



Document Number: DSP1104

Date: 2013-06-19

Version: 1.1.0a

Fibre Channel Host Bus Adapter Diagnostics Profile

Information for Work-in-Progress version:

IMPORTANT: This document is not a standard. It does not necessarily reflect the views of the DMTF or all of its members. Because this document is a Work in Progress, it may still change, perhaps profoundly. This document is available for public review and comment until the stated expiration date.

It expires on: 2013-12-19

Provide any comments through the DMTF Feedback Portal:

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

Document Type: Specification

Document Status: Work In Progress

Document Language: en-US

Copyright notice

Copyright © 2013 Distributed Management Task Force, Inc. (DMTF). All rights reserved.

DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems management and interoperability. Members and non-members may reproduce DMTF specifications and documents, provided that correct attribution is given. As DMTF specifications may be revised from time to time, the particular version and release date should always be noted.

Implementation of certain elements of this standard or proposed standard may be subject to third party patent rights, including provisional patent rights (herein "patent rights"). DMTF makes no representations to users of the standard as to the existence of such rights, and is not responsible to recognize, disclose, or identify any or all such third party patent right, owners or claimants, nor for any incomplete or inaccurate identification or disclosure of such rights, owners or claimants. DMTF shall have no liability to any party, in any manner or circumstance, under any legal theory whatsoever, for failure to recognize, disclose, or identify any such third party patent rights, or for such party's reliance on the standard or incorporation thereof in its product, protocols or testing procedures. DMTF shall have no liability to any party implementing such standard, whether such implementation is foreseeable or not, nor to any patent owner or claimant, and shall have no liability or responsibility for costs or losses incurred if a standard is withdrawn or modified after publication, and shall be indemnified and held harmless by any party implementing the standard from any and all claims of infringement by a patent owner for such implementations.

For information about patents held by third-parties which have notified the DMTF that, in their opinion, such patent may relate to or impact implementations of DMTF standards, visit <http://www.dmtf.org/about/policies/disclosures.php>.

CONTENTS

33	Foreword	5
34	Introduction.....	6
35	1 Scope	7
36	2 Normative references	7
37	3 Terms and definitions	8
38	4 Symbols and abbreviated terms	8
39	5 Synopsis	10
40	6 Description	10
41	7 Implementation	14
42	7.1 FC HBA test Information	14
43	7.2 CIM_FCHBADiagnosticTest	17
44	7.3 CIM_FCHBADiagnosticSettingData	18
45	7.4 CIM_FCHBADiagnosticServiceCapabilities	21
46	7.5 Fibre Channel Host Bus Adapter Diagnostics Profile indications support	22
47	7.6 Diagnostics alert indications and standard messages	23
48	8 Methods	33
49	8.1 CIM_FCHBADiagnosticTest.RunDiagnosticService()	33
50	8.2 Profile conventions for operations	34
51	9 Use cases	34
52	9.1 Overview	34
53	9.2 Use case summary	34
54	9.3 Verifying FC HBA health	35
55	9.4 Troubleshooting SAN issues	35
56	10 CIM elements	36
57	10.1 CIM_FCHBADiagnosticTest	38
58	10.2 CIM_FCHBADiagnosticSettingData	38
59	10.3 CIM_FCHBADiagnosticServiceCapabilities	39
60	10.4 CIM_RegisteredProfile	39
61	10.5 CIM_AffectedJobElement	40
62	10.6 CIM_AvailableDiagnosticService	40
63	10.7 CIM_ElementCapabilities	40
64	10.8 CIM_ElementSettingData (DiagnosticSettingData)	41
65	10.9 CIM_ElementSettingData (JobSettingData)	41
66	10.10 CIM_ElementSoftwareIdentity	41
67	10.11 CIM_HostedService	42
68	10.12 CIM_OwningJobElement	42
69	10.13 CIM_RecordAppliesToElement	42
70	10.14 CIM_ServiceAffectsElement	43
71	10.15 CIM_ServiceAvailableToElement	43
72	10.16 CIM_ServiceComponent	43
73	10.17 CIM_UseOfLog	44
74	10.18 CIM_FilterCollection	44
75	10.19 CIM_IndicationFilter	44
76	10.20 CIM_MemberOfCollection	45
77	10.21 CIM_OwningCollectionElement	45
78	ANNEX A (informative) Change log	46
79		

Figures

- Figure 1 – Fibre Channel Host Bus Adapter Diagnostics Profile: Profile class diagram 13
- Figure 2 – Fibre Channel Host Bus Adapter Diagnostics Profile: Profile class diagram..... 13

Tables

Table 1 – Referenced profiles	10
Table 2 – Test type information.....	14
Table 3 – CIM_FCHBADiagnosticTest property requirements	17
Table 4 – CIM_FCHBADiagnosticTest property requirements	18
Table 5 – CIM_FCHBADiagnosticSettingData property requirements	19
Table 6 – CIM_FCHBADiagnosticSettingData.EchoMechanism.....	20
Table 7 – CIM_FCHBADiagnosticSettingData.PingMechanism	21
Table 8 – CIM_FCHBADiagnosticServiceCapabilities property requirements	21
Table 9 – Fibre Channel Host Bus Adapter Diagnostics Profile use cases	34
Table 10 – CIM elements: Fibre Channel Host Bus Adapter Diagnostics Profile	36
Table 11 – Class: CIM_FCHBADiagnosticTest	38
Table 12 – Class: CIM_FCHBADiagnosticSettingData	39
Table 13 – Class: CIM_FCHBADiagnosticServiceCapabilities.....	39
Table 14 – Class: CIM_RegisteredProfile	39
Table 15 – Class: CIM_AffectedJobElement	40
Table 16 – Class: CIM_AvailableDiagnosticService	40
Table 17 – Class: CIM_ElementCapabilities.....	40
Table 18 – Class: CIM_ElementSettingData	41
Table 19 – Class: CIM_ElementSettingData	41
Table 20 – Class: CIM_ElementSoftwareIdentity	42
Table 21 – Class: CIM_HostedService	42
Table 22 – Class: CIM_OwningJobElement	42
Table 23 – Class: CIM_RecordAppliesToElement	43
Table 24 – Class: CIM_ServiceAffectsElement	43
Table 25 – Class: CIM_ServiceAvailableToElement	43
Table 26 – Class: CIM_ServiceComponent.....	44
Table 27 – Class: CIM_UseOfLog	44
Table 28 – Class: CIM_FilterCollection.....	44
Table 29 – Class: CIM_IndicationFilter	45
Table 30 – Class: CIM_MemberOfCollection.....	45
Table 31 – Class: CIM_OwningCollectionElement	45

116

Foreword

117 The *Fibre Channel Host Bus Adapter Diagnostics Profile* (DSP1104) was prepared by the Diagnostics
118 Working Group of the DMTF.

119 DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems
120 management and interoperability. For information about the DMTF, see <http://www.dmtf.org>.

121 Acknowledgments

122 The DMTF acknowledges the following individuals for their contributions to this document:

- 123 • Rodney Brown – IBM Corporation
- 124 • Carl Chan – WBEM Solutions, Inc.
- 125 • Peter Lamanna – EMC Corporation
- 126 • Mike Walker – Storage Networking Industry Association

127 Introduction

128 A *profile* is a collection of Common Information Model (CIM) elements and behavior rules that represent a
129 specific area of management. The purpose of the profile is to ensure interoperability of Web-Based
130 Enterprise Management (WBEM) services for a specific subset of the CIM schema — in this case, FC
131 HBA diagnostics.

132 Diagnostics is a critical component of systems management. Diagnostic services are used in problem
133 containment to maintain availability, achieve fault isolation for system recovery, establish system integrity
134 during boot, increase system reliability, and perform routine proactive system verification. The goal of the
135 Common Diagnostic Model (CDM) is to define industry-standard building blocks based on, and consistent
136 with, the DMTF CIM, which enable seamless integration of vendor-supplied diagnostic services into
137 system and storage area network management frameworks.

138 The goal of the *Fibre Channel Host Bus Adapter Diagnostics Profile* is to define industry-standard building
139 blocks that enable seamless problem determination support for Fibre Channel Host Bus Adapters (FC
140 HBA) and to troubleshoot network problems involving FC HBAs. The profile extends the standard
141 diagnostic profile by identifying a base set of FC HBA functions that should be diagnosed by provider
142 implementations. Suppliers can differentiate their diagnostic offering by providing this base set of
143 diagnostics and developing diagnostics to analyze proprietary features of the FC HBA.

144 Document conventions

145 Typographical conventions

146 The following typographical conventions are used in this document:

- 147 • Document titles are marked in *italics*.
- 148 • Important terms that are used for the first time are marked in *italics*.

149 ABNF usage conventions

150 Format definitions in this document are specified using ABNF (see [RFC5234](#)), with the following
151 deviations:

- 152 • Literal strings are to be interpreted as case-sensitive Unicode characters, as opposed to the
153 definition in [RFC5234](#) that interprets literal strings as case-insensitive US-ASCII characters.

Fibre Channel Host Bus Adapter Diagnostics Profile

1 Scope

The *Fibre Channel Host Bus Adapter Diagnostics Profile* specializes the *Diagnostics Profile* (DSP1002) by defining the diagnostic tests needed to determine the health of an FC HBA as well as the tests needed to troubleshoot storage area network problems involving FC HBAs. The diagnostic tests are defined as subclasses of CIM_DiagnosticTest.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated or versioned references, only the edition cited (including any corrigenda or DMTF update versions) applies. For references without a date or version, the latest published edition of the referenced document (including any corrigenda or DMTF update versions) applies.

DMTF DSP0004, *CIM Infrastructure Specification 2.6*,
http://dmtof.org/sites/default/files/standards/documents/DSP0004_2.6.pdf

DMTF DSP0200, *CIM Operations over HTTP 1.3*,
http://dmtof.org/sites/default/files/standards/documents/DSP0200_1.3.pdf

DMTF DSP1001, *Management Profile Specification Usage Guide 1.0*,
http://dmtof.org/sites/default/files/standards/documents/DSP1001_1.0.pdf

DMTF DSP1002, *Diagnostics Profile 2.1*,
http://dmtof.org/sites/default/files/standards/documents/DSP1002_2.1.0a.pdf

DMTF DSP1033, *Profile Registration Profile 1.0*,
http://dmtof.org/sites/default/files/standards/documents/DSP1033_1.0.pdf

DMTF DSP1054, *Indications Profile 1.2*,
http://dmtof.org/sites/default/files/standards/documents/DSP1054_1.2.pdf

DMTF DSP1119, *Diagnostics Job Control Profile 1.0.0*,
http://dmtof.org/sites/default/files/standards/documents/DSP1119_1.0.0b.pdf

DMTF DSP8055, *Diagnostics Message Registry 1.0.0b*,
http://www.dmtf.org/sites/default/files/standards/documents/DSP8055_1.0.0b.xml

IETF RFC5234, *ABNF: Augmented BNF for Syntax Specifications, January 2008*,
<http://tools.ietf.org/html/rfc5234>

ISO/IEC Directives, Part 2, *Rules for the structure and drafting of International Standards*,
<http://isotc.iso.org/livelink/livelink.exe?func=ll&objId=4230456&objAction=browse&sort=subtype>

T11, *Fibre Channel Generic Services – 5 (FC-GS-5)*, T11 document T11/1677-D, Rev 8.51,

T11, *Fibre Channel Storage Network Ping (SNPing)*, T11 document T11/07-116v5, Rev 0.65,

T11, *Storage Management – HBA – 2nd Generation (SM-HBA-2)*, T11 document T11/1841-D, Rev 0.20,
<ftp://ftp.t10.org/t11/document.06/06-691v1.pdf>

190 SMI-S 1.3 FC HBA Profile (in Host Book)
191 http://www.snia.org/sites/default/files/SMI-Sv1.3r6_Host.book_.pdf
192
193 SMI-S 1.6 Storage HBA Profile (in Host Book)
194 http://www.snia.org/sites/default/files/SMI-Sv1.6r4-Host.book_.pdf

195 3 Terms and definitions

196 In this document, some terms have a specific meaning beyond the normal English meaning. Those terms
197 are defined in this clause.

