IBM System Storage N series

System-Level Diagnostics Guide

Contents

Preface

About this guide

This document applies to IBM N series systems running Data ONTAP, including systems with gateway functionality. If the term *7-Mode* is used in the document, it refers to Data ONTAP operating in 7-Mode, which has the same features and functionality found in the prior Data ONTAP 7.1, 7.2, and 7.3 release families. If the terms *Cluster-Mode* or *clustered Data ONTAP* are used in this document, they refer to the Data ONTAP features and functionality designed for clusters, which are different from 7-Mode and prior Data ONTAP 7.1, 7.2, and 7.3 release families.

In this document, the term *gateway* describes IBM N series storage systems that have been ordered with gateway functionality. Gateways support various types of storage, and they are used with third-party disk storage systems—for example, disk storage systems from IBM, HP®, Hitachi Data Systems®, and EMC®. In this case, disk storage for customer data and the RAID controller functionality is provided by the back-end disk storage system. A gateway might also be used with disk storage expansion units specifically designed for the IBM N series models.

The term *filer* describes IBM N series storage systems that either contain internal disk storage or attach to disk storage expansion units specifically designed for the IBM N series storage systems. Filer storage systems do not support using third-party disk storage systems.

Supported features

IBM System Storage N series storage systems are driven by NetApp Data ONTAP software. Some features described in the product software documentation are neither offered nor supported by IBM. Please contact your local IBM representative or reseller for further details.

Information about supported features can also be found on the N series support website (accessed and navigated as described in Websites).

Websites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. The following web pages provide N series information:

- A listing of currently available N series products and features can be found at the following web page:

  www.ibm.com/storage/nas/

- The IBM System Storage N series support website requires users to register in order to obtain access to N series support content on the web. To understand how the N series support web content is organized and navigated, and to access the N series support website, refer to the following publicly accessible web page:

  www.ibm.com/storage/support/nseries/

  This web page also provides links to AutoSupport information as well as other important N series product resources.

- IBM System Storage N series products attach to a variety of servers and operating systems. To determine the latest supported attachments, go to the IBM N series interoperability matrix at the following web page:

  www.ibm.com/systems/storage/network/interophome.html

- For the latest N series hardware product documentation, including planning, installation and setup, and hardware monitoring, service and diagnostics, see the IBM N series Information Center at the following web page:

  publib.boulder.ibm.com/infocenter/nasinfo/nseries/index.jsp

Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your IBM N series product, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure they are connected.
- Check the power switches to make sure the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Refer to the N series support website (accessed and navigated as described in Websites) for information on known problems and limitations.

Using the documentation

The latest versions of N series software documentation, including Data ONTAP and other software products, are available on the N series support website (accessed and navigated as described in Websites).

Current N series hardware product documentation is shipped with your hardware product in printed documents or as PDF files on a documentation CD. For the latest N series hardware product documentation PDFs, go to the N series support website.

Hardware documentation, including planning, installation and setup, and hardware monitoring, service, and diagnostics, is also provided in an IBM N series Information Center at the following web page:

publib.boulder.ibm.com/infocenter/nasinfo/nseries/index.jsp

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services. Visit the following web page for support telephone numbers:

www.ibm.com/planetwide/

Firmware updates

IBM N series product firmware is embedded in Data ONTAP. As with all devices, ensure that you run the latest level of firmware. Any firmware updates are posted to the N series support website (accessed and navigated as described in Websites).

Note: If you do not see new firmware updates on the N series support website, you are running the latest level of firmware.

Verify that the latest level of firmware is installed on your machine before contacting IBM for technical support.

How to send your comments

Your feedback helps us to provide the most accurate and high-quality information. If you have comments or suggestions for improving this document, please send them by email to starpubs@us.ibm.com.

Be sure to include the following:
- Exact publication title
- Publication form number (for example, GC26-1234-02)

- Page, table, or illustration numbers
- A detailed description of any information that should be changed

Introduction to system-level diagnostics

System-level diagnostics provides a command-line interface for tests that search for and determine hardware problems on supported storage systems. You use system-level diagnostics to confirm that a specific component is operating properly or to help identify faulty components.

