<th>SA HBA</th>
<th>Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
During the identification process, HP SIM determines whether or not a managed node is running the ESXi operating system. If an ESXi operating system is running, HP SIM attempts to contact both the VMware providers and HP Insight Providers. HP SIM identification communicates with these providers so that it can immediately contact and collect data from the appropriate providers. HP Insight Management WBEM Providers report the most up-to-date information regarding the hardware in two ways: polling the system in two minute increments and, for some subsystems, sending alerts when something has occurred on the hardware.

Figure 3 shows examples of sensors that can be monitored using HP SIM and Insight providers. The image also shows the type of sensor, its state, and, in certain cases, its location, for example, fans, power meter, and so forth. Table B-1 in Appendix B lists the component information provided by the environment according to data source.

Figure 3. HP SIM list of monitored sensors

Proactive notification of server issues

An indication is a Distributed Management Task Force (DMTF) concept that formalizes an event representation into an instance of a CIM class. In order for the management application, in this case HP SIM, to receive event notification from the Insight Providers for ESXi, a subscription to WBEM events must be initiated from the management application. Once the subscription is made, the Insight Providers for ESXi will start delivering indications to the management application server as events
occur. The server consolidated health status is updated as the indication is delivered. Every event or indication is delivered with the following information from the computer system generating the event:

- Event time
- Computer system name
- HP Insight Management WBEM Provider version
- Computer system IP address
- Computer system OS name
- Computer system serial number and Globally Unique Identifier (GUID)
- Computer system product ID and model name
- Severity
- Recommended action
- Probable cause

Figure 4 shows examples of event notifications. Here it can be seen that each notification has a status, severity, system name, and event occurrence time associated with it.

The Insight Providers deliver component information such as temperature, status (failed, repaired, degraded), and redundancy. This data comes from sources such as the main (base server) system, processor (CPU) subsystem, fan subsystem, power supply subsystem, memory subsystem, storage subsystem, and network subsystem.
HP VMware ESXi provider and profile summary

The Insight Providers conform to the Systems Management Architecture for Server Hardware (SMASH) and Storage Management Initiative Specification (SMI-S) standards. The Insight Providers extend the CIM data model to provide administrators with information specific to ProLiant platforms. The Insight Providers collect data from various sources such as drivers and system firmware to populate the data model. HP SIM 5.3.2 or later provides seamless integration with the Insight Providers for ESXi, including identification, inventory, event monitoring, and status polling.

ProLiant server information available using VMware’s vSphere client and vCenter Server

Two versions of management software are also available directly from VMware:

- VMware ESXi includes a client application utility named vSphere client. vSphere client is a system management program primarily focused on the management of virtual machines on individual servers with certain hardware management capabilities included. vSphere client uses VMware CIM providers to retrieve server hardware component information.

- VMware vCenter Server is another VMware management application available from the VMware website. VMware vCenter Server is a system management program primarily focused on the management of virtual machines with certain hardware management capabilities included. VMware vCenter Server is capable of simultaneously managing multiple servers. It uses vSphere client as its primary user interface to access each server.

Currently, vSphere client can display certain ProLiant server information by retrieving and decoding data using the standard Intelligent Platform Management Interface (IPMI). However, this interface is limited and there is more detailed ProLiant server information available that vSphere client may display incorrectly or not display at all (depending on vSphere client version) due to the HP IPMI OEM-specific data implementation.

Comparison of HP SIM with HP Insight Providers and vCenter Server/vSphere Client with VMware providers

The optimum system management environment for HP ProLiant servers is HP SIM with the HP Insight Providers. This configuration gives HP ProLiant servers a superior set of management capabilities. Table B-1 in Appendix B provides a side-by-side comparison of the information available in each environment, sorted by data source.

Managing HP VMware ESXi

With HP VMware ESXi, ProLiant customers can plug new servers directly into their existing VMware vSphere client environments, while ensuring active hardware management using Insight Providers.

