

BS ISO/IEC 24775-8:2014



BSI Standards Publication

Information technology — Storage management

Part 8: Media libraries

bsi.

...making excellence a habit.
AVA **Documents**
Document Sharing Hub

National foreword

This British Standard is the UK implementation of ISO/IEC 24775-8:2014.

The UK participation in its preparation was entrusted to Technical Committee ICT/-/1, Information systems co-ordination.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2014.
Published by BSI Standards Limited 2014

ISBN 978 0 580 84215 3
ICS 35.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2014.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------



INTERNATIONAL STANDARD



Information technology – Storage management – Part 8: Media libraries

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

H

ICS 35.200

ISBN 978-2-8322-1956-0

Warning! Make sure that you obtained this publication from an authorized distributor.

Contents

FOREWORD.....	13
Introduction	15
1 Scope	18
2 Normative references	18
3 Terms and definitions	18
4 Typographical conventions.....	20
4.1 Maturity model.....	20
4.2 Experimental maturity level	20
4.3 Implemented maturity level	20
4.4 Stable maturity level.....	21
4.5 Finalized maturity level.....	21
4.6 Deprecated Material.....	21
5 Storage Library Profile.....	23
5.1 Description	23
5.1.1 General.....	23
5.1.2 Instance Diagrams	23
5.1.3 System Level View	23
5.1.4 MediaAccessDevice-centric View	24
5.1.5 ChangerDevice-centric View	25
5.1.6 Physical View	25
5.1.7 StorageMediaLocation Instance Diagram	26
5.1.8 Durable Names and Correlatable IDs of the Profile	26
5.1.9 Media Library Indications	27
5.2 Health and Fault Management Considerations.....	36
5.3 Cascading Considerations	36
5.4 Supported Subprofiles and Packages.....	36
5.5 Methods of this Profile.....	36
5.6 Client Considerations and Recipes	36
5.6.1 Recipe Overview	36
5.6.2 Discover a Storage Media Library	36
5.6.3 Determine Library Physical Media Capacity.....	37
5.6.4 Determine Physical Media Inventory	37
5.6.5 Discover Storage Library Control Type	37
5.6.6 Determine Library Drive Capacity	37
5.6.7 Determine Drive Data Path Technology.....	37
5.6.8 Find asset Information.....	37
5.6.9 Discovery of Mailslots, Import/Export Elements or LimitedAccessPorts in a Storage Library.....	38
5.6.10 Counting assets in large storage libraries	38
5.7 Registered Name and Version	38
5.8 CIM Elements.....	38
5.8.1 General.....	38
5.8.2 CIM_ChangerDevice	47
5.8.3 CIM_Chassis	48
5.8.4 CIM_ComputerSystem	48
5.8.5 CIM_ComputerSystemPackage	49
5.8.6 CIM_ElementCapabilities	49
5.8.7 CIM_ElementSoftwareIdentity.....	50
5.8.8 CIM_MediaAccessDevice	50
5.8.9 CIM_PackagedComponent	50
5.8.10 CIM_PhysicalMedia.....	51
5.8.11 CIM_PhysicalMediaInLocation	

5.8.12	CIM_ProtocolControllerForUnit	52
5.8.13	CIM_Realizes	52
5.8.14	CIM_SCSIProtocolController	52
5.8.15	CIM_SoftwareIdentity	53
5.8.16	CIM_StorageLibraryCapabilities	53
5.8.17	CIM_StorageMediaLocation	54
5.8.18	CIM_SystemDevice (System to Changer Device)	54
5.8.19	CIM_SystemDevice (System to MediaAccessDevice)	54
5.8.20	CIM_SystemDevice (System to SCSIProtocolController)	55
6	Element Counting Subprofile	56
6.1	Description	56
6.1.1	General	56
6.1.2	Discovery	56
6.2	Health and Fault Management Considerations	56
6.3	Cascading Considerations	56
6.4	Supported Subprofiles and Packages	56
6.5	Methods of the Profile	56
6.5.1	GetClassTypes	56
6.5.2	GetUnitTypes	57
6.5.3	ReportCapacity	58
6.6	Client Considerations and Recipes	58
6.7	Registered Name and Version	59
6.8	CIM Elements	59
6.8.1	General	59
6.8.2	CIM_ConfigurationReportingService	60
6.8.3	CIM_HostedService	60
7	InterLibraryPort Connection Subprofile	61
7.1	Introductory remark	61
7.2	Description	61
7.3	Durable Names and Correlatable IDs	61
7.4	Health and Fault Management Considerations	62
7.5	Cascading Considerations	62
7.6	Supported Subprofiles and Packages	62
7.7	Methods of the Profile	62
7.8	Client Considerations and Recipes	62
7.9	Registered Name and Version	62
7.10	CIM Elements	62
7.10.1	General	62
7.10.2	CIM_InterLibraryPort	62
7.10.3	CIM_LibraryExchange	63
8	Library Capacity Subprofile	64
8.1	Description	64
8.2	Health and Fault Management Considerations	64
8.3	Cascading Considerations	64
8.4	Supported Subprofiles and Packages	64
8.5	Client Considerations and Recipes	64
8.6	Registered Name and Version	64
8.7	CIM Elements	65
8.7.1	General	65
8.7.2	CIM_ConfigurationCapacity	65
8.7.3	CIM_ElementCapacity	65
9	Limited Access Port Elements Subprofile	66
9.1	Description	66
9.1.1	General	66

9.1.2	Instance Diagram	66
9.2	Health and Fault Management Considerations	67
9.3	Cascading Considerations	67
9.4	Supported Subprofiles and Packages	67
9.5	Methods of the Profile	67
9.6	Client Considerations and Recipes	67
9.7	Registered Name and Version	67
9.8	CIM Elements	68
9.8.1	General	68
9.8.2	CIM_Container	68
9.8.3	CIM_LimitedAccessPort	69
9.8.4	CIM_Magazine	69
9.8.5	CIM_Realizes	69
9.8.6	CIM_SystemDevice	70
10	Media Movement Subprofile	71
10.1	Description	71
10.2	Health and Fault Management Considerations	72
10.2.1	NULL Instance Handling	72
10.2.2	Media Movement Subprofile Standard Messages	72
10.3	Cascading Considerations	72
10.4	Supported Subprofiles and Packages	72
10.5	Methods of the Profile	73
10.5.1	Moving a piece of PhysicalMedia	73
10.5.2	Timeout parameter	73
10.5.3	ForceUnload parameter	73
10.6	Client Considerations and Recipes	74
10.6.1	Concurrent library access by SMI clients and other applications	74
10.6.2	Use of the ForceUnload parameter	74
10.6.3	Job Lifecycle Indications	74
10.7	Registered Name and Version	74
10.8	CIM Elements	74
10.8.1	General	74
10.8.2	CIM_HostedService	74
10.8.3	SNIA_MediaMovementService	75
11	Partitioned Tape Library Profile	76
11.1	Description	76
11.1.1	Overview	76
11.1.2	PTL Model	76
11.1.3	PTL Configuration	77
11.1.4	PTL Configuration Methods	78
11.2	Health and Fault Management Consideration	78
11.3	Cascading Considerations	78
11.4	Supported Profiles, Subprofiles, and Packages	79
11.5	Client Considerations and Recipes	79
11.6	Registered Name and Version	79
11.7	CIM Elements	79
11.7.1	General	79
11.7.2	CIM_ChangerDevice	81
11.7.3	CIM_Chassis (PTL System)	81
11.7.4	CIM_ComputerSystemPackage (PTL System to Chassis)	82
11.7.5	CIM_ConcreteIdentity (Slots to Slots)	82
11.7.6	CIM_Container (Chassis to slots)	82
11.7.7	CIM_ElementCapabilities	83
11.7.8	CIM_ElementSettingData	83

11.7.9 CIM_HostedDependency (PTLSystem to Partition)	83
11.7.10CIM_HostedDependency (PTLSystem to Unallocated Partition)	83
11.7.11CIM_LimitedAccessPort	84
11.7.12CIM_MediaAccessDevice	84
11.7.13CIM_PhysicalMediaInLocation	85
11.7.14CIM_PhysicalTape	85
11.7.15CIM_Product	85
11.7.16CIM_ProductElementComponent (PTL System)	85
11.7.17CIM_Realizes (Slots to Changers)	86
11.7.18CIM_Realizes (Slots to Ports)	86
11.7.19CIM_Realizes (Slots to TapeDrive)	86
11.7.20CIM_StorageMediaLocation	87
11.7.21CIM_SystemDevice (PTL System to ChangerDevice)	87
11.7.22CIM_SystemDevice (PTL System to LimitedAccessPort)	87
11.7.23CIM_SystemDevice (PTL System to MediaAccessDevice)	88
11.7.24SNIA_ComputerSystem (PTL System)	88
11.7.25SNIA_ComputerSystem (Partition)	89
11.7.26SNIA_ComputerSystem (Unallocated Partition)	89
11.7.27SNIA_PartitionedLibrarySetting	90
11.7.28SNIA_PartitionedLibrarySystemCapabilities	91
11.7.29SNIA_PartitionedLibrarySystemConfigurationService	91
12 Virtual Tape Library Profile	93
12.1 Description	93
12.1.1 Overview	93
12.1.2 Package	93
12.1.3 Virtual Library System	94
12.1.4 Virtual Library System configuration	97
12.2 Health and Fault Management Consideration	100
12.3 Cascading Considerations	100
12.4 Supported Profiles and Packages	101
12.5 Methods of the profile	101
12.6 Client Considerations and Recipes	101
12.7 Registered Name and Version	101
12.8 CIM Elements	101
12.8.1 General	101
12.8.2 CIM_AllocatedFromStoragePool (Pool from Concrete Pool)	105
12.8.3 CIM_AllocatedFromStoragePool (Pool from Primordial Pool)	105
12.8.4 CIM_AllocatedFromStoragePool (StorageExtent from Concrete Pool)	106
12.8.5 CIM_ChangerDevice	106
12.8.6 CIM_Chassis (Virtual Tape Library)	107
12.8.7 CIM_ComputerSystem (Virtual Library System)	107
12.8.8 CIM_ComputerSystem (Virtual Tape Library)	108
12.8.9 CIM_ComputerSystemPackage	108
12.8.10CIM_ConcreteComponent (StorageExtent from Primordial Pool)	109
12.8.11CIM_ConcreteDependency (Virtual Library System to MediaLibrary)	109
12.8.12CIM_Container (Chassis to StorageMediaLocations)	110
12.8.13CIM_ElementCapabilities (Virtual Tape Library Capabilities)	110
12.8.14CIM_ElementCapabilities (Virtual Tape Library System Capabilities)	110
12.8.15CIM_ElementCapabilities (Virtual Tape Service Capabilities)	111
12.8.16CIM_ElementSettingData (Physical Tape)	111
12.8.17CIM_HostedCollection	111
12.8.18CIM_HostedDependency (Virtual Library System to VirtualLibrary)	111
12.8.19CIM_HostedService (Virtual Tape Library Configuration Service)	112
12.8.20CIM_HostedService (Virtual Tape Library System Service)	112