System-level diagnostics is available for supported storage systems only. Entering system-level diagnostics at the command-line interface of unsupported storage systems generates an error message.

You run system-level diagnostics after one of the following common troubleshooting situations:

- Initial system installation
- Addition or replacement of hardware components
- System panic caused by an unidentified hardware failure
- Access to a specific device becomes intermittent or the device becomes unavailable
- System response time becomes sluggish

To run system-level diagnostics, you must already be running Data ONTAP because you need to reach the **Maintenance mode boot** option in Data ONTAP. There are several approaches to get to this option, but this is the recommended approach taken in the procedures documented in this guide. Some hardware components in your system may require a specific approach, and this would be documented in the applicable field replaceable unit flyer. This guide does not provide detailed definitions of specific commands, subcommands, tests, or conditions. The *na_sldiag(1) man page* describes the various commands and subcommands available for running system-level diagnostics.

Once the command is entered, the tests run in the background and the passed or failed outcome of the tests is logged in the internal memory-based log, which has a fixed size. Some tests are utilities and will simply state completed rather than passed or failed. After you run the appropriate tests, the procedures documented in this guide help you generate status report. Once the test results show a successful completion of system-level diagnostics, it is a recommended best practice to clear the log.

In the event of test failures, the status reports will help technical support make appropriate recommendations. The failure could be resolved by

re-installing a field-replaceable unit, by ensuring cables are connected, or by enabling specific tests recommended by technical support and then re-running those tests. If the failure cannot be resolved, then there is a hardware failure and the affected hardware must be replaced.

There are no error messages that require further definitions or explanations.

Requirements for running system-level diagnostics

Depending on the system-level diagnostic tests you are running, you need to be aware of time and system hardware requirements.

Each documented task has slight differences; use the recommended procedure for the task.

The following requirements must be met when running system-level diagnostics; otherwise, parts of the tests fail and error messages appear in the status report:

General requirements

- Each system being tested must be on a separate network.

  The network interface test assigns unique static IP addresses, beginning with 172.25.150.23, to all available network interfaces on a storage system. This results in network interface ports on different storage controllers being assigned the same IP address. If all the systems being tested are on the same network, then duplicate ip address warning messages appear on the connected consoles. These warning messages do not affect the test results.

System memory requirements

- You need to set aside time when running memory tests; the larger the memory capacity of your storage system, the longer it takes.

NIC requirements

- All adjacent network interface ports on the system must be connected for best performance using a standard Ethernet cable.

  Examples of adjacent ports are e0a and e0b or e2c and e2d.

  Attention: e0M and e0P ports cannot be connected together due to an internal switch connection. In systems with e0M and e0P ports, the most efficient pairings are e0M with e0a and e0P with e0b.

- If there are a number of network interface ports on the system, you may need to run the NIC system-level diagnostic test several times, limiting each run to no more than two pairs each time.

SAS requirements

- When running the SAS system-level diagnostic tests, adjacent SAS ports must be connected for best performance; storage shelves must be disconnected from the ports.

  Note: Connections between adjacent SAS ports is no longer a requirement for systems running Data ONTAP 8.2; however, only the internal loopback test will be run for systems with unconnected SAS ports.

FC-AL requirements

- When running the FC-AL system-level diagnostic tests, you must have loopback hoods on FC-AL interfaces on the motherboard or expansion adapters for best performance; all other cables for storage or Fibre Channel networks must be disconnected from the ports.

  Note: While the use of loopback hoods on FC-AL interfaces are no longer requirements for systems running Data ONTAP 8.2, the scope of the test coverage on the interface is also reduced.

Interconnect requirements

- Both platform controller modules in a dual controller system must be in Maintenance mode for the interconnect system-level diagnostic test to run.

  Attention: You will receive a warning message if you attempt to run the interconnect system-level diagnostic test with other system-level diagnostic tests.

