



ISO/IEC 14776-415

Edition 1.0 2019-12

INTERNATIONAL STANDARD



Information technology – Small Computer System Interface (SCSI) –
Part 415: SCSI Architecture Model - 5 (SAM-5)
iteh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 14776-415:2019
<https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019>





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2019 ISO/IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about ISO/IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

iTeh STANDARDS (Standards.iteh.ai)

[ISO/IEC 14776-415:2019](#)

<https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019>



ISO/IEC 14776-415

Edition 1.0 2019-12

INTERNATIONAL STANDARD



Information technology – Small Computer System Interface (SCSI) –
Part 415: SCSI Architecture Model - 5 (SAM-5)
(standards.iteh.ai)

ISO/IEC 14776-415:2019
<https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.200

ISBN 978-2-8322-7662-4

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



**ISO/IEC
14776-415**

**Information technology -
Small Computer System Interface (SCSI) -
Part 415: SCSI Architecture Model - 5 (SAM-5)**

**iTeh STANDARD PREVIEW
(standards.iteh.ai)**

[ISO/IEC 14776-415:2019](#)
<https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019>

Reference number
ISO/IEC 14776-415:2019 © ISO/IEC 2019

1 Scope	15
2 Normative references	15
3 Terms, definitions, symbols, abbreviations, and conventions	15
3.1 Terms and definitions	15
3.2 Symbols and Abbreviations	30
3.2.1 Abbreviations	30
3.2.2 Units	30
3.3 Keywords	30
3.4 Editorial conventions	32
3.5 Numeric and character conventions	33
3.5.1 Numeric conventions	33
3.5.2 Byte encoded character strings conventions	34
3.6 UML notation conventions	34
3.6.1 Notation conventions overview	34
3.6.2 Constraint and note conventions	34
3.6.3 Class diagram conventions	35
3.6.4 Object diagram conventions	40
3.7 State machine conventions	42
3.7.1 State machine conventions overview	42
3.7.2 Transitions	43
3.7.3 Messages, requests, indications, confirmations, responses, and event notifications	43
3.7.4 State machine counters, timers, and variables	44
3.8 Bit and byte ordering	44
3.9 Notation for procedure calls	46
4 SCSI architecture model	47
4.1 Overview	47
4.2 Compliance requirements	47
4.3 The SCSI distributed service model	49
4.4 The SCSI client-server model	50
4.4.1 SCSI client-server model overview	50
4.4.2 Synchronizing client and server changes	51
4.4.3 Server request/response ordering	51
4.5 The SCSI structural model	52
4.6 SCSI classes	53
4.6.1 SCSI classes overview	53
4.6.2 SCSI Domain class	54
4.6.3 Service Delivery Subsystem class	55
4.6.4 SCSI Device class	55
4.6.4.1 SCSI Device class overview	55
4.6.4.2 SCSI Device Name attribute	56
4.6.5 SCSI Port class	57
4.6.5.1 SCSI Port class overview	57
4.6.5.2 Relative Port Identifier attribute	58
4.6.6 SCSI Target Port class	58
4.6.6.1 SCSI Target Port class overview	58
4.6.6.2 Target Port Identifier attribute	58
4.6.6.3 Target Port Name attribute	59
4.6.6.4 Send Data-In operation	59
4.6.6.5 Receive Data-Out operation	59
4.6.6.6 Terminate Data Transfer operation	59
4.6.6.7 Send Command Complete operation	59
4.6.6.8 Task Management Function Executed operation	59
4.6.7 Task Router class	59
4.6.7.1 Task Router class overview	59
4.6.7.2 Route Command operation	60