198 The terms "shall" ("required"), "shall not," "should" ("recommended"), "should not" ("not recommended"),
199 "may," "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described
200 in [ISO/IEC Directives, Part 2](#), Annex H. The terms in parenthesis are alternatives for the preceding term,
201 for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that
202 [ISO/IEC Directives, Part 2](#), Annex H specifies additional alternatives. Occurrences of such additional
203 alternatives shall be interpreted in their normal English meaning.

204 The terms "clause," "subclause," "paragraph," and "annex" in this document are to be interpreted as
205 described in [ISO/IEC Directives, Part 2](#), Clause 5.

206 The terms "normative" and "informative" in this document are to be interpreted as described in [ISO/IEC](#)
207 [Directives, Part 2](#), Clause 3. In this document, clauses, subclauses, or annexes labeled "(informative)" do
208 not contain normative content. Notes and examples are always informative elements.

209 The terms defined in [DSP0004](#), [DSP0200](#), and [DSP1001](#) apply to this document.

210 4 Symbols and abbreviated terms

211 The following symbols and abbreviations are used in this document.

212 4.1

213 CDM

214 Common Diagnostic Model

215 4.2

216 CIM

217 Common Information Model

218 4.3

219 CIMOM

220 CIM Object Manager

221 4.4

222 CRU

223 Customer Replaceable Unit

224 4.5

225 CT

226 Common Transport

227 4.6

228 FRU

229 Field Replaceable Unit

230	4.7
231	FC
232	Fibre Channel
233	4.8
234	HBA
235	Host Bus Adapter
236	4.9
237	ICMP
238	Internet Control Message Protocol
239	4.10
240	LED
241	Light-Emitting Diode
242	4.11
243	LUN
244	Logical Unit Number
245	4.12
246	ME
247	Managed Element
248	4.13
249	MOF
250	Managed Object Format
251	4.14
252	PD
253	Problem Determination
254	4.15
255	PFA
256	Predictive Failure Analysis
257	4.16
258	POST
259	Power-On Self-Test
260	4.17
261	SAN
262	Storage Area Network
263	4.18
264	SLP
265	Service Location Protocol
266	4.19
267	SM-HBA
268	Storage Management Host Bus Adapter

269 **4.20**
 270 **SNPing**
 271 Storage Network Ping

272 **4.21**
 273 **WBEM**
 274 Web-Based Enterprise Management

275 **4.22**
 276 **WWPN**
 277 World Wide Port Name

278 **5 Synopsis**

279 **Profile Name:** Fibre Channel Host Bus Adapter Diagnostics

280 **Version:** 1.1.0a

281 **Organization:** DMTF

282 **CIM schema version:** 2.31

283 **Central Class:** CIM_FCHBADiagnosticTest

284 **Scoping Class:** CIM_ComputerSystem

285 **Specializes:** Diagnostics Profile 2.1.0

286 The *Fibre Channel Host Bus Adapter Diagnostics Profile* extends the management capability of
 287 referencing profiles by adding common methods for determining that the FC HBA is operating normally
 288 and for troubleshooting Fibre Channel network problems involving the FC HBA in a managed system.

289 CIM_FCHBADiagnosticTest shall be the Central Class of this profile. The instance of
 290 CIM_FCHBADiagnosticTest shall be the Central Instance of this profile. CIM_ComputerSystem shall be
 291 the Scoping Class of this profile. The instance of CIM_ComputerSystem with which the Central Instance
 292 is associated through an instance of CIM_HostedService shall be the Scoping Instance of this profile.

293 The CIM_ManagedElement is CIM_PortController or a subclass of it.

294 Table 1 identifies profiles on which this profile has a dependency.

295 **Table 1 – Referenced profiles**

Profile Name	Organization	Version	Description
Diagnostics	DMTF	2.1	Specializes
Profile Registration	DMTF	1.0	Mandatory
FC HBA	SNIA	1.3.0	Deprecated: Optional
Storage HBA	SNIA	1.6.0	Optional. This profile would be used when the protocol supported by the HBA is Fibre Channel.

296 **6 Description**

297 Two categories of Fibre Channel Host Bus Adapter (FC HBAs) diagnostics are useful in SAN
 298 environments: those that diagnose the FC HBA itself and those used to help troubleshoot network

299 problems. These two classes can be further categorized into two different types: destructive and non-
300 destructive.

301 [DSP1002](#) defines destructive tests as those that have the potential for destroying data, permanently
302 altering the state, or reconfiguring the device. In the case of an FC HBA, any test that could cause a
303 previously executing application to lose access to the SAN should be considered destructive because it
304 could cause the data contained in an active transaction to be lost. An example would be using a loopback
305 to verify data pathways. When the loopback runs, the FC HBA cannot carry normal traffic.

306 Nondestructive diagnostics are those that can be safely executed without disrupting normal traffic, such
307 as using a form of echo to verify the accessibility of a SAN device. Practical SAN management requires
308 both types and both categories of diagnostics to maintain operations in production environments. As
309 such, all FC HBA diagnostics shall work in a normal operating system environment. Special pre-boot
310 environments shall not be required. The diagnostic tests specified in this profile may be implemented in
311 the FC HBA's firmware, the driver, or the FC HBA Diagnostics Provider itself. The goal of the *Fibre*
312 *Channel Host Bus Adapter Diagnostics Profile* is to define a set of standard diagnostics that meet these
313 needs and are both vendor and hardware agnostic.

314 FC HBAs are field replaceable units (FRUs); when defective, they are simply replaced. When the host
315 system or SAN management framework wishes to verify the health of an FC HBA, the diagnostic test
316 should not have to be concerned with testing the individual FC HBA components. Rather the diagnostic
317 test needs to be able to call upon a single diagnostic that tests the entire FC HBA. This self-test shall be
318 comprehensive, similar to a Power-On Self-Test (POST). By its nature, this test is destructive. All FC HBA
319 diagnostic providers shall support a self-test.

320 Verifying the health of an FC HBA nondestructively is problematic. Any definitive health verification
321 disrupts, suspends, or corrupts normal data traffic. However, it is possible to determine relative health of
322 the FC HBA by using data, such as its current operational state, error counts, and the results of its last
323 POST. Diagnostics providers should take advantage of this test to report any detected degraded
324 conditions before they become problems. Executing this test would also verify that basic communications
325 with the FC HBA are operational. All FC HBA diagnostic providers shall support a Status test.

326 To enable the isolation of certain types of faults, FC HBAs should also be testable at their boundaries.
327 The boundaries of an FC HBA are its connection to the system bus and its connection to the Fibre
328 Channel SAN. Being able to test at these boundaries makes it possible to isolate problems to the FC HBA
329 or to the SAN. For instance, if the transmit side of the cable from the FC HBA to the switch broke, the
330 HBA would still have a link but would not receive any responses. From the viewpoint of the host, the
331 source of the problem would not be clear; it could be a problem with the FC HBA or something on the
332 SAN itself. Putting the FC HBA into loopback would show that the pathway from the host through the HBA
333 was working properly and that the problem is something on the SAN.

334 There are both internal and external Fibre Channel (FC) loopbacks. Internal loopbacks are desirable
335 because they allow the HBA to be tested remotely without having to physically reconfigure the SAN.
336 However, because internal loopbacks are implemented in circuitry and not in the FC optics, they do not
337 test the entire data pathway through the FC HBA. By their nature, FC loopback tests are destructive. All
338 FC HBA diagnostic providers shall support both internal and external FC loopback tests.

339 Loopbacks can also be implemented at the FC HBA's host bus interface. These loopbacks are helpful in
340 isolating problems occurring between the FC HBA and the host system. If an FC HBA is failing internal
341 loopback tests, the problem lies in the data path of the HBA if that HBA can pass host bus interface
342 loopback tests. As with FC loopbacks, host bus interface loopbacks are destructive. All FC HBA
343 diagnostic providers shall support host bus interface loopbacks only if the FC HBA being tested supports
344 them.

345 One of the most familiar and powerful tools in an IP network maintenance engineer's "toolbox" is the Ping
346 utility. This utilizes the Internet Control Message Protocol (ICMP) that is supported by every Network
347 Interface Card (NIC) to provide a simple method of testing for the presence of an NIC at a specified
348 address. To minimize the use of SAN bandwidth, both the size of the data packet to be transmitted and

the number of iterations should be kept small. The input parameters of the Ping test are similar to those defined by T11's [Fibre Channel Storage Network Ping](#) (SNPing) utility specification for Fibre Channel devices. All FC HBA diagnostic providers shall support a Ping test, and the Ping test shall be nondestructive.

Another common network troubleshooting technique is to repeatedly send traffic to a specific device, have it echoed back, and then verify that the data is still intact. This is similar to Ping, except that it is acceptable to generate enough traffic for the test to become destructive (that is, disruptive to other network traffic). This Echo test can be useful when resolving network configuration or performance issues. The size and content of the data packet to be sent may be varied. Because sustained Echo tests increase network latency and can be disruptive, they should be considered destructive. All FC HBA diagnostic providers shall support an Echo test.

Like any other programmed device, FC HBAs can sometimes be affected by software errors that can cause them to behave erratically, enter an unknown state, or stop working altogether. Resetting an FC HBA often clears these conditions and restores the host's access to the FC SAN. Because resetting an FC HBA causes it to lose its current state information and any transactions that are in progress, Reset shall be considered destructive. All FC HBA diagnostic providers shall support a Reset test.

Many host systems contain multiple FC HBAs. If one of these HBAs is known to be malfunctioning, it can be difficult to visually identify which HBA is the defective unit when attempting to replace it. Flashing one or more LEDs on the HBA in a known pattern, or beaconing, resolves this problem. The flashing LEDs allow the HBA in question to be easily identified. Beaconing is nondestructive. All FC HBA diagnostic providers shall support a Beacon test only if the FC HBA under test supports it.

The *Fibre Channel Host Bus Adapter Diagnostics Profile* describes the set of tests necessary for diagnosing FC HBA issues and troubleshooting some SAN issues. Each test is a specialization of CIM_DiagnosticTest. The supported service modes, user controls, log options, and loop controls for each test are advertised through the CIM_FCHBADiagnosticsServiceCapabilities instance. For tests with specifiable parameters, the default parameter values are advertised through instances of CIM_ElementSettingData that associate an instance of CIM_FCHBADiagnosticSettingData to the test. Where supported, clients specify non-default test parameters by creating instances of CIM_FCHBADiagnosticSettingData that are associated to instances of CIM_FCHBADiagnosticTest. This is illustrated in Figure 1.

