

Troubleshooting Enterprise Production Environments

Using Dell Server Diagnostic Tools

Dell™ server diagnostic tools are designed to enhance fault isolation and root-cause analysis in enterprise production environments. This article discusses various tools available for server diagnostics at the tier 1, tier 2, and tier 3 levels, along with best practices for the use of server diagnostic tools.

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Server diagnostic tools can help IT organizations troubleshoot a wide range of potential problems that may arise in enterprise production environments. Dell server diagnostic tools are designed to provide early warning of server health conditions so that impending problems can be corrected before they cause downtime. In addition, Dell server diagnostic tools can enable effective fault isolation and root-cause analysis after hardware failures occur.

Enterprise diagnostic tools are divided into three tiers. Tools in each tier are designed to address unique diagnostic needs that arise during different stages of the server deployment and life cycle (see Figure 1):

- **Tier 1 tools:** Provide a basic assessment of system functionality in a pre-operating system (OS) environment
- **Tier 2 tools:** Support comprehensive hardware diagnosis and help inform hardware technical support decisions in a pre-OS environment
- **Tier 3 tools:** Provide comprehensive hardware diagnosis, real-time monitoring and reporting, and predictive failure alerts in a post-OS environment

Tier 1 server diagnostic tools

Tier 1 diagnostics comprise hardware detection tools that are built into Dell PowerEdge™ and PowerEdge SC server firmware. No additional software or hardware needs to be installed to take advantage of tier 1 features. These diagnostics are always available as long as the server is powered up. The server reports the results of tier 1 diagnostics by logging error messages in system logs, by displaying messages on the LCD, and by selectively illuminating the Dell Active ID or power button LED. While administrators can disable reporting of many tier 1 diagnostics during BIOS or Embedded Server Management (ESM) setup, best practices dictate that diagnostics remain configured as active to enable efficient hardware support.

Tier 2 server diagnostic tools

Tier 2 offers comprehensive hardware diagnostic tools that can be used to determine the current status of PowerEdge and PowerEdge SC servers. These tools provide diagnostic modules that focus on specific subsystem and functional areas of the server—and hence provide direction for administrators during root-cause analysis of a server failure. Because tier 2 diagnostics are OS independent, they are particularly useful in the pre-OS environment.

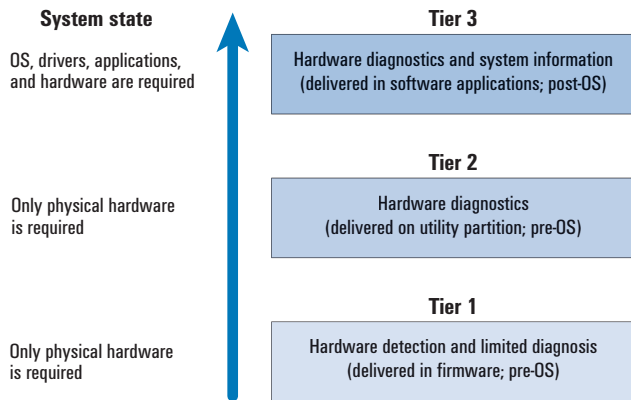


Figure 1. Three-tiered strategy for server diagnostics

Tier 2 tools are delivered on the utility partition of Dell PowerEdge servers and are also available on the Dell OpenManage™ Server Assistant CD. Currently, Dell offers two tier 2 diagnostic tools:¹

- Dell 32-Bit Diagnostics
- MP Memory

Dell 32-Bit Diagnostics overview

Dell 32-Bit Diagnostics is an executable tool consisting of a graphical user interface (GUI) and test modules for individual server subsystems. In addition to the GUI, Dell 32-Bit Diagnostics also offers a command-line interface (CLI) to enable administrators to execute diagnostics using scripts or batch files.

Dell 32-Bit Diagnostics can determine whether individual devices and subsystems are operating as expected. However, the diagnostics provide only local control and output.

Dell 32-Bit Diagnostics offers the following methods of execution:

- **Express test:** The express test executes a test package for each server subsystem but does not run the full set of tests available in the test package for each of the subsystems.
- **Extended test:** The extended test executes all available tests in each test package for all subsystems.
- **Custom test:** The custom test allows administrators to select and execute individual tests from the test package for each subsystem.
- **Multiple pass:** The multiple pass method enables administrators to run multiple iterations of customized tests.