HP VMware ESXi does not provide support for the System Management Homepage (SMH). In place of SMH, HP SIM should be used to view management information for ProLiant servers running ESXi.

VMware ESXi provides a simplified approach to managing server compute nodes, with a robust set of standards-based management capabilities. Administrators can also use the integrated remote CLI for storage, network, and host configuration, as well as for maintenance, patches, and updates. The automatic configuration capabilities in VMware ESXi provide detection, discovery, and intelligent-default configuration.

HP VMware ESXi management capabilities are numerous:
Remote Command Line Interface. It is possible to manage VMware ESXi through a remote execution environment that can run VMware ESXi command scripts.

Advanced manageability and usability features. Users can manage the entire virtualized IT environment with VMware ESXi.

VMware’s vSphere client. Users can manage VMware ESXi, virtual machines, and (optionally) VMware vCenter Server with a common user interface.

VMware View Portal. VMware ESXi can be managed with simple Web interface (formerly known as the Management User Interface, or MUI).

Virtual machine shortcuts. For self help, users have direct access to virtual machines through a Web browser.

Remote devices. It is possible to install software in a virtual machine running on a server from the CD-ROM of a desktop.

Agent-less Hardware Management with CIM. CIM provides a protocol for monitoring hardware health and status through VMware vCenter Server.

Using HP-SIM to manage servers running ESXi

HP SIM 5.3.2 or later and the Insight Providers are fully integrated to support identification, inventory, event monitoring, and status polling. In order for HP SIM to successfully identify a VMware ESXi managed node, the user must enter system level WBEM credentials. The WBEM credentials can be entered through the “First Time Wizard,” through the Global Protocol Settings page, or through the Systems Protocol Settings page.

The “First Time Wizard”

When HP SIM is started for the first time, it raises the First Time Wizard. The First Time Wizard allows the user to enter a variety of HP SIM configuration parameters:

- Managed Environment: Specifies all operating systems managed by the Central Management Server (CMS).
- System Automatic Discovery: Use the wizard to enable discovery, set up the discovery schedule, and enter the IP address ranges or host names of the systems to discover.
- Credentials: Use the wizard to set the sign-in credentials and the SNMP credentials for the System Automatic Discovery task.
- Configure Managed Systems: Configure managed systems as they are discovered, by configuring WBEM and WMI, SNMP, SSH access, and trust relationship.
- Privilege Elevation: Enable privilege elevation if, on HP-UX, Linux, and ESX managed systems, you are required to sign in as a non-root user and then request privilege elevation to run root-level tools.
- E-mail: Enter the e-mail settings that the CMS will use to send e-mail notifications. You can set up Automatic Event Handling tasks that prompt HP SIM to send e-mails when the CMS receives a specific event.

The WBEM credentials entered here are applied globally (see Figure 5).
**Figure 5. HP SIM First Time Wizard credential screen**

**First Time Wizard**
Configure HP Systems Insight Manager settings

**WBEM**
Options ➔ Protocol Settings ➔ Global Protocol Settings

HP Systems Insight Manager uses the WBEM protocol to identify and communicate with managed systems.

**WBEM / WinM Global Protocol Settings**

In the fields below, enter the default WBEM / WinM user names and passwords. These defaults apply to newly discovered systems. For Windows-based systems, user names should include the domain, for example, domain\username.

<table>
<thead>
<tr>
<th>User name</th>
<th>Password</th>
<th>Confirm password</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default 1</td>
<td>host</td>
<td>*********</td>
</tr>
</tbody>
</table>

**WMI Mapper Proxy**

In order to communicate with Windows systems, which use Windows Management Instrumentation (WMI), a WMI mapper proxy must be configured so that HP Systems Insight Manager can retrieve managed system data via the proxy.

Enter the mapper proxy system hostname and port number below. Make sure the user name and password credentials for this system are included in the Global Protocol Settings above.

