

INTERNATIONAL
STANDARD

ISO/IEC
5965

Second edition
2023-05

**Information technology — Swordfish
Scalable Storage Management API
Specification**



Reference number
ISO/IEC 5965:2023(E)

© ISO/IEC 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Foreword

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <https://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by SNIA (as Swordfish Scalable Storage Management API Specification, Version, 1.2.4a) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

This second edition cancels and replaces the first edition (ISO/IEC 5965:2021), which has been technically revised.

The main changes are as follows:

- document has been aligned with DMTF's Redfish Forum 2021.1 release of the Redfish Specification, schema bundle, and other supporting materials;
- support for NVMe and NVMe-oF has been added, expanding the API to support the management of NVMe and NVMe-oF devices and systems;
- the Swordfish Standalone Configuration has been added in the /Storage collection at the ServiceRoot. This simplification of the hierarchy features Storage systems at the ServiceRoot and makes standalone implementations easier to instrument;
- substantial schema changes have been made, including:
 - enhancements to Volume, including new Actions (e.g., ChangeRAIDLayout, ForceEnable); addition of InitializeMethod, IOPerfModeEnabled, and OwningStorageResource and link to JournalingMedia; added InitializeMethod property; added IsBootCapable,

- enhancements to StoragePools,
- addition of NVMeDomain schema, and Split NVMeFirmwareImage and NVMeDomains schemas,
- deprecation of use of NetworkPort; replacement with Port;
- security has been improved, including:
 - new requirements added to NVMeDrive to conform to schema updates for SecureErase,
 - enhancement of CHAP definitions and usage in StorageGroup;
- Profiles have been expanded, including:
 - addition of new profiles for Access Rights management, Connectivity Rights management, Management Controllers, NVMe EBOF, PCIe JBOF, and NVMe-oF,
 - movement of Swordfish profiles to SwordfishInteroperabilityProfile as base – extends Redfish Interoperability Profile, adding support for “conditionals” and comparison for Required Profiles,
 - update of FeaturesRegistry to v1.3.0 to correspond to latest versions of all profiles,
 - updates in multiple profiles to correct conformance to interoperability schema. Modifications to support change for new RequiredProfiles conditionals support.
 - addition of new profile for Swordfish NVMe Front End (used by complex devices such as arrays),
 - enhancement of profiles to include support / requirements for /Storage (move support to v1.1.0 level),
 - addition of NVMe drive, Advanced Features and Ethernet Attach profiles,
 - enhancement of Swordfish event profile,
 - addition of SupportedPoolTypes to StoragePool Profiles.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Contents

USAGE	12
DISCLAIMER	13
Current Revision	13
Contact SNIA	13
FEEDBACK AND INTERPRETATIONS	13
INTENDED AUDIENCE	14
VERSIONING POLICY	14
Revision History	14
About SNIA	20
Acknowledgements	20
1 Abstract	23
2 Scope	24
2.1 Document Goals	24
2.2 Audience Assumptions	25
3 Normative References	26
3.1 Overview	26
3.2 Approved references	26
3.3 References under development	28
3.4 Other references	28
4 Terms and Definitions	29
4.1 Overview	29
4.2 Swordfish-specific Terms	29
4.2.1 Definitions	29
4.2.2 Symbols and abbreviated terms	30
4.3 Reference to Redfish terms	30
4.4 Keywords (normative language terms)	30
5 Swordfish Overview	32
5.1 Introduction	32
5.2 Relation to Redfish	32
5.3 Storage System Models	33
5.4 The ServiceRoot and ServiceContainer entities	37
5.4.1 Overview	37
5.4.2 The Storage resource collection	37