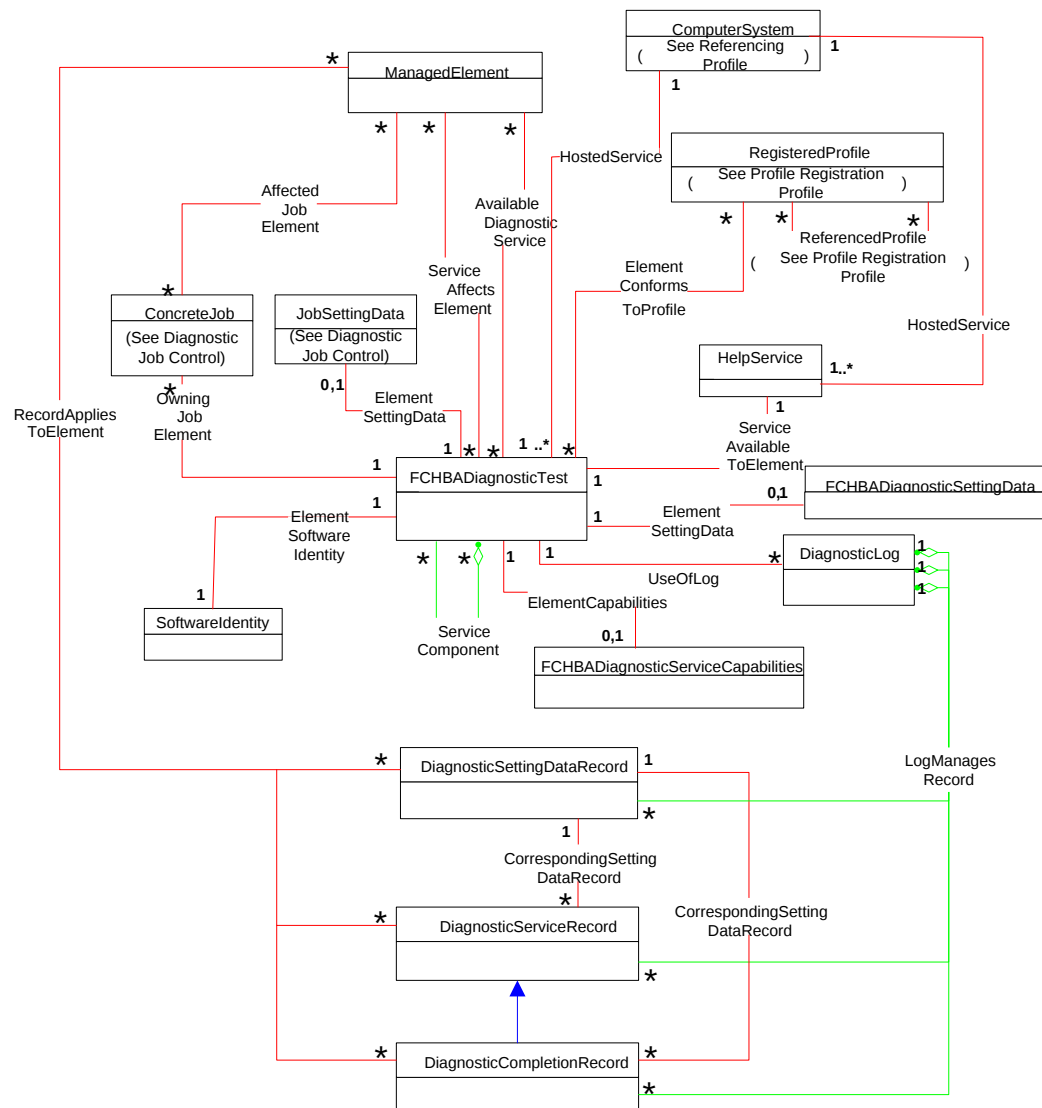


Figure 1 – Fibre Channel Host Bus Adapter Diagnostics Profile: Profile class diagram

The ManagedElement that is the UserOfService reference on the AvailableDiagnosticService association is an FC HBA (as represented by the CIM_PortController class). The ManagedElements that are AffectedElement references on the ServiceAffectsElement associations can be any element that is affected by the DiagnosticTest (for example, the PortController, FCPorts or the system that contains them). The ServiceAffectsElement has a broader scope than the AvailableDiagnosticService association.

7 Implementation

This clause provides additional implementation details for the various diagnostic tests of this profile.

7.1 FC HBA test Information

Table 2 contains information about the test types.

Table 2 – Test type information

Test Name	Test Information	
Beacon	Description	The diagnostic causes at least one of the LEDs of an FC HBA to flash on and off.
	Coverage Range	FC HBA LEDs
	Destructive	No
	User Control	The user may specify the number of iterations or the duration that the LED blinks on and off.
	Execution Time	The test shall run on the order of seconds or minutes.
	Built into Device	Yes
	Details	The LED flash pattern is determined by the vendor, but the pattern shall be distinct from that of normal activity. The LED to be flashed may be the normal activity/status LEDs or separate LEDs provided solely for beaconing.
Echo	Description	The diagnostic verifies the data path from host to target.
	Coverage Range	The complete data path from host to target
	Destructive	The diagnostic can cause a loss of network bandwidth and cause problems for some applications.
	User Control	The user may specify the type of Echo test, the buffer size and buffer pattern to be used, and the target device.
	Execution Time	The test shall run on the order of seconds or minutes.
	Built into Device	Yes
	Details	The FC HBA must be connected to a SAN that contains a device that supports Echo.
External Loopback	Coverage Area	The diagnostic verifies that the entire data path through an FC HBA is working properly.
	Coverage Range	The entire FC HBA data path
	Destructive	The diagnostic blocks all access to the SAN while it is in progress.
	User Control	The user may specify the buffer size and buffer pattern to be used.
	Execution Time	The test shall run on the order of seconds or minutes.
	Built into Device	Yes
	Details	A loopback connector is required. With an external loopback connector attached to the FC HBA, data packets are sent to the FC HBA and then read back. The results are compared to verify that the data does not change.

Test Name	Test Information	
Host Bus Loopback	Coverage Area	The diagnostic tests an FC HBA's host bus interface.
	Coverage Range	The data path from the host system's memory to the FC HBA's host bus interface
	Destructive	This test blocks all access to the SAN while it is in progress.
	User Control	The user may specify the buffer size and buffer pattern to be used.
	Execution Time	The test shall run on the order of seconds.
	Built into Device	Yes
	Details	After activating the host bus loopback, data packets are sent to the FC HBA and then read back. The results are compared to verify that the data has not changed.
Internal Loopback	Coverage Area	The diagnostic verifies the integrity of internal data paths in the FC HBA.
	Coverage Range	The data path from the host through most of the FC HBA is tested. The actual placement of the loopback is vendor-dependent, but it is normally before the Fibre Channel optics.
	Destructive	The diagnostic blocks all access to the SAN while it is in progress.
	User Control	The user may specify the buffer size and buffer pattern to be used.
	Execution Time	The test shall run on the order of seconds.
	Built into Device	Yes
	Details	After activating the internal loopback, data packets are sent to the FC HBA and then read back. The results are compared to verify that the data has not changed.
Ping	Coverage Area	The diagnostic verifies the existence and accessibility of devices on the SAN.
	Coverage Range	Complete data path from host to target
	Destructive	No
	User Control	The user may specify the type of Ping test, the buffer size and buffer pattern to be used, and the target device.
	Execution Time	The test shall run on the order of seconds or minutes.
	Built into Device	Yes

Test Name	Test Information	
	Details	The FC HBA must be connected to a SAN that contains a device that supports the desired Ping mechanism. Fibre Channel protocol does not contain any constructs similar to ICMP Ping that are universally implemented. The closest match to Ping is the optional Fibre Channel Echo Extended Link (FC Echo). It sends a single frame of data to a recipient that then returns it without modifying its content. Determining that the content has not changed verifies that the recipient is present and can be communicated with correctly. Another possible mechanism for implementing Ping functionality would be to use SCSI commands, such as Inquiry, to access the device. This would provide coverage for all SCSI devices connected to the SAN. Because no one mechanism can provide coverage for all FC devices, a Ping test shall support both FC and SCSI Inquiry. Other mechanisms such as FC Trace Route may also be used. To minimize the use of SAN bandwidth, both the size of the data packet to be transmitted and the number of iterations should be kept small. The input parameters of this Ping test should be similar to those defined by T11's Fibre Channel Storage Network Ping (SNPing) utility specification for Fibre channel devices.
Reset	Coverage Area	The diagnostic causes the FC HBA to reinitialize itself.
	Coverage Range	The entire FC HBA
	Destructive	Any traffic in progress is lost, and the FC HBA is unable to carry traffic while this test is in progress.
	User Control	None
	Execution Time	The test shall run on the order of seconds.
	Built into Device	Yes
	Details	The implementation of this test is vendor specific.
Self-Test	Coverage Area	This test allows all components of the FC HBA to be tested.
	Coverage Range	The entire FC HBA except for the FC optics
	Destructive	The FC HBA is unable to carry traffic while this test is in progress.
	User Control	None
	Execution Time	The test shall run on the order of seconds.
	Built into Device	Yes
	Details	The details of the self-test are vendor specific. It is expected that the test will be comprehensive, testing all possible components on the FC HBA. The test is not expected to test the FC optics. The test must leave the HBA in the same state that it was in before the test was run.
Status	Coverage Area	The diagnostic checks the health of the FC HBA, not including the FC optics.
	Coverage Range	The data path to the FC HBA and the entire FC HBA except for the FC optics is tested
	Destructive	No
	User Control	None
	Execution Time	The test shall run on the order of seconds.
	Built into Device	Yes

Test Name	Test Information	
	Details	The implementation of this test is vendor unique but should take into consideration the state of the FC port. Other possible data sources to be used include the results of the last POST or self-test, trends in error counts, and vendor-specific data.

7.2 CIM_FCHBADIagnosticTest

The CIM_FCHBADIagnosticTest class can be used for a variety of tests necessary for diagnosing FC HBA issues. Table 3 defines the valid property values and whether the test is mandatory or optional. An implementation may extend this class and add vendor-defined tests by using the Vendor Defined range of the FCHBATestType valuemap.

Table 4 provides additional information about the CIM_FCHBADIagnosticTest class.

Table 3 – CIM_FCHBADIagnosticTest property requirements

Test Name	Criteria	ElementName*	FCHBATestType	TestType*
Vendor extension test	Optional	FC HBA <vendor extension> Test	1	(1) Other, (2) Functional, (3) Stress, (4) Health Check and/or (5) Access Test
Beacon	Optional	FC HBA Beacon Test	2	(2) Functional
Echo	Mandatory	FC HBA Echo Test	3	(3) Stress (5) Access Test
External Loopback	Mandatory	FC HBA External Loopback Test	4	(2) Functional (5) Access Test
Host Bus Loopback	Optional	FC HBA Host Bus Loopback Test	5	(2) Functional
Internal Loopback	Mandatory	FC HBA Internal Loopback Test	6	(2) Functional
Ping	Mandatory	FC HBA Ping Test	7	(5) Access Test
Reset	Mandatory	FC HBA Reset Test	8	(2) Functional
Self	Mandatory	FC HBA Self-Test	9	(2) Functional
Status	Mandatory	FC HBA Status Test	10	(4) Health Check

An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticTest.