- **Hostname**: enter.mappertp.com
- **Port Number**: 5989
Global Protocol Settings page

A user may enter credentials in the global protocol settings page at any time by navigating to Options-->Protocol Settings-->Global Protocol Settings. When discovery runs (default schedule is once daily) or when new nodes are discovered, the global WBEM credentials are used to identify WBEM on the managed node (see Figure 6). If the ESXi managed node has already been discovered and does not have WBEM listed as a management protocol, then the user must run Options-->Identify.

Figure 6. HP SIM Global Protocol Settings page
System Protocol Settings page
If the user does not supply credentials at the global level, then the user can declare the credentials at the managed node level. From the System page the user selects the “Tools & Links” tab, “System Protocol Settings.” Once the system credentials are entered, the user must run “Identify” so that the credentials are validated (see Figure 7). The credentials will only be applied to the managed node that is selected.

Figure 7. HP SIM System Protocol Settings page
The HP SIM Systems page provides an overview of the managed node. The Systems page summary includes IP and DNS information, links to additional management tools such as property pages, and WBEM events list. Figure 8 provides examples of how the HP SIM Systems page integrates with HP Insight Providers.

**Figure 8.** HP SIM Systems Page for an ESXi host server
HP SIM can subscribe for and receive WBEM indications. These indications are asynchronous alerts that give HP SIM users a real-time status for hardware components that are experiencing problems. Figures 9 and 10 provide an example of how WBEM indications are activated and deactivated. Figure 9 depicts an example of how these indications are reported using the HP SIM interface. Each indication or event in the Events list contains a link that will provide a detailed display of the indication content.

To create a subscription in the user interface, click **Options → Events → Subscribe to WBEM Events**. The user does not have to supply any specific information; it is generated by HP SIM.

**Figure 9.** Subscribing for WBEM indications using the HP SIM user interface
Alternatively, users may choose to create subscriptions using the CLI:

```
Mxwbemsub -a -n <node name>
```

Users can specify which HP SIM Central Management Server (CMS) is the destination address for the WBEM subscription. In the example shown in Figure 10, the HP SIM CMS is not declared and the local CMS is being used as the destination.

Figure 10. Subscribing for WBEM indications using the HP SIM CLI, and a list of existing subscriptions

**Status Polling**

The Status Polling module allows HP SIM to keep status up to date and provides a timely and accurate depiction for users. The depiction uses status icons to indicate condition status; this allows the user to drill down through status screens following the top-level status through various levels to identify the specific instance of offending hardware. Figure 11 shows the status icons along with their associated severity level.

Figure 11. Status icons and their respective health status definitions
Every five minutes, HP SIM Status Polling collects an overall status value from the Insight Providers. This polling task collects the overall status from all WBEM protocol nodes. In Figure 12, the circled item shows the health status on the SIM systems page. This example indicates that a Major condition exists.

Figure 12. Health Status link
Identifying problems with hardware components

HP SIM, using HP Insight Providers, provides a way to identify malfunctioning hardware components. The Systems page Health Status link reflects the status reported by the providers. Select the Health Status link to navigate to the SIM Property Pages status tab. The following example illustrates an error status in HP SIM. Selecting the Health Status link launches the SIM property pages. The property page status tab then shows the error status is traceable to Power Supply 2, as shown in Figure 13.

Figure 13. Following a status to the offending hardware instance
**Data Collection and Reporting**

HP SIM Data Collection and Reporting inventories the hardware and software/firmware on the managed node. This data is cached within SIM so that a user can compare inventories at different points in time or compare the hardware configuration on different servers. By default, data collection is run bi-weekly (administrators can alter the collection interval).

SIM provides a default Data Collection Report. The default report link (Figure 14) can be found on the Systems Page under the Tools and Links tab. This default report (Figure 15) contains an overview of the OS and hardware/software inventories.

