



Management of VMware ESXi™ on HP ProLiant Servers

WHITE PAPER

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Introduction

VMware vSphere™, the industry's first cloud operating system, leverages the power of virtualization to transform datacenters into dramatically simplified cloud computing infrastructures, and enables IT organizations to deliver the next generation of flexible and reliable IT services. It does this by using internal and external resources securely and with low risk. With vSphere providing the foundation for internal and external clouds using federation and standards to bridge internal and external cloud infrastructures, organizations of all sizes can achieve the full benefits of cloud computing including:

- 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 offering improved security, increased reliability, and simplified management. The compact architecture is designed to integrate directly into virtualization-optimized server hardware—enabling rapid installation, configuration, and deployment.

Functionally, VMware ESXi 4 is equivalent to ESX 4, offering the same levels of performance and scalability. However, the Linux-based service console has been removed—reducing the footprint to less than 70MB of memory. The functionality of the service console is replaced by remote command line interfaces (such as the vSphere CLI or vCLI and the PowerCLI, which is a PowerShell-based interface), APIs for hypervisor and virtual machine management, and adherence to system management standards. Administrators can use the vCLI or PowerCLI 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 VMware ESXi is functionally equivalent to VMware ESX, it supports the entire vSphere suite of products and features.

Customers have the choice of deploying VMware ESXi on HP ProLiant Servers either with select flash media devices (known as VMware ESXi Embedded) or on to the local hard drive of a server (known as VMware ESXi Installable). VMware ESXi 4 also introduces experimental support for PXE boot installation, enabling 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 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 vSphere command line interface (vCLI) for storage, network, host configuration, as well as for maintenance of patches and updates.* HP adds to the manageability of VMware ESXi by integrating with HP Systems Insight Manager (HP SIM), the industry's only unified storage and server management platform.

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VMware ESX users typically use the service console to run hardware agents for performance and health monitoring. However, VMware ESXi enables an agentless approach to monitoring via industry-standard protocols like CIM (Common Information Model). 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 SMASH¹ 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 VMware vCenter™ are available separately.

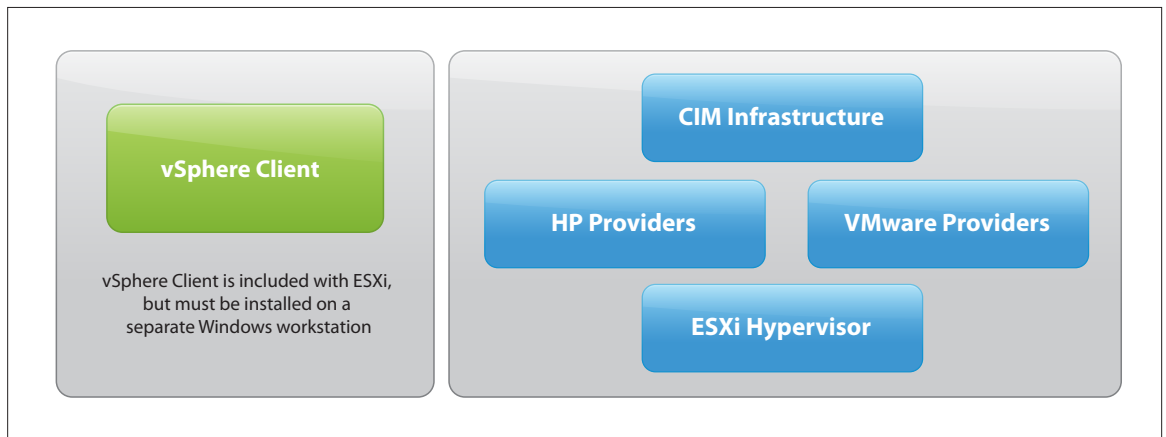


Figure 1. Software included with VMware vSphere ESXi

Hardware Monitoring with HP System Insight Manager

The HP Insight Providers for VMware ESXi collect management data from the ProLiant base server system and its processor, fan, power supply, memory, network, storage, and network subsystems.

Information provided includes properties and health status for all individual devices and redundant sets per subsystem, plus real-time event notifications. HP 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 its status.

1 SMASH - Systems Management Architecture for Server Hardware is a management initiative driven by DTMF that specifies the data model (based on CIM).