How to use online command-line help

You can get command-line syntax help from the command line by entering the name of the command followed by **help** or the question mark (?).

The fonts or symbols used in syntax help are as follows:

keyword
> Specifies the name of a command or an option that must be entered as shown.

< > (less than, greater than symbols)
> Specify that you must replace the variable identified inside the symbols with a value.

| (pipe)
> Indicates that you must choose one of the elements on either side of the pipe.

[ ] (brackets)
> Indicate that the element inside the brackets is optional.

{ } (braces)
> Indicate that the element inside the braces is required.

You can also type the question mark at the command line for a list of all the commands that are available at the current level of administration (administrative or advanced).

The following example shows the result of entering the **environment help** command at the storage system command line. The command output displays the syntax help for the **environment** commands.

```
toaster> environment help
Usage: environment status |
[status] [shelf [<adapter>]] |
[status] [shelf_log] |
[status] [shelf_stats] |
[status] [shelf_power_status] |
[status] [chassis [all | list-sensors | Fan | Power | Temp | Power Supply | RTC Battery
| NVRAM4-temperature-7 | NVRAM4-battery-7]]
```

Running system installation diagnostics

You run diagnostics after an initial system installation to identify the version of system-level diagnostics and the supported devices on your storage system, and to verify that the installation is successful and that all hardware is functioning properly.

Before you begin

Your storage system must already be running Data ONTAP.

Procedure

1. At the storage system prompt, enter the following command to get to the LOADER prompt:
   ```
   halt
   ```
2. On the node with the replaced component, enter the following command at the LOADER prompt:
   ```
   boot_diags
   ```

   Note: You must enter this command from the LOADER prompt for system-level diagnostics to function properly. The **boot_diags** command starts special drivers designed specifically for system-level diagnostics.

   Important: During the **boot_diags** process, you might see the following prompts:
   - A prompt warning of a system ID mismatch and asking to override the system ID.
   - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the partner remains down.

   You can safely respond y to these prompts.
   The Maintenance mode prompt (*>) appears.
3. View the version of system-level diagnostics present on your storage system by entering the following command:
   ```
   sldiag version show
   ```
   The version is displayed in the format **System Level Diagnostics** *X.nn.nn*. The *X* is an alpha reference and *nn.nn* are major and minor numeric references, respectively.
4. Identify the device types in your new system installation so that you know which components to verify by entering the following command:

```
sldiag device types
```
Your storage system displays some or all of the following devices:

- **ata** is an Advanced Technology Attachment device.
- **bootmedia** is the system booting device.
- **cna** is a Converged Network Adapter not connected to a network or storage device.
- **env** is motherboard environmentals.
- **fcache** is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
- **fcal** is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.
- **fcvi** is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
- **interconnect** or **nvram-ib** is the high-availability interface.
- **mem** is system memory.
- **nic** is a Network Interface Card not connected to a network.
- **nvram** is nonvolatile RAM.
- **nvmem** is a hybrid of NVRAM and system memory.
- **sas** is a Serial Attached SCSI device not connected to a disk shelf.
- **serviceproc** is the Service Processor.
- **storage** is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
- **toe** is a TCP Offload Engine, a type of NIC.

5. Run all the default selected diagnostic tests on your storage system by entering the following command:
```
sldiag device run
```

6. View the status of the test by entering the following command:
```
sldiag device status
```
Your storage system provides the following output while the tests are still running:

```
There are still test(s) being processed.
```

After all the tests are complete, the following response appears by default:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

7. Verify that there are no hardware problems on your new storage system by entering the following command:

```
sldiag device status -long -state failed
```
The example shows that the tests were run without the appropriate hardware:

If the system-level diagnostics tests...	Then...

Were completed without any failures	There are no hardware problems and your storage system returns to the prompt.
	
	 1. Clear the status logs by entering the following command:
	 `sldiag device clearstatus`
	
	 2. Verify that the log is cleared by entering the following command:
	 `sldiag device status`
	
	 The following default response is displayed:
	
	 SLDIAG: No log messages are present.
	
