

# vSphere Client Hardware Health Monitoring

VMware vSphere 4.1

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## Purpose of This Document

VMware vSphere™ provides health monitoring data for ESX hardware to support datacenter virtualization. Health monitoring data is available from the VMware vSphere Client as well as from several programmatic interfaces.

This document describes:

- The basic architecture that supports hardware health monitoring in ESX
- The health information that is available by default
- How partners and independent hardware vendors can extend the architecture to provide health information about their own systems
- How systems management vendors can extract hardware health information

## Hardware Health Monitoring Options

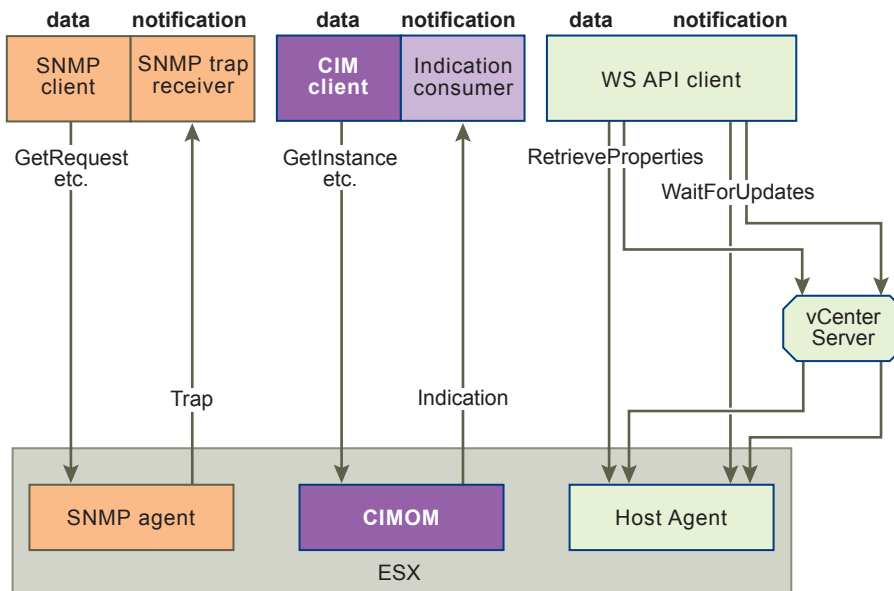
VMware supports health monitoring through several interfaces, including APIs, CLIs, and GUIs. Users can create their own health monitoring software using the APIs, or they can take advantage of existing GUI or CLI clients to access hardware health information.

Health monitoring clients can connect directly to an ESX server, or to the vCenter™ Server that manages an ESX server. Clients that connect to vCenter Server can view hardware health information for any managed ESX server through a single connection.

## Programmatic Interfaces for Health Monitoring

For those who want the power and flexibility to design their own health monitoring solutions, VMware supports the following protocols. Two of them are industry-standard protocols, and one is a proprietary API designed specifically for managing vSphere datacenters:

- CIM (Common Information Model)
- SNMP (Simple Network Management Protocol)
- vSphere Web Services API (WS API)

**Figure 1.** Health Monitoring APIs

This document uses the term “notification” in a generic sense, including both SNMP traps and CIM indications.

The arrows in [Figure 1](#) and [Figure 2](#) represent initial messages, whether requests or notifications. No arrows are shown for replies.

## Polling and Notification

All three of these interfaces offer both polling and asynchronous notification capabilities.

**Table 1.** Polling and Notification Capabilities

	Polling	Notification
<b>SNMP</b>	get, get next	SNMP traps
<b>CIM</b>	get instance, enumerate instances	CIM indications
<b>WS API</b>	RetrieveProperties	Events (WaitForUpdates)

Notifications for SNMP and CIM conform to a subscribe-push model, whereas WS API events use a delayed reply model to approximate asynchronous notifications. The WaitForUpdates function keeps a request open until the server has changes to report.