4.6.6.3 Route Task Management Function operation	60
4.6.6.4 Reroute Conglomerate Command operation	61
4.6.6.5 Reroute Conglomerate Task Management Functions operation.....	61
4.6.6.6 Stop Conglomerate Task Management Functions Rerouting operation	62
4.6.7 SCSI Initiator Port class	62
4.6.8.1 SCSI Initiator Port class overview	62
4.6.8.2 Initiator Port Identifier attribute	63
4.6.8.3 Initiator Port Name attribute	63
4.6.8.4 Send SCSI Command operation	63
4.6.8.5 Send Task Management Request operation.....	63
4.6.8.6 Get Initiator Port Identifier operation	63
4.6.8.7 Get Initiator Port Name operation.....	63
4.6.9 SCSI Target Device class.....	64
4.6.10 Logical Unit Conglomerate class	65
4.6.11 Level 1 Hierarchical Logical Unit class	66
4.6.12 Level 2 Hierarchical Logical Unit class	67
4.6.13 Level 3 Hierarchical Logical Unit class	68
4.6.14 Level 4 Hierarchical Logical Unit class	68
4.6.15 Hierarchical Logical Unit class	68
4.6.16 Management Logical Unit class	68
4.6.17 Well Known Logical Unit class	69
4.6.18 Logical Unit class	69
4.6.18.1 Logical Unit class overview	69
4.6.18.2 LUN attribute	71
4.6.18.3 Logical Unit Name attribute	71
4.6.18.4 Dependent Logical Unit attribute	72
4.6.18.5 Device Type attribute	72
4.6.19 Device Server class	72
4.6.19.1 Device Server class overview	72
4.6.19.2 Data-In Delivered operation	72
https://standards.iec.org/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019	72
4.6.19.3 Data-Out Received operation.....	72
4.6.19.4 Data Transfer Terminated operation	73
4.6.20 Copy Manager class	73
4.6.20.1 Copy Manager class overview	73
4.6.20.2 Create ROD Token operation.....	73
4.6.20.3 Process ROD Token operation	73
4.6.21 Task Manager class	73
4.6.21.1 Task Manager class overview	73
4.6.21.2 SCSI Command Received operation	73
4.6.21.3 Task Management Request Received operation	74
4.6.21.4 Data Transfer Terminated operation	74
4.6.21.5 Nexus Loss operation.....	74
4.6.21.6 Transport Reset operation.....	74
4.6.21.7 Power Loss Expected operation.....	74
4.6.22 Task Set class.....	74
4.6.23 Command class	74
4.6.23.1 Command class overview	74
4.6.23.2 I_T_L Nexus attribute	74
4.6.23.3 Command Identifier attribute	75
4.6.23.4 Task Attribute attribute	75
4.6.23.5 CDB attribute	75
4.6.23.6 CRN attribute.....	75
4.6.23.7 Command Priority attribute.....	75
4.6.23.8 Status attribute	75
4.6.23.9 Sense Data attribute	75
4.6.23.10 Sense Data Length attribute.....	75
4.6.23.11 Service Response attribute	75
4.6.23.12 Status Qualifier attribute.....	75

4.6.23.13 First Burst Enabled attribute	75
4.6.23.14 Device Server Buffer attribute	75
4.6.23.15 Application Client Buffer Offset attribute	76
4.6.23.16 Request Byte Count attribute	76
4.6.23.17 Delivery Result attribute	76
4.6.24 Task Management Function class	76
4.6.24.1 Task Management Function class overview	76
4.6.24.2 Function Identifier attribute	76
4.6.24.3 I_T Nexus attribute	76
4.6.24.4 I_T_L Nexus attribute	76
4.6.24.5 Command Identifier attribute	76
4.6.24.6 Service Response attribute	76
4.6.24.7 Additional Response Information attribute	77
4.6.25 Administrative Logical Unit class	77
4.6.25.1 Administrative Logical Unit class overview	77
4.6.25.2 Rerouted commands and task management functions	77
4.6.25.2.1 Overview	77
4.6.25.2.2 Commands rerouted due to incorrect logical unit selection	77
4.6.25.2.3 Command rerouting in response to an administrative logical unit request	77
4.6.25.2.4 Task management function rerouting in response to an administrative logical unit request	78
4.6.26 Subsidiary Logical Unit class	79
4.6.26.1 Subsidiary Logical Unit class overview	79
4.6.26.2 Binding attribute	79
4.6.26.3 Host Bind Identifier attribute	79
4.6.27 SCSI Initiator Device class	80
4.6.28 Application Client class	81
4.6.28.1 Application Client class overview	81
4.6.28.2 Command Complete Received operation	81
4.6.28.3 Received Task Management Function Executed operation	81
4.6.28.4 Nexus Loss operation	82
4.6.28.5 Transport Reset operation	82
4.6.29 Application Client Task Management Function class	82
4.6.29.1 Application Client Task Management Function class overview	82
4.6.29.2 Function Identifier attribute	82
4.6.29.3 I_T Nexus attribute	82
4.6.29.4 I_T_L Nexus attribute	82
4.6.29.5 Command Identifier attribute	82
4.6.29.6 Service Response attribute	82
4.6.29.7 Additional Response Information attribute	82
4.6.30 Application Client Task Set class	83
4.6.31 Application Client Command class	83
4.6.31.1 Application Client Command class overview	83
4.6.31.2 I_T_L Nexus attribute	83
4.6.31.3 Command Identifier attribute	83
4.6.31.4 CDB attribute	84
4.6.31.5 Task Attribute attribute	84
4.6.31.6 Status attribute	84
4.6.31.7 Service Response attribute	84
4.6.31.8 Data-In Buffer attribute	84
4.6.31.9 Data-In Buffer Size attribute	84
4.6.31.10 Data-Out Buffer attribute	85
4.6.31.11 Data-Out Buffer Size attribute	85
4.6.31.12 CRN attribute	85
4.6.31.13 Command Priority attribute	85
4.6.31.14 First Burst Enabled attribute	85
4.6.31.15 Sense Data attribute	85
4.6.31.16 Sense Data Length attribute	85
4.6.31.17 Status Qualifier attribute	85

