

Sun Management Center Hardware Diagnostic Suite

White Paper



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901 San Antonio Road, Palo Alto, CA 94303 U.S.A.

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Sun Management Center Hardware Diagnostic Suite



Maintaining a high level of availability in mission-critical enterprise environments is crucial. Unplanned outages are costly, both in lost productivity and, all too frequently, direct revenue.

Hardware today is generally reliable, and techniques such as configuring systems with redundant components and clustering further increase availability. However, even the most reliable components can fail, immediately affecting availability or compromising systems by stripping them of their redundancy.

When faults occur, system administrators must quickly identify and isolate them and take corrective actions. Comprehensive, network-savvy diagnostic tools can help speed these tasks and reduce downtime. Periodic health checks, scheduled and run in the background, help to maintain on-going availability by proactively detecting latent faults, allowing hardware to be fixed *before* it causes an unplanned outage. In addition, testing hardware for potential faults on a regular basis can reduce scheduled down-time for system maintenance, as this becomes an on-going activity.

Because it is critical that little or no service interruptions occur in an enterprise environment, non-intrusive diagnostics are needed to provide fault isolation without jeopardizing system availability. On-line diagnostic tests that can run concurrently with user applications afford the best solution. Furthermore, the ideal diagnostic tools must be convenient and easy-to-use. Specifically, they should integrate with other system management applications, provide remote access for the entire enterprise from a single access point, and feature a graphical user interface that is easy to use, secure, and platform-independent.



Product Overview

Sun Management Center Hardware Diagnostic Suite is a Sun Management Center software add-on solution for testing and validating SPARC™ hardware in an enterprise environment. This comprehensive on-line diagnostic test suite enables system administrators to quickly diagnose, detect, and isolate failing components, reducing — or possibly eliminating — downtime caused by hardware failure. It further enhances system availability by stimulating and detecting hardware faults, warning of latent problems before they cause system downtime.

Hardware Diagnostic Suite provides the following features and benefits for enterprise environments:

- Performs testing that is data-safe and not resource-intensive, so testing runs concurrently with applications and does not affect day-to-day operations.
- Supports networked environments, enabling administrators and service engineers to remotely monitor and manage multiple test sessions on Sun systems.
- Presents a user-friendly GUI that runs on the Solaris™ Operating Environment and Microsoft Windows 95, 98, and NT, providing convenient access throughout the enterprise.
- Allows test sessions to be scheduled and run periodically for routine system validation, or run on demand for immediate hardware health checks.
- Is integrated with Sun Management Center, providing a single management framework and a single access point for administrators and service engineers.
- Provides the ability to alert the system administrator to important Hardware Diagnostic Suite events through the Sun Management Center alarm features, allowing corrective actions to take place.
- Takes advantage of the Sun Management Center enterprise-wide security measures to authorize or limit user access.
- Access to Hardware Diagnostic Suite is available through Sun Remote Services, a service solution included in SunSpectrumSM Platinum and Gold Support packages.

Product Architecture

Four components comprise the Hardware Diagnostic Suite architecture (see Figure 1):

- The *Hardware Diagnostic Suite tests*, which test and validate the correct operation of SPARC hardware.
- The *Hardware Diagnostic Suite agent*, which manages test sessions on the target machines.
- The *Hardware Diagnostic Suite server*, which acts as a conduit between the console and the agents.
- The *Hardware Diagnostic Suite console*, which provides the user interface.

The Hardware Diagnostic Suite is integrated with the Sun Management Center, and its components are installed and run on the same systems as the corresponding Sun Management Center components.

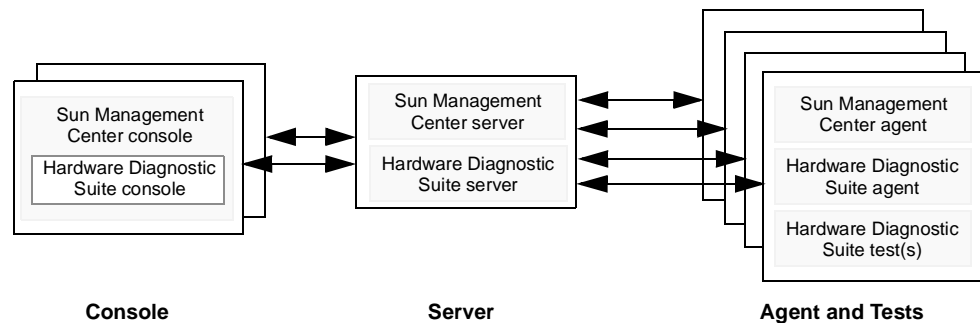


Figure 1 Hardware Diagnostic Suite high-level architecture.