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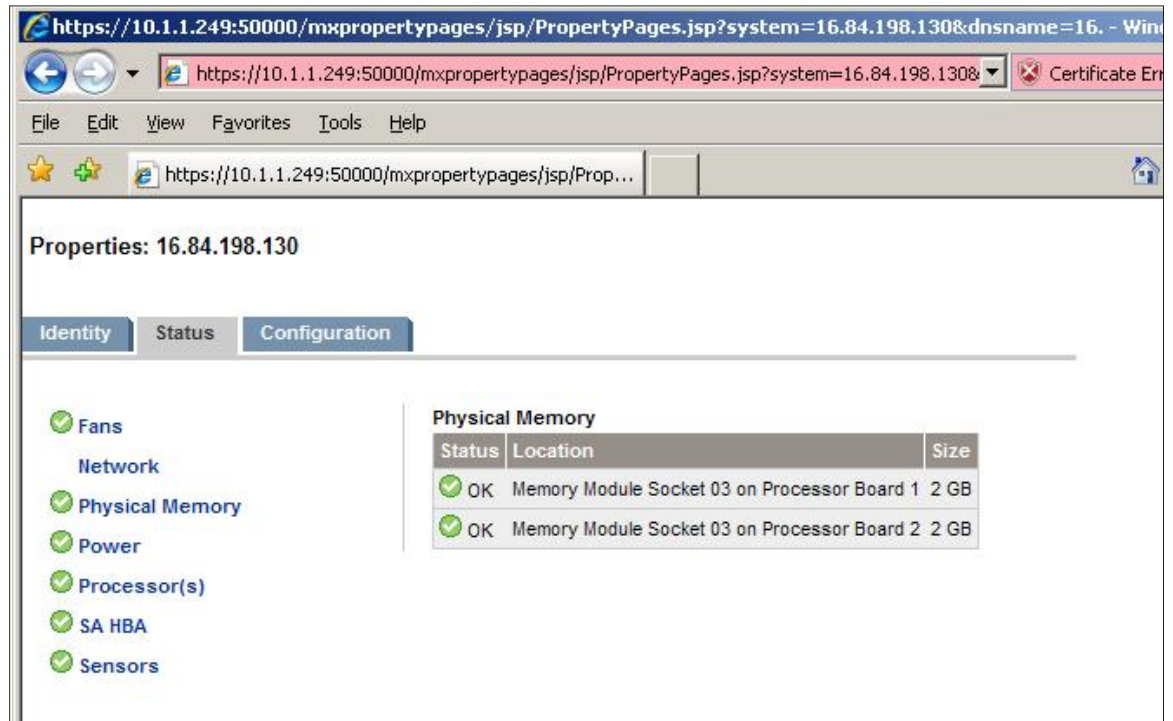


Figure 2. HP SIM Physical Memory status

During the identification process, HP SIM determines if a managed node is running on VMware ESXi operating system. If a VMware ESXi operating system is detected, HP SIM attempts to contact both the VMware providers and HP Insight Providers.* If both the VMware and HP Insight Providers are present, HP SIM identification will log the presence of both sets of providers. This will enable HP SIM WBEM interfaces to more effectively manage VMware ESXi. HP Insight Management WBEM Providers report the most up-to-date information regarding the hardware in two ways: Polling of the system in two minute increments and, for some subsystems, alerts that are sent when something has occurred on the hardware.

Starting with HP SIM 5.3.2 and later, users have the facility to extract following information from VMware ESXi:

- Network Provider – Ethernet ports information, statistics, port link status, and IP and MAC addresses.
- SmartArray Provider – Smart Array controller, external storage enclosure, internal drive cages, data and spare drives, and logical volume information.
- PCI Provider – PCI device, adapter card, and slot information.
- Sensor Provider – 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.