5.4.3	The Systems resource collection	38
5.4.4	The Chassis resource collection	38
5.4.5	The StorageSystems resource collection	38
5.5	Swordfish model overview	39
5.5.1	The Storage resource	39
5.5.2	The StorageController resource	40
5.5.3	The Endpoint resource	40
5.5.4	The Endpoint Collection resource	40
5.5.5	The ConsistencyGroup resource	40
5.5.6	The ConsistencyGroup Collection resource	40
5.5.7	The StorageGroup resource	40
5.5.8	The StoragePool resource	41
5.5.9	The Volume resource	41
5.5.10	The FileSystem resource	42
6	Features and Profiles	43
6.1	Overview	43
6.2	Requirement for SupportedFeatures	43
6.3	EnergyStar for Storage Feature	44
6.4	Class of Service Feature	44
6.4.1	Overview	44
6.4.2	Class of Service Model	44
6.4.3	ServiceRoot Additions	49
6.4.4	The StorageService resource	49
7	Schema Considerations	53
7.1	Schema Introduction	53
7.1.1	Overview	53
7.1.2	Swordfish Extension of the Redfish ServiceRoot	53
7.2	Default values and NULLABLE attributes	53
7.3	Common schema annotations	54
7.4	Property implementation requirements	56
7.5	Schema repository	56
7.6	Referencing other schemas	56
8	Implementation requirements	57
8.1	Security	57
8.2	General constraints	57
8.2.1	Redfish elements	57

8.2.2	Storage Events	57
8.3	Discovering Swordfish resources	58
8.4	ClassOfService requirements	59
8.5	StorageSystems requirements	59
8.6	Entity Sets	60
8.7	Addressing entities within a collection	60
8.8	Addressing members of a ResourceCollection	60
8.9	HTTP status codes	61
8.9.1	Overview	61
8.9.2	Create	61
8.9.3	Update, Replace, Delete	62
8.9.4	Actions	63
9	Swordfish type definitions	65
9.1	Overview	65
9.2	Introduction	65
9.3	Universal properties	65
9.4	Frequently used properties	67
9.5	Common Swordfish Objects	69
9.5.1	Capacity	69
9.5.2	CapacityInfo	70
9.5.3	Identifier	71
9.5.4	IOStatistics	74
9.5.5	IOWorkload	77
9.5.6	IOWorkloadComponent	78
9.5.7	Location	80
9.5.8	Oem	97
9.5.9	ReplicaInfo	97
9.5.10	ReplicaRequest	119
9.5.11	Schedule	120
9.5.12	Status	125
9.6	Swordfish Schema Types	133
9.6.1	CapacitySource 1.2.0	133
9.6.2	CapacitySourceCollection	138
9.6.3	ClassOfService 1.2.0	140
9.6.4	ClassOfServiceCollection	145
9.6.5	ConsistencyGroup 1.1.0	147
9.6.6	ConsistencyGroupCollection	163
9.6.7	DataProtectionLineOfService 1.3.0	165

9.6.8	DataProtectionLoSCapabilities 1.2.0	174
9.6.9	DataSecurityLineOfService 1.1.1	182
9.6.10	DataSecurityLoSCapabilities 1.2.0	190
9.6.11	DataStorageLineOfService 1.3.1	199
9.6.12	DataStorageLoSCapabilities 1.2.2	205
9.6.13	FeaturesRegistry 1.1.1	211
9.6.14	FileShare 1.2.0	214
9.6.15	FileShareCollection	225
9.6.16	FileSystem 1.2.2	227
9.6.17	FileSystemCollection	239
9.6.18	HostedStorageServices	241
9.6.19	IOConnectivityLineOfService 1.2.1	243
9.6.20	IOConnectivityLoSCapabilities 1.2.0	250
9.6.21	IOPerformanceLineOfService 1.1.1	256
9.6.22	IOPerformanceLoSCapabilities 1.3.0	260
9.6.23	LineOfService 1.1.0	263
9.6.24	LineOfServiceCollection	265
9.6.25	NVMeDomain 1.1.0	267
9.6.26	NVMeDomainCollection	271
9.6.27	NVMeFirmwareImage 1.1.0	273
9.6.28	SpareResourceSet 1.0.1	276
9.6.29	StorageGroup 1.5.0	280
9.6.30	StorageGroupCollection	296
9.6.31	StoragePool 1.7.1	298
9.6.32	StoragePoolCollection	335
9.6.33	StorageReplicaInfo 1.4.0	338
9.6.34	StorageService 1.5.0	340
9.6.35	StorageServiceCollection	355
9.6.36	StorageSystemCollection	357
9.6.37	Volume 1.8.0	359
9.6.38	VolumeCollection	410