12.8.21	CIM_HostedService (Virtual Tape Service)	113
12.8.22	CIM_HostedStoragePool (Primordial)	113
12.8.23	CIM_LimitedAccessPort	113
12.8.24	CIM_LogicalIdentity	114
12.8.25	CIM_MediaAccessDevice	114
12.8.26	CIM_MemberOfCollection	115
12.8.27	CIM_PhysicalMediaInLocation	115
12.8.28	CIM_Product	115
12.8.29	CIM_ProductElementComponent (Virtual Tape Library)	115
12.8.30	CIM_Realizes (Slots to Changers)	116
12.8.31	CIM_Realizes (Slots to Ports)	116
12.8.32	CIM_Realizes (Slots to TapeDrive)	116
12.8.33	CIM_ServiceAffectsElement	117
12.8.34	CIM_SettingAssociatedToCapabilities (Setting To Capabilities)	117
12.8.35	CIM_SettingsDefineCapabilities	117
12.8.36	CIM_SettingsDefineState	117
12.8.37	CIM_StorageExtent (Assigned)	118
12.8.38	CIM_StorageExtent (Imported)	118
12.8.39	CIM_StorageMediaLocation	119
12.8.40	CIM_StoragePool (Concrete)	120
12.8.41	CIM_StoragePool (Primordial)	120
12.8.42	CIM_SystemDevice (System to Primordial StorageExtent)	121
12.8.43	CIM_SystemDevice (VTL to ChangerDevice)	121
12.8.44	CIM_SystemDevice (VTL to LimitedAccessPort)	121
12.8.45	CIM_SystemDevice (VTL to MediaAccessDevice)	122
12.8.46	CIM_SystemSpecificCollection (Unassigned)	122
12.8.47	SNIA_PhysicalTape (Virtual Tape)	122
12.8.48	SNIA_VirtualTapeLibraryCapabilities	123
12.8.49	SNIA_VirtualTapeLibraryConfigurationService	123
12.8.50	SNIA_VirtualTapeLibrarySetting	124
12.8.51	SNIA_VirtualTapeLibrarySystemCapabilities	125
12.8.52	SNIA_VirtualTapeLibrarySystemService	125
12.8.53	SNIA_VirtualTapeService	126
12.8.54	SNIA_VirtualTapeServiceCapabilities	126
12.8.55	SNIA_VirtualTapeSetting	126
13	Virtual Tape Library Copy Profile	128
13.1	Description	128
13.2	Tape Copy Services	128
13.2.1	Summary	128
13.2.2	Definitions	128
13.3	Recipes	133
13.3.1	Simple Snapshot recipe	133
13.3.2	Selective Tape Copy recipe	133
13.4	Health and Fault Management Consideration	134
13.5	Cascading Considerations	134
13.6	Registered Name and Version	134
13.7	CIM Elements	134
13.7.1	General	134
13.7.2	CIM_ElementCapabilities	135
13.7.3	CIM_HostedService	135
13.7.4	SNIA_TapeCopyCapabilities	135
13.7.5	SNIA_TapeCopyService	136
13.7.6	SNIA_TapeMetaData	137
14	Library Views Profile	138

14.1	Synopsis.....	138
14.2	Description	138
14.2.1	Overview	138
14.2.2	Goals of SNIA_ View Classes	138
14.3	Implementation.....	139
14.3.1	View Class Capabilities	139
14.3.2	Media Location Views	139
14.3.3	Masking and Mapping Views.....	140
14.3.4	Health and Fault Management Consideration	140
14.3.5	Cascading Considerations	140
14.4	Methods of the Profile	140
14.4.1	Extrinsic Methods of the Profile	140
14.4.2	Intrinsic Methods of the Profile	140
14.5	Use Cases.....	141
14.6	CIM Elements.....	141
14.6.1	General.....	141
14.6.2	CIM_ElementCapabilities (View Capabilities)	142
14.6.3	SNIA_ExposedView	142
14.6.4	SNIA_MediaLocationView	143
14.6.5	SNIA_SystemMediaLocationView (MediaLocationViews).....	143
14.6.6	SNIA_ViewCapabilities.....	144
Annex A	(informative) SMI-S Information Model.....	145
Bibliography		146

Figure 1 - Experimental maturity level tag	20
Figure 2 - Implemented maturity level tag.....	21
Figure 3 - Stable maturity level tag	21
Figure 4 - Deprecated tag	22
Figure 5 - Storage Library-centric Instance Diagram	24
Figure 6 - MediaAccessDevice-centric Instance Diagram	25
Figure 7 - ChangerDevice-centric Instance Diagram	25
Figure 8 - Physical View Instance Diagram	26
Figure 9 - StorageMediaLocation Instance Diagram	26
Figure 10 - Instance Diagram	56
Figure 11 - InterLibraryPort Connection Instance Diagram	61
Figure 12 - Library Capacity Instance Diagram	64
Figure 13 - Tape Libraries with Magazines in LimitedAccessPorts	66
Figure 14 - Tape Libraries with no Magazines in LimitedAccessPorts	67
Figure 15 - Storage Library Centric View	71
Figure 16 - Media-centrc View	72
Figure 17 - Partitioned Tape Library System Model	77
Figure 18 - Partitioned Tape Library Configuration Model	77
Figure 19 - Block Diagram	93
Figure 20 - Virtual Library System Package Diagram	94
Figure 21 - Virtual Tape Library System	95
Figure 22 - VTL - Block to Tape	96
Figure 23 - Virtual Library System-Services	97
Figure 24 - Drive Mapping	98
Figure 25 - Virtual Library Services.....	99
Figure 26 - Virtual Tape Service	100
Figure 27 - Tape Copy Services Class Diagram.....	128
Figure 28 - TapeMetaData Class Definition	129

Table 1 - CIM Elements for Storage Library	38
Table 2 - SMI Referenced Properties/Methods for CIM_ChangerDevice	48
Table 3 - SMI Referenced Properties/Methods for CIM_Chassis	48
Table 4 - SMI Referenced Properties/Methods for CIM_ComputerSystem	49
Table 5 - SMI Referenced Properties/Methods for CIM_ComputerSystemPackage	49
Table 6 - SMI Referenced Properties/Methods for CIM_ElementCapabilities	49
Table 7 - SMI Referenced Properties/Methods for CIM_ElementSoftwareIdentity	50
Table 8 - SMI Referenced Properties/Methods for CIM_MediaAccessDevice	50
Table 9 - SMI Referenced Properties/Methods for CIM_PackagedComponent	51
Table 10 - SMI Referenced Properties/Methods for CIM_PhysicalMedia	51
Table 11 - SMI Referenced Properties/Methods for CIM_PhysicalMediaInLocation	51
Table 12 - SMI Referenced Properties/Methods for CIM_ProtocolControllerForUnit	52
Table 13 - SMI Referenced Properties/Methods for CIM_Realizes	52
Table 14 - SMI Referenced Properties/Methods for CIM_SCSIProtocolController	52
Table 15 - SMI Referenced Properties/Methods for CIM_SoftwareIdentity	53
Table 16 - SMI Referenced Properties/Methods for CIM_StorageLibraryCapabilities	53
Table 17 - SMI Referenced Properties/Methods for CIM_StorageMediaLocation	54
Table 18 - SMI Referenced Properties/Methods for CIM_SystemDevice (System to Changer Device)	54
Table 19 - SMI Referenced Properties/Methods for CIM_SystemDevice (System to MediaAccessDevice)	54
Table 20 - SMI Referenced Properties/Methods for CIM_SystemDevice (System to SCSIProtocolController)	55
Table 21 - CIM Elements for Storage Library Element Counting	59
Table 22 - SMI Referenced Properties/Methods for CIM_ConfigurationReportingService	60
Table 23 - SMI Referenced Properties/Methods for CIM_HostedService	60
Table 24 - CIM Elements for Storage Library InterLibraryPort Connection	62
Table 25 - SMI Referenced Properties/Methods for CIM_InterLibraryPort	63
Table 26 - SMI Referenced Properties/Methods for CIM_LibraryExchange	63
Table 27 - CIM Elements for Storage Library Capacity	65
Table 28 - SMI Referenced Properties/Methods for CIM_ConfigurationCapacity	65
Table 29 - SMI Referenced Properties/Methods for CIM_ElementCapacity	65
Table 30 - CIM Elements for Storage Library Limited Access Port Elements	68
Table 31 - SMI Referenced Properties/Methods for CIM_Container	68
Table 32 - SMI Referenced Properties/Methods for CIM_LimitedAccessPort	69
Table 33 - SMI Referenced Properties/Methods for CIM_Magazine	69
Table 34 - SMI Referenced Properties/Methods for CIM_Realizes	70
Table 35 - SMI Referenced Properties/Methods for CIM_SystemDevice	70
Table 36 - Media Movement Standard Messages	72
Table 37 - CIM Elements for Storage Library Media Movement	74
Table 38 - SMI Referenced Properties/Methods for CIM_HostedService	74
Table 39 - SMI Referenced Properties/Methods for SNIA_MediaMovementService	75
Table 40 - Supported Profiles for Partitioned Tape Library	79
Table 41 - CIM Elements for Partitioned Tape Library	79
Table 42 - SMI Referenced Properties/Methods for CIM_ChangerDevice	81
Table 43 - SMI Referenced Properties/Methods for CIM_Chassis (PTL System)	81
Table 44 - SMI Referenced Properties/Methods for CIM_ComputerSystemPackage	

(PTL System to Chassis)	82
Table 45 - SMI Referenced Properties/Methods for CIM_ConcreteIdentity (Slots to Slots)	82
Table 46 - SMI Referenced Properties/Methods for CIM_Container (Chassis to slots)	83
Table 47 - SMI Referenced Properties/Methods for CIM_ElementCapabilities	83
Table 48 - SMI Referenced Properties/Methods for CIM_ElementSettingData	83
Table 49 - SMI Referenced Properties/Methods for CIM_HostedDependency (PTLSysSystem to Partition)	83
Table 50 - SMI Referenced Properties/Methods for CIM_HostedDependency (PTLSysSystem to Unallocated Partition)	84
Table 51 - SMI Referenced Properties/Methods for CIM_LimitedAccessPort	84
Table 52 - SMI Referenced Properties/Methods for CIM_MediaAccessDevice	84
Table 53 - SMI Referenced Properties/Methods for CIM_PhysicalMediaInLocation	85
Table 54 - SMI Referenced Properties/Methods for CIM_Product	85
Table 55 - SMI Referenced Properties/Methods for CIM_ProductElementComponent (PTL System)	86
Table 56 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to Changers)	86
Table 57 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to Ports)	86
Table 58 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to TapeDrive)	87
Table 59 - SMI Referenced Properties/Methods for CIM_StorageMediaLocation	87
Table 60 - SMI Referenced Properties/Methods for CIM_SystemDevice (PTL System to ChangerDevice)	87
Table 61 - SMI Referenced Properties/Methods for CIM_SystemDevice (PTL System to LimitedAccessPort)	88
Table 62 - SMI Referenced Properties/Methods for CIM_SystemDevice (PTL System to MediaAccessDevice)	88
Table 63 - SMI Referenced Properties/Methods for SNIA_ComputerSystem (PTL System)	88
Table 64 - SMI Referenced Properties/Methods for SNIA_ComputerSystem (Partition)	89
Table 65 - SMI Referenced Properties/Methods for SNIA_ComputerSystem (Unallocated Partition)	90
Table 66 - SMI Referenced Properties/Methods for SNIA_PartitionedLibrarySetting	90
Table 67 - SMI Referenced Properties/Methods for SNIA_PartitionedLibrarySystemCapabilities	91
Table 68 - SMI Referenced Properties/Methods for SNIA_PartitionedLibrarySystemConfigurationService	92
Table 69 - Supported Profiles for Virtual Tape Library	101
Table 70 - CIM Elements for Virtual Tape Library	101
Table 71 - SMI Referenced Properties/Methods for CIM_AllocatedFromStoragePool (Pool from Concrete Pool)	105
Table 72 - SMI Referenced Properties/Methods for CIM_AllocatedFromStoragePool (Pool from Primordial Pool)	106
Table 73 - SMI Referenced Properties/Methods for CIM_AllocatedFromStoragePool (StorageExtent from Concrete Pool)	106
Table 74 - SMI Referenced Properties/Methods for CIM_ChangerDevice	106
Table 75 - SMI Referenced Properties/Methods for CIM_Chassis (Virtual Tape Library)	107
Table 76 - SMI Referenced Properties/Methods for CIM_ComputerSystem (Virtual Library System)	107
Table 77 - SMI Referenced Properties/Methods for CIM_ComputerSystem (Virtual Tape Library) ..	108
Table 78 - SMI Referenced Properties/Methods for CIM_ComputerSystemPackage	109
Table 79 - SMI Referenced Properties/Methods for CIM_ConcreteComponent (StorageExtent from Primordial Pool)	109