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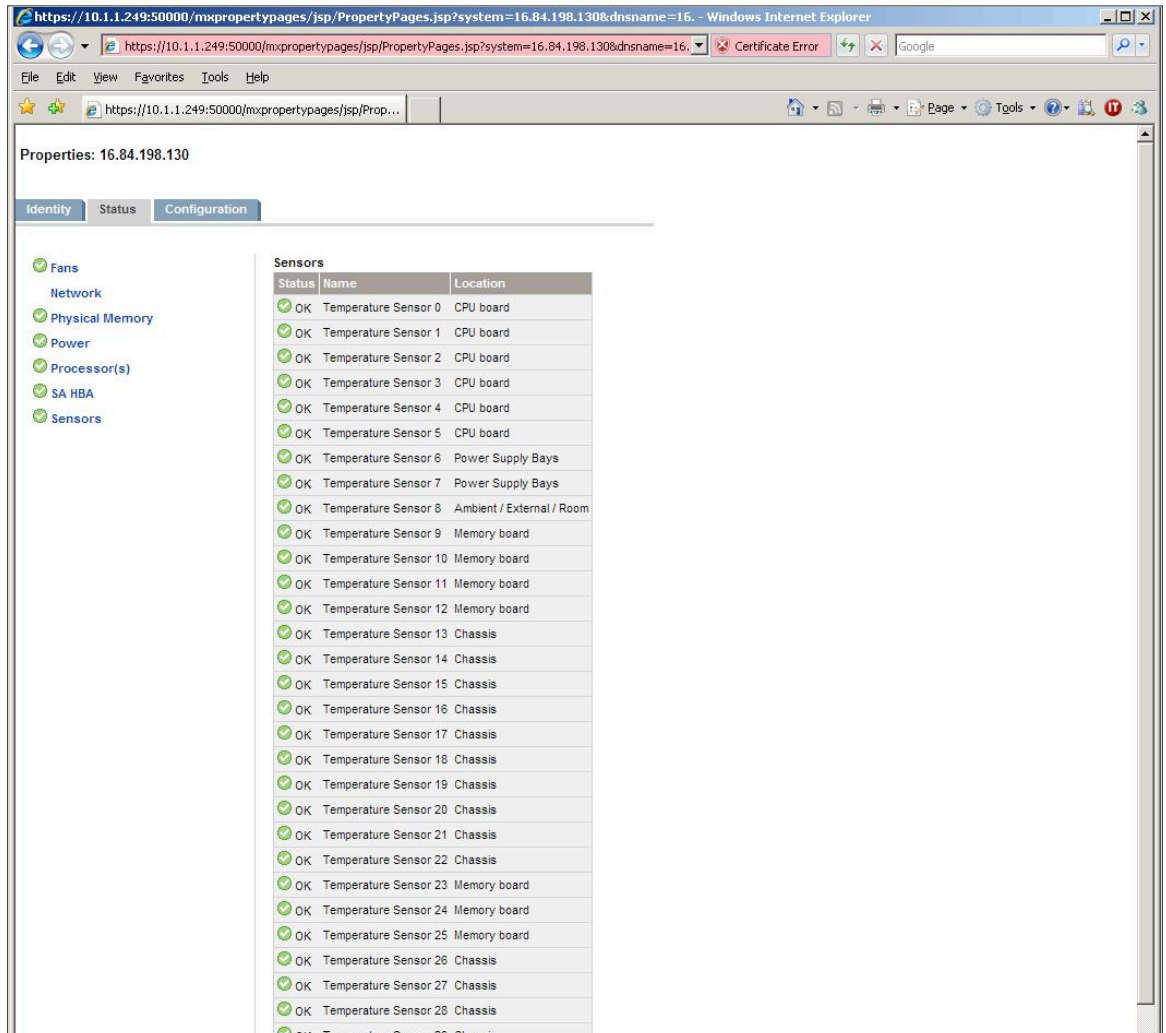


Figure 3. HP SIM list of monitored sensors

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

Proactive notification of server issues

HP SIM gets notified through the instrumentation provider or the CIM Object Manager (CIMOM) which is written to monitor change in state and generate an instance of an indication for particular events. 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 VMware ESXi, a subscription to WBEM events must be initiated from the management application. Once the subscription is made, the Insight Providers for VMware 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:*

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- 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, and system name and event occurrence time associated with it.