Annex A: Bibliography 413

A.1 Overview	413
A.2 Informational references	413

List of Tables

1	Revision history	15
2	Contributors	21
3	Approved normative references	26
4	References under development	28
5	Swordfish terms	29
6	Redfish terms	30
7	Normative language terms	31
8	Default and Nullable Interaction	54
9	Schema annotations	54
10	Universal properties	65
11	Frequent properties	67
12	Capacity properties	69
13	CapacityInfo properties	70
14	Identifier properties	72
15	DurableNameFormat property values	73
16	IOStatistics properties	75
17	IOWorkload properties	77
18	IOWorkloadComponent properties	78
19	IOAccessPattern property values	80
20	Location properties	81
21	LocationType property values	95
22	Orientation property values	95
23	RackOffsetUnits property values	96
24	Reference property values	96
25	Oem properties	97
26	ReplicaInfo properties	98
27	ConsistencyState property values	109
28	ConsistencyStatus property values	109
29	ConsistencyType property values	110
30	ReplicaFaultDomain property values	110
31	ReplicaPriority property values	110
32	ReplicaProgressStatus property values	111
33	ReplicaReadOnlyAccess property values	113
34	ReplicaRecoveryMode property values	113
35	ReplicaRole property values	114
36	ReplicaState property values	114

37	ReplicaType property values	116
38	ReplicaUpdateMode property values	117
39	RequestedReplicaState property values	117
40	UndiscoveredElement property values	119
41	ReplicaRequest properties	120
42	Schedule properties	121
43	EnabledDaysOfWeek property values	123
44	EnabledMonthsOfYear property values	124
45	Status properties	125
46	Health property values	131
47	HealthRollup property values	131
48	Severity property values	131
49	State property values	132
50	CapacitySource 1.2.0 properties	134
51	CapacitySourceCollection properties	139
52	ClassOfService 1.2.0 properties	141
53	ClassOfServiceCollection properties	145
54	ConsistencyGroup 1.1.0 properties	148
55	AssignReplicaTarget action parameters	156
56	CreateReplicaTarget action parameters	157
57	RemoveReplicaRelationship action parameters	158
58	ResumeReplication action parameters	159
59	ReverseReplicationRelationship action parameters	160
60	SplitReplication action parameters	160
61	SuspendReplication action parameters	161
62	ConsistencyMethod property values	161
63	ConsistencyType property values	162
64	ReplicaType property values	162
65	ReplicaUpdateMode property values	163
66	ConsistencyGroupCollection properties	164
67	DataProtectionLineOfService 1.3.0 properties	166
68	CreateReplicas action parameters	171
69	RecoveryGeographicObjective property values	172
70	RecoveryTimeObjective property values	173
71	ReplicaType property values	174
72	DataProtectionLoSCapabilities 1.2.0 properties	174
73	SupportedRecoveryGeographicObjectives property values	180
74	SupportedRecoveryTimeObjectives property values	181

75	SupportedReplicaTypes property values	181
76	DataSecurityLineOfService 1.1.1 properties	182
77	AntivirusScanPolicies property values	186
78	ChannelEncryptionStrength property values	187
79	DataSanitizationPolicy property values	187
80	HostAuthenticationType property values	188
81	MediaEncryptionStrength property values	188
82	SecureChannelProtocol property values	189
83	UserAuthenticationType property values	189
84	DataSecurityLoSCapabilities 1.2.0 properties	191
85	SupportedAntivirusScanPolicies property values	195
86	SupportedChannelEncryptionStrengths property values	196
87	SupportedDataSanitizationPolicies property values	196
88	SupportedHostAuthenticationTypes property values	197
89	SupportedMediaEncryptionStrengths property values	198
90	SupportedSecureChannelProtocols property values	198
91	SupportedUserAuthenticationTypes property values	199
92	DataStorageLineOfService 1.3.1 properties	200
93	AccessCapabilities property values	203
94	ProvisioningPolicy property values	204
95	RecoveryTimeObjectives property values	205
96	DataStorageLoSCapabilities 1.2.2 properties	206
97	SupportedAccessCapabilities property values	209
98	SupportedProvisioningPolicies property values	210
99	SupportedRecoveryTimeObjectives property values	210
100	FeaturesRegistry 1.1.1 properties	211
101	FileShare 1.2.0 properties	214
102	DefaultAccessCapabilities property values	223
103	FileShareQuotaType property values	224
104	FileSharingProtocols property values	224
105	WritePolicy property values	225
106	FileShareCollection properties	226
107	FileSystem 1.2.2 properties	228
108	AccessCapabilities property values	238
109	CharacterCodeSet property values	238
110	FileSystemCollection properties	239
111	HostedStorageServices properties	241
112	IOConnectivityLineOfService 1.2.1 properties	244