---

**Figure 14.** Default Data Collection Report link on System Page

![Default Data Collection Report link on System Page](image-url)

---

**Figure 15.** Default Data Collection Report content

![Default Data Collection Report content](image-url)
Figure 15. Default Data Collection Report excerpt

<table>
<thead>
<tr>
<th>Product SubType</th>
<th>Product ID</th>
<th>Product Model</th>
<th>Serial Number</th>
<th>Serial Number (Logical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP ProLiant</td>
<td>491505-001</td>
<td>ProLiant DL380 G6</td>
<td></td>
<td>2U15923087U</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version</th>
<th>Operating System Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0.0</td>
<td>Hypervisor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU Family 170 Model 10 Stepping 5)</th>
<th>CPU Speed (MHz)</th>
<th>Slot Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2000</td>
<td>1</td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>1</td>
</tr>
<tr>
<td>2000</td>
<td>2000</td>
<td>1</td>
</tr>
</tbody>
</table>

- for accessing management information in an enterprise environment. Provides an operating system interface through which instrumented components provide information and
- for accessing management information in an enterprise environment. Provides an operating system interface through which instrumented components provide information and
- for accessing management information in an enterprise environment. Provides an operating system interface through which instrumented components provide information and

<table>
<thead>
<tr>
<th>Revision</th>
<th>Status</th>
<th>Condition</th>
<th>Maximum Capacity (watts)</th>
<th>Used Capacity (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(KB)</th>
<th>Memory Technology</th>
<th>Part Number</th>
<th>Serial Number</th>
<th>Location</th>
<th>Location ID</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- unavailable | Undefined |
- unavailable | Undefined |

<table>
<thead>
<tr>
<th>Sensor Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp 1 (13.0.12.30)</td>
</tr>
<tr>
<td>Temp 2 (14.0.12.30)</td>
</tr>
<tr>
<td>Temp 3 (15.0.12.30)</td>
</tr>
</tbody>
</table>
SIM also allows an administrator to create custom reports for one or more managed nodes (Figure 16). A user can select one or more reporting categories and select individual properties from each category. The report can be exported to XML or CSV.

**Figure 16.** Reporting Menu

**New Report**
Create a report for the target systems

Targets: prwSnS2

**Step 2: Specify Parameters**

Report name: 

Select items to show in report:

- General
- UNIX
- HP-UX only
- Cellular
- Virtual Machines
- Storage
- Events
- Others

Layout for generated or saved report:

- Show all systems in the same table
- Show each system in a separate table

Format for current run of generated report (format not saved with report):

- HTML (Recommended for viewing)
- XML
- CSV
Property pages

HP SIM Property pages (Figure 17) display overall server characteristics, status information, and configuration/inventory data. The Property page data, prepared and reported in real time, is exclusively WBEM data.

Figure 17. Property page examples

- [Image of Property page examples]
Indications in the HP SIM user interface

The Insight Providers for ESXi deliver indications to HP SIM as events occur. HP SIM receives notification by monitoring a change in state that generates an instance of an indication for a particular event. Indications are displayed in All Events or on an individual system basis under the System Page Events tab (Figure 18). Open an event to get more details.

Figure 18. Indications in the Events tab
Troubleshooting WBEM Indications in HP SIM
Follow these steps if a subscription fails:

1. Make sure WBEM is a discovered protocol on the managed node: Systems Page->Product Description table->Management Protocols.
2. Make sure the node is accessible: Properties link on the Systems Page or Options->Identify.

Follow these steps if no indications display in HP SIM:

1. Select Options->Events->Event Filter Settings.
2. Select Accept unregistered events as highlighted in Figure 19. This option is not selected by default.
3. Try to list the known subscriptions: `Mxwbemsusb -l -n <node name>`

Running the list command contacts the Small Footprint CIM Broker (SFCB) CIMOM on the ESXi managed node and searches for the subscription.