Refer to the “Dell diagnostic test packages” sidebar in this article for a complete list of Dell 32-Bit Diagnostics test packages.

Results of diagnostic tests, including any errors detected, can be easily viewed by selecting the Information tab in the tool’s main menu. The Dell 32-Bit Diagnostics tests provide several types of guidance for administrators, such as help in determining whether devices are functional; determining device versions and other identity information; determining mean time to failure (MTTF); and extracting system event logs (SEs) into human-readable form.

Dell 32-Bit Diagnostics best practices

Administrators should execute the Dell 32-Bit Diagnostics extended diagnostic test in the preproduction environment. Best practices dictate running the extended test upon receipt of the server; this allows organizations to identify any hardware problems early in the server’s life cycle, preventing time and resources from being spent configuring and deploying a server that has faulty hardware. Running the extended test prior to deploying a server also makes fault isolation and troubleshooting easy for administrators and technical support staff at this stage in the life cycle of the server. If time does not permit a full extended test, organizations should at least execute the express test on each server in the preproduction environment.

After a server has been serviced or updated with additional hardware devices, administrators should run Dell 32-Bit Diagnostics custom tests on the newly added hardware. At this time, best practices also dictate running the express test to ensure that the service or upgrade process did not break the functionality of any other device or subsystem on the server.

MP Memory overview

MP Memory is a Dell-developed, DOS-based memory test tool. This tool is efficient for large (greater than 4 GB) memory configurations. The tool supports single-processor or multiprocessor configurations as well as processors using Intel® Hyper-Threading Technology. MP Memory operates only on Dell PowerEdge servers that are Intel processor-based.

This tool complements Dell 32-Bit Diagnostics tests and helps provide complete, comprehensive diagnostics on the server in a pre-OS environment. *Note:* Dell 32-Bit Diagnostics does not provide any memory diagnostic tests, and MP Memory is currently the only Dell-offered memory diagnostic tool for pre-OS environments.

MP Memory offers the following methods of execution:

- **Express test:** The express test runs a memory data bus stress test and signal integrity tests.
- **Custom test:** The custom test enables administrators to choose any of the eight available memory tests.

¹Dell eighth-generation server platforms, which are equipped with the Dell Remote Access Controller 4 (DRAC 4), also offer virtual media and remote console redirection features that enable remote diagnosis of the server using tier 2 diagnostic tools.

DELL DIAGNOSTIC TEST PACKAGES

Dell provides two types of tier 2 server diagnostic tools: Dell 32-Bit Diagnostics and MP Memory. Dell also supplies two types of tier 3 server diagnostic tools: Dell OpenManage Server Administrator Diagnostic Service and Dell PowerEdge Diagnostics. Each of these Dell tools comprises multiple test packages, listed below.

Tier 2 Dell 32-Bit Diagnostics test packages

Systems:

- BIOS
- CD drive
- CD-RW/DVD combination drive
- CPU
- DVD drive
- ESM
- Floppy disk drive
- I/O advanced programmable interrupt controller (IOAPIC)
- Intelligent Platform Management Interface (IPMI)
- Keyboard and mouse
- Modem
- Parallel port
- Peripheral Component Interconnect (PCI)
- Plug and play
- Remote access controller (RAC)
- Serial port
- System board devices
- System board monitors
- Systems management BIOS (SMBIOS)
- Systems management bus (SMBus)
- Universal Serial Bus (USB)

Storage:

- Level 1 (L1) and level 2 (L2) cache
- IDE controller
- IDE disk drive
- RAID controller
- SCSI controller
- SCSI disk drive
- SCSI tape

Tier 2 MP Memory mnemonics test packages

- **Memory Data Bus Stress Test:** Stress; test ID 1
- **Signal Integrity Test 1:** Integ1; test ID 2
- **Signal Integrity Test 2:** Integ2; test ID 3
- **Event Log Scan:** Evlog; test ID 4
- **Memory Address Line Test:** Mats; test ID 10
- **Memory Bit Coupling Test:** TestA; test ID 40
- **Memory ECC Bit Coupling Test:** Ecc; test ID 50
- **Memory Bit Coupling Test:** TestY; test ID 70