Test Component

The Hardware Diagnostic Suite test components check and validate correct operation of SPARC hardware. All tests run in a non-intrusive and non-destructive fashion, making each Hardware Diagnostic Suite test session safe for live systems running other applications. In addition, all tests have less than one percent impact on CPU load, so application performance is not affected.

The Hardware Diagnostic Suite includes tests for communication ports, memory, network, peripherals, processor, and storage enclosure hardware. These tests support device testing in both 32-bit and 64-bit environments.



The following tests are included with the Hardware Diagnostic Suite. Any number of tests can be selected for a given test session, providing flexibility for system administrators.

- *CD-ROM Test*

CD-ROM test verifies the connectivity and functionality of CD-ROM drives. It determines whether or not the media is loaded, reads the CD-ROM table of contents, then reads data tracks. A random number of blocks is read each time.

- *Disk and Floppy Test*

The Disk and Floppy test checks the connectivity and functionality of disk drives and floppy drives. It performs random seek checks and read testing on the disks. It also runs both synchronous I/O and asynchronous I/O tests on the media. Asynchronous I/O uses the `async()` read feature of the Solaris Operating Environment disk drivers. Because of data-safety concerns, no write testing is performed on disk media.

- *Processor Test*

The Processor test checks the floating point unit on machines with SPARC or UltraSPARC™ CPUs. It runs a series of tests that check the registers, single- and double-precision floating point to integer conversions, addition, subtraction, multiplication, division, lock check, timing, branching and non-branching condition instructions. It also runs six benchmarks as part of verifying the FPU: *linpack*, *cparanoia*, *clorenz*, *cvector*, *kcsqrt*, *kcdiv*.

- *Memory Test*

The Memory test checks the physical memory of the system under test. It checks for parity errors, hard and soft correction code (ECC) errors, and indicates the SIMM locations where the intermittent and persistent errors occurred. This test also detects memory read errors and memory addressing problems by reading through portions of the available physical memory. This test does not write to any physical memory location in the system.

- *Network Test*

The Network test uses the Internet Control Message Protocol (ICMP) to check all networking hardware on the system. It sends out packets with random data and length, packets of maximum and minimum length in size, and packets with predetermined patterns of data to confirm correct network



hardware operation. For this test to be meaningful, the machine under test must be attached to a network with at least one other system on the network.

- *Parallel Test*

The Parallel test verifies the functionality of the IEEE 1284 parallel port device by performing an internal loopback test that transfers a known data pattern.

- *Serial Test*

The Serial test checks the system's on-board serial ports (*zs[0,1]*, *zsh[0,1]*, *se[0,1]*, and *se_hdlc[0,1]*), as well as multi-terminal interface (ALM2) boards (*mcp[0-3]*). Data is written and read in asynchronous and synchronous modes utilizing various internal loopback paths.

- *SPARCstorage™ Array Controller Test*

This test checks the functionality of the controller board on the SPARCstorage™ array by checking the state of the array's battery and fan modules. It also invokes SCSI read buffer commands of various sizes to the array's NVRAM, verifying the host and array Fibre Channel hardware, the array resident management software, and the hardware component interaction on the array controller card.

- *Tape Test*

This test verifies that the tape drive is connected, the tape media is loaded, and the drive type can be determined.



Agent Component

The Hardware Diagnostic Suite agent component manages the test session on the target machine and interacts with the server component to pass test information to the appropriate console. It checks the target machine for testable devices, executes and monitors test sessions, and performs notifications and logging of test error messages. The agent also re-checks for testable devices automatically after a successful reconfiguration of the hardware by the Solaris Operating Environment.

The Hardware Diagnostic Suite agent component must be installed on all target machines where diagnostic testing is to be performed. The Sun Management Center agent must also be installed on these systems.