---

**Figure 19. Event Filter Settings**

Specify settings on the central management server for filtering registered and unregistered events by severity (registered events only) and IP address.

Enter IP range (e.g., 172.25.76.18 - 172.25.76.100), individual IP address, or host name, or simply enter an asterisk (*) to accept SNMP traps from all ranges.

- **Accept SNMP traps from discovered systems in IP ranges**: `*`
- **Discard SNMP traps from discovered systems in IP ranges**: `*`
Using HP Insight Control /Virtual Machine Manager to manage ESXi

HP VMware ESXi can be managed (Figure 20) in HP Insight Control /Virtual Machine Manager (VMM). The following features are supported for HP VMware ESXi:

- Copy/move virtual machine
- Create/deploy virtual machine guest template
- Create virtual machine guest back-up
- Restore virtual machine guest back-up
- Recover virtual machine of a failed host
- Handle pre-failure alerts – move virtual machines to alternate hosts before server failure
- Start/Stop/Suspend/Resume virtual machine guests
- Performance data information of virtual machine hosts

Figure 20. VMM management features for HP ESXi

Note:
The Copy/Move operations require that the ESXi host be managed by vCenter Server and the vCenter Server credentials be specified through HP SIM. The failed host recovery and handling pre-failure alert feature uses VMware’s VMotion.
Hardware Monitoring using vSphere Client and VMware vCenter Server

There are two ways to view server hardware information using vSphere software:

- vCenter Server is the tool which provides unified management of all the hosts and VMs in your data center from a single console with an aggregate performance monitoring of clusters, hosts and VMs. It uses a client application utility named vSphere Client as its primary user interface.
- A standalone VMware ESXi installation can also be managed with vSphere Client. Although it only provides a subset of functionality available when used with vCenter Server, it does include the capability to retrieve server hardware component information.

To manage a single ESXi host server, run the vSphere Client tool to connect to the ESXi host server by supplying the server’s IP address and user root login credentials. The vSphere Client interface provides system hardware inventory and server administration functions.

Under the Inventory view, the vSphere Client has multiple tabs that group the server information being displayed, including management tasks that can be performed on the server. The Summary tab shows general information about the server and allows creation of new virtual machines, new resource pool, entry to maintenance mode, and reboot and shutdown of the ESXi server. Other tabs show the virtual machines created, CPU and memory allocation, real-time CPU performance chart, and user permissions. The Configuration tab displays all server hardware inventory data, some software inventory, and updated overall server, subsystem and individual device health status. Figure 21 shows the Health Status page displayed by the vSphere Client.

Figure 21. Configuration tab Health Status data from an ESXi server
The Events tab shows all management actions performed on the ESXi host. To view these events, the vSphere Client must be connected to the vCenter Server.

The Alarms tab shows all the alerts that have been triggered for a host, as well as all the Alert definitions that pertain to that host. These alerts may be defined for the particular host, or may be defined at a higher level in the inventory and inherited by the host. vCenter Server can set alerts based on hardware health such as fan or power supply state. Table A-1 in Appendix A lists the hardware information that vCenter Server can monitor and provide alarms for. Figure 22 shows an example of an alert that has been triggered on an ESXi host in vCenter Server and in HP SIM.

Figure 22. Alarms on ESXi host using VMware’s vCenter Server
Insight Remote Support integration

The HP Insight Remote Support Software is a portfolio of infrastructure remote support software that automatically provides continuous secure remote support for HP servers and storage. Systems can be remotely monitored for hardware failure using proven secure technology. In many cases, problems can be avoided before they occur. HP Insight Remote Support is integrated with HP Systems Insight Manager (SIM) and provides the following:

- Continuous remote monitoring of the hardware environment
- Automatic event generation and routing
- Alerts to accurately diagnose and receive support
- Proactive advisories to improve the hardware environment.
- Detailed fault analysis of environment hardware
- Warranty and Service Contract entitlement management