4.6.32 Discovery class	85
4.6.32.1 Discovery class overview	85
4.6.32.2 I_T Nexus attribute	86
4.6.32.3 I_T_L Nexus attribute	86
4.6.32.4 Return I_T Nexus operation	86
4.6.32.5 Return I_T_L Nexus operation	86
4.7 Logical unit number (LUN).....	86
4.7.1 Overview	86
4.7.2 Logical unit representation format.....	87
4.7.3 LUNs overview.....	87
4.7.4 Minimum LUN addressing requirements.....	87
4.7.5 Single level LUN structure	88
4.7.6 Complex LUN structures.....	91
4.7.6.1 Complex LUN structures overview	91
4.7.6.2 Logical unit conglomerate LUN structure	91
4.7.6.3 Hierarchical LUN structure	92
4.7.7 Addressing methods	95
4.7.7.1 Simple logical unit addressing method.....	95
4.7.7.2 Peripheral device addressing method.....	95
4.7.7.3 Flat space addressing method	97
4.7.7.4 Logical unit addressing method.....	98
4.7.7.5 Extended logical unit addressing.....	99
4.7.7.5.1 Extended logical unit addressing formats	99
4.7.7.5.2 Well known logical unit addressing	102
4.7.7.5.3 Extended flat space addressing method	103
4.7.7.5.4 Long extended flat space addressing method	103
4.7.7.5.5 Logical unit not specified addressing.....	104
4.8 SCSI ports	104
4.8.1 SCSI port configurations	104
4.8.2 SCSI devices with multiple SCSI ports	105
https://standards.iteh.ai/doc/Standards/01/04485a54-71a5-4edf-94c9-38804842/iso-rc-14776-415-2019	105
4.8.3 SCSI target device with multiple SCSI ports structure.....	106
4.8.4 SCSI initiator device with multiple SCSI initiator ports structure.....	107
4.8.5 SCSI device with multiple SCSI ports structure	107
4.8.6 SCSI initiator device view of SCSI target device with multiple SCSI target ports	108
4.8.7 SCSI target device view of a SCSI initiator device with multiple SCSI initiator ports.....	111
4.9 The SCSI model for distributed communications	112
 5 SCSI command model	117
5.1 The Execute Command procedure call	117
5.2 Command descriptor block (CDB).....	118
5.3 Status	120
5.3.1 Status codes	120
5.3.2 Status qualifier	121
5.3.3 Status precedence	124
5.4 SCSI transport protocol services for SCSI commands	124
5.4.1 SCSI transport protocol services for SCSI commands overview	124
5.4.2 Command and status SCSI transport protocol services	125
5.4.2.1 Command and status SCSI transport protocol services overview	125
5.4.2.2 Send SCSI Command SCSI transport protocol service request	125
5.4.2.3 SCSI Command Received SCSI transport protocol service indication	125
5.4.2.4 Send Command Complete SCSI transport protocol service response	126
5.4.2.5 Command Complete Received SCSI transport protocol service confirmation	126
5.4.3 Data transfer SCSI transport protocol services.....	127
5.4.3.1 Overview	127
5.4.3.2 Data-In delivery service	129
5.4.3.2.1 Send Data-In SCSI transport protocol service request.....	129
5.4.3.2.2 Data-In Delivered SCSI transport protocol service confirmation	129
5.4.3.3 Data-Out delivery service	129