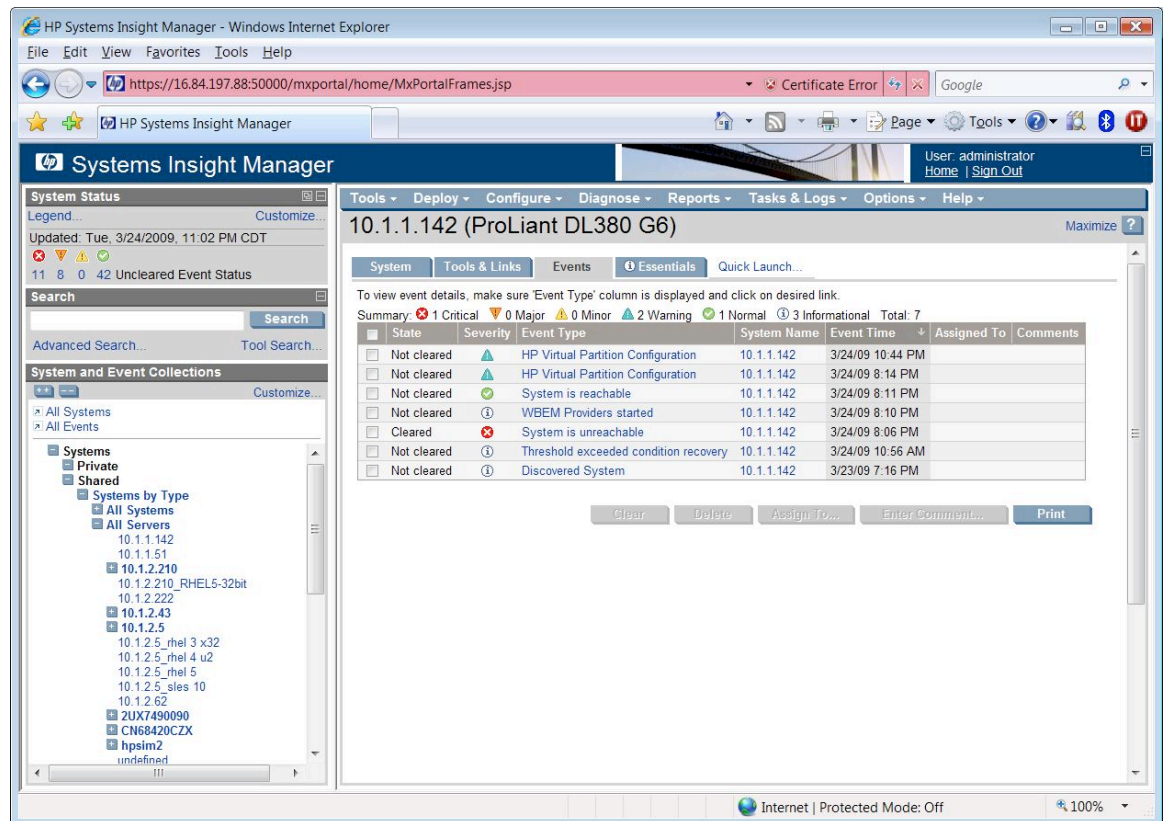


Figure 4. HP SIM Event Notification

HP 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.*

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Using HP Insight Control / Virtual Machine Manager (VMM) to manage virtual machines running VMware ESXi

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

- Copy virtual machine
- Move virtual machine
- Create virtual machine guest template
- 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

Note: The Copy / Move operations require that the VMware ESXi host be managed by vCenter and the vCenter credentials be specified through HP SIM.

The failed host recovery and handling prefailure alert feature uses VMware VMotion™.