	 3. Exit Maintenance mode by entering the following command:
	 `halt`
	
	 4. Enter the following command at the firmware prompt to reboot the storage system:
	 `boot`
	
	 You have completed system-level diagnostics.

Resulted in some test failures	Determine the cause of the problem. 1. Exit Maintenance mode by entering the following command: `halt` 2. Perform a clean shutdown and disconnect the power supplies. 3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system. 4. Reconnect the power supplies and power on the storage system. 5. Repeat Steps 1 through 7 of *Running system installation diagnostics*.

The following example shows how the full status of failures that occurred
is displayed:

```
*> sldiag device status -long -state failed

TEST START ----------------------------------------
DEVTYPE: nvram_ib
NAME: external  loopback test
START DATE: Sat Jan  3 23:10:55 GMT 2009

STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan  3 23:11:04 GMT 2009

LOOP: 1/1
TEST END ------------------------------------------

TEST START ----------------------------------------
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
 Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK   OK
Error Count: 2  Run Time: 70 secs
>>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END ------------------------------------------
```

Running system panic diagnostics

Running diagnostics after your storage system suffers a system panic can help you to identify the possible cause of the panic.

Procedure

1. At the storage system prompt, enter the following command to get to the LOADER prompt:
   ```
   halt
   ```

2. On the node with the replaced component, enter the following command at the LOADER prompt:
   ```
   boot_diags
   ```

   Note: You must enter this command from the LOADER prompt for system-level diagnostics to function properly. The **boot_diags** command starts special drivers designed specifically for system-level diagnostics.

   Important: During the **boot_diags** process, you might see the following prompts:
   - A prompt warning of a system ID mismatch and asking to override the system ID.
   - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the partner remains down.

   You can safely respond y to these prompts.
   The Maintenance mode prompt (*>) appears.

3. Run diagnostics on all the devices by entering the following command:
   ```
   sldiag device run
   ```

4. View the status of the test by entering the following command:
   ```
   sldiag device status
   ```
   Your storage system provides the following output while the tests are still running:

   ```
   There are still test(s) being processed.
   ```

   After all the tests are complete, you receive the following default response:

   ```
   *> <SLDIAG:_ALL_TESTS_COMPLETED>
   ```

5. Identify the cause of the system panic by entering the following command:
   `sldiag device status -long -state failed`
   The example shows that the tests were run without the appropriate hardware:

If the system-level diagnostics tests...	Then...

Were completed without any failures	There are no hardware problems and your storage system returns to the prompt.
	
	1. Clear the status logs by entering the following command:
	`sldiag device clearstatus`
	
	2. Verify that the log is cleared by entering the following command:
	`sldiag device status`
	
	The following default response is displayed:
	
	`SLDIAG: No log messages are present.`
	
	3. Exit Maintenance mode by entering the following command:
	`halt`
	
	4. Enter the following command at the firmware prompt to reboot the storage system:
	`boot`
	
	You have completed system-level diagnostics.

Resulted in some test failures	Determine the cause of the problem. 1. Exit Maintenance mode by entering the following command: `halt` 2. Perform a clean shutdown and disconnect the power supplies. 3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system. 4. Reconnect the power supplies and power on the storage system. 5. Repeat Steps 1 through 5 of *Running system panic diagnostics*.

The following example displays the full status of the failures that occurred:

```
*> sldiag device status -long -state failed

TEST START ----------------------------------------
DEVTYPE: nvram_ib
NAME: external  loopback test
START DATE: Sat Jan  3 23:10:55 GMT 2009

STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan  3 23:11:04 GMT 2009

LOOP: 1/1
TEST END ------------------------------------------

TEST START ----------------------------------------
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
 Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK   OK
Error Count: 2  Run Time: 70 secs
>>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END ------------------------------------------
```

What to do next

If the failures persist after repeating the steps, you need to replace the hardware.

Running slow system response diagnostics

Running diagnostics can help you identify the causes of slow system response times.