Table 80 - SMI Referenced Properties/Methods for CIM_ConcreteDependency (Virtual Library System to MediaLibrary)	109
Table 81 - SMI Referenced Properties/Methods for CIM_Container (Chassis to StorageMediaLocations).....	110
Table 82 - SMI Referenced Properties/Methods for CIM_ElementCapabilities (Virtual Tape Library Capabilities)	110
Table 83 - SMI Referenced Properties/Methods for CIM_ElementCapabilities (Virtual Tape Library System Capabilities)	110
Table 84 - SMI Referenced Properties/Methods for CIM_ElementCapabilities (Virtual Tape Service Capabilities)	111
Table 85 - SMI Referenced Properties/Methods for CIM_ElementSettingData (Physical Tape).....	111
Table 86 - SMI Referenced Properties/Methods for CIM_HostedCollection.....	111
Table 87 - SMI Referenced Properties/Methods for CIM_HostedDependency (Virtual Library System to VirtualLibrary).....	112
Table 88 - SMI Referenced Properties/Methods for CIM_HostedService (Virtual Tape Library Configuration Service)	112
Table 89 - SMI Referenced Properties/Methods for CIM_HostedService (Virtual Tape Library System Service).....	112
Table 90 - SMI Referenced Properties/Methods for CIM_HostedService (Virtual Tape Service).....	113
Table 91 - SMI Referenced Properties/Methods for CIM_HostedStoragePool (Primordial)	113
Table 92 - SMI Referenced Properties/Methods for CIM_LimitedAccessPort	113
Table 93 - SMI Referenced Properties/Methods for CIM_LogicalIdentity	114
Table 94 - SMI Referenced Properties/Methods for CIM_MediaAccessDevice	114
Table 95 - SMI Referenced Properties/Methods for CIM_MemberOfCollection	115
Table 96 - SMI Referenced Properties/Methods for CIM_PhysicalMediaInLocation	115
Table 97 - SMI Referenced Properties/Methods for CIM_Product	115
Table 98 - SMI Referenced Properties/Methods for CIM_ProductElementComponent (Virtual Tape Library).....	116
Table 99 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to Changers)	116
Table 100 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to Ports)	116
Table 101 - SMI Referenced Properties/Methods for CIM_Realizes (Slots to TapeDrive)	117
Table 102 - SMI Referenced Properties/Methods for CIM_ServiceAffectsElement.....	117
Table 103 - SMI Referenced Properties/Methods for CIM_SettingAssociatedToCapabilities (Setting To Capabilities)	117
Table 104 - SMI Referenced Properties/Methods for CIM_SettingsDefineCapabilities	117
Table 105 - SMI Referenced Properties/Methods for CIM_SettingsDefineState	118
Table 106 - SMI Referenced Properties/Methods for CIM_StorageExtent (Assigned).....	118
Table 107 - SMI Referenced Properties/Methods for CIM_StorageExtent (Imported)	119
Table 108 - SMI Referenced Properties/Methods for CIM_StorageMediaLocation	120
Table 109 - SMI Referenced Properties/Methods for CIM_StoragePool (Concrete)	120
Table 110 - SMI Referenced Properties/Methods for CIM_StoragePool (Primordial)	121
Table 111 - SMI Referenced Properties/Methods for CIM_SystemDevice (System to Primordial StorageExtent)	121
Table 112 - SMI Referenced Properties/Methods for CIM_SystemDevice (VTL to ChangerDevice).....	121
Table 113 - SMI Referenced Properties/Methods for CIM_SystemDevice (VTL to LimitedAccessPort).....	122
Table 114 - SMI Referenced Properties/Methods for CIM_SystemDevice (VTL to MediaAccessDevice)	122

Table 115 - SMI Referenced Properties/Methods for CIM_SystemSpecificCollection (Unassigned)	122
Table 116 - SMI Referenced Properties/Methods for SNIA_PhysicalTape (Virtual Tape).....	123
Table 117 - SMI Referenced Properties/Methods for SNIA_VirtualTapeLibraryCapabilities	123
Table 118 - SMI Referenced Properties/Methods for SNIA_VirtualTapeLibraryConfigurationService	124
Table 119 - SMI Referenced Properties/Methods for SNIA_VirtualTapeLibrarySetting	124
Table 120 - SMI Referenced Properties/Methods for SNIA_VirtualTapeLibrarySystemCapabilities	125
Table 121 - SMI Referenced Properties/Methods for SNIA_VirtualTapeLibrarySystemService.....	125
Table 122 - SMI Referenced Properties/Methods for SNIA_VirtualTapeService.....	126
Table 123 - SMI Referenced Properties/Methods for SNIA_VirtualTapeServiceCapabilities	126
Table 124 - SMI Referenced Properties/Methods for SNIA_VirtualTapeSetting	127
Table 125 - CIM Elements for Tape Copy Service	134
Table 126 - SMI Referenced Properties/Methods for CIM_ElementCapabilities	135
Table 127 - SMI Referenced Properties/Methods for CIM_HostedService	135
Table 128 - SMI Referenced Properties/Methods for SNIA_TapeCopyCapabilities	136
Table 129 - SMI Referenced Properties/Methods for SNIA_TapeCopyService	136
Table 130 - SMI Referenced Properties/Methods for SNIA_TapeMetaData	137
Table 131 - Related Profiles for Library Views.....	138
Table 132 - CIM Elements for Library Views	141
Table 133 - SMI Referenced Properties/Methods for CIM_ElementCapabilities (View Capabilities)	142
Table 134 - SMI Referenced Properties/Methods for SNIA_ExposedView	142
Table 135 - SMI Referenced Properties/Methods for SNIA_MediaLocationView	143
Table 136 - SMI Referenced Properties/Methods for SNIA_SystemMediaLocationView (MediaLocationViews)	144
Table 137 - SMI Referenced Properties/Methods for SNIA_ViewCapabilities.....	144

INFORMATION TECHNOLOGY – STORAGE MANAGEMENT – Part 8: Media libraries

FOREWORD

- 1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.
- 2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees and ISO member bodies.
- 3) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC National Committees and ISO member bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC, ISO and ISO/IEC publications is accurate, IEC or ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees and ISO member bodies undertake to apply IEC, ISO and ISO/IEC publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any ISO, IEC or ISO/IEC publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 5) ISO and IEC do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. ISO or IEC are not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or ISO or its directors, employees, servants or agents including individual experts and members of their technical committees and IEC National Committees or ISO member bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication of, use of, or reliance upon, this ISO/IEC publication or any other IEC, ISO or ISO/IEC publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this ISO/IEC publication may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 24775-8 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This International Standard, together with ISO/IEC 24775-1 to ISO/IEC 24775-7, replaces ISO/IEC 24775, second edition, published in 2011, and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) reorganization into eight parts;
- b) maturity identification using stages; and
- c) new profiles.

The list of all currently available parts of the ISO/IEC 24775 series, under the general title *Information technology – Storage management*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

Introduction

Storage Library Profile and related subprofiles defined in this book provide a standard CIM interface to monitor and control various aspects of removable media libraries including tape libraries. Once a library supports this standard, any SMI-S client based on this standard can discover a tape library, determine its capacity, perform inventory, monitor status, move tapes and perform other configuration and control operations. This standard also standardizes library specific life-cycle and alert indications that are delivered to a client asynchronously, once a client subscribes to these indications.

This book covers Media Libraries of the SMI-S standards listed below. While ISO/IEC 24775-2, (Common Architecture) describes SMI-S concepts and terms, some of the profiles and subprofiles referenced in this Storage Library profile are specified in ISO/IEC 24775-3, (Common Profiles).

Parts of this Standard

This International Standard is subdivided into the following parts:

- *Information technology – Storage management – Part 1: Overview*
- *Information technology – Storage management – Part 2: Common architecture*
- *Information technology – Storage management – Part 3: Common profiles*
- *Information technology – Storage management – Part 4: Block devices*
- *Information technology – Storage management – Part 5: Filesystems*
- *Information technology – Storage management – Part 6: Fabric*
- *Information technology – Storage management – Part 7: Host elements*
- *Information technology – Storage management – Part 8: Media libraries*

Changes since the Last Edition

This edition cancels and replaces the second edition published in 2011 and constitutes a technical revision. This edition includes the following significant changes with respect to the previous edition. The changes fall into three broad categories:

- **Improved organization.** This International Standard has been reorganized into eight parts to provide more information more easily. The parts are as follows.
 - *Part 1 Overview:* The overview book provides a high level overview of the standard.
 - *Part 2 Common Architecture:* This part covers general information about the interface, such as security and protocols.
 - *Part 3 Common Profiles:* This part covers component profiles that extend profiles in other books, such as target ports and job control.
 - *Part 4 Block Devices:* This part covers storage profiles that support various forms of disk storage.
 - *Part 5 Filesystems:* This part covers profiles that support filesystems, such as NAS (Network Attached Storage).
 - *Part 6 Fabric:* This part covers profiles that deal with interconnection of host servers and storage devices, such as switches.
 - *Part 7 Host Elements:* This part covers profiles for storage software on host servers, such as disk partitioning and Host Hardware RAID controllers.
 - *Part 8 Media Libraries:* This part covers profiles that deal with removable media such as tape libraries.

- **Maturity identification.** As material is added to the standard it goes through various stages of maturity. The initial stage is *Experimental*, which is material that has not yet been implemented and is subject to change. The other stages indicate the degree of implementations. The stages are:
 - **Experimental:** Full design review, no commercial implementations.
 - **Implemented:** Initial implementations available, may be removed at minor revision.
 - **Stable:** Three or more vendors have implemented the identified material, backward compatibility assured, removed only at major revision.
 - **Finalized:** Relies solely on Finalized content, deprecated only at major revision.
 - **Deprecated:** Obsolete material, may be removed in future revisions.

For a more detailed explanation of each maturity level and its typographical indication, see Clause 4 Typographical Conventions.
- **Expanded scope.** The range of SAN components modeled by the profiles defined in the parts has been greatly expanded.
 - New profiles include:
 - *Part 3 Common Profiles:* Serial Attached SCSI (SAS) Target Port, Serial ATA (SATA) Target Ports, SB Target Port, SAS Initiator Ports, ATA Initiator Ports, FC-SB-x Initiator Ports, FCoE Initiator Ports, Power Supply, Fan, Sensors, Base Server, Media Access Device, Storage Enclosure, Software Inventory, Profile Registration, Proxy Server System Management, Operational Power.
 - *Part 4 Block Devices:* Block Storage Views, CKD Block Services, Erasure, Storage Server Asymmetry, Volume Composition, Storage Element Protection, Replication Services, Pools from Volumes, Group Masking and Mapping, Thin Provisioning.
 - *Part 5 Filesystems:* File Export, File Server Manipulation, File Storage, Filesystem, Filesystem Copy Services, Filesystem Performance, Filesystem Quotas, NAS Network Port, Host Filesystem, Filesystem Remote Copy Services.
 - *Part 6 Fabric:* Fibre Channel Security, Fabric Views, Virtual Fabrics, Switch Partitioning, SAS Expander, N Port Virtualizer, Inter Fabric Routing.
 - *Part 7 Host Elements:* Storage HBA, Host Hardware RAID Controller.
 - *Part 8 Media Libraries:* Partitioned Tape Library, Virtual Tape Library, Virtual Tape Library Copy and Library Views.
 - The following experimental profiles were removed from the International Standard:
 - *Part 3 Common Profiles:* Security, 3rd Party Authentication, Authorization, Credential Management, Identity Management, Security Role Based Access Control and Security Resource Ownership.
 - *Part 4 Block Devices:* Pool Management Policy.
 - The following profiles were deprecated:
 - *Part 3 Common Profiles:* Cascading (replaced by direct use of cascading classes).
 - *Part 4 Block Devices:* Volume Management (and not replaced).
 - *Part 6 Fabric:* Router (and not replaced).
 - *Part 7 Host Elements:* FC HBA (replaced by Storage HBA), SB Multipath Management (and not replaced).
 - *Part 8 Media Libraries:* InterLibraryPort Connection (and not replaced).
 - In addition, many of the existing profiles have been enhanced.

This International Standard was prepared by the SNIA (Storage Networking Industry Association)¹. The standard is often referred to as **SMI-S** (*Storage Management Initiative Specification*).

1. Storage Networking Industry Association, 425 Market Street, Suite 1020, San Francisco, CA 94105, U.S.A.
<http://www.snia.org>

INFORMATION TECHNOLOGY – STORAGE MANAGEMENT – Part 8: Media libraries

1 Scope

This part of ISO/IEC 24775 models various details of the following objects of the media library for monitoring.

- Library
- Drives
- Changer Devices
- Slots
- IO Slots
- SCSI Interfaces and SCSI and FC Target Ports
- Physical Tapes
- Physical Package
- Magazines

In general, a CIM client can monitor the health and status of the above objects as well as get alert, status change and lifecycle CIM indications. In addition, a client can control the movement of media in a library using this standard.