Tier 3 Diagnostic Service test packages

Systems:

- CD drive
- CD-RW/DVD combination drive
- CMOS (complementary metal-oxide semiconductor)
- DVD drive
- Floppy disk drive
- Memory
- Modem
- Network
- Parallel port
- PCI
- RAC
- Serial port

Storage:

- IDE controller
- IDE disk drive
- RAID controller
- SCSI controller
- SCSI disk drive
- SCSI tape

Third-party systems:

- Broadcom modem diagnostics
- Broadcom network diagnostics
- Intel network diagnostics

Tier 3 Dell PowerEdge Diagnostics test packages

Systems:

- CD drive
- CD-RW/DVD combination drive
- CMOS
- DVD drive
- Floppy disk drive
- Hard disk drive
- Modem
- Network interface card (NIC)
- Parallel port
- PCI bus
- Serial port
- Video controller

Storage:

- RAID controller
- SCSI controller
- Tape drives, storage arrays, tape autoloaders, and tape libraries

Switch	Description
/?	Causes the program to show the parameter syntax and additional help information, and to perform parameter checks before exiting to DOS.
/#	Allows the administrator to specify the maximum number of CPUs that will be used during the memory testing. The value must be between 1 and 16. If this parameter is not specified, the program uses all available CPUs during testing. If this parameter is specified but the number of CPUs present on the system is less than the value specified, MP Memory will issue a failure error code and error message.
/a	Enables the use of a spinning activity indicator for each CPU. The activity indicators will slow down testing slightly.
/c	Displays configuration memory size (in MB) and then returns to the command line.
/e%	Displays the ending percentage of the memory to be tested. The default is to test to the end of detected memory (100 percent).
/es#	Displays the specific ending address.
/loop	Enables a loop count to run all selected tests. Administrators should specify "0" to loop until a failure occurs.
/o	Displays the name of an optional file to capture the enhanced test code messages.
/r	Allows the administrator to select the pattern(s) to use during the test(s). This parameter may be used multiple times to select more than one pattern. If this parameter is not used, all available parameters are used. Note that the error-correcting code (ECC) test uses its own pattern.
/s%	Displays the starting percentage of the memory to be tested. The default is to test from the beginning of detected memory (0 percent).
/ss#	Displays the specific starting address.
/ttest	Allows the administrator to select which test to run. This parameter may be used multiple times to select more than one test. If this parameter is not used, all available tests will run. The text for <i>test</i> must be one of the mnemonics listed in the "Tier 2 MP Memory mnemonics test packages" section of the "Dell diagnostic test packages" sidebar in this article and may not include any punctuation (including spaces or quotes).
/v	Enables verbose mode, which displays additional on-screen information.
/w	Causes the program to wait for a key press before exiting.
/y	Enables Hyper-Threading Technology detection.

Figure 2. MP Memory command-line switches

Refer to the "Dell diagnostic test packages" sidebar in this article for a complete list of MP Memory mnemonics test packages.

MP Memory command-line switches and memory codes

MP Memory can be run from a CLI with several command-line parameters to modify each test's behavior as required. CLI capability is ideal for IT organizations that want to create custom scripts or batch files to execute diagnostic services. The syntax for MP Memory CLI commands is as follows:

```
mpmemory [/?] [/#] [/a] [/c] [/e%] [/es#]
[/loop] [/o] [/r [/r]] [/s%] [/ss#]
[/ttest [/t...]] [/v] [/w] [/y]
```

Figure 2 explains each MP Memory command-line switch. Figure 3 describes MP Memory return codes.

Tier 3 server diagnostic tools

Tier 3 tools are offered primarily to provide comprehensive hardware diagnostics for servers in a post-OS environment. These tools offer preventive diagnostic capabilities through real-time system monitoring and reporting. In addition, tier 3 diagnostics allow administrators to troubleshoot hardware-related issues on a server without bringing the server down.