Table 4 – CIM_FCHBADiagnosticTest property requirements

Test Name	Characteristics*	Comment
Beacon		
Echo	4 (Is Destructive) 10 (Additional Hardware Required)	The FC HBA must be connected to a SAN that contains a device that supports Echo.
External Loopback	4 (Is Destructive) 10 (Additional Hardware Required)	A loopback connector is required.
Host Bus Loopback	4 (Is Destructive)	
Internal Loopback	4 (Is Destructive)	
Ping	4 (Is Destructive) 10 (Additional Hardware Required)	The FC HBA must be connected to a SAN that contains a device that supports the desired Ping mechanism.
Reset	4 (Is Destructive)	
Self-Test	4 (Is Destructive)	
Status		
Beacon		

An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticTest

7.3 CIM_FCHBADiagnosticSettingData

One or more instances of the CIM_FCHBADiagnosticSettingData class may be implemented. They are associated to CIM_FCHBADiagnosticTest by using CIM_ElementSettingData. The vendor-defined default values may be specified and advertised by using an instance of CIM_FCHBADiagnosticSettingData that is referenced by the instance of CIM_ElementSettingData whose property value for IsDefault is 1 (Is Default).

A diagnostic test may require parameters to run. Some parameters may affect how the test is run, while other parameters provide the values to be used by the test.

The CIM_DiagnosticSettingData class contains properties that affect how a diagnostic test is run (for example, LoopControl, QuickMode); how errors are handled (for example, HaltOnError); or how results are logged (for example, LogOptions). CIM_DiagnosticSettingData is an argument to the CIM_DiagnosticTest.RunDiagnosticService() extrinsic method. If additional properties are needed that control the behavior of the diagnostic test, they should be defined in a subclass of CIM_DiagnosticSettingData.

The client may use the vendor-defined default CIM_FCHBADiagnosticSettingData instance as an argument to the CIM_FCHBADiagnosticTest.RunDiagnosticService() extrinsic method. Alternatively, the client may create its own instance of CIM_FCHBADiagnosticSettingData and use it instead.

The CIM_FCHBADiagnosticSettingData class defines the parameters that may be used by some of the FC HBA tests. Table 5 lists these test parameters and shows which tests might use them. An implementation may extend this class and define additional parameters for any other Vendor Defined tests.

Table 5 – CIM_FCHBADiagnosticSettingData property requirements

Test Name	ElementName*	Target Device	Echo Mechanism	LUN	Buffer Sizes	Buffer Pattern	Ping Mechanism
Beacon	FC HBA Beacon Test						
Echo	FC HBA Echo Test	Used	Used	Used	Used	Used	
External Loopback	FC HBA External Loopback Test				Used	Used	
Host Bus Loopback	FC HBA Host Bus Loopback Test				Used	Used	
Internal Loopback	FC HBA Internal Loopback Test				Used	Used	
Ping	FC HBA Ping Test	Used		Used	Used	Used	Used
Reset	FC HBA Reset Test						
Self	FC HBA Self-Test						
Status	FC HBA Status Test						
Stress	FC HBA Beacon Test						

An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticSettingData.

7.3.1 CIM_FCHBADiagnosticSettingData.TargetDevice

This property is used by a client for the Echo and Ping tests to specify which device they are targeting.

The Echo and Ping tests send packets of data from the local host to a remote device on the FC SAN. The CIM_DiagnosticService.RunDiagnosticService() extrinsic method requires a reference to the managed element (local FC HBA) to be used in the test. However, in order to run the test, the address of the remote device is needed.

When FC Echo is being used, this property contains either the World Wide Port Name (WWPN) or the FC port address of the device to be targeted. Typically, a port address is used for point-to-point and arbitrated loops, while a WWPN is normally used in fabrics. When SCSI Inquiry is to be used, the property must contain a WWPN.

The string is formatted as ASCII characters representing hexadecimal digits. The only characters to be used shall be 0–9 and A–F. Leading zeros are permitted. WWPNs shall contain 16 characters. FC port addresses shall contain six characters.

For the Echo and Ping tests, TargetDevice has no default value; that is, a value must be specified.

NOTE When SCSI commands are used, in addition to specifying the target device, the client must specify a LUN on the target device using CIM_FCHBADiagnosticSettingData.LUN.

7.3.2 CIM_FCHBADiagnosticSettingData.TargetDeviceFormat

This property specifies the format of the TargetDevice value, which is a string formatted as ASCII characters representing hexadecimal digits. The only characters to be used shall be 0–9 and A–F. Leading zeros are permitted. WWPNs shall contain 16 characters. FC port addresses shall contain six characters.

7.3.3 CIM_FCHBADiagnosticSettingData.EchoMechanism

This property is used by a client for the Echo test to specify one of the Echo test types listed in Table 6.

Table 6 – CIM_FCHBADiagnosticSettingData.EchoMechanism

EchoMechanism Value	Criteria	Notes
1 (Other)	Optional	
2 (FC Echo)	Mandatory	The default
3 (SCSI read/write buffer)	Mandatory	
4 (FC Trace Route)	Optional	
5 (FC Test)	Optional	

Fibre Channel Echo Extended Link (FC Echo) can be used to implement the Echo test against many, but not all, FC devices. CT Pass Through allows SCSI read/write buffer commands to be used to implement Echo against SCSI or SAS devices attached to the SAN. Because no one mechanism can be used to implement the Echo test against all possible devices, FC HBA providers shall support both of these mechanisms in order to maximize the number of testable devices.

Support for FC Trace Route is optional and requires the use of the HBA_SendCTPassThruV2 function to send an FC Trace Route CT payload. Support for FC Test is also optional and requires the use of the SMHBA_SendTEST function. Both of these functions require that the FC HBA, the associated HBAAPI library, and the target support SM-HBA.

7.3.4 CIM_FCHBADiagnosticSettingData.LUN

This property is used by a client for the tests shown in Table 5 to specify which LUN they are targeting when SCSI commands are used as the Echo mechanism or Ping mechanism.

The typical default value is 0. The vendor-defined default value is advertised by using the default instance of CIM_FCHBADiagnosticSettingData.

If no value is specified by the client, the vendor-defined default value will be used.

7.3.5 CIM_FCHBADiagnosticSettingData.BufferSizes

This array property is used by a client for the tests shown in Table 5 to specify the data buffer sizes to be used during the test.

The vendor-defined default value is advertised by using the default instance of CIM_FCHBADiagnosticSettingData.

If no value is specified by the client, the vendor-defined default value will be used.

7.3.6 CIM_FCHBADiagnosticSettingData.BufferPattern

This octet array property is used by a client for the tests shown in Table 5 to specify the data pattern to be used by the test. If the buffer pattern is smaller than BufferSizes, the pattern will be repeated as necessary to fill the buffer. If the buffer pattern is larger than BufferSizes, the pattern will be truncated.

The vendor-defined default value is advertised by using the default instance of CIM_FCHBADiagnosticSettingData.

If no value is specified by the client, the vendor-defined default pattern will be used.

7.3.7 CIM_FCHBADiagnosticSettingData.PingMechanism

This property is used by a client for the Ping test to specify the tests shown in Table 7. Vendors may extend PingMechanism to include other mechanisms for implementing Ping. The mechanism used

depends upon the capabilities of the device being tested. Clients may not know which mechanism is appropriate for a particular device. Therefore, providers shall have a mode where every mechanism is tried in succession until one is successful or all have been tried.

Table 7 – CIM_FCHBADiagnosticSettingData.PingMechanism

PingMechanism Value	Criteria	Notes
1 (Other)	Optional	
2 (Use All)	Mandatory	The default
3 (FC Echo)	Mandatory	
4 (SCSI Inquiry)	Mandatory	

7.4 CIM_FCHBADiagnosticServiceCapabilities

The SupportedLoopControl property lists the loop controls that are supported by the Diagnostic Service. The values are: 0 (Unknown), 1 (Other), 2 (Continuous), 3 (Count), 4 (Timer), 5 (ErrorCount), and 0x8000 (No Loop Control). Table 8 provides more information.

Table 8 – CIM_FCBHADiagnosticServiceCapabilities property requirements

Test Name	SupportedLoopControl*	BufferSizesSupported	MaxPatternSizeSupported
Beacon	3 (Count) 4 (Timer)		
Echo	0x8000 (No Loop Control)	Used	Used
External Loopback	2 (Continuous) 3 (Count)	Used	Used
Host Bus Loopback	2 (Continuous) 3 (Count)	Used	Used
Internal Loopback	2 (Continuous) 3 (Count)	Used	Used
Ping	3 (Count)	Used	Used
Reset	0x8000 (No Loop Control)		
Self	0x8000 (No Loop Control)		
Status	0x8000 (No Loop Control)		

An asterisk (*) indicates that the property is inherited from the parent class CIM_DiagnosticServiceCapabilities.

7.4.1 CIM_FCHBADiagnosticServiceCapabilities.SupportedLoopControl

This array property is used by a provider for the tests shown in Table 8 to specify whether the test supports loop control. If loop control is not supported, the value of this property is 0x8000 (No Loop Control). If the test can be run a specified number of iterations, this array property shall contain the value 3 (Count). If the test can be run in a continuous manner, this array property shall contain the value 2 (Continuous).

7.4.2 CIM_FCHBADiagnosticServiceCapabilities.BufferSizesSupported

This array property is used by a provider for those tests shown in Table 8 to specify the buffer sizes supported by the test.

7.4.3 CIM_FCHBADiagnosticServiceCapabilities.MaxPatternSizeSupported

This property is used by a provider for those tests shown in Table 8 to specify the size of the largest pattern a client may specify in octets (8 bits). If the buffer pattern is smaller than the size of the data buffer, the pattern will be repeated as necessary to fill the buffer. If the buffer pattern is larger than the data buffer size, the pattern will be truncated.

7.5 Fibre Channel Host Bus Adapter Diagnostics Profile indications support

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains certain elements in its support for the DMTF Indications Profile. This subclause identifies those constraints.

7.5.1 CIM_IndicationFilter (StaticIndicationFilter)

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains some of the properties of the StaticIndicationFilter version of the CIM_IndicationFilter class and makes the class mandatory. The class is mandatory because some of the alert indication filters are mandatory and the *Fibre Channel Host Bus Adapter Diagnostics Profile* requires that static versions of mandatory indication filters be populated.

7.5.1.1 CIM_IndicationFilter.Name

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains names of the profile-defined alert indication filters as prescribed by [DSP1054](#). The names for the indication filters are identified in the entries for the indications in Table 15. The Name shall be formatted as defined by the following ABNF rule:

"DMTF:Fibre Channel Host Bus Adapter Diagnostics:" MessageID

The MessageID shall have the same value of the MessageID in the Query for the filter.

7.5.1.2 CIM_IndicationFilter.Query

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the Query properties of the profile-defined alert indication filters as prescribed by [DSP1054](#). The Query properties for the indication filters are identified in the entries for the indications in Table 10.

7.5.1.3 CIM_IndicationFilter.QueryLanguage

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the QueryLanguage properties of the profile-defined alert indication filters as prescribed by [DSP1054](#). The QueryLanguage properties for the indication filters are identified in the entries for the indications in Table 10.

7.5.2 CIM_FilterCollection (ProfileSpecificFilterCollection)

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the CollectionName property of the ProfileSpecificFilterCollection version of the CIM_FilterCollection class.

7.5.2.1 CIM_FilterCollection.CollectionName

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the CollectionName of the profile-defined ProfileSpecificFilterCollection filter collection as prescribed by [DSP1054](#). The CollectionName for the filter collection shall be formatted as defined by the following ABNF rule:

"DMTF:Fibre Channel Host Bus Adapter Diagnostics:ProfileSpecifiedAlertIndicationFilterCollection"

7.5.3 CIM_MemberOfCollection (IndicationFilterInFilterCollection)

7.5.3.1 CIM_MemberOfCollection.Collection

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the Collection property to be the reference to the ProfileSpecificFilterCollection filter collection.