The future versions of this standard shall address partitioned tape libraries and virtual tape libraries. Note that the experimental subprofile modelling partitioned tape libraries and virtual tape libraries in the previous version of this standard has been withdrawn and hence is now omitted from this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in the document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document, including any amendments, applies.

ISO/IEC 24775-2:2014, *Information technology – Storage management – Part 2: Common architecture*

ISO/IEC 24775-3:2014, *Information technology – Storage management – Part 3: Common profiles*

ISO/IEC 24775-4:2014, *Information technology – Storage management – Part 4: Block devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 24775-2, *Information Technology – Storage Management, Part 2 Common Architecture* and the following apply.

3.1

changer device

robotic arm and control logic within a storage media library that moves media from one location to another

3.2

media access device

device that performs read and write operations on media

Note 1 to entry: In tape libraries, it is the tape drive.

3.3

storage media location

various locations within a media library where the physical media can be placed

Note 1 to entry: These include the changer devices, the media access devices, physical slots or magazines, and I/O slots.

3.4

storage media library

library in which a large number of removable media can be stored and retrieved

Note 1 to entry: A library also contains a limited number of media access devices for reading and writing to the media.

Note 2 to entry: A changer device within the library moves the media between a stored location and drive or between two locations.

Note 3 to entry: The drives, changers and the library are controlled by a host typically via the SCSI and/or FC ports, but other types of ports are possible.

Note 4 to entry: A storage media library typically is a tape library.

3.5

limited access port

operator-accessible window of a storage media library through which physical media is fed into the library or physical media can be retrieved out of a library

Note 1 to entry: A Limited access port is also known as an I/O Port, Import Export Port, Mailslot, etc.

3.6

library capacity

capacity of a storage media library is measured in terms of the number of physical media it can hold

3.7

magazine

container that holds multiple physical media

Note 1 to entry: Some storage media libraries have magazines that fit into the physical slot instead of single media.

4 Typographical conventions

4.1 Maturity model

In addition to informative and normative content, this International Standard includes guidance about the maturity of emerging material that has completed a rigorous design review but has limited implementation in commercial products. This material is clearly delineated as described in Clause 4. The typographical convention is intended to provide a sense of the maturity of the affected material, without altering its normative content. By recognizing the relative maturity of different sections of the International Standard, an implementer should be able to make more informed decisions about the adoption and deployment of different portions of the International Standard in a commercial product.

This International Standard has been structured to convey both the formal requirements and assumptions of the Information Technology – Storage Management API and its emerging implementation and deployment lifecycle. Over time, the intent is that all content in the International Standard will represent a mature and stable design, be verified by extensive implementation experience, assure consistent support for backward compatibility, and rely solely on content material that has reached a similar level of maturity. Unless explicitly labeled with one of the subordinate maturity levels defined for this International Standard, content is assumed to satisfy these requirements and is referred to as “Finalized”. Since much of the evolving International Standard content in any given release will not have matured to that level, this International Standard defines three subordinate levels of implementation maturity that identify important aspects of the content’s increasing maturity and stability. Each subordinate maturity level is defined by its level of implementation experience, its stability and its reliance on other emerging standards. Each subordinate maturity level is identified by a unique typographical tagging convention that clearly distinguishes content at one maturity model from content at another level.

4.2 Experimental maturity level

No material is included in this International Standard unless its initial architecture has been completed and reviewed. Some content included in this International Standard has complete and reviewed design, but lacks implementation experience and the maturity gained through implementation experience. This content is included in order to gain wider review and to gain implementation experience. This material is referred to as “Experimental”. It is presented here as an aid to implementers who are interested in likely future developments within the SMI International Standards. The contents of an Experimental profile may change as implementation experience is gained. There is a high likelihood that the changed content will be included in an upcoming revision of the International Standard. Experimental material can advance to a higher maturity level as soon as implementations are available. Figure 1 is a sample of the typographical convention for Experimental content.

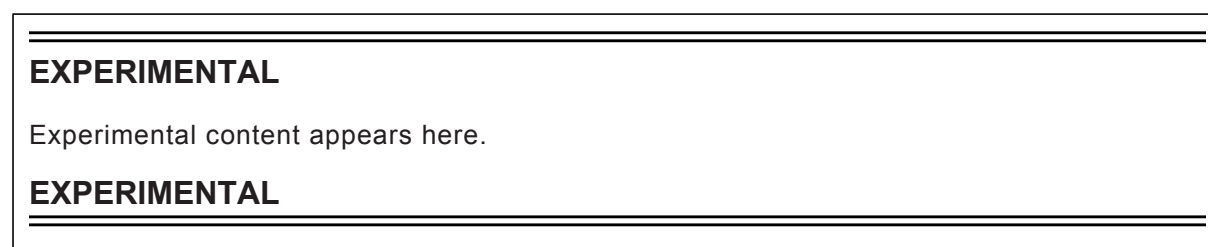


Figure 1 - Experimental maturity level tag

4.3 Implemented maturity level

Profiles for which initial implementations have been completed are classified as “Implemented”. This indicates that at least two different vendors have implemented the profile, including at least one provider implementation. At this maturity level, the underlying architecture and modeling are stable, and changes in future revisions will be limited to the correction of deficiencies identified through additional implementation experience. Should the material become obsolete in the future, it shall be deprecated in a minor revision of the

International Standard prior to its removal from subsequent releases. Figure 2 is a sample of the typographical convention for Implemented content.

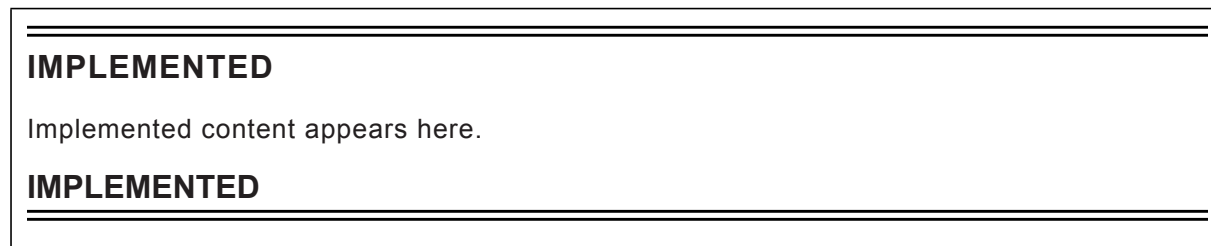


Figure 2 - Implemented maturity level tag

4.4 Stable maturity level

Once content at the Implemented maturity level has garnered additional implementation experience, it can be tagged at the Stable maturity level. Material at this maturity level has been implemented by three different vendors, including both a provider and a client. Should material that has reached this maturity level become obsolete, it may only be deprecated as part of a minor revision to the International Standard. Material at this maturity level that has been deprecated may only be removed from the International Standard as part of a major revision. A profile that has reached this maturity level is guaranteed to preserve backward compatibility from one minor International Standard revision to the next. As a result, Profiles at or above the Stable maturity level shall not rely on any content that is Experimental. Figure 3 is a sample of the typographical convention for Implemented content.

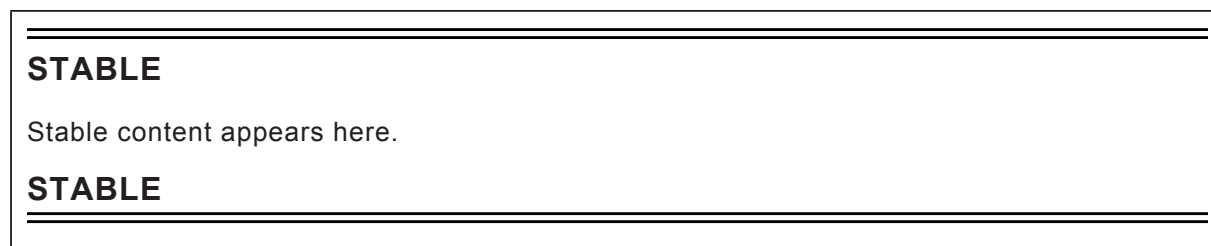


Figure 3 - Stable maturity level tag

4.5 Finalized maturity level

Content that has reached the highest maturity level is referred to as “Finalized.” In addition to satisfying the requirements for the Stable maturity level, content at the Finalized maturity level shall solely depend upon or refine material that has also reached the Finalized level. If International Standard content depends upon material that is not under the control of the SNIA, and therefore not subject to its maturity level definitions, then the external content is evaluated by the SNIA to assure that it has achieved a comparable level of completion, stability, and implementation experience. Should material that has reached this maturity level become obsolete, it may only be deprecated as part of a major revision to the International Standard. A profile that has reached this maturity level is guaranteed to preserve backward compatibility from one minor International Standard revision to the next. Over time, it is hoped that all International Standard content will attain this maturity level. Accordingly, there is no special typographical convention, as there is with the other, subordinate maturity levels. Unless content in the International Standard is marked with one of the typographical conventions defined for the subordinate maturity levels, it should be assumed to have reached the Finalized maturity level.

4.6 Deprecated Material

Non-Experimental material can be deprecated in a subsequent revision of the International Standard. Sections identified as “Deprecated” contain material that is obsolete and not recommended for use in new development efforts. Existing and new implementations may still use this material, but shall move to the newer approach as soon as possible. The material is

of the material being deprecated determines how long it will continue to appear in the International Standard. Implemented content shall be retained at least until the next revision of the specialization, while Stable and Finalized material shall be retained until the next major revision of the International Standard. Providers shall implement the deprecated elements as long as it appears in the International Standard in order to achieve backward compatibility. Clients may rely on deprecated elements, but are encouraged to use non-deprecated alternatives when possible.

Deprecated sections are documented with a reference to the last published version to include the deprecated section as normative material and to the section in the current International Standard with the replacement. Figure 4 contains a sample of the typographical convention for deprecated content.



Figure 4 - Deprecated tag

STABLE

5 Storage Library Profile

5.1 Description

5.1.1 General

The schema for a storage library provides the classes and associations necessary to represent various forms of removable media libraries. This profile defines the subset of classes that supply the necessary information for robotic storage libraries.

This profile further describes how the classes are to be used to satisfy various use cases and offers suggestions to agent implementers and client application developers.

The relevant objects for a storage library should be instantiated in the name space of the provider (or agent) for a storage library resource. Whenever an instance of a class for a resource may exist in multiple name spaces a *durable name* is defined to aid clients in correlating the objects across name spaces. For storage libraries, durable names are defined for the following resources:

- ChangerDevice
- ComputerSystem
- MediaAccessDevice

The durable names are defined in 5.1.8 "Durable Names and Correlatable IDs of the Profile". All other objects do not require durable names and have instances within a single name space.

5.1.2 Instance Diagrams

The following instance diagrams represent five related views of the Storage Library Profile:

- a) System Level
- b) MediaAccessDevice and its physical and logical relationships
- c) ChangerDevice and its connections to SoftwareIdentity, ProtocolController, and StorageMediaLocation
- d) StorageMediaLocation and its relationship to PhysicalMedia and other physical classes
- e) StorageMediaLocation and its required Realizes relationships.

5.1.3 System Level View

Figure 5: "Storage Library-centric Instance Diagram" shows the required components for a ComputerSystem. Note that LogicalDevice subclasses shall be associated with ComputerSystem via SystemDevice.

NOTE Classes using a red outline and associations using a dotted outline represent optional components that have been included in the diagram as an aid to understanding.