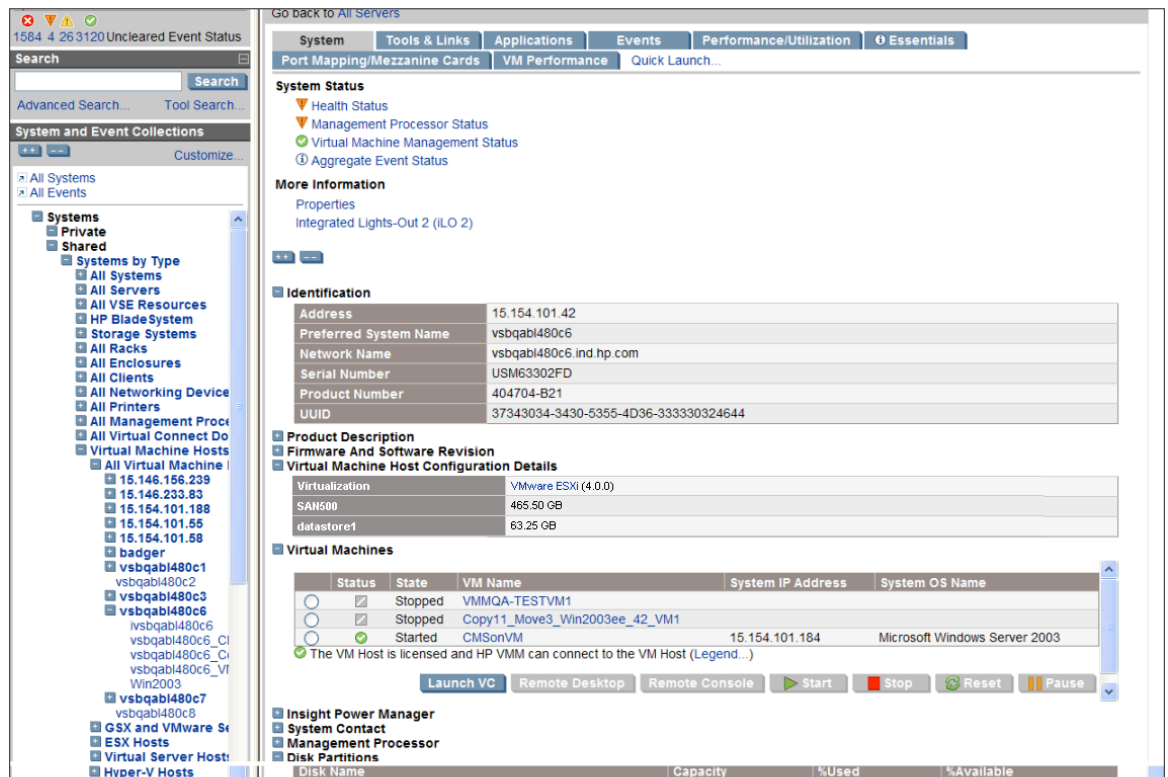


Figure 5. HP Virtual Machine Monitor features

Figure 5 shows the various features of VMM to manage HP integrated with VMware ESXi.

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Hardware Monitoring using vSphere Client and VMware vCenter

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

- vCenter is a tool that provides unified management of all the hosts and virtual machines in your datacenter from a single console with an aggregate performance monitoring of clusters, hosts, and virtual machines. 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, 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 VMware 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 in vCenter, 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 pools, entry into maintenance mode, and the reboot and shutdown of the VMware 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 6 shows the Health Status page displayed by the vSphere Client.*