5.4.3.3.1 Receive Data-Out SCSI transport protocol service request	129
5.4.3.3.2 Data-Out Received SCSI transport protocol service confirmation.....	130
5.4.3.4 Terminate Data Transfer service	130
5.4.3.4.1 Terminate Data Transfer SCSI transport protocol service request..	130
5.4.3.4.2 Data Transfer Terminated SCSI transport protocol service confirmation	131
5.5 Command lifetime.....	131
5.6 Aborting commands.....	132
5.7 Command processing example	139
5.8 Commands that complete with CHECK CONDITION status.....	140
5.8.1 Overview	140
5.8.2 Handling commands when ACA is not in effect	140
5.8.3 Aborting commands terminated with a CHECK CONDITION status without establishing an ACA	140
5.9 Auto contingent allegiance (ACA).....	141
5.9.1 ACA overview	141
5.9.2 Establishing an ACA	141
5.9.3 Handling new commands received on the faulted I_T nexus when ACA is in effect	142
5.9.4 Handling new commands received on non-faulted I_T nexuses when ACA is in effect	142
5.9.4.1 Command processing that is permitted for commands received on a non-faulted I_T nexuses during ACA	142
5.9.4.2 Handling new commands received on non-faulted I_T nexuses when ACA is in effect.....	142
5.9.5 Clearing an ACA condition.....	143
5.10 Overlapped commands	144
5.11 Incorrect logical unit numbers for commands.....	145
5.12 Task attribute exception conditions	145
5.13 Sense data	146
5.13.1 Command terminated sense data or polled sense data	146
5.13.2 Command completed sense data	146
5.14 Unit attention conditions	146
5.14.1 Unit attention conditions that are not coalesced	146
5.14.2 Coalescing unit attention conditions	149
https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019	
6 SCSI events and event notification model	151
6.1 SCSI events overview	151
6.2 Establishing a unit attention condition subsequent to detection of an event	153
6.3 Conditions resulting from SCSI events	154
6.3.1 Power on.....	154
6.3.2 Hard reset	155
6.3.3 Logical unit reset.....	155
6.3.4 I_T nexus loss.....	156
6.3.5 Power loss expected.....	156
6.4 SCSI transport protocol services for event notification	157
6.4.1 SCSI transport protocol service for event notification overview.....	157
6.4.2 Nexus Loss SCSI transport protocol service indication	157
6.4.3 Transport Reset SCSI transport protocol service indication	157
6.4.4 Power Loss Expected SCSI transport protocol service indication	157
7 Task management functions	159
7.1 Task management function procedure calls.....	159
7.2 ABORT TASK.....	160
7.3 ABORT TASK SET	161
7.4 CLEAR ACA	161
7.5 CLEAR TASK SET	162
7.6 I_T NEXUS RESET	162
7.7 LOGICAL UNIT RESET.....	163
7.8 QUERY TASK	163
7.9 QUERY TASK SET	164
7.10 QUERY ASYNCHRONOUS EVENT	164
7.11 Task management function lifetime.....	166