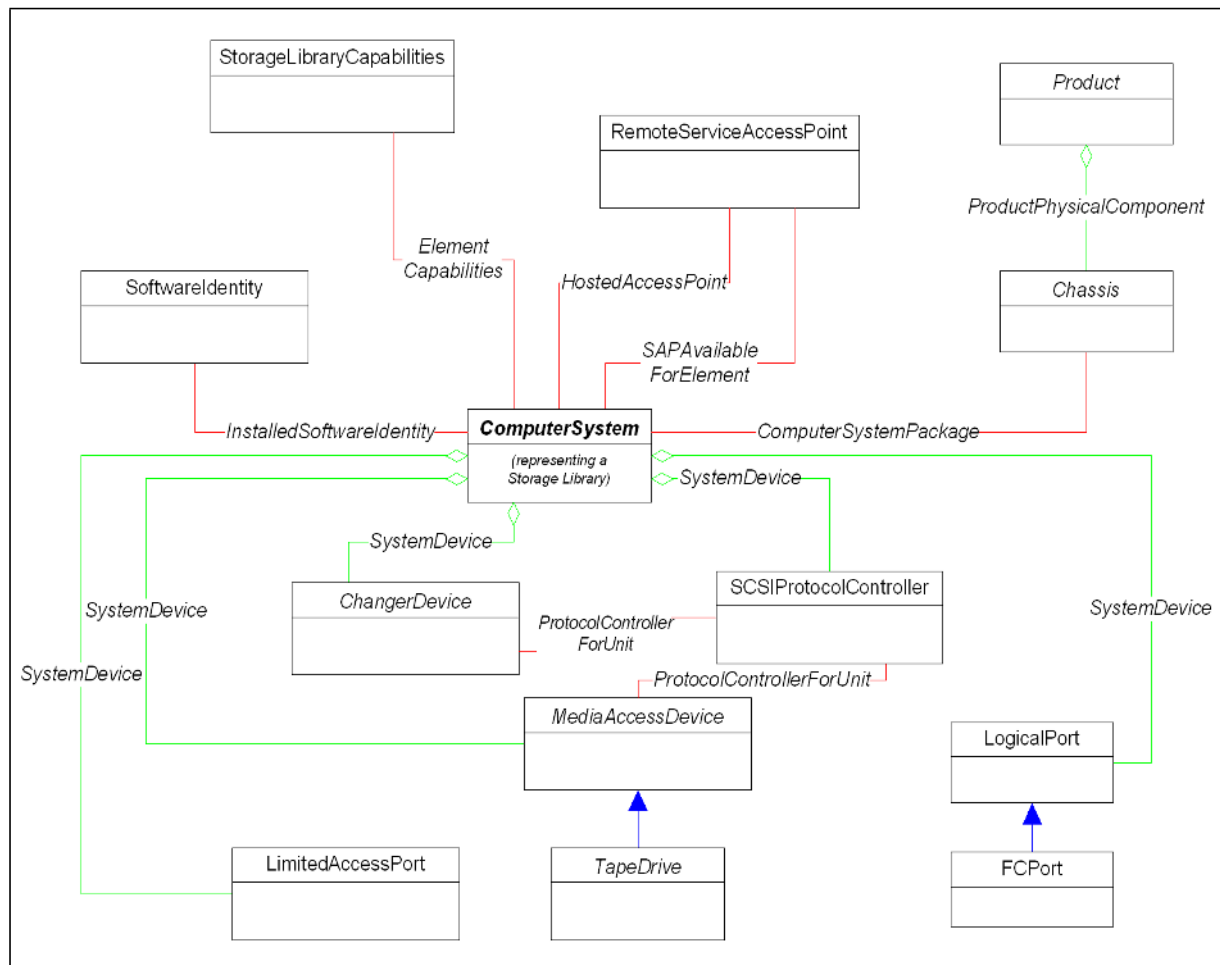


Figure 5 - Storage Library-centric Instance Diagram

5.1.4 MediaAccessDevice-centric View

Figure 6: "MediaAccessDevice-centric Instance Diagram" shows the required classes related to MediaAccessDevice. Though not shown in this figure, both MediaAccessDevice and ProtocolController are connected to a ComputerSystem instance through the SystemDevice association. In some libraries, notably small autoloaders, external hosts access a library's ChangerDevice through the ProtocolController of a MediaAccessDevice. For such libraries, an additional ProtocolControllerForUnit association should be instantiated between the MediaAccessDevice's ProtocolController and the affected ChangerDevice. ProtocolControllerForUnit is a many-to-many association, so a single ProtocolController can be connected to multiple LogicalDevices if this accurately represents a library's configuration.

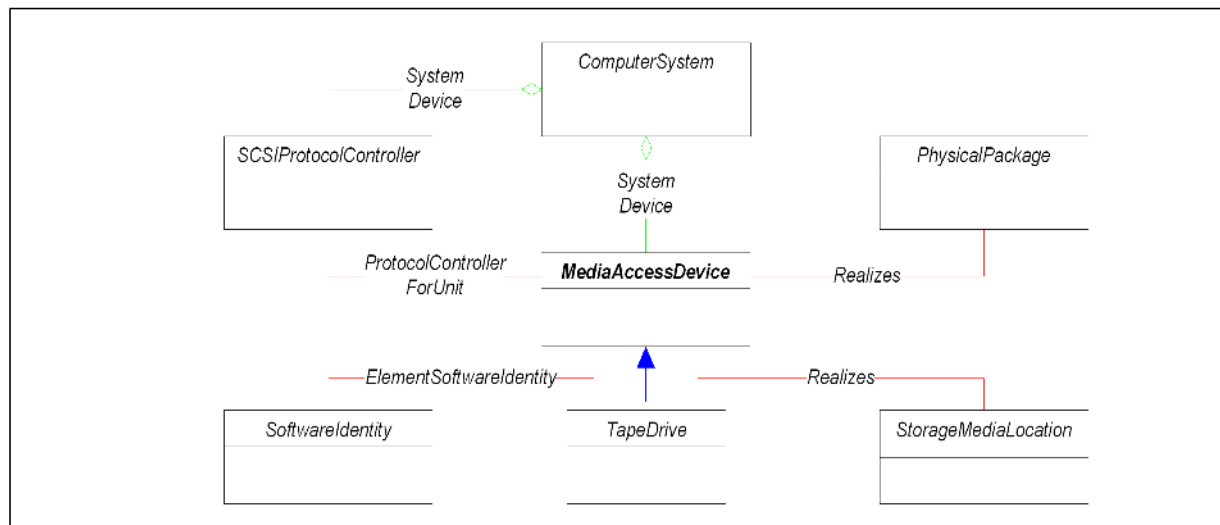


Figure 6 - MediaAccessDevice-centric Instance Diagram

5.1.5 ChangerDevice-centric View

Figure 7: "ChangerDevice-centric Instance Diagram" shows the required classes related to ChangerDevice.

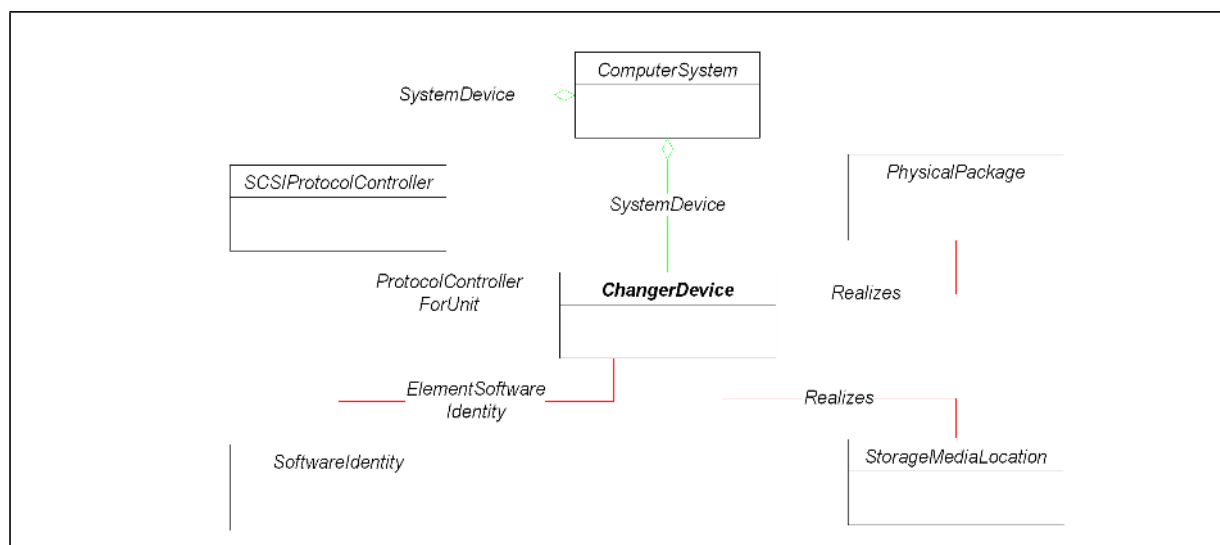


Figure 7 - ChangerDevice-centric Instance Diagram

5.1.6 Physical View

Figure 8: "Physical View Instance Diagram" shows important physical components of a storage library and how they relate. With regard to StorageMediaLocation and Magazine, one of two implementation alternatives shall be selected.

- Instantiate multiple Magazines associated to Chassis via Container, then instantiate StorageMediaLocations that are contained (again via Container) within each Magazine.
- Instantiate multiple StorageMediaLocations directly associated to Chassis via Container, without the use of Magazines. Other optional classes, such as Panel, can also be used to group StorageMediaLocations, but this is not mandatory.

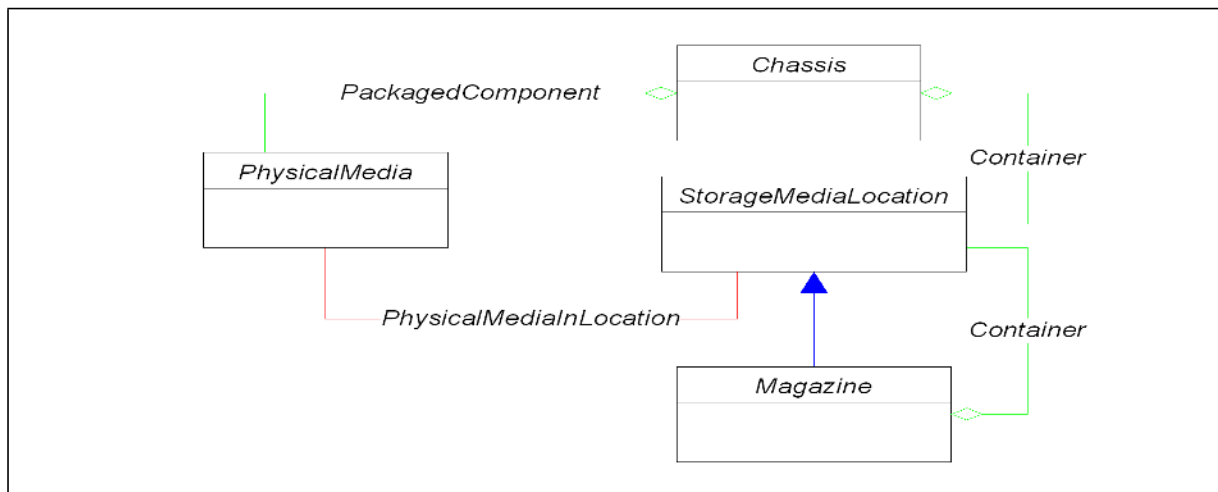


Figure 8 - Physical View Instance Diagram

5.1.7 StorageMediaLocation Instance Diagram

Figure 9: "StorageMediaLocation Instance Diagram" shows relationships between various LogicalDevices (i.e., MediaAccessDevices, LimitedAccessPort, and ChangerDevice) and StorageMediaLocation. For each LogicalDevice that can hold media, at least one StorageMediaLocation shall be associated via Realizes.

The figure also shows how PhysicalMedia is conceptually placed "inside" a LogicalDevice by associating PhysicalMedia with a StorageMediaLocation that Realizes a LogicalDevice (see Figure 9: "StorageMediaLocation Instance Diagram"). All tapes, irrespective of the location, are associated with the chassis using PackagedComponent.