Procedure

1. At the storage system prompt, enter the following command to get to the LOADER prompt:
   ```
   halt
   ```

2. On the node with the replaced component, enter the following command at the LOADER prompt:
   ```
   boot_diags
   ```

   Note: You must enter this command from the LOADER prompt for system-level diagnostics to function properly. The **boot_diags** command starts special drivers designed specifically for system-level diagnostics.

   Important: During the **boot_diags** process, you might see the following prompts:
   - A prompt warning of a system ID mismatch and asking to override the system ID.
   - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the partner remains down.

   You can safely respond y to these prompts.
   The Maintenance mode prompt (*>) appears.

3. Run diagnostics on all the devices by entering the following command:
   ```
   sldiag device run
   ```

4. View the status of the test by entering the following command:
   ```
   sldiag device status
   ```
   Your storage system provides the following output while the tests are still running:
   ```
   There are still test(s) being processed.
   ```

   After all the tests are complete, the following response appears by default:
   ```
   *> <SLDIAG:_ALL_TESTS_COMPLETED>
   ```

5. Identify the cause of the system sluggishness by entering the following command:

```
sldiag device status -long -state failed
```
The example shows that the tests were run without the appropriate hardware:

If the system-level diagnostics tests...	Then...

Were completed without any failures	There are no hardware problems and your storage system returns to the prompt.
	
	 1. Clear the status logs by entering the following command:
	 `sldiag device clearstatus`
	
	 2. Verify that the log is cleared by entering the following command:
	 `sldiag device status`
	
	 The following default response is displayed:
	
	 SLDIAG: No log messages are present.
	
	 3. Exit Maintenance mode by entering the following command:
	 `halt`
	
	 4. Enter the following command at the firmware prompt to reboot the storage system:
	 `boot`
	
	 You have completed system-level diagnostics.

Resulted in some test failures	Determine the cause of the problem. 1. Exit Maintenance mode by entering the following command: `halt` 2. Perform a clean shutdown and disconnect the power supplies. 3. Verify that you observed all the requirements for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system. 4. Reconnect the power supplies and power on the storage system. 5. Repeat Steps 1 through 5 of *Running slow system response diagnostics*.

If the system-level diagnostics tests...	Then...
Resulted in the same test failures	Technical support might recommend modifying the default settings on some of the tests to help identify the problem.
	1. Modify the selection state of a specific device or type of device on your storage system by entering the following command: `sldiag device modify [-dev` *devtype*`|mb|slots`*lotnum*`] [-name` *device*`] [-selection` *enable*|*disable*|*default*|*only*`]` `-selection` *enable | disable | default | only* allows you to enable, disable, accept the default selection of a specified device type or named device, or only enable the specified device or named device by disabling all others first.
	2. Verify that the tests were modified by entering the following command: `sldiag option show`
	3. Repeat Steps 3 through 5 of *Running slow system response diagnostics*.
	4. After you identify and resolve the problem, reset the tests to their **default** states by repeating substeps 1 and 2.
	5. Repeat Steps 1 through 5 of *Running slow system response diagnostics*.

The following example pulls up the full status of failures that occurred:

```
*> sldiag device status -long -state failed

TEST START -----------------------------------------
DEVTYPE: nvram_ib
NAME: external  loopback test
START DATE: Sat Jan  3 23:10:55 GMT 2009

STATUS: Completed
ib3a: could not set loopback mode, test failed
END DATE: Sat Jan  3 23:11:04 GMT 2009

LOOP: 1/1
TEST END -------------------------------------------

TEST START -----------------------------------------
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
 Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK   OK
Error Count: 2  Run Time: 70 secs
>>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END -------------------------------------------
```

What to do next

If the failures persist after repeating the steps, you need to replace the hardware.

Running hardware installation diagnostics

You run diagnostics after adding or replacing hardware components in your storage system to verify that the component has no problems and that the installation is successful.