HP Insight Remote Support Standard

HP Insight Remote Support Standard requires access to an encrypted outbound initiated Internet connection (HTTPS/443). This secured internet technology used is considered acceptable within most companies’ security policies. For customer IT environments with 1 to 10 servers, HP recommends installing and using the HP Insight Remote Support Standard. From 11 to 50 server environments with limited IT Staff, HP recommends using HP Insight Remote Support Standard, unless the customer prefers using HP Systems Insight Manager and the more advanced HP Insight Remote Support Pack. When a customer’s environment grows more complex, it is easy to migrate from HP Insight Remote Support Standard to HP Insight Remote Support Pack with HP SIM.

HP Insight Remote Support Pack

The HP Insight Remote Support Pack is the comprehensive remote support software product in the HP Insight Remote Support software portfolio. It is ideal for use in mid-sized to large IT environments where customers require a local management console. Incremental to the Insight Remote Support Standard features, it provides comprehensive remote support, including fault diagnostics, pre-failure advisories, warranty, and service status. Its console integrates with the HP SIM central management server console. The console allows the skilled IT operator to set boundaries and thresholds of the IT environment to be remotely supported. For IT environments with 50 or more servers with technical IT staff, HP recommends using the HP Insight Remote Support Pack with HP SIM.

HP Virtualization Bundles

The HP Virtualization bundles are the world’s first end-to-end solution that delivers high application availability without external storage. An Illuminata© white paper explains how these easy-to-buy bundles reduce the complexity of virtualization. Many small and mid-sized organizations are using server virtualization to achieve cost reductions by up to 52% by reducing the number of servers or to provide cost-effective high availability failover. To take advantage of some of the most critical features in VMware vSphere, customers need to implement high availability storage area networks. For many midsized customers, this is a challenge because adding external storage increases their hardware costs and impacts overall IT management. The HP Virtualization bundles allow an organization to pool all of the storage that is either inside a ProLiant server or directly attached to it, into one virtualized pool of storage. Combined with HP ProCurve data center networking solutions, this allows an organization to quickly implement a fully virtual infrastructure, with all of its benefits, using pre-tested building blocks.
Appendix A: Changing standards in the server management environment

The system management world is moving to standards other than Simple Network Management Protocol (SNMP) because SNMP-based management solutions have received increased scrutiny for their simple structure and weak security protocol relative to current alternatives. SNMP is a management standard in widespread use for a variety of management needs. It is a lightweight, mature, and non-proprietary standard. However, there are limitations to SNMP server management:

- **No guaranteed delivery:** The UDP transport mechanism used with SNMP does not provide guaranteed delivery of alerts, events, or queries.
- **Limited security:** The most commonly used versions of SNMP, SNMP v1 and v2, do not provide security features such as message authentication and encryption. SNMP does not use Secure Socket Layer (SSL).
- **Requires customization:** The management information base (MIB) data structures use discrete islands of information that are adequate for representing devices but not other components such as applications, services, or their associations.
- **No automation:** Managing servers with SNMP-based agent configurations can be a labor-intensive process.

Management tools are being deployed today in much greater volumes to improve system availability and IT operational efficiency in data centers and remote server locations. As server technologies have multiplied in the areas of auditing, security, remote access, automation, individual server management, and management of multiple systems, the need to converge on a consistent solution has emerged. Customers have many needs:

- **Standardized ways of representing and transmitting management data independent of the server hardware, management console, or the state of the server.**
- **More reliable, routable, and secure protocols for communicating between management consoles and the managed devices.** Administrators need to be able to manage servers regardless of their physical location. Administrators also need to ensure that their ability to access servers remotely does not increase server vulnerability to viruses or other problems.
- **Management applications that are easily configured, thus reducing initial configuration times and the number of mistakes.**

VMware ESXi for ProLiant uses the emerging standard and industry trend of provider-based, Common Information Model (CIM) management standards and infrastructure. WBEM uses the CIM standard to represent systems, networks, applications, devices, and other managed components in an object-oriented fashion. In addition, Systems Management Architecture for Server Hardware (SMASH) and Storage Management Initiative Specification (SMI-S), secure and robust standards being driven by the Distributed Management Task Force (DMTF) and Storage Networking Industry Association (SNIA) organizations, are quickly gaining momentum. The HP Insight Management WBEM Providers (Insight Providers) are based on the SMASH and SMI-S standards, and further extend them to support information that is specific to ProLiant platforms.