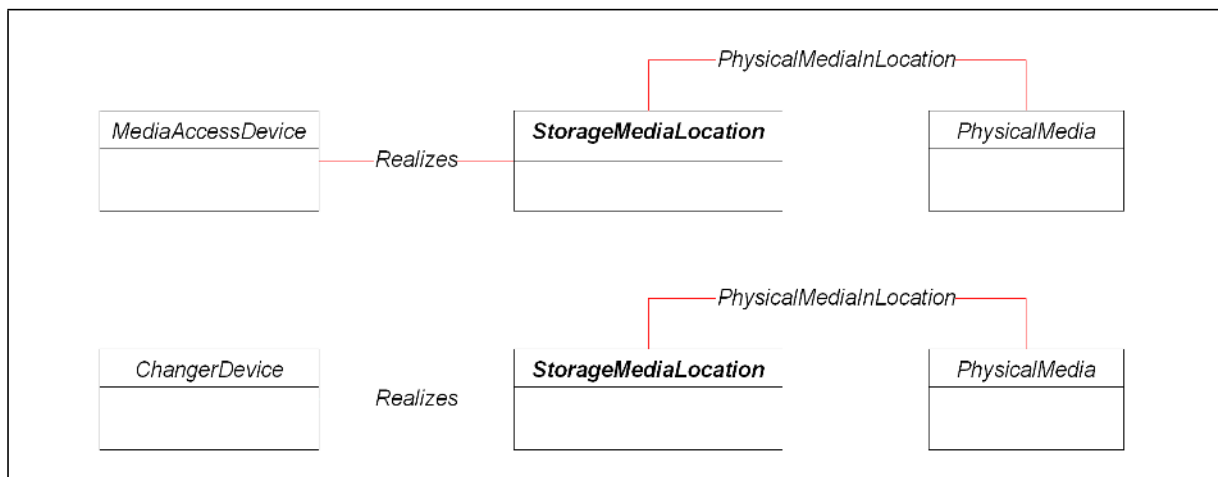


Figure 9 - StorageMediaLocation Instance Diagram

5.1.8 Durable Names and Correlatable IDs of the Profile

Different implementations use different approaches to uniquely identify the SCSI units pertinent to Storage Media Libraries (i.e., Changer Devices and Media Access Devices). The agent should utilize the same Durable Name techniques described for volumes in ISO/IEC 24775-2, *Information Technology – Storage Management, Part 2 Common Architecture*, 8.5 "Guidelines for Storage System Names". The chosen name is stored in the Name attribute of the logical device with the corresponding setting for the NameFormat attribute. Allowable name formats and device pairings for the Storage Library Profile are:

- FCPort.FCPort.PermanentAddress = Fibre Channel Port World Wide Name. NameFormat should be set to "WWN".
- ChangerDevice.DeviceID = Vendor+Product+Serial Number+(optional instance number). Vendor, Model and Serial number should be taken from the ChangerDevice's associated ComputerSystem, Product, and/or Chassis. An option instance number may be added to uniquely denote more than one ChangerDevice "inside" a ComputerSystem.
- MediaAccessDevice (or TapeDrive).DeviceID = Vendor+Product+Serial number for the MediaAccessDevice.
- ComputerSystem.Name = Vendor+Product+Serial number for the storage library and/or its associated Product and Chassis. NameFormat should be set to "Vendor+Product+Serial".

Please refer to ISO/IEC 24775-2, *Information Technology – Storage Management, Part 2 Common Architecture* 8.6 "Standard Formats for Correlatable Names" for additional information.

5.1.9 Media Library Indications

5.1.9.1 Read Warning Alert

The drive is having severe trouble reading.

Probable Cause: The drive is having problems reading data. No data has been lost, but there has been a reduction in the performance.

5.1.9.2 Write Warning Alert

The drive is having severe trouble writing.

Probable Cause: Worn out media.

Recommended Actions: 1. Discard the worn out media. 2. Use a new cleaning media.

5.1.9.3 Hard Error Alert

The drive had a hard read or write error.

Probable Cause: Bad media or drive. The operation has stopped because an error has occurred while reading or writing data that the drive cannot correct.

5.1.9.4 Media Alert

Media can no longer be written/read, or performance is severely degraded.

Probable Cause: Bad media.

Recommended Actions: 1. Copy any data you require from this media. 2. Do not use this media again. 3. Restart the operation with a different media.

5.1.9.5 Read Failure Alert

The drive can no longer read data from the storage media.

Probable Cause: Worn out media.

Recommended Actions: 1. Replace media. 2. Call the drive supplier help line.

5.1.9.6 Write Failure Alert

The drive can no longer write data to the media.

Probable Cause: The media is from a faulty batch or the drive is faulty.

Recommended Actions: 1. Use known-good media to test the drive. 2. If the problem persists, call the media drive supplier.

5.1.9.7 Media Life Alert

The media has exceeded its specified life.

Probable Cause: The media has reached the end of its calculated useful life.

Recommended Actions: 1. Copy any data you need to another media. 2. Discard the old media.

5.1.9.8 Not Data Grade Alert

The cartridge is not data-grade. Any data you write to the media is at risk. Replace the cartridge with a data- grade media.

Probable Cause: The cartridge is not data-grade. Any data you write to the media is at risk.

Recommended Actions: Replace the cartridge with a data-grade media.

5.1.9.9 Write Protect Alert

Write command is attempted to a write protected media.

Probable Cause: Replace with writable media.

Recommended Actions: You are trying to write to a write protected cartridge. Remove the write protection or use another media.

5.1.9.10 No Removal Alert

Manual or software unload attempted when prevent media removal is on.

Probable Cause: Wait until drive is not in-use.

Recommended Actions: You cannot eject the cartridge because the drive is in use. Wait until the operation is complete before ejecting the cartridge.

5.1.9.11 Cleaning Media Alert

Cleaning media loaded into drive

Probable Cause: The media in the drive is a cleaning cartridge.

Recommended Actions: Replace this media with writeable media.

5.1.9.12 Unsupported Format Alert

Attempted load of unsupported media format (e.g., DDS2 in DDS1 drive).

Probable Cause: You have tried to load a cartridge of a type that is not supported by this drive.

Recommended Actions: Insert media of a type supported by this drive.

5.1.9.13 Recoverable Snapped Tape Alert

Tape snapped/cut in the drive where media can be de-mounted.

Probable Cause: The operation has failed because the tape in the drive has snapped.

Recommended Actions: 1. Discard the old tape. 2. Restart the operation with a different tape.

5.1.9.14 Unrecoverable Snapped Tape Alert

Tape snapped/cut in the drive where media cannot be de-mounted.

Probable Cause: The operation has failed because the tape in the drive has snapped.

Recommended Actions: 1. Do not attempt to extract the tape cartridge. 2. Call the tape drive supplier help line.

5.1.9.15 Memory Chip In Cartridge Failure Alert

Memory chip failed in cartridge.

Probable Cause: The memory in the media has failed, which reduces performance.

Recommended Actions: Do not use the cartridge for further write operations.

5.1.9.16 Forced Eject Alert

Manual or forced eject while drive actively writing or reading.

Probable Cause: The operation has failed because the media was manually de-mounted while the drive was actively writing or reading.

5.1.9.17 Read Only Format Alert

Media loaded that is read-only format.

Probable Cause: You have loaded a cartridge of a type that is read-only in this drive. The cartridge will appear as write protected.

5.1.9.18 Directory Corrupted On Load Alert

Drive powered down while loaded, or permanent error prevented the directory being updated.

Probable Cause: The directory on the cartridge has been corrupted. File search performance will be degraded.

Recommended Actions: The directory can be rebuilt by reading all the data on the cartridge.

5.1.9.19 Nearing Media Life Alert

Media may have exceeded its specified number of passes.

Probable Cause: The storage media is nearing the end of its calculated life.

Recommended Actions: 1. Use another storage media for your next backup. 2. Store this storage media in a safe place in case you need to restore data from it.

5.1.9.20 Clean Now Alert

The drive thinks it has a head clog or needs cleaning.

Probable Cause: The drive needs cleaning:

Recommended Actions: 1. If the operation has stopped, eject the storage media and clean the drive. 2. If the operation has not stopped, wait for it to finish and then clean the drive. Check the drive users manual for device specific cleaning.

5.1.9.21 Clean Periodic Alert

The drive is ready for a periodic cleaning.

Probable Cause: The drive is due for routine cleaning.

Recommended Actions: 1. Wait for the current operation to finish. 2. Then use a cleaning cartridge. Check the drive users manual for device specific cleaning instructions.

5.1.9.22 Expired Cleaning Media Alert

The cleaning media has expired.

Probable Cause: The last cleaning cartridge used in the drive has worn out.

Recommended Actions: 1. Discard the worn out cleaning cartridge. 2. Wait for the current operation to finish. 3. Then use a new cleaning cartridge.

5.1.9.23 Invalid Cleaning Media Alert

Invalid cleaning media type used.

Probable Cause: The last cleaning cartridge used in the drive was an invalid type.

Recommended Actions: 1. Do not use this cleaning cartridge in this drive. 2. Wait for the current operation to finish. 3. Then use a valid cleaning cartridge.

5.1.9.24 Retention Requested Alert

The drive is having severe trouble reading or writing, which will be resolved by a retention cycle.

Probable Cause: The drive has requested a retention operation.

5.1.9.25 Dual-Port Interface Error Alert

Failure of one interface port in a dual-port configuration (i.e. Fibre Channel)

Probable Cause: A redundant interface port on the drive has failed.

5.1.9.26 Drive Maintenance Alert

The drive requires preventive maintenance (not cleaning).

Probable Cause: Preventive maintenance of the drive is required.

Recommended Actions: Check the drive users manual for device specific preventive maintenance tasks or call the drive supplier help line.

5.1.9.27 Hardware A Alert

The drive has a hardware fault that requires reset to recover.

Probable Cause: The drive has a hardware fault.

Recommended Actions: 1. Eject the media or magazine. 2. Reset the drive. 3. Restart the operation.

5.1.9.28 Hardware B Alert

The drive has a hardware fault that is not read/write related or requires a power cycle to recover.

Probable Cause: The drive has a hardware fault.

Recommended Actions: 1. Turn the drive off and then on again. 2. Restart the operation. 3. If the problem persists, call the drive supplier help line.

5.1.9.29 Interface Alert

The drive has identified an interface fault.

Probable Cause: Bad cable or drive interface.

Recommended Actions: 1. Check the cables and cable connections. 2. Restart the operation.

5.1.9.30 Eject Media Alert

Error recovery action: Media Ejected.

Recommended Actions: 1. Eject the media or magazine. 2. Insert the media or magazine again. 3. Restart the operation.

5.1.9.31 Download Failure Alert

Firmware download failed.

Probable Cause: The firmware download has failed because you have tried to use the incorrect firmware for this drive.

Recommended Actions: Obtain the correct firmware and try again.

5.1.9.32 Loader Hardware A Alert

Loader mechanism is having trouble communicating with the drive.

Probable Cause: The changer mechanism is having difficulty communicating with the drive.

Recommended Actions: 1. Turn the autoloader off then on. 2. Restart the operation. 3. If a problem persists, call the drive supplier help line.

5.1.9.33 Loader Stray Media Alert

Stray media left in loader after previous error recovery.

Probable Cause: A media has been left in the autoloader by a previous hardware fault.

Recommended Actions: 1. Insert an empty magazine to clear the fault. 2. If the fault does not clear, turn the autoloader off and then on again. 3. If the problem persists, call the drive supplier help line.

5.1.9.34 Loader Hardware B Alert

Loader mechanism has a hardware fault.

Probable Cause: There is a problem with the autoloader mechanism.

5.1.9.35 Loader Door Alert

Changer door open.

Probable Cause: The operation has failed because the autoloader door is open.

Recommended Actions: 1. Clear any obstructions from the autoloader door. 2. Eject the magazine and then insert it again. 3. If the fault does not clear, turn the autoloader off and then on again. 4. If the problem persists, call the drive supplier help line.

5.1.9.36 Loader Hardware C Alert

The loader mechanism has a hardware fault that is not mechanically related.

Probable Cause: The autoloader has a hardware fault.

Recommended Actions: 1. Turn the autoloader off and then on again. 2. Restart the operation. 3. If the problem persists, call the drive supplier help line. Check the autoloader users manual for device specific instructions on turning the device power on and off.

5.1.9.37 Loader Magazine Alert

Loader magazine not present.

Probable Cause: The autoloader cannot operate without the magazine.

Recommended Actions: 1. Insert the magazine into the autoloader. 2. Restart the operation.

5.1.9.38 Loader Predictive Failure Alert

Predictive failure of loader mechanism hardware.

Recommended Actions: A hardware failure of the changer mechanism is predicted. Call the drive supplier help line.

5.1.9.39 Load Statistics Alert

Drive or library powered down with media loaded.

Probable Cause: Media statistics have been lost at some time in the past.