## VMware API Language Bindings

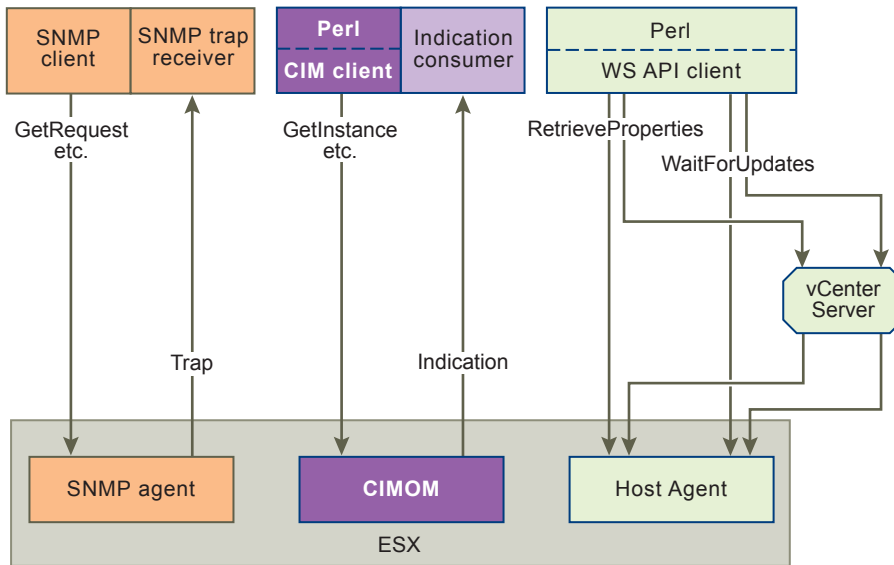
The WS API is language-agnostic. The API is defined in a Web Services Description Language (WSDL) file. You can bind the WSDL to your choice of client-side stubs.

VMware provides client bindings for Perl in the VMware vSphere SDK for Perl. The SDK includes an additional API layer that you can use to simplify common operations.

The vSphere SDK for Perl also contains an API for CIM operations. A Perl client can access either the CIMOM (CIM Object Manager) or the Host Agent to gather hardware information.

## WS-Management

VMware supports the WS-Management protocol, in addition to the CIM-XML protocol, for communications with the CIMOM. Clients can use either protocol, but the VMware vSphere SDK for Perl contains client libraries to support WS-Management functions.

**Figure 2.** VMware Perl APIs in Health Monitoring Clients

## Command-Line Interfaces for Health Monitoring

CLIs are available for all three protocols supported by VMware.

**Table 2.** CLIs for Monitoring Hardware Health

<b>SNMP</b>	snmpget, snmpgetnext, snmpwalk
<b>CIM</b>	wbemcli, owexecwql, wbemop, cimcli
<b>WS API</b>	VMware vSphere PowerCLI

The vSphere PowerCLI interface supports many standard PowerShell options. The capability to pipe .NET objects from one command to another gives you considerable power in managing vSphere objects from the command line.

## Graphical Interfaces for Health Monitoring

A number of commercial GUI clients that use SNMP are available for health monitoring, such as HP Openview, IBM Tivoli Netcool, and Dell OpenManage.

VMware provides the vSphere Client for managing ESX datacenters. The vSphere Client takes advantage of both the CIM API and the Web Services API to gather information about the hardware. It uses the WS API for most management tasks, and the CIM API for hardware health monitoring.

## vSphere Client Health Status Display

When you connect the vSphere Client to a single ESX host, it displays data related only to that host. Health monitoring data is available on the Configuration tab in the Health Status pane of the Hardware display. [Figure 3, "Power Supply Sensor,"](#) on page 4 shows an example of the vSphere Client display when connected to a single host.