**Web-based Enterprise Management**

WBEM is a set of management and Internet standard technologies that have been brought together by the DMTF to unify enterprise computing environment management. The core set of WBEM standards includes a data model (CIM) and a management protocol. The original WBEM protocol, CIM-XML, is in widespread use on Linux and UNIX systems and is the foundation for the SMI-S.

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2 DMTF WBEM Definition, 2005, [www.dmtf.org/standards/wbem](http://www.dmtf.org/standards/wbem)
WBEM has been broadened to include Web Services for Management (WS-Management) as an alternative management protocol.

WBEM is generally viewed as more versatile than previous management standards such as SNMP because of its richer data model, which includes associations and inheritance, and its web-based protocols. Security can be built into WBEM more simply than into SNMP because it can leverage more secure, web-based protocols such as HTTPS.

Common Information Model

CIM is defined by the DMTF. It is the data model standard used in many management applications. A data model represents the elements of a system, including hardware, OS, and applications. It defines elements from network and storage hardware, as well as servers. It also defines the associations between those elements. Because it defines the management data in a common way, it enables management tools from a variety of vendors to be platform independent. CIM is a conceptual information model for describing management that is not bound to a particular implementation. This allows for the interchange of management information between management systems and applications. This can be either "agent-to-manager" or "manager-to-manager" communication that provides for Distributed System Management (DSM). CIM is the underlying data model for management initiatives such as SMASH and SMI-S. CIM is also the data model used by tools such as HP Systems Insight Manager (HP SIM) and HP OpenView.

Systems Management Architecture for Server Hardware

SMASH is a management initiative driven by the DMTF that specifies the data model (based on CIM) and protocols to be used for managing server hardware. It is a comprehensive management initiative, designed to address a need for cross-platform standards to manage servers from multiple vendors. It is routable, secure, and uses common industry-standard protocols. SMASH is specifically designed to manage servers using a lightweight CIM object model that is a subset of the CIM Schema.

The Server Management Command Line Protocol (SM CLP) is one of the protocols specified by SMASH. It consists of human-oriented commands that are also suitable for use with scripts. SM CLP supports network access through Telnet and also Secure Shell v2 (SSHv2) for secure access. The SM CLP provides a lightweight command line syntax that allows systems from different vendors to be represented in similar ways. Products from server vendors, including standalone servers, server blades, rack servers, and partitionable servers, can support SM CLP commands. As a result, users on a management station or a client can execute common operations such as system power-on and power-off, system log display, boot configuration, and text-based remote console using the same commands across disparate vendor platforms. Since SMASH standardizes only the messages exchanged with management applications, it provides a high degree of interoperability for performing functions, regardless of the actual feature implementation.
Appendix B: Hardware information available in management tools

Currently, vSphere Client can display certain ProLiant server information by retrieving and decoding data using the standard Intelligent Platform Management Interface, such as individual and overall status, main system, processor, fan, power supply and memory subsystem.

However, there is more detailed ProLiant server information available with HP SIM. It provides more comprehensive details:

- Main System ranging from temperature and health status to OS version.
- Processor subsystem including chip model to processor collection health status.
- Fan subsystem inclusive of redundancy set and health status.
- Power supply subsystem removal conditions and temperature operating range.
- Memory subsystem from manufacturing details to memory collection health status.