113	AccessProtocols property values	246
114	IOConnectivityLoSCapabilities 1.2.0 properties	250
115	SupportedAccessProtocols property values	253
116	IOPerformanceLineOfService 1.1.1 properties	257
117	IOPerformanceLoSCapabilities 1.3.0 properties	260
118	LineOfService 1.1.0 properties	264
119	LineOfServiceCollection properties	266
120	NVMeDomain 1.1.0 properties	268
121	NVMeDomainCollection properties	272
122	NVMeFirmwareImage 1.1.0 properties	274
123	NVMeDeviceType property values	276
124	SpareResourceSet 1.0.1 properties	276
125	StorageGroup 1.5.0 properties	281
126	AccessCapability property values	294
127	AccessState property values	295
128	AuthenticationMethod property values	295
129	StorageGroupCollection properties	296
130	StoragePool 1.7.1 properties	299
131	AddDrives action parameters	326
132	RemoveDrives action parameters	328
133	SetCompressionState action parameters	329
134	SetDeduplicationState action parameters	329
135	SetEncryptionState action parameters	330
136	NVMePoolType property values	330
137	PoolType property values	331
138	SupportedPoolTypes property values	331
139	SupportedProvisioningPolicies property values	332
140	SupportedRAIDTypes property values	332
141	StoragePoolCollection properties	336
142	StorageReplicaInfo 1.4.0 properties	338
143	StorageService 1.5.0 properties	340
144	SetEncryptionKey action parameters	354
146	StorageServiceCollection properties	355
147	StorageSystemCollection properties	357
148	Volume 1.8.0 properties	360
149	AssignReplicaTarget action parameters	391
150	ChangeRAIDLAYOUT action parameters	392
151	CreateReplicaTarget action parameters	394

152	Initialize action parameters	395
153	RemoveReplicaRelationship action parameters	396
154	ResumeReplication action parameters	397
155	ReverseReplicationRelationship action parameters	398
156	SplitReplication action parameters	398
157	SuspendReplication action parameters	399
158	AccessCapabilities property values	399
159	EncryptionTypes property values	400
160	InitializeMethod property values	400
161	InitializeType property values	401
162	LBAFormatsSupported property values	401
163	ProvisioningPolicy property values	402
164	RAIDType property values	402
165	ReadCachePolicy property values	406
166	ReplicaType property values	406
167	ReplicaUpdateMode property values	407
168	VolumeType property values	407
169	VolumeUsage property values	408
170	WriteCachePolicy property values	408
171	WriteCacheState property values	409
172	WriteHoleProtectionPolicy property values	409
173	VolumeCollection properties	411

List of Figures

1	Model Overview	32
2	Logical Subsystem in Swordfish Standalone Configuration	34
3	Swordfish Standalone Configuration Example	35
4	Logical Subsystem in Swordfish Integrated Configuration	36
5	Swordfish Integrated Configuration Example	37
6	Logical Subsystem in Integrated Service Configuration	45
7	Integrated Service Configuration Example	46
8	Logical Subsystem in Standalone Service Configuration	47
9	Standalone Service Configuration Example	48

USAGE

Copyright (c) 2016 - 2022 SNIA. All rights reserved. All other trademarks or registered trademarks are the property of their respective owners.

The SNIA hereby grants permission for individuals to use this document for personal use only, and for corporations and other business entities to use this document for internal use only (including internal copying, distribution, and display) provided that:

1. Any text, diagram, chart, table or definition reproduced must be reproduced in its entirety with no alteration, and,
2. Any document, printed or electronic, in which material from this document (or any portion hereof) is reproduced must acknowledge the SNIA copyright on that material, and must credit the SNIA for granting permission for its reuse.