When you connect the vSphere Client to vCenter Server, it displays data for all ESX hosts managed by vCenter Server. After you select a host in the inventory pane, the health status display for that host is available on the Hardware Status tab. You might have to scroll through the tabs if the Hardware Status tab is not visible. [Figure 4, "Temperature Sensor,"](#) on page 5 shows an example of the vSphere Client display when connected to vCenter Server.

The vSphere Client displays health information as health status sensors. A sensor can represent either hardware or software data.

## Hardware Health

A hardware sensor represents a logical interpretation of one or more physical measurements in the host machine, such as a voltage monitor on a power supply output.

A hardware sensor displayed by the vSphere Client might not correspond to a single physical measurement. For example, when you connect to vCenter Server, you might see one sensor that is an aggregate representation of the health of an entire host. The aggregate system health sensor is a way to roll up similar sensor data across all devices in the system.

Figure 3 shows an example of a hardware sensor that reports a power supply voltage within normal limits for power supply #1. The sensor value is Normal.

In the same figure, power supply #2 is not reported within normal limits. Its status is Unknown. This might be the result of the power supply being turned off.

**Figure 3.** Power Supply Sensor

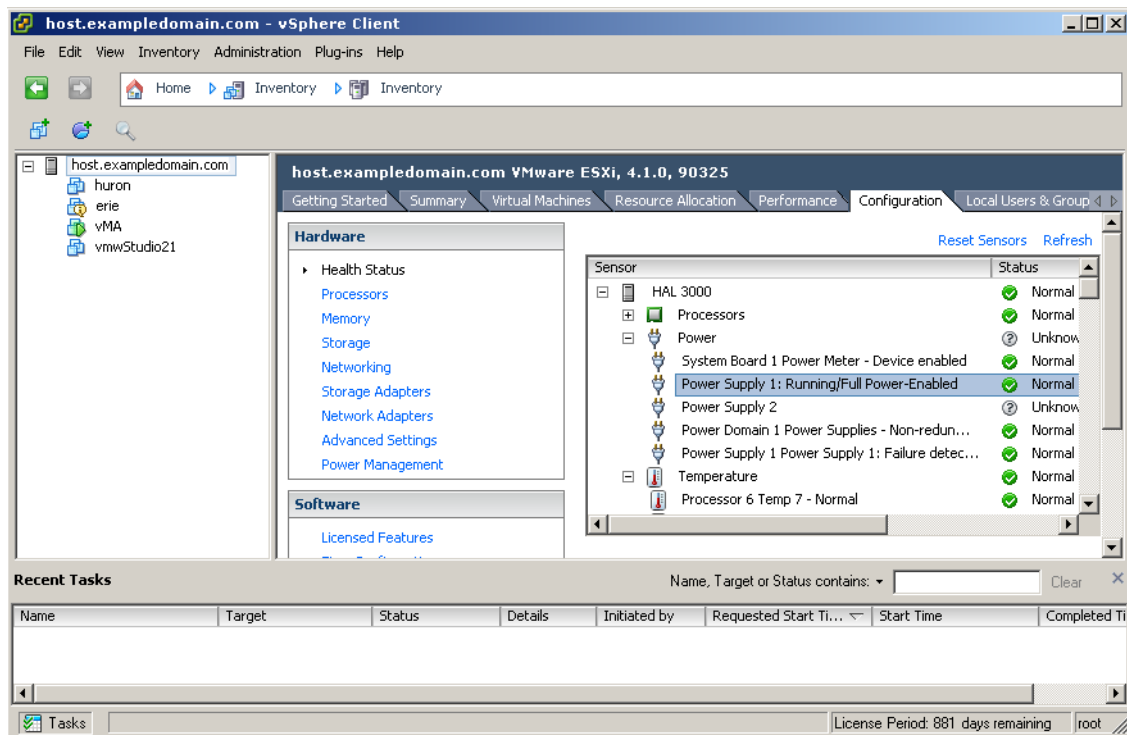
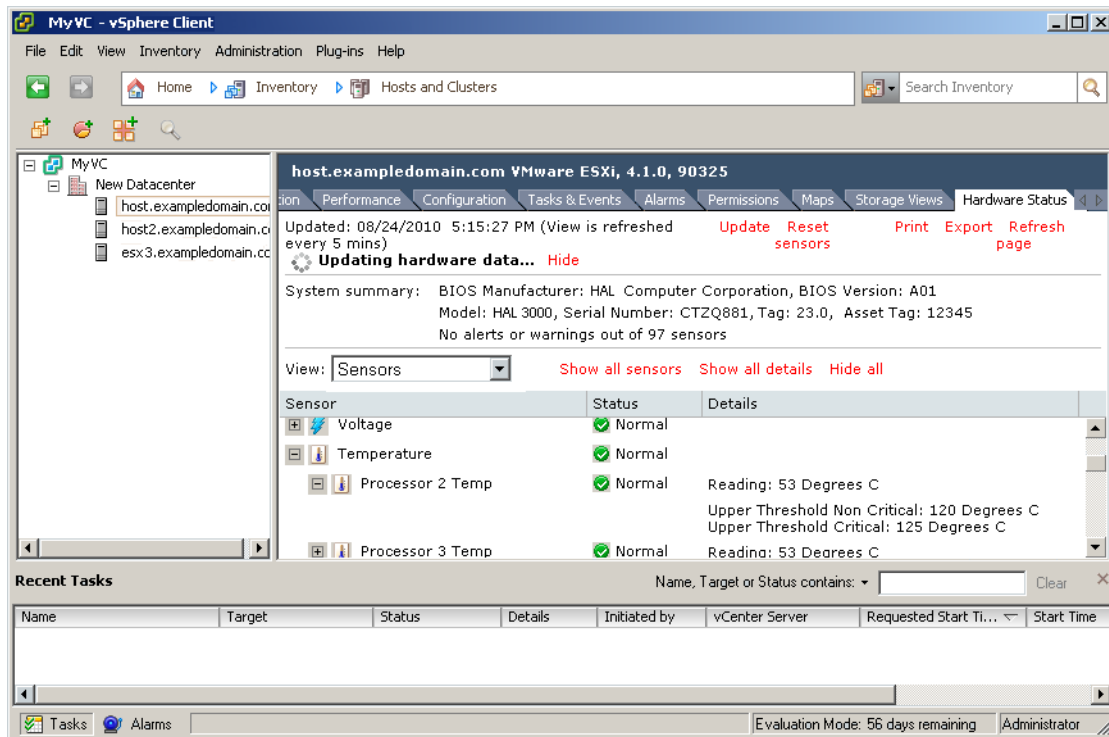