Server Component

The Hardware Diagnostic Suite server component acts as a conduit between the console and the agents, accepting requests from the console and passing these requests to the appropriate Hardware Diagnostic Suite agent. It then relays the response from the agents back to the console. The multi-threaded server component is based on Java™ technology and handles multiple data requests from Hardware Diagnostic Suite agents and users.

The server component only needs to be installed on a single server machine in the enterprise network in order to communicate with other Hardware Diagnostic Suite agents and consoles. However, it must be installed on a system that is running the Sun Management Center server.

Console Component

The Hardware Diagnostic Suite console component provides the graphical user interface (see Figure 2). The Hardware Diagnostic Suite console is integrated into and displayed in the Sun Management Center console details window. It enables administrators to select devices to test, initiate or schedule testing, monitor a test session, and access log information.

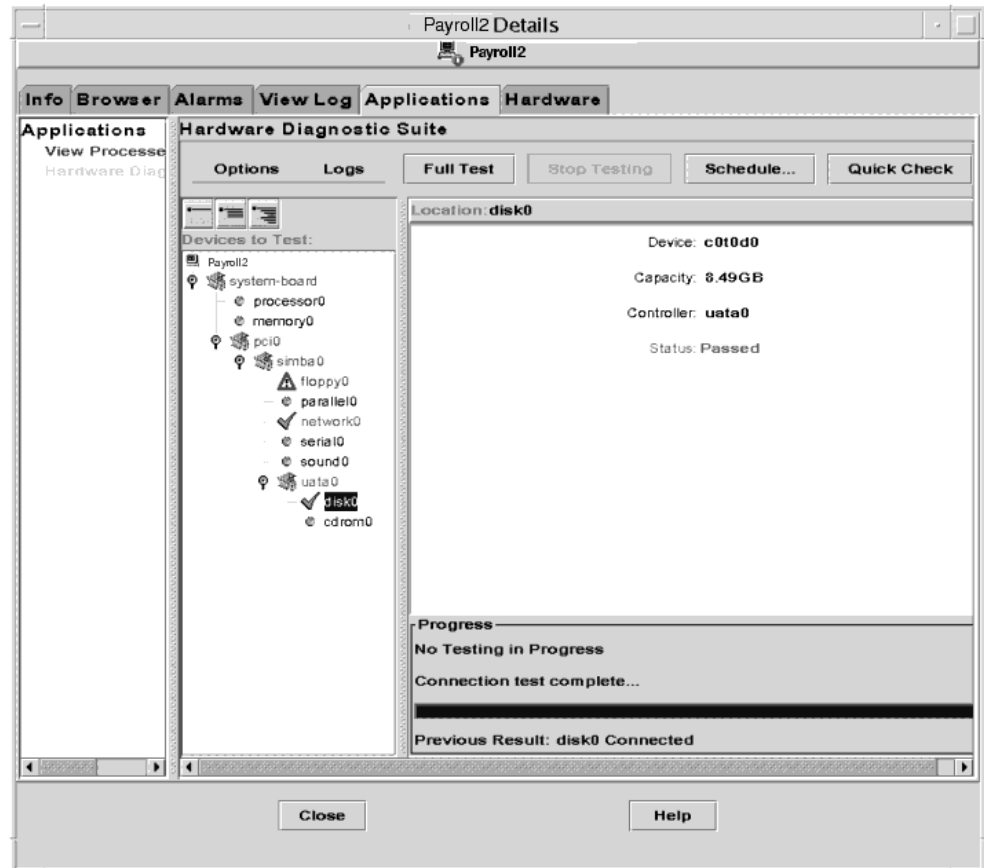


Figure 2 Hardware Diagnostic Suite console.



The Hardware Diagnostic Suite console component is supported on systems running the Solaris Operating Environment as well as Microsoft Windows 95, Windows 98, and Windows NT platforms through the use of Java technology. It can be run on multiple workstations in the enterprise, providing convenient access for administrators.

Enhancing Availability

Hardware Diagnostic Suite has the potential to enhance overall system availability through latent fault detection and by reducing scheduled downtime to perform system diagnostics and maintenance.