Procedure

1. As the node boots, interrupt the boot process by pressing `Ctrl-C`.

2. If the boot process was interrupted too late and the Boot Menu appeared, perform the following steps:

   a. Select the Maintenance mode option from the displayed menu.

   b. After the system boots to Maintenance mode, enter the following command at the prompt:
      `halt`
      After you issue the command, wait until the system stops at the LOADER prompt.

      Important: During the boot process, you might see the following prompts:
      - A prompt warning of a system ID mismatch and asking to override the system ID.
      - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the healthy node remains down.

      You can safely respond y to these prompts.

3. On the node with the replaced component, enter the following command at the LOADER prompt:
   `boot_diags`

   Note: You must enter this command from the LOADER prompt for system-level diagnostics to function properly. The **boot_diags** command starts special drivers designed specifically for system-level diagnostics.

   Important: During the **boot_diags** process, you might see the following prompts:
   - A prompt warning of a system ID mismatch and asking to override the system ID.
   - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the partner remains down.

You can safely respond y to these prompts.
The Maintenance mode prompt (*>) appears.

4. Run the default tests on the particular device you added or replaced by entering the following command:

`sldiag device run [-dev `*`devtype`*`|mb|slot`*`slotnum`*`] [-name `*`device`*`]`

- `-dev` *devtype* specifies the type of device to be tested.

  - **ata** is an Advanced Technology Attachment device.
  - **bootmedia** is the system booting device.
  - **cna** is a Converged Network Adapter not connected to a network or storage device.
  - **env** is motherboard environmentals.
  - **fcache** is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
  - **fcal** is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.
  - **fcvi** is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
  - **interconnect** or **nvram-ib** is the high-availability interface.
  - **mem** is system memory.
  - **nic** is a Network Interface Card not connected to a network.
  - **nvram** is nonvolatile RAM.
  - **nvmem** is a hybrid of NVRAM and system memory.
  - **sas** is a Serial Attached SCSI device not connected to a disk shelf.
  - **serviceproc** is the Service Processor.
  - **storage** is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
  - **toe** is a TCP Offload Engine, a type of NIC.

- `mb` specifies that all the motherboard devices are to be tested.
- `slot` *slotnum* specifies that a device in a specific slot number is to be tested.
- `-name`*device* specifies a given device class and type.

5. View the status of the test by entering the following command:

`sldiag device status`

Your storage system provides the following output while the tests are still running:

```
There are still test(s) being processed.
```

After all the tests are complete, the following response appears by default:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

6. Verify that no hardware problems resulted from the addition or replacement of hardware components on your storage system by entering the following command:
   ```
   sldiag device status [-dev devtype|mb|slotslotnum] [-name device]
   -long -state failed
   ```
   The example shows that the tests were run without the appropriate hardware:

If the system-level diagnostics tests...	Then...
Were completed without any failures	There are no hardware problems and your storage system returns to the prompt.
	1. Clear the status logs by entering the following command: `sldiag device clearstatus [-dev devtype|mb|slotslotnum]`

	2. Verify that the log is cleared by entering the following command:
	`sldiag device status [-dev devtype|mb|slotslotnum]`
	
	The following default response is displayed:
	
	`SLDIAG: No log messages are present.`

	3. Exit Maintenance mode by entering the following command: `halt`
	4. Enter the following command at the firmware prompt to reboot the storage system: `boot` You have completed system-level diagnostics.

If the system-level diagnostics tests...	Then...
Resulted in some test failures	Determine the cause of the problem.
	1. Exit Maintenance mode by entering the following command: `halt`
	2. Perform a clean shutdown and disconnect the power supplies.
	3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system.
	4. Reconnect the power supplies and power on the storage system.
	5. Repeat Steps 1 through 6 of *Running hardware installation diagnostics*.

The following example pulls up the full status of failures resulting from testing a newly installed FC-AL adapter:

```
*> sldiag device status -dev fcal -long -state failed

TEST START -----------------------------------------
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
 Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK   OK
Error Count: 2  Run Time: 70 secs
>>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END -------------------------------------------
```

What to do next

If the failures persist after repeating the steps, you need to replace the hardware.