Figure 4 on page 5 shows a temperature sensor with an absolute reading that is within its normal range. The temperature sensor is configured with non-critical and critical temperature limits. If the temperature ever exceeds its configured limits, the green icon in the Status column will change to a red or yellow color, indicating either a critical problem or a degraded status.

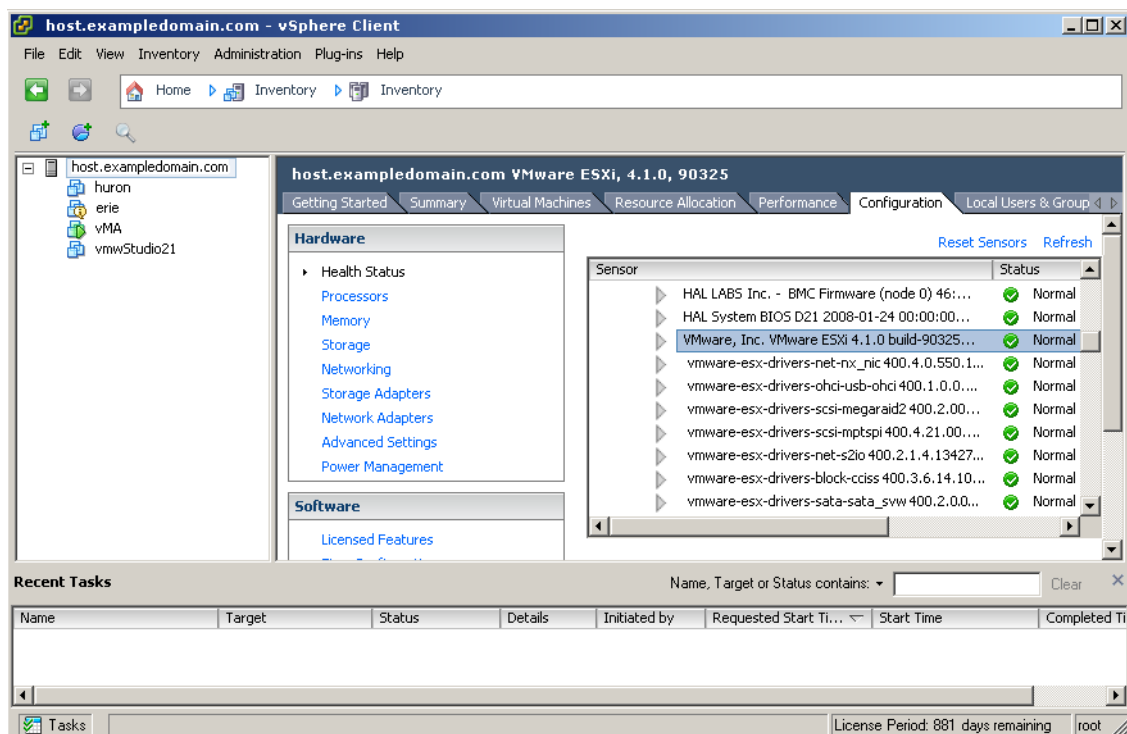
Figure 4. Temperature Sensor



## Software Health

The vSphere Client displays software information as a sensor. A software sensor reports a description of an installed software or firmware module. Software sensors are displayed for system BIOS, device drivers, and virtual machine hypervisors. Figure 5 shows some software sensors, including the name and version of the ESX hypervisor.

Figure 5. Software Sensor



## Sensors Displayed in the vSphere Client

The set of sensors displayed for an ESX host depends on the specific hardware. This document cannot give a complete list of all the sensors you see.

Sensors displayed in the vSphere Client are grouped by type. For instance, all sensors related to power supplies are shown together, and all sensors related to fans are shown together. The sensor groups you see in the vSphere Client might include some or all of these groups:

- Processors
- Memory
- Power
- Voltage
- Temperature
- Fan
- Network
- Software Components

Your hardware might show fewer groups or more groups than this list, depending on what sensors are actually present. The version of the ESX hypervisor also affects which sensor groups are shown.

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**NOTE** The Software Components group is introduced in vSphere 4.1. Earlier versions of VMware software do not report installed software.

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## How the vSphere Client Collects Sensor Data

The vSphere Client collects sensor data in different ways, depending on the sensor type and the server to which you connect. Regardless of the data source, it is handled by the CIM Object Manager (CIMOM) and conforms to the CIM standard.

[Figure 6](#) on page 7 shows the basic CIM architecture on an ESX host.

## Hardware Sensors

Many of the sensors displayed for an ESX host are derived from information reported by the Intelligent Platform Management Interface (IPMI) built into the hardware. The IPMI standard defines a cross-platform architecture for collecting and communicating information about the hardware.

Additional information about the host is gathered from the SMBIOS subsystem on the host.

## Software Sensors

Software sensors in the vSphere Client derive from data reported by a different provider. This data reports the installed software and current version information. Any software that is packaged and installed as a vSphere Installation Bundle (VIB) is represented as a software sensor, including ESX drivers and the hypervisor itself.