Latent Fault Detection

Hardware Diagnostic Suite's integration with Sun Management Center alarms enables system administrators to enhance availability through latent fault detection. The Sun Management Center software monitors systems, using alarms to notify administrators when abnormal conditions occur. By default, all Hardware Diagnostic Suite test session errors trigger a Sun Management Center critical alarm, and the alarm is displayed in the Sun Management Center console. Administrators can customize these alarms so they are triggered by specific Hardware Diagnostic Suite events, and can define the specific corrective actions that take place when an alarm occurs.

Figure 3 illustrates a typical series of events occurring on a target machine. The target machine has the Sun Management Center agent, Hardware Diagnostic Suite agent, and Hardware Diagnostic Suite tests installed. After a test has been initiated, either manually from the console or via a scheduled session, the Hardware Diagnostic Suite agent performs the requested hardware check. In this example, the test stimulates and detects a fault in the hardware, and the Hardware Diagnostic Suite agent logs this error to a file. The Sun Management Center agent monitors this file for errors, and generates an alarm. This alarm initiates pre-defined corrective actions, including sending e-mail to administrators and running a script that can potentially correct the fault.

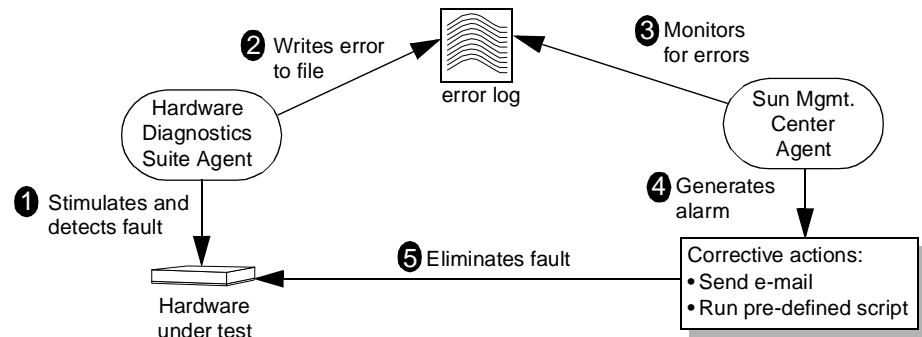


Figure 3 Enabling availability through latent fault detection.

As an example, system administrators can customize the response associated with Hardware Diagnostic Suite detecting an error on one FPU of a multi-processor system. This error can be configured to raise an alarm that automatically takes the suspect CPU off-line. It can also send e-mail notification to system administrators, informing them of the event.

Reduced System Maintenance Down-time

Hardware Diagnostic Suite can also increase availability by reducing system maintenance down-time. All diagnostic tests are non-intrusive and can run during normal operations without affecting application performance. This reduces the need to schedule down-time to run diagnostic checks and perform system maintenance. Instead, tests can be scheduled to run regularly in the background, validating correct hardware operation on an on-going basis.

System Requirements

The following sections describe in more detail the hardware and software requirements for the Hardware Diagnostic Suite application.

Supported Systems

The Hardware Diagnostic Suite agent supports diagnostic testing of the following Sun platforms:



- Sun Ultra™ 1, Ultra 2, Ultra 5, Ultra 10, Ultra 30, Ultra 60, and Ultra 450 workstations
- Sun Enterprise™ 2, Sun Enterprise 150, Sun Enterprise 250, Sun Enterprise 450 workgroup servers
- Sun Enterprise 3X00, Sun Enterprise 4X00, Sun Enterprise 5X00, Sun Enterprise 6X00, and Sun Enterprise 10000 servers
- SPARCserver™ 1000 and SPARCserver 1000E servers
- SPARCcenter™ 2000 and SPARCcenter 2000E servers

Hardware and Software Requirements

Hardware Diagnostic Suite is an integrated component of Sun Management Center. All Hardware Diagnostic Suite components must be installed in the enterprise network with the corresponding Sun Management Center components. For example, the Hardware Diagnostic Suite server component must be installed on the system running the Sun Management Center server. Similarly, the Sun Management Center agent must be installed on hosts that wish to run the Hardware Diagnostic Suite agent.

The minimum hardware recommendations and supported operating environment versions for each Hardware Diagnostic Suite component are listed in Table 1.