Dell offers two tier 3 diagnostic tools:

- Dell OpenManage Server Administrator Diagnostic Service (available on PowerEdge servers)
- Dell PowerEdge Diagnostics (available on both PowerEdge and PowerEdge SC servers)

Diagnostic Service overview

Dell OpenManage Server Administrator Diagnostic Service, included with Dell OpenManage Server Administrator (OMSA), consists of test modules that can be run locally or remotely over the network to diagnose a server. Diagnostic Service test modules provide an optimal way to diagnose a server without incurring downtime, because these tests can be run in parallel with other applications that reside on the server. The Diagnostic Service provides preventive hardware diagnostics for Dell PowerEdge servers to help predict and proactively deal with hardware failures. It is supported on both Red Hat® Linux® and Microsoft® Windows® operating systems, thus providing a single diagnostic architecture for the enterprise.

The Diagnostic Service is installed using the Managed Server option on the Dell OpenManage Systems Management CD that is delivered with Dell PowerEdge servers. This diagnostic tool is designed to be easy to access and can be used either locally or remotely from the HTML-based GUI that is provided with it, or locally using a CLI that facilitates scripted functions.

The Diagnostic Service tool offers key features and services that enable administrators to perform the following tasks:

- **Device enumeration:** Inventory all testable devices on the server.
- **Device and test selection:** Select the devices on which diagnostic tests will be run, and the tests that will be run on these devices.

Code	Description
0	All operations have passed.
1	One or more operations have failed. The CLI interface should show a detailed error message from each processor that detected a problem.
2	The administrator aborted the testing.

Figure 3. MP Memory return codes

- **Diagnostic scheduler:** Select diagnostic tests to run at specific times and frequencies. This scheduling option is helpful for administrators who need to run preventive maintenance tasks during off-hours or non-peak times. This feature allows administrators to review scheduled tests and make changes to them, such as adding, deleting, and rescheduling tests. Multiple tests, grouped by task, can also be scheduled.
- **Diagnostic test review:** Review the selected diagnostic tests.
- **Diagnostic test status:** View the status of the diagnostic tests that are running.
- **Abort, suspend, and resume tests:** Abort, suspend, and resume the selected diagnostic tests.
- **Diagnostic result history:** View the diagnostic test execution history log, which contains a record of the results of previously run diagnostic tests. This feature enables administrators to specify the maximum size of the result history log file in the Diagnostic Application Settings window.
- **Hardware configuration changes:** View changes that have occurred to the testable devices on a server since the server was rebooted, the secure port server was restarted, or inventory was last performed. This feature reports changes in the system configuration, such as the addition or removal of a hard drive.
- **Hardware configuration changes history:** View the hardware configuration changes history log.
- **E-mailing logs:** Transfer logs to a central location using the e-mail interface provided by OMSA. The logs are sent as an e-mail attachment and include a current snapshot of the hardware configuration for inventory purposes, the diagnostic test execution history log, and the hardware configuration change history log.
- **Options for setting configuration parameters:** Set any of several configuration parameters—Log File Size, Number of Passes, Halt Execution of Test on First Error, Quick Test, and Halt Multiple Pass Test Execution on Error.

Refer to the “Dell diagnostic test packages” sidebar in this article for a complete list of Dell OpenManage Server Administrator Diagnostic Service test packages.

Diagnostic Service CLI

The OMSA CLI was designed for administrators who want to manage servers without installing the secure port server or using a Web browser interface. Administrators can either run a single diagnostic command or write a custom script to run on multiple servers.

Diagnostic Service CLI commands run from a command prompt and are context-sensitive. As a result, if a given hardware component is not available on the server, CLI commands related to that component will not be available. Custom scripts for all servers are generally run in the background and are not context-sensitive.

Therefore, administrators can distribute a command to run on a set of servers without worrying that the test will abort the script. If a CLI command runs on a server that does not have the requisite component installed, then the test package will return a message that says “Error! No device found to run X test on this machine.”

In this message, X is the name of the command issued.

The `omdiag` command allows administrators to run the Diagnostic Service diagnostic tests from the OMSA CLI. When diagnostic tests are run from the CLI, administrators can abort the tests from either the CLI or GUI. Figure 4 provides a high-level summary of the Diagnostic Service CLI commands available.