5.1.9.40 Media Directory Invalid at Unload Alert

Error preventing the media directory being updated on unload.

Probable Cause: The directory on the media just unloaded has been corrupted.

Recommended Actions: The directory can be rebuilt by reading all the data.

5.1.9.41 Media System area Write Failure Alert

Write errors while writing the system area on unload.

Probable Cause: The media just unloaded could not write its system area successfully.

Recommended Actions: 1. Copy data to another cartridge. 2. Discard the old cartridge.

5.1.9.42 Media System Area Read Failure Alert

Read errors while reading the system area on load.

Probable Cause: The media system area could not be read successfully at load time.

Recommended Actions: Copy data to another cartridge.

5.1.9.43 No Start of Data Alert

Media damaged, bulk erased, or incorrect format.

Probable Cause: The start of data could not be found on the media.

Recommended Actions: 1. Check that you are using the correct format media. 2. Discard the media or return the media to your supplier.

5.1.9.44 Loading Failure Alert

The drive is unable to load the media

Probable Cause: The operation has failed because the media cannot be loaded and threaded.

Recommended Actions: 1. Remove the cartridge, inspect it as specified in the product manual, and retry the operation. 2. If the problem persists, call the drive supplier help line.

5.1.9.45 Library Hardware A Alert

Changer mechanism is having trouble communicating with the internal drive.

Probable Cause: The library mechanism is having difficulty communicating with the drive.

Recommended Actions: 1. Turn the library off then on. 2. Restart the operation. 3. If the problem persists, call the library supplier help line.

5.1.9.46 Library Hardware B Alert

Changer mechanism has a hardware fault.

Recommended Actions: There is a problem with the library mechanism. If the problem persists, call the library supplier help line.

5.1.9.47 Library Hardware C Alert

The changer mechanism has a hardware fault that requires a reset to recover.

Probable Cause: The library has a hardware fault.

Recommended Actions: 1. Reset the library. 2. Restart the operation. Check the library users manual for device specific instructions on resetting the device.

5.1.9.48 Library Hardware D Alert

The changer mechanism has a hardware fault that is not mechanically related or requires a power cycle to recover.

Probable Cause: The library has a hardware fault.

Recommended Actions: 1. Turn the library off then on again. 2. Restart the operation. 3. If the problem persists, call the library supplier help line. Check the library users manual for device specific instructions on turning the device power on and off.

5.1.9.49 Library Diagnostic Required Alert

The changer mechanism may have a hardware fault which would be identified by extended diagnostics.

Probable Cause: The library mechanism may have a hardware fault.

Recommended Actions: Run extended diagnostics to verify and diagnose the problem. Check the library users manual for device specific instructions on running extended diagnostic tests.

5.1.9.50 Library Interface Alert

The library has identified an interface fault.

Probable Cause: Bad cable.

Recommended Actions: 1. Check the cables and connections. 2. Restart the operation.

5.1.9.51 Failure Prediction Alert

Predictive failure of library hardware.

Recommended Actions: A hardware failure of the library is predicted. Call the library supplier help line.

5.1.9.52 Library Maintenance Alert

Library preventative maintenance required.

Probable Cause: Operator action.

Recommended Actions: Preventive maintenance of the library is required. Check the library users manual for device specific preventative maintenance tasks, or call your library supplier help line.

5.1.9.53 Library Humidity Limits

Library humidity limits exceeded.

Probable Cause: Library humidity range is outside the operational conditions.

5.1.9.54 Library Voltage Limits Alert

Library voltage limits exceeded.

Probable Cause: Potential problem with a power supply.

5.1.9.55 Library Stray Media Alert

Stray cartridge left in library after previous error recovery.

Probable Cause: Cartridge left in picker or drive.

Recommended Actions: 1. Insert an empty magazine to clear the fault. 2. If the fault does not clear, turn the library off and then on again. 3. If the problem persists, call the library supplier help line.

5.1.9.56 Library Pick Retry Alert

Operation to pick a cartridge from a slot had to perform an excessive number of retries before succeeding.

Probable Cause: There is a potential problem with the drive ejecting cartridges or with the library mechanism picking a cartridge from a slot.

Recommended Actions: 1. Run diagnostics to determine the health of the Library. 2. If the problem persists, call the library supplier help line.

5.1.9.57 Library Place Retry Alert

Operation to place a cartridge in a slot had to perform an excessive number of retries before succeeding.

Probable Cause: Worn cartridge or bad storage slot/ magazine.

Recommended Actions: 1. No action needs to be taken at this time. 2. If the problem persists, call the library supplier help line.

5.1.9.58 Library Load Retry Alert

Operation to load a cartridge in a drive had to perform an excessive number of retries before succeeding.

Probable Cause: Worn cartridge or picker.

Recommended Actions: Run diagnostics to determine the health of the library.

5.1.9.59 Library Door Alert

Library door open is preventing the library from functioning.

Probable Cause: The library has failed because the door is open.

Recommended Actions: 1. Clear any obstructions from the library door. 2. Close the library door. 3. If the problem persists, call the library supplier help line.

5.1.9.60 Library Mailslot Alert

Mechanical problem with import/export mailslot.

Probable Cause: There is a mechanical problem with the library media mailslot.

Recommended Actions: Check for wedged storage media in import/export mailslot.

5.1.9.61 Library Magazine Alert

Library magazine not present.

Probable Cause: Administrator has removed the library's magazine.

Recommended Actions: 1. Insert the magazine into the library. 2. Restart the operation.

5.1.9.62 Library Security Alert

Library door opened then closed during operation.

Probable Cause: Administrator is trying to remove or insert a storage media.

5.1.9.63 Library Security Mode Alert

Library security mode changed.

Probable Cause: Administrator changed security mode.

Recommended Actions: The library security mode has been changed. The library has either been put into secure mode, or the library has exited the secure mode. This is for information purposes only. No action is required.

5.1.9.64 Library Offline Alert

Library manually turned offline

Probable Cause: The library has been manually turned offline and is unavailable for use.

5.1.9.65 Library Drive Offline Alert

Library turned internal drive offline.

Probable Cause: Drive failure.

Recommended Actions: A drive inside the library has been taken offline. This is for information purposes only. No action is required.

5.1.9.66 Library Scan Retry Alert

Operation to scan the bar code on a cartridge had to perform an excessive number of retries before succeeding.

Probable Cause: There is a potential problem with the bar code label or the scanner hardware in the library mechanism.

Recommended Actions: 1. No action needs to be taken at this time. 2. If the problem persists, call the library supplier help line.

5.1.9.67 Library Inventory Alert

Inconsistent media inventory.

Probable Cause: Media label has changed or bad bar code scanner subsystem problem.

Recommended Actions: 1. Redo the library inventory to correct inconsistency. 2. Restart the operation. Check the applications users manual or the hardware users manual for specific instructions on redoing the library inventory.

5.1.9.68 Library Illegal Operation Alert

Illegal operation detected.

Probable Cause: A library operation has been attempted that is invalid at this time.

5.1.9.69 Pass Through Mechanism Failure Alert

Error occurred in pass-through mechanism during self test or while attempting to transfer a cartridge between library modules

Probable Cause: A failure has occurred in the cartridge pass- through mechanism between two library modules.

5.1.9.70 Cartridge in Pass-through Mechanism Alert

Cartridge left in the pass-through mechanism between two library modules.

Recommended Actions: A cartridge has been left in the pass-through mechanism from a previous hardware fault. Check the library users guide for instructions on clearing this fault.

5.1.9.71 Unreadable barcode Labels Alert

Unable to read a bar code label on a cartridge during library inventory/scan.

Probable Cause: Bad bar code labels or scanner.

Recommended Actions: The library was unable to read the bar code on a cartridge

5.2 Health and Fault Management Considerations

None.

5.3 Cascading Considerations

None.

5.4 Supported Subprofiles and Packages

Table 1 describes the supported profiles for Storage Library.

Table 1 - Supported Profiles for Storage Library

Profile Name	Organization	Version	Requirement	Description
Access Points	SNIA	1.3.0	Optional	
Location	SNIA	1.4.0	Optional	
Software	SNIA	1.4.0	Optional	
Storage Library Limited Access Port Elements	SNIA	1.2.0	Optional	
Storage Library Media Movement	SNIA	1.1.0	Optional	
Storage Library Capacity	SNIA	1.1.0	Optional	
Storage Library Element Counting	SNIA	1.1.0	Optional	
Storage Library InterLibraryPort Connection	SNIA	1.1.0	Optional	
Physical Package	SNIA	1.5.0	Mandatory	
Launch In Context	DMTF	1.0.0	Optional	Experimental. See DSP1102, version 1.0.0
Indication	SNIA	1.5.0	Mandatory	
FC Target Ports	SNIA	1.4.0	Support for at least one is mandatory.	
SPI Target Ports	SNIA	1.4.0		

5.5 Methods of this Profile

None.

5.6 Client Considerations and Recipes

5.6.1 Recipe Overview

While no pseudo-code-based recipes have been written for this profile, this subclause provides some helpful information for writing management applications and suggests techniques for addressing common use cases.

5.6.2 Discover a Storage Media Library

Discovery of Storage Media Libraries is achieved by looking up instances of ComputerSystem which are subclassed from System and have a corresponding Name and NameFormat property as described above under 5.1.8 "Durable Names and Correlatable IDs of the Profile". Specifically, NameFormat shall be set to "VendorModelSerial" and the Name shall be of the form Vendor+Product+Serial.

5.6.3 Determine Library Physical Media Capacity

The physical media capacity of a library is the number of physical media objects that may be stored in the currently installed configuration of a Storage Media Library. This capacity may be determined by enumerating the StorageMediaLocation instances that are associated with each of the library's Chassis objects.

In implementations that choose to include the Library Capacity Subprofile, minimum and maximum slot capacities for a Storage Library are modeled in the ConfigurationCapacity, which is described in Clause 8 "Library Capacity Subprofile". Since this use case relies on an optional part of the profile, it may not be supported by each agent implementation.

5.6.4 Determine Physical Media Inventory

To determine the physical media inventory of a storage library, clients should discover the Chassis instance associated with a particular ComputerSystem (via the ComputerSystemPackage association), and enumerate the PhysicalMedia instances associated with the Chassis through the PackagedComponent association.

5.6.5 Discover Storage Library Control Type

The control mechanism to a library is either one of these:

- SCSI Media Changer Commands directed to the library's changer device;
- Library control commands directed to a Library Control service.

If a library does not have a ProtocolController instance associated via ProtocolControllerForUnit to the ChangerDevice then the client should conclude that an alternate mechanism for controlling the library is required. This mechanism may vary, but should be represented by an instance of a HostedService associated with the ComputerSystem that models the storage library.

5.6.6 Determine Library Drive Capacity

The current drive capacity of a library may be determined by enumerating the MediaAccessDevice instances through the SystemDevice association of the library.

When the optional Library Capacity Subprofile is implemented, the number of drives discovered should be within the range indicated by the minimum and maximum capacity attribute found on the library Chassis' ElementCapacity association with ConfigurationCapacity for tape drives. This bounds check is not available if the Library Capacity Subprofile is not implemented.

5.6.7 Determine Drive Data Path Technology

Clients can discover the data path protocol of each drive within a storage library by enumerating MediaAccessDevice instances, then following the ProtocolControllerForUnit association linking a MediaAccessDevice with a ProtocolController. Properties within Controller can then be queried for more information. If the MediaAccessDevice has a fibre channel interface, an FCPort instance is linked to its ProtocolController by a ProtocolControllerForPort association. See ISO/IEC 24775-3, *Information Technology – Storage Management, Part 3 Common Profiles*, Clause 9 FC Target Ports Profile for more information on fibre channel connectivity.

5.6.8 Find asset Information

Information about the entire storage library is modeled in the Chassis instances associated with the ComputerSystem. Chassis properties include Manufacturer, Model, Version, and Tag. Tag is an arbitrary identifying string.

To identify asset information for the logical devices, a client should access the corresponding logical device through the ComputerSystem object's SystemDevice association. For each logical device instance the client may then check for asset information from the PhysicalElement associated through a Realizes association. Product information may also be

available through the corresponding ProductPhysicalElement/ProductPhysicalComponent aggregation.