Other than as explicitly provided above, you may not make any commercial use of this document, or any portion thereof, or distribute this document to third parties. All rights not explicitly granted are expressly reserved to SNIA.

Permission to use this document for purposes other than those enumerated above may be requested by emailing tcmd@snia.org. Please include the identity of the requesting individual and/or company and a brief description of the purpose, nature, and scope of the requested use.

All code fragments, scripts, data tables, and sample code in this SNIA document are made available under the following license:

BSD 3-Clause Software License

Copyright (c) 2022, The Storage Networking Industry Association.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of The Storage Networking Industry Association (SNIA) nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

DISCLAIMER

The information contained in this publication is subject to change without notice. The SNIA makes no warranty of any kind with regard to this publication, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The SNIA shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use.

Suggestions for revisions should be directed to <http://www.snia.org/feedback/>.

Current Revision

SNIA is actively engaged in expanding and refining the Swordfish documentation. The most current revision can be found on the SNIA web site at https://www.snia.org/tech_activities/standards/curr_standards/swordfish.

Contact SNIA

Current SNIA practice is to make updates and other information available through their web site at <http://www.snia.org>.

FEEDBACK AND INTERPRETATIONS

Requests for interpretation, suggestions for improvement and addenda, or defect reports are welcome. They should be sent via the SNIA Feedback Portal at

<http://www.snia.org/feedback/> or by mail to the Storage Networking Industry Association, 4360 ArrowsWest Drive, Colorado Springs, Colorado 80907, U.S.A.

INTENDED AUDIENCE

This document is intended for use by individuals and companies engaged in storage management.

VERSIONING POLICY

This document is versioned material. Versioned material shall have a three-level revision identifier, comprised of a version number 'v', a release number 'r' and an errata number 'e'. Future publications of this document are subject to specific constraints on the scope of change that is permissible from one revision to the next and the degree of interoperability and backward compatibility that should be assumed between products designed to this standard. This versioning policy applies to all SNIA Swordfish versioned materials.

Version Number: Versioned material having version number 'v' shall be backwards compatible with all of revisions of that material that have the same version number 'v'. There is no assurance of interoperability or backward compatibility between revisions of a versioned material with different version numbers.

Release Number: Versioned material with a version number 'v' and release number 'r' shall be backwards compatible with previous revisions of the material with the same version number, and a lower release number. A minor revision represents a technical change to existing content or an adjustment to the scope of the versioned material. Each minor revision causes the release number to be increased by one.

Errata Number: Versioned material having version number 'v', a release number 'r', and an errata number 'e' should be backwards compatible with previous revisions of the material with the same version number and release number ("errata versions"). An errata revision of versioned material is limited to minor corrections or clarifications of existing versioned material. An errata revision may be backwards incompatible, if the incompatibility is necessary for correct operation of implementations of the versioned material.

Revision History

The evolution of this document is summarized in Table 1.

Table 1: Revision history

Date	Rev	Notes
19 September 2016	1.0.0	Initial Release
12 October 2016	1.0.1	Errata release for general clean up and formatting consistency
1 November 2016	1.0.2	Errata release to change multiple collections' types from collections (arrays) to ResourceCollections to conform to Redfish usage guidelines Change multiple collections' types from collections (arrays) to ResourceCollections to conform to Redfish usage guidelines and move NavigationProperties from Links section.
24 January 2017	1.0.3	Errata release to move complex types and enum to versioned namespace Schedule schema: add property json schema fix (Swordfish to swordfish) Specification enhancements, multiple areas User's guide: multiple new use cases and new document section
25 April 2017	1.0.4	Errata release with minor updates to schema: move FileShare collection, integrate DMTF and SNIA versions of Volume, fix incorrect property references and update descriptions. Update mockups. User's guide: Update cross-references.
3 October 2017	1.0.5	Errata release to include schema simplifications and other lessons from initial implementations, as well as general cleanup of specification.
13 February 2018	1.0.6	Updated Storage Systems model – added notion of Integrated Service Configuration in addition to (and named) Hosted Service Configuration Added ComplexType common definition section