7.12 SCSI transport protocol services for task management functions.....	166
7.12.1 SCSI transport protocol services for task management functions overview	166
7.12.2 Send Task Management Request SCSI transport protocol service request.....	167
7.12.3 Task Management Request Received SCSI transport protocol service indication.....	167
7.12.4 Task Management Function Executed SCSI transport protocol service response.....	167
7.12.5 Received Task Management Function Executed SCSI transport protocol service confirmation ..	168
7.13 Task management function example.....	169
 8 Task set management.....	171
8.1 Task set management overview.....	171
8.2 Implicit head of queue	171
8.3 Command management model	171
8.4 Task attributes	172
8.4.1 Overview	172
8.4.2 Commands having the SIMPLE task attribute	172
8.4.3 Commands having the ORDERED task attribute	172
8.4.4 Commands having the HEAD OF QUEUE task attribute	172
8.4.5 Commands having the ACA task attribute	172
8.5 Command priority	173
8.6 Command duration limit.....	173
8.6.1 Command duration limit overview	173
8.6.2 Command duration scheduling	174
8.7 LU (logical unit) state machines	174
8.7.1 LU state machine overview.....	174
8.7.2 LU_TM (task manager) state machine.....	176
8.7.2.1 LU_TM state machine overview	176
8.7.2.2 LU_TM command processing	177
8.7.2.3 LU_TM task management function processing	179
8.7.2.4 LU_TM event processing	180
8.7.2.5 LU_TM terminated command processing	182
8.7.2.5.1 LU_TM ACA not established	182
8.7.2.5.2 LU_TM ACA established	183
8.7.3 LU_DS (device server) state machine	185
8.7.3.1 LU_DS state machine overview	185
8.7.3.2 LU_DS command processing.....	185
8.7.3.3 LU_DS background processing.....	188
8.7.4 LU_CS (command state) state machine	189
8.7.4.1 LU_CS state machine overview	189
8.7.4.2 LU_CS1:Idle state	189
8.7.4.2.1 LU_CS1:Idle state description	189
8.7.4.2.2 Transition LU_CS1:Idle to LU_CS2:Dormant	189
8.7.4.2.3 Transition LU_CS1:Idle to LU_CS3:Enabled	189
8.7.4.3 LU_CS2:Dormant state	190
8.7.4.3.1 LU_CS2:Dormant state description	190
8.7.4.3.2 Transition LU_CS2:Dormant to LU_CS3:Enabled	190
8.7.4.3.3 Transition LU_CS2:Dormant to LU_CS1:Idle	190
8.7.4.4 LU_CS3:Enabled state	190
8.7.4.4.1 LU_CS1:Enabled state description	190
8.7.4.4.2 Transition LU_CS3:Enabled to LU_CS1:Idle	191
8.7.4.4.3 Transition LU_CS3:Enabled to LU_CS4:Blocked	191
8.7.4.4.4 Transition LU_CS3:Enabled to LU_CS5:Completed	191
8.7.4.5 LU_CS4:Blocked state	191
8.7.4.5.1 LU_CS4:Blocked state description	191
8.7.4.5.2 Transition LU_CS4:Blocked to LU_CS3:Enabled	191
8.7.4.5.3 Transition LU_CS4:Blocked to LU_CS5:Completed	192
8.7.4.6 LU_CS5:Completed state.....	192
8.7.4.6.1 LU_CS5:Completed state description.....	192
8.7.4.6.2 Transition LU_CS5:Completed to LU_CS1:Idle.....	192

8.8 Task set management examples.....	192
8.8.1 Overview	192
8.8.2 Commands having the HEAD OF QUEUE task attribute	193
8.8.3 Commands having the ORDERED task attribute	195
8.8.4 Commands having the ACA task attribute	196
Annex A (informative) Identifiers and names for objects.....	197
A.1 Identifiers and names overview.....	197
A.2 Identifiers and names.....	198
Annex B (informative) SCSI Initiator Port attributes and SCSI Target Port attributes supported by SCSI transport protocols.....	203
Annex C (informative) Terminology mapping.....	207
C.1 Terminology mapping to SAM-3	207
C.2 Terminology mapping to SAM-4	207
Annex D (informative) SCSI transport protocol acronyms	208
Bibliography	209

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/IEC 14776-415:2019](#)
[https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-
38894847e342/iso-iec-14776-415-2019](https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019)