7.5.3.2 CIM_MemberOfCollection.Member

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the Member property to be a reference to one of the profile-defined alert indication filters.

7.5.4 CIM_OwningCollectionElement (IndicationServiceOfFilterCollection)

7.5.4.1 CIM_OwningCollectionElement.OwnedElement

The *Fibre Channel Host Bus Adapter Diagnostics Profile* constrains the OwnedElement property to be the reference to the ProfileSpecifiedFilterCollection filter collection.

7.6 Diagnostics alert indications and standard messages

7.6.1 DIAG101 - FC HBA port not present

The test ran to completion, but an FC HBA port was not present.

This alert would only be sent if the test discovers an empty port slot in the HBA.

The variables in this message are:

- Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name property of the DiagnosticTest instance.
- HBA Moniker – Identifies a unique name for the HBA under test that was specified.

This could be one of the following names:

- The Object path of the HBA PortController
- The ElementName of the HBA PortController
- A unique user friendly name not in the model (such as, asset name)

The HBA Moniker can be any of these, but whichever one is used shall be used consistently for all HBAs within the scoping profile.

With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType should be set to “Port Missing”.

With this alert, the PerceivedSeverity shall have one of the values of 0 (Unknown), 1 (Other), 3 (Warning), 4 (Minor), 5 (Major), 6 (Critical), or 7 (Fatal/Nonrecoverable).

7.6.2 DIAG102 - FC HBA port offline

The test may or may not have ran to completion, but an FC HBA port was offline.

This alert would only be sent if the port in question was to be exercised by the test and the OperationalStatus of the port in question should be 10 (Stopped). For Ping and Echo, the alert may cause the test to fail to execute to completion. For other tests, the alert would only be a warning that one of the ports was not tested. If multiple ports are reported as offline, multiple alert messages are sent (one for each port that was discovered to be offline).

572 The variables in this message are:

- 573 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
574 property of the DiagnosticTest instance.
- 575 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

576 This could be one of the following names:

- 577 – The Object path of the HBA PortController
- 578 – The ElementName of the HBA PortController
- 579 – A unique user friendly name not in the model (such as, asset name)

580 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
581 all HBAs within the scoping profile.

- 582 • Port Moniker – Identifies a unique name for the HBA port that is offline.

583 This could be one of the following names:

- 584 – The Object path of the FC Port
- 585 – The ElementName of the FC Port
- 586 – A unique user friendly name not in the model (such as, asset name)

587 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
588 all Ports within the scoping profile.

589 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). For test other than Ping or
590 Echo, “1” indicates that a port is offline (the OtherAlertType should be set to “Port Offline”). For Ping and
591 Echo tests, the “5” indicates that the Ping or Echo failed because a needed port was offline.

592 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 5 (Major).

593 **7.6.3 DIAG103 - FC HBA port disabled by the user**

594 The test may or may not have ran to completion, but an FC HBA port was disabled by the user.

595 This alert is only sent if the port in question was to be exercised by the test and the provider can
596 determine that the port was disabled by user action. As with the offline case, the OperationalStatus of the
597 port in question should be 10 (Stopped). If the provider cannot determine that the port was disabled by
598 the user, DIAG102 should be used. For Ping and Echo, this alert may cause the test to fail to execute to
599 completion. For other tests, this alert is only a warning that one of the ports was not tested. If multiple
600 ports are reported as disabled, multiple alert messages are sent (one for each port that was discovered to
601 be disabled).

602 The variables in this message are:

- 603 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
604 property of the DiagnosticTest instance.
- 605 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

606 This could be one of the following names:

- 607 – The Object path of the HBA PortController
- 608 – The ElementName of the HBA PortController
- 609 – A unique user friendly name not in the model (such as, asset name)

610 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
611 all HBAs within the scoping profile.

- 612 • Port Moniker – Identifies a unique name for the HBA port that is disabled.
- 613 This could be one of the following names:
- 614 – The Object path of the FC Port
- 615 – The ElementName of the FC Port
- 616 – A unique user friendly name not in the model (such as, asset name)
- 617 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
- 618 all Ports within the scoping profile.

619 With this alert, the AlertType shall have the value 1 (Other) or 4 (Processing Error). For tests other than
 620 Ping or Echo, “1” indicates that a port is disabled (the OtherAlertType should be set to “Port Disabled”).
 621 For Ping and Echo tests, the “4” indicates that the Ping or Echo failed because a needed port was
 622 disabled.

623 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 5 (Major).

624 **7.6.4 DIAG104 - FC HBA port bypassed**

625 The test may or may not have ran to completion, but an FC HBA port was bypassed.

626 This alert is only sent if the port in question was to be exercised by the test and the port was not tested.
 627 Reasons why the port was bypassed might be:

- 628 • DIAG102 – The port was offline.
- 629 • DIAG103 – The port was disabled.
- 630 • DIAG107 – The port was in Loopback mode.
- 631 • DIAG108 – The port FC Link is down.
- 632 • DIAG121 – The port was in error.
- 633 • DIAG122 – The port was in service.
- 634 • DIAG123 – The port was in an unrecognized state.

635
 636 If the port was bypassed for one of these reasons, the appropriate DIAG message would have been sent
 637 before this message.

638 For Ping and Echo tests, this alert may cause the test to fail to execute to completion. For other tests, this
 639 alert is only a warning that one of the ports was not tested. If multiple ports are reported as bypassed,
 640 multiple alert messages are sent (one for each port that was bypassed).

641 The variables in this message are:

- 642 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
 643 property of the DiagnosticTest instance.
- 644 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

645 This could be one of the following names:

- 646 – The Object path of the HBA PortController
- 647 – The ElementName of the HBA PortController
- 648 – A unique user friendly name not in the model (such as, asset name)

649 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
 650 all HBAs within the scoping profile.

- 651 • Port Moniker – Identifies a unique name for the HBA port that is bypassed.

652 This could be one of the following names:

- 653 – The Object path of the FC Port
- 654 – The ElementName of the FC Port
- 655 – A unique user friendly name not in the model (such as, asset name)

656 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
657 all Ports within the scoping profile.

658 With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType should be set to "Port
659 Bypassed".

660 With this alert, the PerceivedSeverity shall have the value 2 (Information).

661 **7.6.5 DIAG105 - Data received did not match the data transmitted**

662 The test ran to completion, but the data received did not match the data transmitted.

663 This alert would only be sent if the test was an Echo, Ping, or Loopback test and the data transmitted did
664 not match the data received.

665 The variables in this message are:

- 666 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
667 property of the DiagnosticTest instance.
- 668 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

669 This could be one of the following names:

- 670 – The Object path of the HBA PortController
- 671 – The ElementName of the HBA PortController
- 672 – A unique user friendly name not in the model (such as, asset name)

673 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
674 all HBAs within the scoping profile.

675 With this alert, the AlertType shall have the value 5 (Device Alert).

676 With this alert, the PerceivedSeverity shall have the value 5 (Major), 6 (Critical), or 7 (Nonrecoverable).

677 **7.6.6 DIAG107 - FC HBA port in loopback mode**

678 The test may or may not have ran to completion, but an FC HBA port was in Loopback mode.

679 This alert is sent only if the port in question was to be exercised by the test and the provider was in a
680 Loopback test. For Ping and Echo, this alert may cause the test to fail to execute to completion. For other
681 tests, this alert is only a warning that one of the ports was not tested. If multiple ports are reported as in
682 Loopback mode, multiple alert messages are sent (one for each port that was discovered to be in
683 Loopback mode).

684 The variables in this message are:

- 685 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
686 property of the DiagnosticTest instance.
- 687 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

688 This could be one of the following names:

- 689 – The Object path of the HBA PortController
- 690 – The ElementName of the HBA PortController

- 691 – A unique user friendly name not in the model (such as, asset name)
- 692 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
693 all HBAs within the scoping profile.
- 694 • Port Moniker – Identifies a unique name for the HBA port that was in Loopback mode.
- 695 This could be one of the following names:
- 696 – The Object path of the FC Port
697 – The ElementName of the FC Port
698 – A unique user friendly name not in the model (such as, asset name)
- 699 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
700 all Ports within the scoping profile.
- 701 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). For test other than Ping or
702 Echo, “1” indicates that a port was in Loopback mode (the OtherAlertType should be set to “Port in
703 Loopback”). For Ping and Echo tests, the “5” indicates that the Ping or Echo failed because a needed port
704 was in Loopback mode.
- 705 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 5 (Major).
- 706 **7.6.7 DIAG108 - FC link down**
- 707 The test may or may not have ran to completion, but the link from the FC HBA port was down.
- 708 This alert is only sent if the port in question was to be exercised by the test and the FC link from the port
709 was down. For Ping and Echo, this alert may cause the test to fail to execute to completion. For other
710 tests, this alert is only a warning that one of the ports was not tested. If multiple ports are reported with a
711 down FC Link, multiple alert messages are sent (one for each port that was discovered to have a link
712 down).
- 713 The variables in this message are:
- 714 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
715 property of the DiagnosticTest instance.
- 716 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.
- 717 This could be one of the following names:
- 718 – The Object path of the HBA PortController
719 – The ElementName of the HBA PortController
720 – A unique user friendly name not in the model (such as, asset name)
- 721 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
722 all HBAs within the scoping profile.
- 723 • Port Moniker – Identifies a unique name for the HBA port that has a link down.
- 724 This could be one of the following names:
- 725 – The Object path of the FC Port
726 – The ElementName of the FC Port
727 – A unique user friendly name not in the model (such as, asset name)
- 728 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
729 all Ports within the scoping profile.
- 730 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). For test other than Ping or
731 Echo, “1” indicates that a port has a link down (the OtherAlertType should be set to “Port Link Down”). For

732 Ping and Echo tests, the “5” indicates that the Ping or Echo failed because a needed port had its FC link
733 down.

734 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 5 (Major).

735 **7.6.8 DIAG109 - Last Power-On Self Test failed**

736 The test may or may not have ran to completion, but the last power-on self-test failed.

737 This alert is only sent if the last power-on self test failed.

738 The variables in this message are:

739 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
740 property of the DiagnosticTest instance.

741 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

742 This could be one of the following names:

- 743 – The Object path of the HBA PortController
- 744 – The ElementName of the HBA PortController
- 745 – A unique user friendly name not in the model (such as, asset name)

746 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
747 all HBAs within the scoping profile.

748 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). If 1 (Other) is specified,
749 the OtherAlertType should be set to “Last Power-on Self test failed”), but this setting did not affect
750 execution of the requested test. If 5 (Device Alert) is specified, the test failed to execute.

751 With this alert, the PerceivedSeverity shall have the value 2 (Information), 5 (Major), 6 (Critical) or 7
752 (Nonrecoverable).

753 **7.6.9 DIAG111 - Invalid target device address**

754 The test did not run to completion, because the TargetDeviceFormat identified is not supported.

755 This alert is only sent if the device in question was to be exercised by the test and the
756 TargetDeviceFormat is not supported.

757 The variables in this message are:

758 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
759 property of the DiagnosticTest instance.