## Collecting and Reporting Health Data

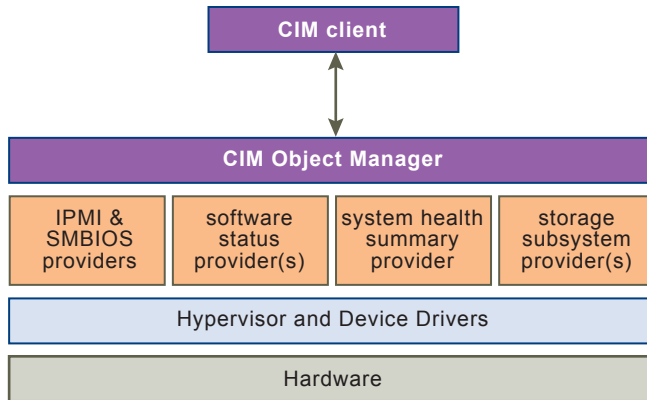
If you connect the vSphere Client to an ESX host rather than to vCenter Server, the sensor data you see in the vSphere Client is collected directly from that host. If you connect the vSphere Client to vCenter Server, you have access to sensors for all the ESX hosts that vCenter Server manages.

### Collecting Health Data on an ESX Host

The CIM subsystem that runs on an ESX host includes a CIMOM and a number of CIM data providers. The CIMOM gathers data from the providers and returns the data to a requesting software module using a standard CIM communication protocol.

Figure 6 represents a typical set of providers that supply data for hardware health status reporting, including a provider supplied by a third-party storage hardware vendor. Third-party providers might not be present on your hardware.

**Figure 6.** Hardware Health Status Providers on an ESX Host

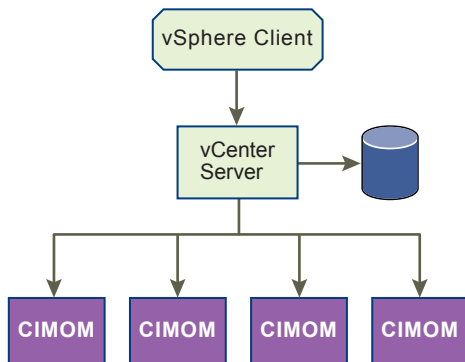


### Collecting Health Data in vCenter Server

When you connect the vSphere Client to vCenter Server, you can access data from any host managed by vCenter Server. The data is collected by a vCenter Server plug-in that acts as a CIM client to each host and stores the responses in its local database. The plug-in refreshes the data at regular intervals.

A connection to vCenter Server provides the additional advantage that system health for each host is summarized in a single sensor. This is not available with a direct connection to an ESX host.

**Figure 7.** vCenter Server Plug-In as a CIM Client



## Third-Party Health Monitoring Features in the vSphere Client

ESX host machines that you get from third parties might report an expanded set of sensor data. The additional sensors can come from different sources. However, third parties must use CIM providers to collect sensor data and report it through the CIMOM. Third parties can, if they choose, implement plug-ins for the vSphere Client that display the data in different ways.

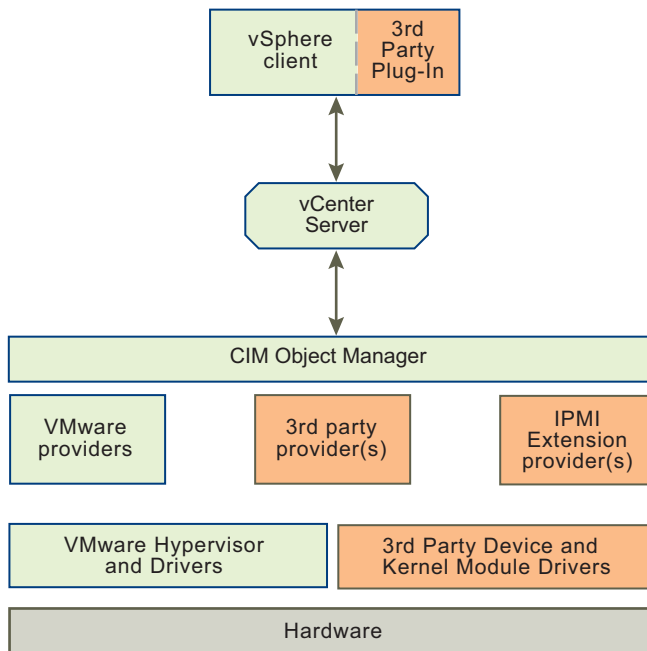
**Figure 8.** Third-Party Health Monitoring Extensions

Figure 8 shows where third-party vendors can add software to extend the out-of-box hardware health monitoring features.