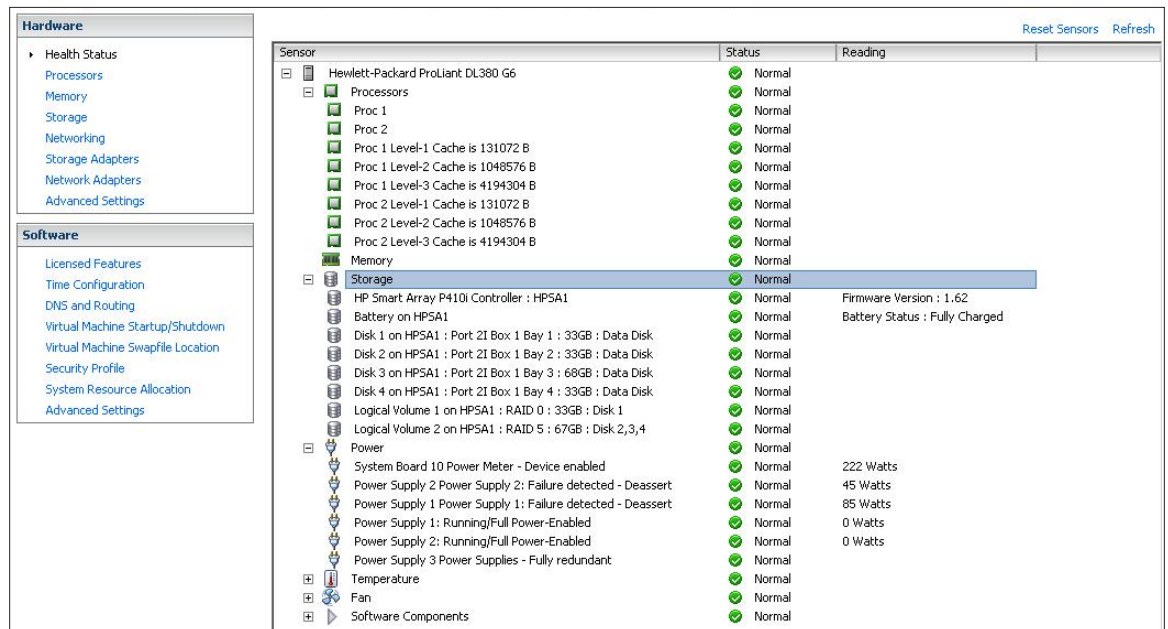


Figure 6. Configuration tab Health Status data from a VMware ESXi server

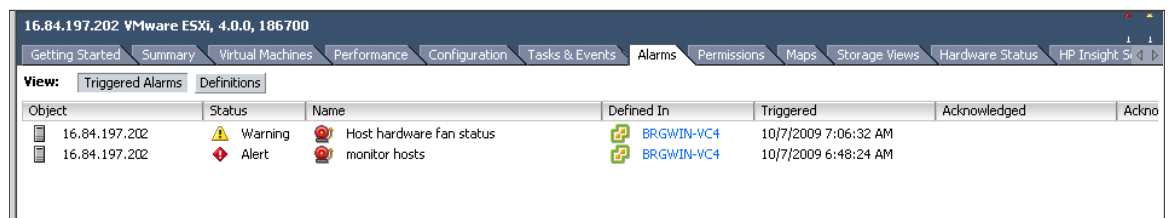


Figure 7. Events on VMware ESXi host using VMware vCenter

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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 has the ability to set alerts based upon hardware health, such as Fan or Power supply state. [Table A-1 in Appendix A](#) lists the hardware information that vCenter can monitor and provide alarms for. [Figure 7](#) shows an example of an alert that has been triggered on an VMware ESXi host.

Appendix A: Hardware Information Available in Management Tools

Currently, vSphere Client can display certain ProLiant server information, 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 comprehensive details about:

- 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 A-1](#) provides a side-by-side comparison of the information available in each environment, sorted by data source.*

DATA SOURCE	HP SIM	VCENTER AND VSPHERE CLIENT
Main System (Base Server)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Individual and overall temperature sensor health status, including temperature readings • System manufacturer, model, BIOS version, and date
Processor (CPU) Subsystem	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Individual and overall processor health status • Individual processor model, speed, sockets, cores, logical processors

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DATA SOURCE	HP SIM	VCENTER AND VSPHERE CLIENT
Fan Subsystem	<ul style="list-style-type: none"> • Individual fan type, variable speed support, physical fan location and health status • Fan module removal conditions and package type • Fan collection health status • Fan redundancy set, number of fans, associations with individual fan members, and redundancy status 	<ul style="list-style-type: none"> • Individual and overall fan health status
Power Supply Subsystem	<ul style="list-style-type: none"> • Individual power supply type, physical power supply location, and health status • Individual power supply module removal conditions and package type • Power supply collection health status • Power supply redundancy set, number of power supplies, associations with individual power supply members, and redundancy status • Power supply temperature exceeded normal operating range • Power supply temperature returned to normal operating range 	<ul style="list-style-type: none"> • Individual and overall power supply health status
Memory Subsystem, Version 2.0 only	<ul style="list-style-type: none"> • System memory capacity, starting and ending address, and health status • 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 • Individual memory board package type, removal conditions, hosting board, locked state, number of sockets, available memory size, total memory size, location, and health status • Individual memory module slot connector layout, gender and description, location, and health status • 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 • Version 2.0: memory collection health status • Memory module has failed or is predicted to fail • Memory board error • Memory redundancy degraded • Memory recovered from degraded redundancy 	<ul style="list-style-type: none"> • Overall memory health status and total physical system memory

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

For More Information

For additional information, refer to the resources listed below.

HP Resources

Distributed Management Task Force, Inc.

<http://www.dmtf.org/standards/cim/>

HP VMware ESXi

<http://h18004.www1.hp.com/products/servers/software/vmware-esx3i/index.html>

HP Provider Architecture on VMware ESXi

<ftp://ftp.compaq.com/pub/products/servers/vmware/esx3i/HP%20WBEM%20Provider%20for%20ESXi%20Scripting%20Tools%20Guide.pdf>

HP Systems Insight Manager

<http://www.hp.com/go/hpsim>

HP VMware ESXi Management Environment

<http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01570108/c01570108.pdf>

VMware Resources

VMware ESXi Product Page

<http://www.vmware.com/products/esxi/>

VMware ESXi Documentation

http://www.vmware.com/support/pubs/vs_pages/vsp_pubs_esxi40_e_vc40.html

Architecture of VMware ESXi

<http://www.vmware.com/resources/techresources/1009>

Management of VMware ESXi

<http://www.vmware.com/resources/techresources/1010>

VMware ESXi Embedded Setup Guide

http://www.vmware.com/pdf/vsphere4/r40/vsp_40_esxi_e_vc_setup_guide.pdf

Getting Started with VMware ESXi Embedded

http://www.vmware.com/pdf/vsphere4/r40/vsp_40_esxi_e_get_start.pdf

VMware Communities

VMware ESXi

<http://communities.vmware.com/community/vmtn/vsphere/esxi>

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