760 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

761 This could be one of the following names:

- 762 – The Object path of the HBA PortController
- 763 – The ElementName of the HBA PortController
- 764 – A unique user friendly name not in the model (such as, asset name)

765 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
766 all HBAs within the scoping profile.

767 • Target Device Format – Identifies TargetDeviceFormat that was specified.

768 With this alert, the AlertType shall have the value 4 (Processing Error).

769 With this alert, the PerceivedSeverity shall have the value 5 (Major).

770 **7.6.10 DIAG112 - Target does not exist**

771 The test did not run to completion, because the TargetDevice identified does not exist.

772 This alert is only sent if the device in question was to be exercised by the test and the TargetDevice could
773 not be found on the HBA.

774 The variables in this message are:

775 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
776 property of the DiagnosticTest instance.

777 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

778 This could be one of the following:

- 779 – The Object path of the HBA PortController
- 780 – The ElementName of the HBA PortController
- 781 – A unique user friendly name not in the model (such as, asset name)

782 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
783 all HBAs within the scoping profile.

784 • Target Device – Identifies TargetDevice that was specified.

785 With this alert, the AlertType shall have the value 4 (Processing Error).

786 With this alert, the PerceivedSeverity shall have the value 5 (Major).

787 **7.6.11 DIAG121 - FC HBA port in error**

788 The test may or may not have ran to completion, but an FC HBA port was in error.

789 This alert is only sent if the port in question was to be exercised by the test. For Ping and Echo, this error
790 may cause the test to fail to execute to completion. For other tests, this error would be reported and the
791 test would continue. If multiple ports are reported as in error, multiple alert messages are sent (one for
792 each port that was discovered to be in error).

793 The variables in this message are:

794 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
795 property of the DiagnosticTest instance.

796 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

797 This could be one of the following names:

- 798 – The Object path of the HBA PortController
- 799 – The ElementName of the HBA PortController
- 800 – A unique user friendly name not in the model (such as, asset name)

801 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
802 all HBAs within the scoping profile.

803 • Port Moniker – Identifies a unique name for the HBA port that is in error.

804 This could be one of the following names:

- 805 – The Object path of the FC Port
- 806 – The ElementName of the FC Port
- 807 – A unique user friendly name not in the model (such as, asset name)

808 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
809 all Ports within the scoping profile.

810 With this alert, the AlertType shall have the value 5 (Device Alert).

811 With this alert, the PerceivedSeverity shall have the value 5 (Major), 6 (Critical) or
812 7 (Fatal/Nonrecoverable).

813 **7.6.12 DIAG122 - FC HBA port in service**

814 The test may or may not have ran to completion, but an FC HBA port is in service.

815 This alert is only sent if the port in question was to be exercised by the test. For Ping and Echo, this alert
816 may cause the test to fail to execute to completion. For other tests, this alert is only a warning that one of
817 the ports was not tested. If multiple ports are reported as in service, multiple alert messages are sent (one
818 for each port that was discovered to be in service).

819 The variables in this message are:

- 820 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
821 property of the DiagnosticTest instance.
- 822 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

823 This could be one of the following names:

- 824 – The Object path of the HBA PortController
- 825 – The ElementName of the HBA PortController
- 826 – A unique user friendly name not in the model (such as, asset name)

827 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
828 all HBAs within the scoping profile.

- 829 • Port Moniker – Identifies a unique name for the HBA port that is in service.

830 This could be one of the following names:

- 831 – The Object path of the FC Port
- 832 – The ElementName of the FC Port
- 833 – A unique user friendly name not in the model (such as, asset name)

834 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
835 all Ports within the scoping profile.

836 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). For tests other than Ping
837 or Echo, “1” indicates that a port is in service (the OtherAlertType should be set to “Port in Service”). For
838 Ping and Echo tests, the “5” indicates that the Ping or Echo failed because a needed port was in service.

839 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 4 (Minor).

840 **7.6.13 DIAG123 – The port was in an unrecognized state**

841 The test may or may not have ran to completion, but an FC HBA port is in an unrecognized state.

842 This alert is only sent if the port in question was to be exercised by the test. For Ping and Echo, this alert
843 may cause the test to fail to execute to completion. For other tests, this alert is only a warning that one of
844 the ports was not tested. If multiple ports are reported as in service, multiple alert messages are sent (one
845 for each port that was discovered to be in an unrecognized state).

846 The variables in this message are:

- 847 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
848 property of the DiagnosticTest instance.
- 849 • HBA Moniker – Identifies a unique name for the HBA under test that was specified.

850 This could be one of the following names:

- 851 – The Object path of the HBA PortController
- 852 – The ElementName of the HBA PortController
- 853 – A unique user friendly name not in the model (such as, asset name)

854 The HBA Moniker can be any of these, but whichever one is used shall be used consistently for
855 all HBAs within the scoping profile.

- 856 • Port Moniker – Identifies a unique name for the HBA port that is in an unrecognized state.

857 This could be one of the following names:

- 858 – The Object path of the FC Port
- 859 – The ElementName of the FC Port
- 860 – A unique user friendly name not in the model (such as, asset name)

861 The Port Moniker can be any of these, but whichever one is used shall be used consistently for
862 all Ports within the scoping profile.

- 863 • Port State – Identifies OperationalStatus for the HBA port that is in an unrecognized state

864 With this alert, the AlertType shall have the value 1 (Other) or 5 (Device Alert). For tests other than Ping
865 or Echo, “1” indicates that a port is in an unrecognized state (the OtherAlertType should be set to “Port in
866 Unrecognized State”). For Ping and Echo tests, the “5” indicates that the Ping or Echo failed because a
867 needed port was in an unrecognized state.

868 With this alert, the PerceivedSeverity shall have the value 3 (Warning) or 4 (Minor).

869 7.6.14 FC HBA alerts using common messages

870 In addition to the alert standard messages that are unique to the FC HBA, the *Fibre Channel Host Bus*
871 *Adapter Diagnostics Profile* may also generate common diagnostic messages (including diagnostic job
872 control messages). Of specific note, the *Fibre Channel Host Bus Adapter Diagnostics Profile* may
873 generate completion status messages (such as DIAG0, DIAG3 or DIAG4) and job-related standard
874 messages (such as DIAG19 or DIAG20).

875 In addition, the implementation may generate DIAG43 or DIAG50 to cover capabilities or settings alerts.

876 7.6.14.1 Common completion status messages

877 The *Fibre Channel Host Bus Adapter Diagnostics Profile* should generate completion status messages to
878 reflect the completion of the test (see [DSP1002](#)). These messages would include:

- 879 • DIAG0 - The test passed.
- 880 • DIAG3 - The device test failed.
- 881 • DIAG4 - The test was completed with warnings.
- 882 • DIAG44 - The test did not start.
- 883 • DIAG45 - The test aborted.

884 7.6.14.2 Diagnostic Job Control messages

885 The *Fibre Channel Host Bus Adapter Diagnostics Profile* should generate messages associated with the
886 Diagnostic Job Control Profile (see [DSP1119](#)). The messages would include:

887

- 888 • DIAG9 - Test continued after last interactive timeout using Default Values.
- 889 • DIAG12 - Job could not be started.
- 890 • DIAG19 - Test killed by client.
- 891 • DIAG20 - Test terminated by client.
- 892 • DIAG21 - Test suspended by client.
- 893 • DIAG34 - Request for Inputs
- 894 • DIAG35 - Request for action
- 895 • DIAG36 - Test killed by test.
- 896 • DIAG37 - Test terminated by test.
- 897 • DIAG38 - Test resumed by client.
- 898 • DIAG39 - JobSetting reset.
- 899 • DIAG40 - JobSetting defaults not used.
- 900 • DIAG48 - Test continued after an interim interactive timeout.
- 901 • DIAG49 - Test terminated after an interactive timeout.

902 7.6.14.3 Settings alert messages

903 Errors in values supplied in the DiagnosticSettings parameter (an embedded instance of
 904 FCHBADiagnosticSettingData) of the RunDiagnosticService method would be reported by using DIAG43
 905 (The Requested DiagnosticSettings is not supported).

906 The DIAG43 message has the following format:

907 The <Diagnostic Test Name> test on the selected Element to test <Element Moniker> ran but the
 908 requested DiagnosticSettings property <DiagnosticSettings Property> of <DiagnosticSettings Value>
 909 is not supported. The value <DiagnosticSettings Used> was used instead.

910 The Element Moniker would be the HBA Moniker. The <DiagnosticSettings Property> could be any one of
 911 the FCHBADiagnosticSettingData properties, including TargetDevice, TargetDeviceFormat,
 912 EchoMechanism, LUN, BufferSizes, BufferPattern, or PingMechanism.

913 The <DiagnosticSettings Value> would be the value supplied for the property. It is the value that is not
 914 supported. The <DiagnosticSettings Used> would be the value that the test used instead of the value that
 915 was supplied.

916 7.6.14.4 Capabilities alert messages

917 Errors in properties supplied in the DiagnosticSettings parameter (an embedded instance of
 918 FCHBADiagnosticSettingData) of the RunDiagnosticService method would be reported by using DIAG50
 919 (Capability to set the DiagnosticSettings parameter not supported for test).

920 The DIAG50 message has the following format:

921 The <Diagnostic Test Name> test on the selected element to test <Element Moniker> ran, but
 922 DiagnosticSettings parameter requested <Diag Setting Property> is not a supported capability and
 923 was ignored.

924 The Element Moniker would be the HBA Moniker. <Diag Setting Property> could be any one of the
 925 FCHBADiagnosticSettingData, including TargetDevice, TargetDeviceFormat, EchoMechanism, LUN,
 926 BufferSizes, BufferPattern, or PingMechanism. The message means that the parameter (property) is not
 927 applicable to the test and was ignored.

928 7.6.14.5 Other common messages

929 In addition, the *Fibre Channel Host Bus Adapter Diagnostics Profile* may also generate other common
 930 messages (see [DSP1002](#)). For example, these messages might include common messages for general
 931 capabilities and settings errors, such as LoopControl or LogOption errors.

932 7.6.15 DIAG50 - Capability to set the DiagnosticSettings parameter not supported for test

933 The test ran, but a property in the DiagnosticSettings input to the RunDiagnosticService method was not
 934 supported by the test and was ignored.

935 This alert would be sent if a client attempted to set a DiagnosticSettings property that cannot be set for
 936 the test.

937 The variables in this message are:

- 938 • Diag Setting Property – Identifies the property that was set, but not supported for the test
- 939 • Diagnostic Test Name – Identifies the Diagnostic Test instance that was run. This is the Name
 940 property of the DiagnosticTest instance.
- 941 • Element Moniker – Identifies a unique name for the element under test (such as, Disk Drive)
 942 that was specified.

943 This could be one of the following:

- 944 – The Object Path of the element
- 945 – The ElementName of the element
- 946 – A unique user friendly name not in the model (such as, asset name)

947 The Element Moniker can be any of these, but whichever one is used shall be used consistently
 948 for all managed elements of the same type within the scoping profile (such as, all disk drives in
 949 a system).

950 With this alert, the AlertType shall have the value 1 (Other). The OtherAlertType should be set to
 951 “Parameter Ignored”.

952 With this alert, the PerceivedSeverity shall have the value 3 (Warning).

953 8 Methods

954 This clause details the requirements for supporting intrinsic operations and extrinsic methods for the CIM
 955 elements defined by this profile.

956 8.1 CIM_FCHBADiagnosticTest.RunDiagnosticService()

957 The RunDiagnosticService() method shall return one of the return code values defined in the [DSP1002](#),
 958 Table 2 – RunDiagnosticsService() Method: Return Code Values.