Diagnostic Service best practices

Dell recommends that administrators use the Diagnostic Service tool to perform tests when the server is up and running—instead of bringing down the server. Administrators should use the CLI scripts to generate batch files containing diagnostic commands, and run the diagnostic commands on a managed server during off-peak hours to reduce the impact of tests on production applications. The Diagnostic Service scripting capability helps administrators perform preventive diagnostics on a network of managed servers and is recommended for real-time system monitoring and reporting.

Dell PowerEdge Diagnostics overview

The Dell PowerEdge Diagnostics program is designed to provide comprehensive, cross-platform (Windows and Linux) hardware diagnostics. Using this tool, diagnostics can be run without bringing down the server. The application comprises a GUI, diagnostics engine, open diagnostic framework, and diagnostic modules.

The Dell PowerEdge Diagnostics program is a stand-alone application with a small footprint. It is downloadable from the Web. This program is designed to be available to administrators rapidly, because it requires no installation. To use the Dell PowerEdge Diagnostics program, the administrator simply downloads the executable from the Dell support site (support.dell.com), unzips it, runs the diagnostics, and then deletes the folder. Removal of the program does not leave any files behind.

Dell PowerEdge Diagnostics best practices


This tool is ideally used when OMSA is not installed or supported on a server. The program helps administrators diagnose issues both by themselves and in conjunction with Dell technical support. Dell recommends that administrators use this tool to run diagnostic tests when the system is up and running.

Tier 3 tools are offered primarily to provide comprehensive hardware diagnostics for servers in a post-OS environment.

Command level 1	Command level 2	Command level 3	Command level 4	Description
omdiag				
	about			Displays version number and properties for the OMSA version installed.
		details=true		Displays information for OMSA.
	system	Any level 3 command for chassis or storage		Runs the test for a specified chassis or storage component.
			passes= <i>n</i>	Runs a test <i>n</i> time(s).
			time= <i>minutes</i>	Runs a test for the specified number of minutes.
			quicktest=true/false	Uses a faster algorithm, if available, to conduct a specific test.
			haltoneerror=true/false	Stops the tests if an error is encountered.
			device= <i>number</i>	Specifies the device on which to run the test.
	chassis	cmos memory modem network parallelport pci serialport rac video		Runs the CMOS test. Runs the memory test. Runs the modem test. Runs the NIC test. Runs the parallel port test. Runs the PCI test. Runs the serial port test. Runs the RAC test. Runs the video test.
			passes= <i>n</i>	Runs a test <i>n</i> time(s).
			time= <i>minutes</i>	Runs a test for the specified number of minutes.
			quicktest=true/false	Uses a faster algorithm, if available, to conduct a specific test.
			haltoneerror=true/false	Stops the tests if an error is encountered.
			device= <i>number</i>	Specifies the device on which to run the test.
	storage	cddvd floppy raidctrl idedevdiag scsidevdiag		Runs the CD/DVD drive test. Runs the floppy disk drive test. Runs the RAID controller and attached device test. Runs the IDE disk and tape device tests. Runs the SCSI controller and attached tape and hard drive tests.
			passes= <i>n</i>	Runs a test <i>n</i> time(s).
			time= <i>minutes</i>	Runs a test for the specified number of minutes.
			quicktest=true/false	Uses a faster algorithm, if available, to conduct a specific test.
			haltoneerror=true/false	Stops the tests if an error is encountered.
			device= <i>number</i>	Specifies the device on which to run the test.

Figure 4. Summary of Diagnostic Service CLI commands

Optimal use of server diagnostic tools

For optimal benefits, a range of tier 1, tier 2, and tier 3 server diagnostic tools should be used throughout the life cycle of a server—from the server’s initial receipt and deployment until the server is retired. When used thoroughly and consistently, server diagnostic tools such as those provided by Dell can be used to identify faulty hardware before it is deployed, alert administrators to impending hardware failures, and analyze the cause of failures that do occur. Proactively monitoring the health of servers in this manner can help minimize server downtime, allowing organizations to operate more effectively with limited IT resources and to keep mission-critical applications up and running. 

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FOR MORE INFORMATION

Dell PowerEdge Diagnostics User’s Guide:
support.dell.com/support/edocs/software/smpediag