Running device failure diagnostics

Running diagnostics can help you determine why access to a specific device becomes intermittent or why the device becomes unavailable in your storage system.

Procedure

1. At the storage system prompt, enter the following command to get to the LOADER prompt:
   `halt`

2. On the node with the replaced component, enter the following command at the LOADER prompt:
   `boot_diags`

   Note: You must enter this command from the LOADER prompt for system-level diagnostics to function properly. The **boot_diags** command starts special drivers designed specifically for system-level diagnostics.

   Important: During the **boot_diags** process, you might see the following prompts:
   - A prompt warning of a system ID mismatch and asking to override the system ID.
   - A prompt warning that when entering Maintenance mode in an HA configuration you must ensure that the partner remains down.

   You can safely respond y to these prompts.
   The Maintenance mode prompt (*>) appears.

3. Run diagnostics on the device causing problems by entering the following command: `sldiag device run [-dev devtype|mb|slotslotnum] [-name device]`
   - **-dev** *devtype* specifies the type of device to be tested.
     - **ata** is an Advanced Technology Attachment device.
     - **bootmedia** is the system booting device.
     - **cna** is a Converged Network Adapter not connected to a network or storage device.
     - **env** is motherboard environmentals.
     - **fcache** is the Flash Cache adapter, also known as the Performance Acceleration Module 2.
     - **fcal** is a Fibre Channel-Arbitrated Loop device not connected to a storage device or Fibre Channel network.

- – **fcvi** is the Fiber Channel Virtual Interface not connected to a Fibre Channel network.
- – **interconnect** or **nvram-ib** is the high-availability interface.
- – **mem** is system memory.
- – **nic** is a Network Interface Card not connected to a network.
- – **nvram** is nonvolatile RAM.
- – **nvmem** is a hybrid of NVRAM and system memory.
- – **sas** is a Serial Attached SCSI device not connected to a disk shelf.
- – **serviceproc** is the Service Processor.
- – **storage** is an ATA, FC-AL, or SAS interface that has an attached disk shelf.
- – **toe** is a TCP Offload Engine, a type of NIC.
- • mb specifies that all the motherboard devices are to be tested.
- • slot *slotnum* specifies that a device in a specific slot number is to be tested.
- • -name*device* specifies a given device class and type.

4. View the status of the test by entering the following command: sldiag device status Your storage system provides the following output while the tests are still running:

```
There are still test(s) being processed.
```

After all the tests are complete, the following response appears by default:

```
*> <SLDIAG:_ALL_TESTS_COMPLETED>
```

5. Identify any hardware problems by entering the following command: sldiag device status [-dev *devtype*|mb|slot*slotnum*] [-name *device*] -long -state failed The example shows that the tests were run without the appropriate hardware:

If the system-level diagnostics tests...	Then...
Resulted in some test failures	Determine the cause of the problem. 1. Exit Maintenance mode by entering the following command: `halt` 2. Perform a clean shutdown and disconnect the power supplies. 3. Verify that you have observed all the considerations identified for running system-level diagnostics, that cables are securely connected, and that hardware components are properly installed in the storage system. 4. Reconnect the power supplies and power on the storage system. 5. Repeat Steps 1 through 5 of *Running device failure diagnostics*.
Resulted in the same test failures	Technical support might recommend modifying the default settings on some of the tests to help identify the problem. 1. Modify the selection state of a specific device or type of device on your storage system by entering the following command: `sldiag device modify [-dev` *devtype*`|mb|slots`*slotnum*`] [-name` *device*`] [-selection` *enable*`|`*disable*`|`*default*`|`*only*`]` `-selection` *enable	disable	default	only* allows you to enable, disable, accept the default selection of a specified device type or named device, or only enable the specified device or named device by disabling all others first. 2. Verify that the tests were modified by entering the following command: `sldiag option show` 3. Repeat Steps 3 through 5 of *Running device failure diagnostics*. 4. After you identify and resolve the problem, reset the tests to their **default** states by repeating substeps 1 and 2. 5. Repeat Steps 1 through 5 of *Running device failure diagnostics*.