959 When failures occur during the execution of a diagnostic test, the failure shall be recorded in the instance
 960 of CIM_DiagnosticServiceRecord that is associated with the test. The reason for the failure shall be
 961 recorded in CIM_DiagnosticServiceRecord.ErrorCode[], and the corresponding
 962 CIM_DiagnosticServiceRecord.ErrorCount[] shall be incremented. Other occurrences of the same failure
 963 during the same test shall not create additional entries in CIM_DiagnosticServiceRecord.ErrorCode[], but
 964 they shall cause the corresponding CIM_DiagnosticServiceRecord.ErrorCount[] to be incremented.

8.2 Profile conventions for operations

Support for operations for each profile class (including associations) shall be as mandated in the [DSP1002](#), clauses 8.5 through 8.24.

9 Use cases

9.1 Overview

This clause contains use cases for the *Fibre Channel Host Bus Adapter Diagnostics Profile*.

How to discover, configure, and run the individual diagnostic tests is detailed in [DSP1002](#). This clause focuses on how to use the FC HBA diagnostic tests to diagnose common SAN issues.

9.2 Use case summary

Table 9 summarizes the use cases that are described in this clause. The use cases are categorized and named, and references are provided to the subclause that describes the use case.

NOTE Although use case names follow the convention for naming classes, properties and methods in the schema, this naming was done for readability only and does not imply any functionality attached to the name.

The CIM_ prefix has been omitted from the class names in the use cases for readability.

Table 9 – Fibre Channel Host Bus Adapter Diagnostics Profile use cases

Category	Use Case Name	Description
Verifying FC HBA Health See 9.3.	Verify Health	Verify the health of an FC HBA without impacting host system access to the SAN. See 9.3.1.
	Verify Hardware	Examine an FC HBA to discover any hardware issues. See 9.3.2.
	Identify HBA	Make a particular FC HBA easy to physically identify. See 9.3.3.
Troubleshooting SAN Issues See 9.4.	Verify Device Accessibility	Verify that a particular device on the SAN is accessible. See 9.4.1
	Stress Test	Create a high volume of traffic to a particular SAN device to help uncover SAN issues. See 9.4.2.
	Troubleshoot an Existing Connection	Discover why a previously accessible device can no longer be accessed. See 9.4.3.
	Troubleshoot a New Connection	Discover why a new SAN device cannot be accessed. See 9.4.4.

9.3 Verifying FC HBA health

The use cases in this clause describe how the client can use the diagnostic tests to verify the health of FC HBAs and to locate them.

9.3.1 Verify health

To substantiate that an FC HBA is healthy and not developing problems, without disrupting the functioning of the host system, the client can use StatusTest.

9.3.2 Verify hardware

The client can confirm that the FC HBA hardware is functioning properly with the following procedure:

- 1) If available, use the Host Bus Loopback Test to prove that the data path between the host system and the FC HBA is functioning properly.
- 2) Use the Self-Test to verify the functionality of the FC HBA hardware components. This test covers all components except for the Fibre Channel optics.
- 3) If the FC HBA is connected to the SAN, Ping, or Echo may be used to verify that the FC optics are working properly. However, if there is a problem on the SAN itself, these tests will fail. Thus, while passing these tests proves that the FC HBA is functioning, failing these tests does not prove that the FC HBA is defective.
- 4) If the FC HBA is not connected to the SAN, or if Ping or Echo fails, the client should use the External Loopback Test to verify that the FC optics are functional.

9.3.3 Identify HBA

When it has been determined that a particular FC HBA has to be replaced, the client can use the Beacon Test to cause the FC HBA's LEDs to flash. The LEDs make it easy to visually identify the defective FC HBA in a host system with multiple FC HBAs.

9.4 Troubleshooting SAN issues

The use cases in this clause describe how the client can use the diagnostic tests to isolate problems occurring on the SAN.

9.4.1 Verify device accessibility

The client can use Ping to verify that a particular FC device can be physically accessed. Echo can also be used, but it generates much more SAN traffic than is necessary for verifying accessibility.

9.4.2 Stress test

Some problems only occur when there are high levels of traffic on the SAN. To help reproduce traffic problems, clients can use Echo. By configuring it with large buffer sizes and high loop counts, large amounts of traffic can be generated.

9.4.3 Troubleshoot an existing connection

There are many reasons why an FC HBA could lose the ability to communicate with a device on the SAN: a cable could be pulled out or broken; a switch could be broken or could lose configuration information; the device itself may be broken; or the device itself could have lost configuration information. Clients can use the following procedure to discover where the problem lies:

- 1017 1) Use Status Test to verify that the FC HBA believes itself to be healthy. If an FC HBA issue is
 1018 suspected, use the procedure in 9.3.2 to validate the hardware. If loss of link is reported, inspect
 1019 the cabling.
- 1020 2) Perform an Internal Loopback Test to verify that data can pass between the host system and
 1021 the FC HBA properly. If the loopback fails, replace the FC HBA.
- 1022 3) Use Ping to verify whether the physical connection to the device has been lost. If the physical
 1023 connection to the device is still present, the configuration of the device itself should be
 1024 investigated.
- 1025 4) Use Echo to verify that the FC HBA can communicate with all devices in its communication
 1026 path. If the Echo fails, investigate the cabling between the device and the switch. A broken
 1027 cable usually results in the link being lost at one end. If the cabling appears intact, investigate
 1028 the device itself. Repeat this step for each device in the communications path until a cabling
 1029 problem is found or the faulty device is found.

1030 9.4.4 Troubleshoot a new connection

1031 When a new device is added to a SAN and a host that should be able to access the SAN cannot access
 1032 it, the issue is usually caused by a configuration error in either the device or the switch. If a configuration
 1033 error cannot be found, the client can use the following procedure to isolate the problem:

- 1034 1) Use Echo to verify that the FC HBA can communicate with all devices in its communication
 1035 path. If the Echo fails, investigate the cabling between the device and the switch. A broken
 1036 cable usually results in the link being lost at one end. If the cabling appears intact, investigate
 1037 the device itself. Repeat this step for each device in the communications path until a cabling
 1038 problem is found or the faulty device is found.

1039 10 CIM elements

1040 Table 10 shows the instances of CIM elements for this profile. Instances of the CIM elements shall be
 1041 implemented as described in Table 10. Clause 7 ("Implementation") and Clause 8 ("Methods") may
 1042 impose additional requirements on these elements.

1043 **Table 10 – CIM elements: Fibre Channel Host Bus Adapter Diagnostics Profile**

Element Name	Requirement	Description
Classes		
CIM_FCHBADiagnosticTest	Mandatory	See 10.1.
CIM_FCHBADiagnosticSettingData	Optional	See 10.2.
CIM_FCHBADiagnosticServiceCapabilities	Optional	See 10.3.
CIM_RegisteredProfile	Mandatory	See 10.4.
CIM_AffectedJobElement	Optional	See 10.5.
CIM_AvailableDiagnosticService	Mandatory	See 10.6.
CIM_ElementCapabilities	Optional	See 10.7.
CIM_ElementSettingData (DiagnosticSettingData)	Optional	See 10.8.
CIM_ElementSettingData (JobSettingData)	Optional	See 10.9.
CIM_ElementSoftwareIdentity	Mandatory	See 10.10.
CIM_HostedService	Mandatory	See 10.11.

Element Name	Requirement	Description
CIM_OwningJobElement	Mandatory	See 10.12.
CIM_RecordAppliesToElement	Optional	See 10.13.
CIM_ServiceAffectsElement	Mandatory	See 10.14.
CIM_ServiceAvailableToElement	Optional	See 10.15.
CIM_ServiceComponent	Optional	See 10.16.
CIM_UseOfLog	Mandatory	See 10.17.
CIM_FilterCollection	Optional	See 10.18.
CIM_IndicationFilter	Mandatory	See 10.19.
CIM_MemberOfCollection	Optional	See 10.20.
CIM_OwningCollectionElement	Optional	See 10.21.
Indications		
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG101"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG101" See 7.6.1.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG102"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG102" See 7.6.2.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG103"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG103" See 7.6.3.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG104"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG104" See 7.6.4.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG105"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG105" See 7.6.5.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG107"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG107" See 7.6.6.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG108"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG108" See 7.6.7.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG109"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG109" See 7.6.8.

Element Name	Requirement	Description
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG111"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG111" See 7.6.9.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG112"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG112" See 7.6.10.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG121"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG121" See 7.6.11.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG122"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG122" See 7.6.12.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity="DMTF" and MessageID="DIAG123"	Optional	Query Language = "DMTF:CQL" Name = "DMTF:Fibre Channel Host Bus Adpater Diagnostics:DIAG123" See 7.6.13.

10.1 CIM_FCHBADiagnosticTest

The CIM_FCHBADiagnosticTest class is used to represent the Diagnostic Testing for an FC HBA. This class specializes CIM_DiagnosticTest as defined in [DSP1002](#). The constraints listed in Table 11 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory elements that must be implemented.

Table 11 – Class: CIM_FCHBADiagnosticTest

Elements	Requirement	Notes
ElementName	Mandatory	See 7.2.
Characteristics	Mandatory	See 7.2.
OtherCharacteristicsDescriptions	Conditional	If Characteristics includes the value of 1 (Other), this property is Mandatory.
FCHBATESTType	Mandatory	See 7.2.
OtherFCHBATESTTypeDescription	Conditional	If FCHBATESTType has a value of 1 (Other), this property is Mandatory.
TestType	Optional	See 7.2.

10.2 CIM_FCHBADiagnosticSettingData

The CIM_FCHBADiagnosticSettingData class is used to pass in test parameters and to specify other test control parameters. This class specializes CIM_DiagnosticSettingData as defined in [DSP1002](#). The constraints listed in Table 12 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory elements that must be implemented.

1055

Table 12 – Class: CIM_FCHBADiagnosticSettingData

Elements	Requirement	Notes
ElementName	Mandatory	See 7.3.
TargetDevice	Optional	See 7.3.1.
TargetDeviceFormat	Optional	See 7.3.2.
EchoMechanism	Optional	See 7.3.3.
OtherEchoMechanism	Conditional	If EchoMechanism has a value of 1 (Other), this property is Mandatory.
LUN	Optional	See 7.3.4.
BufferSizes	Optional	See 7.3.5.
BufferPattern	Optional	See 7.3.6.
PingMechanism	Optional	See 7.3.7.
OtherPingMechanism	Conditional	If PingMechanism has a value of 1 (Other), this property is Mandatory.

1056 **10.3 CIM_FCHBADiagnosticServiceCapabilities**

1057 The CIM_FCHBADiagnosticServiceCapabilities class is used to provide information on the capabilities for
 1058 the FC HBA Diagnostic Service. This class specializes CIM_DiagnosticServiceCapabilities as defined in
 1059 [DSP1002](#). The constraints listed in Table 13 are in addition to those specified in [DSP1002](#). See [DSP1002](#)
 1060 for other mandatory elements that must be implemented.

1061

Table 13 – Class: CIM_FCHBADiagnosticServiceCapabilities

Elements	Requirement	Notes
ElementName	Mandatory	See 7.4.
SupportedLoopControl	Optional	See 7.4.1.
BufferSizesSupported	Optional	See 7.4.2.
MaxPatternSizeSupported	Optional	See 7.4.3.