- Plug-ins to the vSphere Client: See “Custom Tabs in vSphere Client” on page 9
- CIM providers: See “Third-Party Hardware Sensors” on page 8
- CIM IPMI Extension providers: See “Third-Party Hardware Sensors” on page 8
- Device drivers and kernel module drivers: See “Third-Party Hardware Sensors” on page 8

Third party vendors can find documentation and information about the VMware partner program at <http://www.vmware.com/partners>.

## Third-Party Hardware Sensors

The VMware CIM software collects sensor data from the IPMI subsystem and reports it as described in “Sensors Displayed in the vSphere Client” on page 6. All hardware sensors that conform to the IPMI standard are collected. Third parties do not need to add software providers to take advantage of this functionality.

Third parties may choose to implement data providers that use proprietary protocols to collect data on the ESX host, while using the CIMOM to pass data to the vSphere Client by way of vCenter Server. Third-party providers need only translate the proprietary data into standard CIM sensor data, which is reported in the same way as IPMI standard sensors.

Information about disk storage resources might be available from a third-party hardware vendor. A vendor can choose to implement a provider that supplies a separate set of sensor data that is specific to the storage type. Storage sensors are displayed in a separate group that augments the list of sensor groups described in “Sensors Displayed in the vSphere Client” on page 6.

Third parties create CIM providers using the VMware CIM Provider Development Kit. Custom drivers or kernel modules can be created using the VMware Device Driver Development Kit or the VMware Kernel Module Development Kit.

## Third-Party Software Sensors

The VMware CIM software collects information about software supplied by third-party vendors as well as by VMware itself. If a third party packages its software into VIB files, users will see the software reported in the list of software sensors, and the vendor does not need to write CIM providers for it.

## Custom Tabs in vSphere Client

Third-party vendors also have the option to display host status in a different form in the vSphere Client. With the vSphere Client architecture, third parties can customize the vSphere Client. Customization includes the capability to add new tabs to the vSphere Client.

Third-party extensions in the vSphere Client can sort the data and route it to a vendor-specific health monitoring tab for display. Custom tabs can display the data in more specific and meaningful ways than the VMware tab, or include third-party branding.

See *Customizing the vSphere Client* for information about adding tabs to the vSphere Client.

## Purchasing Advice

If you are purchasing hardware to use as an ESX host, consider these factors:

- 1 VMware recommends that you consult the *VMware Compatibility Guide* at <http://www.vmware.com/resources/compatibility/search.php>. This is an interactive Web page that helps you determine whether VMware supports the hardware that you are considering. Supported hardware is compatible with the IPMI standard, which allows the CIM subsystem to collect hardware sensor data.
- 2 Server hardware supported by VMware can be monitored in the Health Status display. The vSphere Client reports a set of sensor groups similar to the set shown in “[Sensors Displayed in the vSphere Client](#)” on page 6.
- 3 For some hardware models with additional third-party vendor software support, other health monitoring data might be available. Contact the vendor for specifics about health monitoring support for any specific model you have in mind.
- 4 Any CIM client can access the same data as the vSphere Client, including data from third-party providers. You can develop your own CIM client or purchase a CIM management client from a third-party software vendor. Custom CIM clients can also access additional vendor-specific CIM data and present the data in other ways.

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If you have comments about this documentation, submit your feedback to: [docfeedback@vmware.com](mailto:docfeedback@vmware.com)

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