Component	Minimum Hardware Recommendations	Supported Operating Environment Version
Agent and Tests	<i>see Supported Systems</i>	Solaris 2.5.1, Solaris 2.6, Solaris 7, and Solaris 8
Server	Ultra 2 workstation (or a machine with equivalent or greater CPU performance) with 256 MB RAM	Solaris 2.6, Solaris 7, and Solaris 8
Console	Ultra 1 workstations (or a machine with equivalent or greater CPU performance) with 128 MB RAM	Solaris 2.6, Solaris 7, Solaris 8, Windows NT, Windows 98, and Windows 95

Table 1 Minimum hardware recommendations and supported operating environments.

Typical Deployment

This section describes a typical deployment of Sun Management Center Hardware Diagnostic Suite in an enterprise environment (see Figure 4). In this example, the server component is installed on a Sun Enterprise 4500 server. The console component runs on a Sun Ultra 2 workstation and a PC running Microsoft Windows 98. Agent and test components are installed on a Sun Ultra 10 workstation, a Sun Enterprise 250 server, and a Sun Enterprise 6500 server.

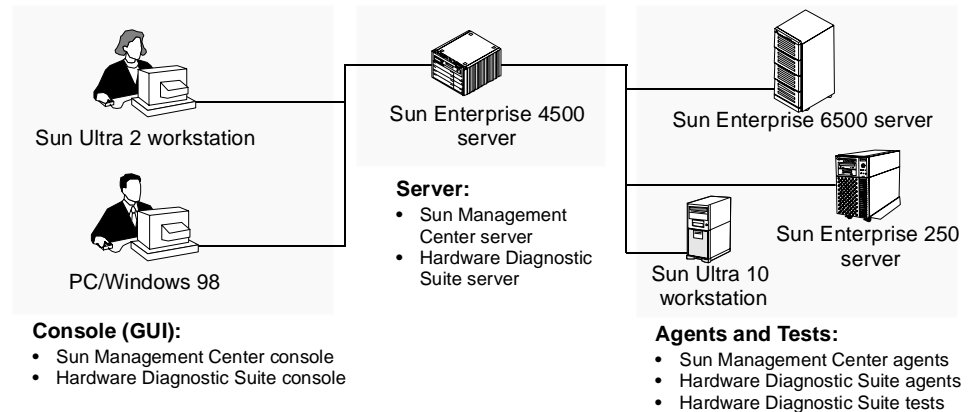


Figure 4 Typical deployment in an enterprise environment.

Scenario

System administrators perform the following common operations when using Hardware Diagnostic Suite in an enterprise environment.

- *Selecting devices to test*

When a target machine is selected in the GUI, the Hardware Diagnostic Suite probes the configuration and displays devices that are testable. Administrators then simply choose the devices to test by selecting them within the GUI. Users can choose individual devices, groups of devices, or all devices on a target machine with a single click, making it quick and easy to set up a customized test session.



- *Starting a test session*

After the devices have been selected, administrators choose to run either a Full Test session or a Quick Check. A Quick Check runs a brief test on all selected devices, making an attempt to communicate with the device and confirm connectivity. A Full Test session checks connectivity and also performs functional, data-safe, non-resource intensive tests that exercise the various subsystems of the selected devices. All tests are designed so they do not interfere with applications currently running on the system, thereby enabling these tests to be run any time without affecting system or application availability.

Administrators can choose to run the tests immediately, or schedule the tests to run at a later time.

- *Monitoring a test session*

The Hardware Diagnostic Suite console displays information about each device, each test as it runs, and the test results. A progress bar displays a graphical representation of the progress of the current test, providing an easy way for administrators to check the status.

As soon as Hardware Diagnostic Suite detects a successful or failing test on a device, it immediately displays the pass or fail status in the GUI with easily identifiable indicators. This makes it simple for administrators to monitor the successful testing of devices and quickly identify devices that may be failing.

- *Reviewing test results*

In addition to displaying test results, the Hardware Diagnostic Suite also saves information on every test session in two log files, enabling administrators to review test results at any time. The Information Log contains informative messages about each test session, such as start and stop times and pass and failure information. The Errors Log contains all error messages that have occurred during test sessions. Severe errors that indicate a serious hardware failure are flagged as *FATAL* or *ERROR*, helping administrators quickly locate devices that need attention.