1062 **10.4 CIM_RegisteredProfile**

1063 The CIM_RegisteredProfile class is defined by the *Profile Registration Profile* ([DSP1033](#)). The
 1064 requirements denoted in Table 14 are in addition to those mandated by [DSP1033](#). See [DSP1033](#) for the
 1065 other mandatory elements that must be implemented.

1066

Table 14 – Class: CIM_RegisteredProfile

Elements	Requirement	Notes
RegisteredName	Mandatory	The value of this property shall be “FC HBA Diagnostics”.
RegisteredVersion	Mandatory	The value of this property shall be “1.0.0”.
RegisteredOrganization	Mandatory	The value of this property shall be 2 (DMTF).

10.5 CIM_AffectedJobElement

Although defined in [DSP1002](#), the CIM_AffectedJobElement class is listed here because the AffectedElement reference is scoped down to CIM_PortController, which is a subclass of CIM_ManagedElement. The constraints listed in Table 15 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_AffectedJobElement that must be implemented.

Table 15 – Class: CIM_AffectedJobElement

Properties	Requirement	Notes
AffectedElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_PortController.
AffectingElement	Mandatory	The property shall be a reference to an instance of CIM_ConcreteJob.

10.6 CIM_AvailableDiagnosticService

Although defined in [DSP1002](#), the CIM_AvailableDiagnosticService class is listed here because the ServiceProvided reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest, and the UserOfService reference is scoped down to CIM_PortController, which is a subclass of CIM_ManagedElement. The constraints listed in Table 16 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_AvailableDiagnosticService that must be implemented.

Table 16 – Class: CIM_AvailableDiagnosticService

Properties	Requirement	Notes
ServiceProvided (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.
UserOfService (overridden)	Mandatory	The property shall be a reference to an instance of CIM_PortController.

10.7 CIM_ElementCapabilities

Although defined in [DSP1002](#), the CIM_ElementCapabilities class is listed here because the ManagedElement reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest, and the Capabilities reference is scoped down to CIM_FCHBADiagnosticServiceCapabilities, which is a subclass of CIM_DiagnosticServiceCapabilities. The constraints listed in Table 17 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ElementCapabilities that must be implemented.

Table 17 – Class: CIM_ElementCapabilities

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.
Capabilities (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticServiceCapabilities.

10.8 CIM_ElementSettingData (DiagnosticSettingData)

Although defined in [DSP1002](#), the CIM_ElementSettingData class is listed here because the ManagedElement reference is scoped down to CIM_FCHBADIagnosticTest, which is a subclass of CIM_DiagnosticTest, and the SettingData reference is scoped down to CIM_FCHBADIagnosticSettingData, which is a subclass of CIM_DiagnosticSettingData. The constraints listed in Table 18 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ElementSettingData that must be implemented.

Table 18 – Class: CIM_ElementSettingData

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADIagnosticTest.
SettingData (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADIagnosticSettingData.
IsDefault	Mandatory	If the instance of CIM_FCHBADIagnosticSettingData is the default setting, this property shall have the value of TRUE.

10.9 CIM_ElementSettingData (JobSettingData)

Although defined in [DSP1002](#), the CIM_ElementSettingData class is listed here because the Dependent reference is scoped down to CIM_FCHBADIagnosticTest, which is a subclass of CIM_DiagnosticTest, and the SettingData reference is scoped down to CIM_JobSettingData, which is a subclass of CIM_SettingData. The constraints listed in Table 19 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ElementSettingData that must be implemented.

Table 19 – Class: CIM_ElementSettingData

Properties	Requirement	Notes
ManagedElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADIagnosticTest.
SettingData (overridden)	Mandatory	The property shall be a reference to an instance of CIM_JobSettingData.
IsDefault	Mandatory	If the instance of CIM_JobSettingData is the default setting, this property shall have the value of TRUE.

10.10 CIM_ElementSoftwareIdentity

Although defined in [DSP1002](#), the CIM_ElementSoftwareIdentity class is listed here because the Dependent reference is scoped down to CIM_FCHBADIagnosticTest, which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 20 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ElementSoftwareIdentity that must be implemented.

1109

Table 20 – Class: CIM_ElementSoftwareIdentity

Properties	Requirement	Notes
Antecedent	Mandatory	The property shall be a reference to an instance of CIM_SoftwareIdentity.
Dependent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

10.11 CIM_HostedService

Although defined in [DSP1002](#), the CIM_HostedService class is listed here because the Dependent reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 21 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_HostedService that must be implemented.

1115

Table 21 – Class: CIM_HostedService

Properties	Requirement	Notes
Antecedent	Mandatory	The property shall be a reference to an instance of CIM_ComputerSystem.
Dependent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

10.12 CIM_OwningJobElement

Although defined in [DSP1002](#), the CIM_OwningJobElement class is listed here because the OwningElement reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 22 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_OwningJobElement that must be implemented.

1121

Table 22 – Class: CIM_OwningJobElement

Properties	Requirement	Notes
OwningElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.
OwnedElement	Mandatory	The property shall be a reference to an instance of CIM_ConcreteJob.

10.13 CIM_RecordAppliesToElement

Although defined in [DSP1002](#), the CIM_RecordAppliesToElement class is listed here because the Dependent reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 23 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_RecordAppliesToElement that must be implemented.

1127

1128

Table 23 – Class: CIM_RecordAppliesToElement

Properties	Requirement	Notes
Antecedent	Mandatory	The property shall be a reference to an instance of CIM_RecordForLog.
Dependent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

1129

10.14 CIM_ServiceAffectsElement

1130 Although defined in [DSP1002](#), the CIM_ServiceAffectsElement class is listed here because the
 1131 AffectedElement reference is scoped down to CIM_PortController, which is a subclass of
 1132 CIM_ManagedElement, and the AffectingElement reference is scoped down to
 1133 CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest. The constraints listed in Table
 1134 24 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of
 1135 CIM_ServiceAffectsElement that must be implemented.

1136

Table 24 – Class: CIM_ServiceAffectsElement

Properties	Requirement	Notes
AffectedElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_PortController.
AffectingElement (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

1137

10.15 CIM_ServiceAvailableToElement

1138 Although defined in [DSP1002](#), the CIM_ServiceAvailableToElement class is listed here because the
 1139 UsersOfService reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of
 1140 CIM_DiagnosticTest. The constraints listed in Table 25 are in addition to those specified in [DSP1002](#).
 1141 See [DSP1002](#) for other mandatory properties of CIM_ServiceAvailableToElement that must be
 1142 implemented.

1143

Table 25 – Class: CIM_ServiceAvailableToElement

Properties	Requirement	Notes
ServiceProvided	Mandatory	The property shall be a reference to an instance of CIM_HelpService.
UsersOfService (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

1144

10.16 CIM_ServiceComponent

1145 Although defined in [DSP1002](#), the CIM_ServiceComponent class is listed here because the
 1146 GroupComponent reference is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of
 1147 CIM_DiagnosticTest, and the PartComponent reference is scoped down to CIM_FCHBADiagnosticTest,
 1148 which is a subclass of CIM_DiagnosticTest. The constraints listed in Table 26 are in addition to those
 1149 specified in [DSP1002](#). See [DSP1002](#) for other mandatory properties of CIM_ServiceComponent that
 1150 must be implemented.

1151

Table 26 – Class: CIM_ServiceComponent

Properties	Requirement	Notes
GroupComponent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.
PartComponent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

1152 **10.17 CIM_UseOfLog**

1153 Although defined in [DSP1002](#), the CIM_UseOfLog class is listed here because the Dependent reference
 1154 is scoped down to CIM_FCHBADiagnosticTest, which is a subclass of CIM_DiagnosticTest. The
 1155 constraints listed in Table 27 are in addition to those specified in [DSP1002](#). See [DSP1002](#) for other
 1156 mandatory properties of CIM_UseOfLog that must be implemented.

1157

Table 27 – Class: CIM_UseOfLog

Properties	Requirement	Notes
Antecedent	Mandatory	The property shall be a reference to an instance of CIM_DiagnosticLog.
Dependent (overridden)	Mandatory	The property shall be a reference to an instance of CIM_FCHBADiagnosticTest.

1158 **10.18 CIM_FilterCollection**

1159 CIM_FilterCollection represents a ProfileSpecificFilterCollection as defined in [DSP1054](#). It defines the
 1160 collection of all the alert indications of the *Fibre Channel Host Bus Adapter Diagnostics Profile*. Table 28
 1161 contains the requirements for elements of this class.

1162

Table 28 – Class: CIM_FilterCollection

Properties	Requirement	Notes
InstanceID	Mandatory	Key: See DSP1054 .
CollectionName	Mandatory	The property shall be “DMTF:Fibre Channel Host Bus Adapter Diagnostics: ProfileSpecifiedAlertIndicationFilterCollection”.

1163

1164 **10.19 CIM_IndicationFilter**

1165 CIM_IndicationFilter represents a StaticIndicationFilter as defined in [DSP1054](#). It defines the format of all
 1166 the alert indication filters of the *Fibre Channel Host Bus Adapter Diagnostics Profile*. Table 29 contains
 1167 the requirements for elements of this class.

1168

Table 29 – Class: CIM_IndicationFilter

Properties	Requirement	Notes
Name	Mandatory	Key: See the Name values as identified in Table 10.
CreationClassName	Mandatory	Key: See DSP1054 .
SystemName	Mandatory	Key: See DSP1054 .
SystemCreationClassName	Mandatory	Key: See DSP1054 .
SourceNamespaces[]	Mandatory	See DSP1054 .
IndividualSubscriptionSupported	Mandatory	See DSP1054 .
Query	Mandatory	See the Query values as identified in Table 10.
QueryLanguage	Mandatory	See the QueryLanguage values as identified in Table 10.

1169

1170 **10.20 CIM_MemberOfCollection**

1171 CIM_MemberOfCollection represents an association between the profile specific FilterCollection and the
 1172 CIM_IndicationFilters for the alert indications. Table 30 contains the requirements for elements of this
 1173 class.

1174

Table 30 – Class: CIM_MemberOfCollection

Properties	Requirement	Notes
Collection	Mandatory	Key: Value shall reference the profile specific FilterCollection instance representing a filter collection containing the alert indication filters.
Member	Mandatory	Key: Value shall reference an Alert IndicationFilter instance representing a contained alert indication filter.

1175

1176 **10.21 CIM_OwningCollectionElement**

1177 CIM_OwningCollectionElement represents an association between the IndicationService that controls the
 1178 profile specific FilterCollection and the profile specific CIM_FilterCollection for the alert indication filters.
 1179 Table 31 contains the requirements for elements of this class.

1180

Table 31 – Class: CIM_OwningCollectionElement

Properties	Requirement	Notes
OwningElement	Mandatory	Key: See DSP1054 .
OwnedElement	Mandatory	Key: Value shall reference the profile specific Alert Indication FilterCollection instance.

1181

ANNEX A
(informative)**Change log**

Version	Date	Description
0.1	2009-02-03	Initial Version
0.2	2009-06-03	Updated
0.3	2009-12-13	Updated
0.4	2009-08-24	Now consistent in style to DSP1002 2.0.0
0.5	2010-11-29	Now consistent with CPUB style
1.0.0.a	2011-04-06	Work In Progress
1.0.0	2011-10-03	DMTF Draft Standard
1.1.0a	2013-06-19	Work In Progress update - Based on DSP1002 v2.1.0a - Adds Standard Messages for new Alert Indications