If the system-level diagnostics tests...	Then...
Were completed without any failures	There are no hardware problems and your storage system returns to the prompt.
	1. Clear the status logs by entering the following command: `sldiag device clearstatus [-dev `*`devtype`*`|mb|slots`*`lotnum`*`]`
	2. Verify that the log is cleared by entering the following command: `sldiag device status [-dev `*`devtype`*`|mb|slots`*`lotnum`*`]`
	The following default response is displayed:
	`SLDIAG: No log messages are present.`
	3. Exit Maintenance mode by entering the following command: `halt`
	4. Enter the following command at the firmware prompt to reboot the storage system: `boot`
	You have completed system-level diagnostics.

The following example shows how the full status of failures resulting from testing the FC-AL adapter are displayed:

```
*> sldiag device status fcal -long -state failed

TEST START ----------------------------------------
DEVTYPE: fcal
NAME: Fcal Loopback Test
START DATE: Sat Jan  3 23:10:56 GMT 2009

STATUS: Completed
Starting test on Fcal Adapter: 0b
Started gathering adapter info.
Adapter get adapter info OK
Adapter fc_data_link_rate: 1Gib
Adapter name: QLogic 2532
Adapter firmware rev: 4.5.2
Adapter hardware rev: 2

Started adapter get WWN string test.
Adapter get WWN string OK wwn_str: 5:00a:098300:035309

Started adapter interrupt test
Adapter interrupt test OK

Started adapter reset test.
Adapter reset OK

Started Adapter Get Connection State Test.
Connection State: 5
Loop on FC Adapter 0b is OPEN

Started adapter Retry LIP test
Adapter Retry LIP OK

ERROR: failed to init adaptor port for IOCTL call

ioctl_status.class_type = 0x1

ioctl_status.subclass = 0x3

ioctl_status.info = 0x0
 Started INTERNAL LOOPBACK:
INTERNAL LOOPBACK   OK
Error Count: 2  Run Time: 70 secs
>>>>> ERROR, please ensure the port has a shelf or plug.
END DATE: Sat Jan  3 23:12:07 GMT 2009

LOOP: 1/1
TEST END ------------------------------------------
```

What to do next

If the failures persist after repeating the steps, you need to replace the
hardware.

Copyright and trademark information

This section includes copyright and trademark information, and important notices.

Copyright information

Copyright ©1994 - 2014 NetApp, Inc. All rights reserved. Printed in the U.S.A.

Portions copyright © 2014 IBM Corporation. All rights reserved.

US Government Users Restricted Rights - Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

References in this documentation to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only IBM's product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any of IBM's or NetApp's intellectual property rights may be used instead of the IBM or NetApp product, program, or service. Evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM and NetApp, are the user's responsibility.

No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP "AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES

(INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S.A. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

Trademark information

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. A complete and current list of other IBM trademarks is available on the Web at http://www.ibm.com/legal/copytrade.shtml

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

NetApp, the NetApp logo, Network Appliance, the Network Appliance logo, Akorri, ApplianceWatch, ASUP, AutoSupport, BalancePoint, BalancePoint Predictor, Bycast, Campaign Express, ComplianceClock, Cryptainer, CryptoShred, CyberSnap, Data Center Fitness, Data ONTAP, DataFabric, DataFort, Decru, Decru DataFort, DenseStak, Engenio, Engenio logo, E-Stack, ExpressPod, FAServer, FastStak, FilerView, Flash Accel, Flash Cache, Flash

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe on any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, N.Y. 10504-1785
U.S.A.

For additional information, visit the web at:
http://www.ibm.com/ibm/licensing/contact/

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law:

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make

improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM web sites are provided for convenience only and do not in any manner serve as an endorsement of those web sites. The materials at those web sites are not part of the materials for this IBM product and use of those web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

If you are viewing this information in softcopy, the photographs and color illustrations may not appear.

IBM ®