Date	Rev	Notes
12 October 2018	1.0.7	Added/updated common Redfish property definitions
		Updates to conform to new SNIA templates.
		Enhanced Spare Capacity Management Model; Deprecated Remaining Capacity
		Added OpenAPI support: schema references and OpenAPI YAML files
		Added iSCSI properties for CHAP
		Event usage enhancements and guidance
		Volume schema updates – RAID Type enum (deprecating VolumeType usage), add ReplicaTargets
		Schema updates: Annotations enhancements: Capabilities designations, owning entities, Redfish.Required usage
		Clarified and updated ClassOfService IsDefault property usage
		Updated Capabilities location in hierarchy
		Fix cardinality issue of StorageReplicaInfo usage in StorageGroups and Volume
		Consolidate Client and Server Endpoint Groups into single Endpoint Group entity (deprecate usage of separate Client Endpoint Group and Server Endpoint Group)
		Add MappedVolume construct to StorageGroup – adds LUN info and other properties
		Clarified and updated ClassOfService IsDefault property usage
		Updated Capabilities location in hierarchy
		Fix cardinality issue of StorageReplicaInfo usage in StorageGroups and Volume

Date	Rev	Notes
		Consolidate Client and Server Endpoint Groups into single Endpoint Group entity (deprecate usage of separate Client Endpoint Group and Server Endpoint Group)
		Add MappedVolume construct to StorageGroup – adds LUN info and other properties
8 November 2018	1.0.7a	Restored RAIDType property that was missing from 1.0.7
		Minor correction to schema versioning
22 August 2019	1.1.0	Restructured to add features and profiles
		Add description of SupportedFeatures usage and requirements
		Add requirements for subsets of Add language to clarify support for use with and without the class of service (now an optional feature)
		Added descriptions of support for seamless extension of Redfish Storage model to Swordfish
		Add updated model diagrams to reflect new model permutations
		Added descriptions of new constructs (e.g., Consistency Groups)
		Cleaned up references to Redfish Specification based on latest version
		Add Status Codes clarification and constraints section
12 November 2019	1.1.0	Released as Technical Position
12 November 2019	1.1.0a	Released as Corrected Technical Position
		Formatting fixes – word wrap in pdf doc format to fix truncated lines
		Consistent object labeling in images (replace drive with disk)

Date	Rev	Notes
		Editorial and grammar changes and cleanup to status code guidance section
24 March 2020	1.1.0b	Released as Corrected Technical Position TLS requirements now based on both ISO and SNIA standards Redfish references now based on both ISO and SNIA standards Bibliography added
29 May 2020	1.2.0	Note: This release is done in conjunction with the DMTF's Redfish Forum Work-in-Progress June 2020 release of DSP-IS0014 (v0.95), which contains multiple schema to support this work. Both are released as Working Drafts / work-in-progress for public review, and plan simultaneous releases in early fall 2020 to support full technical specification level capability and availability. Functionality availability in Swordfish includes: • Enhancements to Volume, StoragePools • New schema: NVMeDomain Other supporting documentation released in conjunction with this specification and schema bundle: • Multiple mockups reflecting multiple implementation permutation options (available on swordfishmockups.com) • Model overview documentation (NVMe to RF/SF Model Mapping Working Draft, dated May 2020)
18 August 2020	1.2.1	Note: This release is done in conjunction with the DMTF's Redfish Forum 2020.3 Release of the Redfish Specification, schema bundle and other supporting materials. Functionality availability in Swordfish includes:
12 July 2022		SNIA Standard