5.6.9 Discovery of Mailslots, Import/Export Elements or LimitedAccessPorts in a Storage Library

Clients may determine the number of LimitedAccessPorts in a library by enumerating the LimitedAccessPorts connected to a ComputerSystem instance via the SystemDevice association.

Note that some smaller libraries do not have the type of import/export element modeled by LimitedAccessPort. As a result, LimitedAccessPort elements are included in an (optional) subprofile (see Clause 9 Limited Access Port Elements Subprofile).

5.6.10 Counting assets in large storage libraries

Very large libraries may contain dozens of MediaAccessDevices and many thousands of StorageMediaLocations and PhysicalMedia. The intrinsic enumerateInstances() method is commonly used to count or gather CIM object instances of this type. Clients may find that using enumerateInstances() to count assets in very large libraries requires an excessive amount of time and processing resources. Providers supporting large libraries may also find that excessive time and resources are consumed attempting to return the bulk of data requested in enumerateInstances() calls. The following suggestions may be of help in situations where large libraries are of interest:

- omit Qualifiers from enumerateInstances() or getInstance() requests;
- request only the lowest-level child class of interest for examination or counting;
- request only the properties of interest in enumerateInstances() or getInstance() requests. When only a count of existing objects is desired, omit all properties from the request;
- use the intrinsic enumerateInstanceNames() or associatorNames() method instead of enumerateInstances() when only a count of existing objects is desired. The enumerateInstanceNames() and associatorNames() calls are much "lighter weight" overall than enumerateInstances();
- if the provider supports it, use the Physical Elements Count Subprofile to quickly count PhysicalMedia and StorageMediaLocation instances. Note that this subprofile is optional and experimental and may not be supported by some providers.

5.7 Registered Name and Version

Storage Library version 1.5.0 (Autonomous Profile)

5.8 CIM Elements

5.8.1 General

Table 2 describes the CIM elements for Storage Library.

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
5.8.2 CIM_ChangerDevice	Mandatory	
5.8.3 CIM_Chassis	Mandatory	
5.8.4 CIM_ComputerSystem	Mandatory	'Top level' system that represents the whole Storage Library. Associated to RegisteredProfile.
5.8.5 CIM_ComputerSystemPackage	Mandatory	

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
5.8.6 CIM_ElementCapabilities	Optional	Class to implement the association between the top-level ComputerSystem representing a Storage Library and its StorageLibraryCapabilities.
5.8.7 CIM_ElementSoftwareIdentity	Mandatory	
5.8.8 CIM_MediaAccessDevice	Mandatory	
5.8.9 CIM_PackagedComponent	Mandatory	
5.8.10 CIM_PhysicalMedia	Mandatory	
5.8.11 CIM_PhysicalMediaInLocation	Mandatory	
5.8.12 CIM_ProtocolControllerForUnit	Mandatory	
5.8.13 CIM_Realizes	Conditional	Conditional requirement: Support for Inter-Library Port profile.
5.8.14 CIM_SCSIProtocolController	Mandatory	
5.8.15 CIM_SoftwareIdentity	Mandatory	
5.8.16 CIM_StorageLibraryCapabilities	Optional	Describes the capabilities of the Storage Library represented by the top level ComputerSystem it is associated with.
5.8.17 CIM_StorageMediaLocation	Mandatory	
5.8.18 CIM_SystemDevice (System to Changer Device)	Mandatory	This association links Changer to the scoping system.
5.8.19 CIM_SystemDevice (System to MediaAccessDevice)	Mandatory	This association links MediaAccessDevice to the scoping system.
5.8.20 CIM_SystemDevice (System to SCSIProtocolController)	Mandatory	This association links SCSIProtocolController to the scoping system.
SELECT * FROM CIM_InstCreation WHERE SourceInstance ISA CIM_ComputerSystem	Mandatory	Creation of a storage library instance.
SELECT * FROM CIM_InstDeletion WHERE SourceInstance ISA CIM_ComputerSystem	Mandatory	Deletion of a storage library instance.
SELECT * FROM CIM_InstCreation WHERE SourceInstance ISA CIM_PhysicalMedia	Mandatory	Creation of a physical media instance.
SELECT * FROM CIM_InstDeletion WHERE SourceInstance ISA CIM_PhysicalMedia	Mandatory	Deletion of a physical media instance.
SELECT * FROM CIM_InstCreation WHERE SourceInstance ISA CIM_MediaAccessDevice	Mandatory	Creation of a media access device instance.
SELECT * FROM CIM_InstDeletion WHERE SourceInstance ISA CIM_MediaAccessDevice	Mandatory	Deletion of a media access device instance.
SELECT * FROM CIM_InstCreation WHERE SourceInstance ISA CIM_ChangerDevice	Mandatory	Creation of a Changer Device instance.
SELECT * FROM CIM_InstDeletion WHERE SourceInstance ISA CIM_ChangerDevice	Mandatory	Deletion of a Changer Device instance.

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_ComputerSystem AND PreviousInstance.OperationalStatus <> SourceInstance.OperationalStatus	Mandatory	Deprecated. Deprecated WQL - Change in OperationalStatus of a storage library.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_MediaAccessDevice AND PreviousInstance.OperationalStatus <> SourceInstance.OperationalStatus	Mandatory	Deprecated. Deprecated WQL - Change in OperationalStatus for a media access device.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_ChangerDevice AND PreviousInstance.OperationalStatus <> SourceInstance.OperationalStatus	Mandatory	Deprecated. Deprecated WQL - Change in OperationalStatus for a Changer Device.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_ComputerSystem AND PreviousInstance.CIM_ComputerSystem::OperationalStatus <> SourceInstance.CIM_ComputerSystem::OperationalStatus	Optional	CQL - Change in OperationalStatus of a storage library.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_MediaAccessDevice AND PreviousInstance.CIM_MediaAccessDevice::OperationalStatus <> SourceInstance.CIM_MediaAccessDevice::OperationalStatus	Optional	CQL - Change in OperationalStatus for a media access device.
SELECT * FROM CIM_InstModification WHERE SourceInstance ISA CIM_ChangerDevice AND PreviousInstance.CIM_ChangerDevice::OperationalStatus <> SourceInstance.CIM_ChangerDevice::OperationalStatus	Optional	CQL - Change in OperationalStatus for a Changer Device.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML1'	Optional	Experimental. The drive is having severe trouble reading. See 5.1.9.1 Read Warning Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.1 Message: Read Warning.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML2'	Optional	Experimental. The drive is having severe trouble writing. See 5.1.9.2 Write Warning Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> , 9.3.6.2 Message: Write Warning.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML3'	Optional	Experimental. The drive had a hard read or write error. See 5.1.9.3 Hard Error Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.3 Message: Hard Error.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML4'	Optional	Experimental. Media can no longer be written/read, or performance is severely degraded. See 5.1.9.4 Media Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.4 Message: Media.

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML5'	Optional	Experimental. The drive can no longer read data from the storage media. See 5.1.9.5 Read Failure Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.5 Message: Read Failure.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML6'	Optional	Experimental. The drive can no longer write data to the media. See 5.1.9.6 Write Failure Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.6 Message: Write Failure.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML7'	Optional	Experimental. The media has exceeded its specified life. See 5.1.9.7 Media Life Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.7 Message: Media Life.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML8'	Optional	Experimental. The cartridge is not data-grade. Any data you write to the media is at risk. Replace the cartridge with a data-grade media. See 5.1.9.8 Not Data Grade Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.8 Message: Not Data Grade.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML9'	Optional	Experimental. Write command is attempted to a write protected media. See 5.1.9.9 Write Protect Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.9 Message: Write Protect.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML10'	Optional	Experimental. Manual or software unload attempted when prevent media removal is on. See 5.1.9.10 No Removal Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.10 Message: No Removal.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML11'	Optional	Experimental. Cleaning media loaded into drive. See 5.1.9.11 Cleaning Media Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.11 Message: Cleaning Media.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML12'	Optional	Experimental. Attempted load of unsupported media format (e.g., DDS2 in DDS1 drive). See 5.1.9.12 Unsupported Format Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.12 Message: Unsupported Format.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML13'	Optional	Experimental. Tape snapped/cut in the drive where media can be de-mounted. See 5.1.9.13 Recoverable Snapped Tape Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.13 Message: Recoverable Snapped Tape.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML14'	Optional	Experimental. Tape snapped/cut in the drive where media cannot be de-mounted. See 5.1.9.14 Unrecoverable Snapped Tape Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.14 Message: Unrecoverable Snapped Tape.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML15'	Optional	Experimental. Memory chip failed in cartridge. See 5.1.9.15 Memory Chip In Cartridge Failure Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.15 Message: Memory Chip In Cartridge Failure.

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML16'	Optional	Experimental. Manual or forced eject while drive actively writing or reading. See 5.1.9.16 Forced Eject Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.16 Message: Forced Eject.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML17'	Optional	Experimental. Media loaded that is read-only format. See 5.1.9.17 Read Only Format Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.17 Message: Read Only Format.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML18'	Optional	Experimental. Drive powered down while loaded, or permanent error prevented the directory being updated. See 5.1.9.18 Directory Corrupted On Load Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.18 Message: Directory Corrupted On Load.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML19'	Optional	Experimental. Media may have exceeded its specified number of passes. See 5.1.9.19 Nearing Media Life Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.19 Message: Nearing Media Life.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML20'	Optional	Experimental. The drive thinks it has a head clog or needs cleaning. See 5.1.9.20 Clean Now Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.20 Message: Clean Now.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML21'	Optional	Experimental. The drive is ready for a periodic cleaning. See 5.1.9.21 Clean Periodic Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.21 Message: Clean Periodic.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML22'	Optional	Experimental. The cleaning media has expired. See 5.1.9.22 Expired Cleaning Media Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.22 Message: Expired Cleaning Media.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML23'	Optional	Experimental. Invalid cleaning media type used. See 5.1.9.23 Invalid Cleaning Media Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.23 Message: Invalid Cleaning Media.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML24'	Optional	Experimental. The drive is having severe trouble reading or writing, which will be resolved by a retention cycle. See 5.1.9.24 Retention Requested Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.24 Message: Retention Requested.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML25'	Optional	Experimental. Failure of one interface port in a dual-port configuration (i.e., Fibre Channel). See 5.1.9.25 Dual-Port Interface Error Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.25 Message: Dual-Port Interface Error.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core13'	Optional	Experimental. Fan failure inside drive mechanism or drive enclosure. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.12 Message: Cooling Fan Failure.

Table 2 - CIM Elements for Storage Library

Element Name	Requirement	Description
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core14'	Optional	Experimental. Power supply unit failure inside the drive enclosure or rack subsystem. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.13 Message: Power Supply Failure.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core15'	Optional	Experimental. Power consumption of the drive is outside specified range. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.14 Message: Drive Power Consumption.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML26'	Optional	Experimental. The drive requires preventive maintenance (not cleaning). See 5.1.9.26 Drive Maintenance Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.26 Message: Drive Maintenance.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML27'	Optional	Experimental. The drive has a hardware fault that requires reset to recover. See 5.1.9.27 Hardware A Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.27 Message: Hardware A.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML28'	Optional	Experimental. The drive has a hardware fault that is not read/write related or requires a power cycle to recover. See 5.1.9.28 Hardware B Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.28 Message: Hardware B.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML29'	Optional	Experimental. The drive has identified an interface fault. See 5.1.9.29 Interface Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.29 Message: Interface.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML30'	Optional	Experimental. Error recovery action: Media Ejected. See 5.1.9.30 Eject Media Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.30 Message: Eject Media.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='SML31'	Optional	Experimental. Firmware download failed. See 5.1.9.31 Download Failure Alert and ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.6.31 Message: Download Failure.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core2'	Optional	Experimental. Drive humidity or temperature limits exceeded. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.2 Message: Environmental.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core17'	Optional	Experimental. Drive voltage limits exceeded. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.15 Message: Drive Voltage.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core18'	Optional	Experimental. Predictive failure of drive hardware. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.16 Message: Predictive Failure.
SELECT * FROM CIM_AlertIndication WHERE OwningEntity='SNIA' and MessageID='Core19'	Optional	Experimental. The drive may have a hardware fault that may be identified by extended diagnostics. See ISO/IEC 24775-2, <i>Information Technology – Storage Management, Part 2 Common Architecture</i> 9.3.1.17 Message: Diagnostics Required.