Table B-1 provides a side-by-side comparison of the information available in each environment, sorted by data source.

Table B-1. Comparison of information provided by data source

<table>
<thead>
<tr>
<th>Data source</th>
<th>HP SIM</th>
<th>vCenter Server and vSphere Client</th>
</tr>
</thead>
</table>
| Main System (Base Server) System | - System temperature exceeded normal operating range  
- System temperature has returned to normal operating range  
- Server model, serial number, product number and universal unique identifier (UUID)  
- System OS name, type, version number and description  
- Leverage VMware providers Host/Guest associations for virtual connections to blade servers  
- Leverage VMware providers for sensors  
- Computer System Consolidated health status | - Individual and overall temperature sensor health status, including temperature readings  
- System manufacturer, model, BIOS version and date |
| Processor (CPU) Subsystem | - Processor temperature exceeded normal operating range  
- Processor temperature has returned to normal operating range  
- Individual processor number, core and thread number, speed, physical socket location and health status  
- Individual processor chip model, manufacturer, version  
- Individual processor cache size, line size, cache level and type, read and write policy and health status  
- Processor collection health status | - Individual and overall processor health status  
- Individual processor model, speed, sockets, cores, logical processors |
| Fan Subsystem | - Individual fan type, variable speed support, physical fan location and health status  
- Fan module removal conditions and | - Individual and overall fan health status |
<table>
<thead>
<tr>
<th>Data source</th>
<th>HP SIM</th>
<th>vCenter Server and vSphere Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>package type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan collection health status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan redundancy set, number of fans, associations with individual fan members, and redundancy status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply Subsystem</td>
<td>• Individual power supply type, physical power supply location and health status</td>
<td>• Individual and overall power supply health status</td>
</tr>
<tr>
<td></td>
<td>• Individual power supply module removal conditions and package type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Power supply collection health status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Power supply redundancy set, number of power supplies, associations with individual power supply members, and redundancy status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Power supply temperature exceeded normal operating range</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Power supply temperature returned to normal operating range</td>
<td></td>
</tr>
<tr>
<td>Memory Subsystem, Version 2.0 only</td>
<td>• System memory capacity, starting and ending address, and health status</td>
<td>• Overall memory health status, and total physical system memory</td>
</tr>
<tr>
<td></td>
<td>• Individual memory module manufacturer, part number, serial number, removal conditions, data and total width, capacity, speed, type, position, form factor, bank label, SPD byte, location and health status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Individual memory board package type, removal conditions, hosting board, locked state, number of sockets, available memory size, total memory size, location and health status</td>
<td></td>
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<tr>
<td></td>
<td>• Individual memory module slot connector layout, gender and description, location, and health status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Version 2.0: memory redundancy set type, load balance algorithm, operating speed, available and total memory size, current, target and available configurations, and redundancy status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Version 2.0: memory collection health status</td>
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</tr>
<tr>
<td></td>
<td>• Memory module has failed or is predicted to fail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Memory board error</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Memory redundancy degraded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Memory recovered from degraded redundancy</td>
<td></td>
</tr>
</tbody>
</table>
For more information

For additional information, refer to the resources listed below.

<table>
<thead>
<tr>
<th>Resource description</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Systems Insight Manager</td>
<td><a href="http://www.hp.com/go/hpsim">http://www.hp.com/go/hpsim</a></td>
</tr>
<tr>
<td>HP ProCurve</td>
<td><a href="http://www.procurve.com/">http://www.procurve.com/</a></td>
</tr>
<tr>
<td>VMware ESXi</td>
<td><a href="http://www.vmware.com/products/vi/esx/esx3i.html">http://www.vmware.com/products/vi/esx/esx3i.html</a></td>
</tr>
<tr>
<td>VMware Documentation</td>
<td><a href="http://www.vmware.com/support/pubs/">http://www.vmware.com/support/pubs/</a></td>
</tr>
</tbody>
</table>

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