Date	Rev	Notes
		• NVMe Mapping Support, Enhancements to Volume, StoragePools Additional Enhancements in the Specification and schema: • Added InitializeMethod property to Volume. • Made DedicateSpareDrives ReadWrite-able • Added enhanced Volume Access Capabilities and usage in StorageGroup. • Fix multiple URI issues across various schema. Updated formatting of tables to support automatic table numbering and ISO compatible table representation.
29 September 2020	1.2.1a	Added bibliography and updated TLS references
20 October 2020	1.2.1c	Updated with additional Redfish.URI annotations.
31 October 2020	1.2.1c	Released as SNIA Standard
2 March 2021	1.2.2	Added sections to document use of complex types. Updated common properties sections. Schema changes: Add actions to Add and Remove drives directly from StoragePool. Split NVMeFirmwareImage and NVMeDomains schemas. Deprecate use of NetworkPort; replace with Port. Update Redfish.URI references. Corrected \$ref references in JSON schema files. Fix incorrect references in deprecated JSON files.
30 August 2021	1.2.3	Adds updates / corrections to Redfish.URI annotations Add IsBootCapable to Volume
12 July 2022		SNIA Standard

Date	Rev	Notes
		Add SupportedPoolTypes to StoragePool
5 December 2021	1.2.3	Release as SNIA Standard
12 April 2022	1.2.4	Release as Working Draft. Schema changes: • FeaturesRegistry: Errata fix – make Features property a collection. • IOStatistics: clarify intent regarding reset / wrap. • StoragePool: errata fixes for Actions. • Volume: errata fixes for Actions. Add: LBAFormatsSupported property to NVMeNamespaceProperties.
12 July 2022	1.2.4a	Release as SNIA Standard. Includes Errata fixes to multiple profiles.

About SNIA

The Storage Networking Industry Association (SNIA) is a non-profit organization made up of member companies spanning information technology. A globally recognized and trusted authority, SNIA's mission is to lead the storage industry in developing and promoting vendor-neutral architectures, standards and educational services that facilitate the efficient management, movement and security of information.

Acknowledgements

The SNIA Scalable Storage Management Technical Work Group, which developed and reviewed this work in progress, would like to recognize the significant contributions made by the following members listed in Table 2.

Table 2: Contributors

Member	Representatives (* – prior employer)
Broadcom Inc.	Richelle Ahlvers(*)
Cisco Systems, Inc.	Krishnakumar Gowravaram
Dell Inc.	Patrick Boyd
	George Ericson
	Jim Pendergraft
	Sean McGinnis
	Michael Raineri
	Rich Roscoe
Futurewei Inc.	Sean McGinnis(*)
Hitachi Data Systems	Eric Hibbard
Hewlett Packard Enterprise	Jeff Hilland
	Chris Lionetti
	John Mendonca
	Doug Voigt
Inova Development Inc.	Karl Schopmeyer
Intel Corporation	Richelle Ahlvers
	Rajalaxmi Angadi
	Phil Cayton
	Klaudia Jablonska
	Mariusz Krzywiński
	Mateusz Mania
	Slawek Putyrski
	Paul von Behren
Microsemi Corporation	Anand Nagarjan
Microsoft Corporation	Hector Linares
	Jim Pinkerton

Member	Representatives (* – prior employer)
	Michael Pizzo
	Scott Seligman
NetApp, Inc.	Don Deel
	Nilesh Maheshwari
ScienceLogic	Patrick Strick
VMware, Inc.	Murali Rajagopal

1 Abstract

The Swordfish Scalable Storage Management API (“Swordfish”) defines a RESTful interface and a standardized data model to provide a scalable, customer-centric interface for managing storage and related data services. It extends the Redfish Scalable Platforms Management API Specification (DSP0266) from the DMTF.

2 Scope

2.1 Document Goals

Swordfish extends the Redfish Scalable Platforms Management API Specification to define a comprehensive, RESTful API for storage management that addresses block storage, file systems, object storage, and storage network infrastructure. It is centered around common operational and business concerns of storage management, including:

- Configuration and provisioning
- Monitoring
- Event and log management
- Performance assessment
- Diagnostics
- Fault detection and remediation
- Security
- Accounting and resource consumption

Swordfish's storage model is built around well-defined classes of service, which provide a means to map high-level business goals and objectives to specific, storage-based actions and requirements, in a clear and consistent way that can be applied uniformly across a broad spectrum of storage configurations and storage types (e.g., block storage, file systems, object stores). Common storage management functionality covered by class of service includes snapshots, replication, mapping and masking, and provisioning.