- *Suspending, resuming, and stopping a test session*

Administrators can suspend or stop any test session that is in session. Suspended sessions can then be resumed at a later time.

- *Scheduling a test session*

Administrators can choose to run tests automatically, either once at a specific time or periodically. Periodic testing is useful for regularly monitoring the health of enterprise hardware.

Administrators also choose between scheduling a custom test on selected devices or scheduling a pre-defined test session. The custom option gives administrators complete control of exactly which devices are tested, while the pre-defined test sessions make it easy to quickly schedule common diagnostic operations on all available devices. Pre-defined tests include a connection test, full functional test, processor check, and SCSI disk check. Pre-defined tests of every other disk in the system — useful when there are many disks in the system — are also available.

- *Customizing Sun Management Center alarms*

Administrators can customize Sun Management Center alarms for use with Hardware Diagnostic Suite. By default, all Hardware Diagnostic Suite test session error messages that occur trigger a Sun Management Center critical alarm, and the alarm is displayed in the Sun Management console.

Administrators can customize the Sun Management Center alarms so they are triggered by specific Hardware Diagnostic Suite events, and can define the corrective actions that take place when an alarm occurs.

For More Information

Sun Microsystems posts product information in the form of data sheets, specifications, and white papers on its Internet World Wide Web site. Please see <http://www.sun.com/sunmanagementcenter/> for more information.

Look for these and other Sun technology white papers:

- *Sun Management Center Hardware Diagnostic Suite 1.0 User's Guide*, part number 806-0453-10.
- *Sun Management Center—Managing the Integrated Enterprise*, Technical Brief, Sun Microsystems, 12/99.
- *The Architecture of The Sun Enterprise SyMON*, Technical White Paper, Sun Microsystems, 6/99.

(NOTE: Sun Management Center was previously named Sun Enterprise SyMON.)





Sun Microsystems Incorporated
901 San Antonio Road
Palo Alto, CA 94303 USA
650 960-1300
FAX 650 969-9131
<http://www.sun.com>

Sales Offices

Africa (North, West and Central):
+33 1 30674680
Argentina: +54-11-4317-5600
Australia: +61-2-9844-5000
Austria: +43-1-60563-0
Belgium: +32-2-716 79 11
Brazil: +55-11-5181-8988
Canada: +905-477-6745
Chile: +56-2-3724500
Colombia: +571-629-2323
Commonwealth of Independent States:
+7-502-935-8411
Czech Republic: +420-2-33 00 93 11
Denmark: +45 4556 5000
Estonia: +372-6-308-900
Finland: +358-9-525-561
France: +33-01-30-67-50-00
Germany: +49-89-46008-0
Greece: +30-1-6188111
Hungary: +36-1-202-4415
Iceland: +354-563-3010
India: +91-80-5599595
Ireland: +353-1-8055-666
Israel: +972-9-9513465
Italy: +39-039-60551
Japan: +81-3-5717-5000
Kazakhstan: +7-3272-466774
Korea: +822-3469-0114
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Lithuania: +370-729-8468
Luxembourg: +352-49 11 33 1
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Mexico: +52-5-258-6100
The Netherlands: +31-33-450-1234
New Zealand: +64-4-499-2344
Norway: +47-2202-3900
People's Republic of China:
Beijing: +86-10-6803-5588
Chengdu: +86-28-619-9333
Guangzhou: +86-20-8777-9913
Shanghai: +86-21-6466-1228
Hong Kong: +852-2802-4188
Poland: +48-22-8747800
Portugal: +351-1-412-7710
Russia: +7-502-935-8411
Singapore: +65-438-1888
Slovak Republic: +421-7-522 94 85
South Africa: +2711-805-4305
Spain: +34-91-596-9900
Sweden: +46-8-623-90-00
Switzerland: +41-1-825-7111
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Turkey: +90-212-236 3300
United Arab Emirates: +971-4-366-333
United Kingdom: +44-1-276-20444
United States: +1-800-555-9SUN OR +1-650-960-1300
Venezuela: +58-2-905-3800
Worldwide Headquarters:
650-960-1300 or 800-555-9SUN
Internet: www.sun.com