The Redfish specification provides the protocols and a core set of data models and behaviors for the management of systems. It defines the elements and behaviors that are mandatory for all Redfish implementations. Additionally it defines additional elements and behaviors that can be chosen by system vendors or manufacturers. The specifications also defines points at which OEM (system vendor) extensions can be provided by a given implementation. The specifications specifies normative requirements for Redfish Services and associated materials, such as Redfish Schema files. The Redfish specifications does not set requirements for Redfish clients, but will indicate what a Redfish client should do in order to access and utilize a Redfish Service successfully and effectively.

The Swordfish specification defines additional data models and behaviors for the management of storage systems and storage infrastructure. A Swordfish implementation shall conform to all requirements specified in the Redfish specifications.

Swordfish is suitable for a wide range of storage, from small-scale object drives, integrated RAID cards or RBODs providing storage services, to external disk arrays or file servers, to infrastructure providing storage services for converged, hyperscale and large scale cloud environments.

This document defines the Swordfish Scalable Storage Management API.

2.2 Audience Assumptions

As Swordfish is designed as an extension of the Redfish specification, this document is written with the presumption that the reader has a detailed understanding of the Redfish specification. This document cannot be fully understood without that context.

3 Normative References

3.1 Overview

The documents referenced in Table 3 are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3.2 Approved references

The approved references that contribute to this document are summarized in Table 3.

Table 3: Approved normative references

Tag	Title (Version)	Author	URL
ISO - 8601	Data elements and interchange formats – Information interchange – Representation of dates and times – Part 1: Basic rules	ISO / IEC	http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?csnumber=70907
ISO - Direct	ISO / IEC Directives, Part 2: Principles and rules for the structure and drafting of ISO and IEC documents	ISO / IEC	https://www.iso.org/sites/directives/current/part2/index.xhtml
Redfish	Redfish Scalable Platforms Management API Specification (v1.15.1)	DMTF	https://www.dmtf.org/sites/default/files/standards/documents/DSP0266_1.15.1.pdf
OData	Open Data Protocol (v. 4.01)	OASIS	http://docs.oasis-open.org/odata/odata/v4.01/odata-v4.01-part1-protocol.html

Tag	Title (Version)	Author	URL
RFC3986	Uniform Resource Identifier (URI): Generic Syntax (2005)	The Internet Society	http://www.rfc-base.org/txt/rfc-3986.txt
CSDL	Common Schema Definition Language (4.01)	OASIS	https://docs.oasis-open.org/odata/odata/v4.01/odata-v4.01-part3-csdl.pdf
ITIL	ITIL Glossary (2011)	ITIL	https://www.axelos.com/Corporate/media/Files/Glossaries/ITIL_2011_Glossary_GB-v1-0.pdf
Units	The Unified Code for Units of Measure (v2.0.1)	Regenstrief Institute, Inc. and the UCUM Organization	http://unitsofmeasure.org/trac
ISO-20648	Information technology — TLS specification for storage systems	ISO/IEC	https://www.iso.org/standard/68622.html
SPC-4	SCSI Primary Commands - 4 (SPC-4) INCITS 513-2015	T10	http://www.techstreet.com/cgi-bin/joint.cgi/incits
Features	Swordfish Features Registry, version 1.3	SNIA	https://redfish.dmtf.org/registries/swordfish/v1/SwordfishFeatureRegistry.1.3.0.json
Messages	Swordfish Message Registry, version 1.0.2	SNIA	https://redfish.dmtf.org/registries/swordfish/v1/Swordfish.1.0.2.json
EnergyStar	ENERGY STAR® Program Requirements for Data Center Storage	EPA	ENERGY STAR® Program Requirements for Data Center Storage

3.3 References under development

Documents referenced in Table 4 are under active development, and subject to revision or replacement at any time. In the event that the provided URL is no longer valid, refer to the related parent page to locate a replacement.

Table 4: References under development

Tag	Title (Version)	Author	URL	Parent Page
RedfishResource	Redfish Resource and Schema Guide	DMTF	https:// www.dmtf.org/ sites/ default/ files/ standards/ documents/ DSP2046_2022.1.pdf	http:// www.dmtf.org/ redfish

3.4 Other references

None defined in this document.