Table 1 — Numbering conventions.....	33
Table 2 — Constraint and note notation	34
Table 3 — Class diagram notation for classes.....	35
Table 4 — Multiplicity notation	36
Table 5 — Class diagram notation for associations.....	36
Table 6 — Class diagram notation for aggregations.....	37
Table 7 — Class diagram notation for generalizations	38
Table 8 — Class diagram notation for dependency	39
Table 9 — Object diagram notation for objects	40
Table 10 — Object diagram notation for link.....	40
Table 11 — Example of ordering of bits and bytes within a data dword	45
Table 12 — Example of ordering of bits and bytes within a data dword element	45
Table 13 — Command identifier scopes	84
Table 14 — Single level LUN structure using peripheral device addressing method	88
Table 15 — Single level LUN structure using flat space addressing method	88
Table 16 — Single level LUN structure using extended flat space addressing method.....	89
Table 17 — Single level LUN structure using long extended flat space addressing method.....	89
Table 18 — Complex LUN structures	91
Table 19 — Logical unit conglomerate LUN structure	91
Table 20 — Format of addressing fields in the logical unit conglomerate LUN structure	92
Table 21 — ADDRESS METHOD field in the logical unit conglomerate LUN structure.....	92
Table 22 — Hierarchical LUN structure adjustments	93
Table 23 — Hierarchical LUN structure	94
Table 24 — Format of addressing fields in the hierarchical LUN structure.....	94
Table 25 — ADDRESS METHOD field in the hierarchical LUN structure	95
Table 26 — Simple logical unit addressing format.....	95
Table 27 — Peripheral device addressing format	96
Table 28 — Flat space addressing format	97
Table 29 — Logical unit addressing format.....	98
Table 30 — Extended logical unit addressing format.....	100
Table 31 — LENGTH field and related sizes https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019	100
Table 32 — Two byte extended logical unit addressing format	101
Table 33 — Four byte extended logical unit addressing format.....	101
Table 34 — Six byte extended logical unit addressing format	101
Table 35 — Eight byte extended logical unit addressing format	101
Table 36 — Logical unit extended addressing	102
Table 37 — Well known logical unit extended addressing format.....	103
Table 38 — Extended flat space addressing format	103
Table 39 — Long extended flat space addressing format.....	104
Table 40 — Logical unit not specified extended addressing format.....	104
Table 41 — CONTROL byte	119
Table 42 — Status codes.....	120
Table 43 — Status qualifier format.....	121
Table 44 — SCOPE field	122
Table 45 — QUALIFIER field	123
Table 46 — SCSI device conditions that abort commands in a SCSI initiator device	133
Table 47 — SCSI device conditions that abort commands in a SCSI target device	134
Table 48 — Task management functions that abort commands	135
Table 49 — Command related conditions that abort commands	137
Table 50 — Command handling when ACA is not in effect	140
Table 51 — Handling for new commands received on a faulted I_T nexus during ACA	142
Table 52 — Handling for new commands received on non-faulted I_T nexuses during ACA	143
Table 53 — Unit attention condition precedence level	147
Table 54 — Unit attention additional sense codes for events detected by SCSI target devices.....	154
Table 55 — Task Management Functions	159
Table 56 — Additional Response Information argument for QUERY TASK	164
Table 57 — Additional Response Information argument for QUERY ASYNCHRONOUS EVENT	165
Table 58 — UADE DEPTH field	165

Table 59 — Task attributes	172
Table 60 — Command priority	173
Table 61 — Aborting commands already in a task set if an ACA is not established.....	182
Table 62 — Handling of commands already in a task set if an ACA is established.....	183
Table 63 — Task attribute and state indications in examples.....	193
Table 64 — Dormant command blocking boundary requirements.....	195
Table A.1 — Identifier attribute size and support requirements.....	198
Table A.2 — Name attribute size and support requirements	198
Table A.3 — Identifier attribute size for each SCSI transport protocol.....	199
Table A.4 — Identifier attribute format for each SCSI transport protocol.....	200
Table A.5 — Name attribute size for each SCSI transport protocol.....	201
Table A.6 — Name attribute format for each SCSI transport protocol	202
Table B.1 — SCSI Initiator Port attributes and SCSI Target Port attributes that are supported by ADT-2, FCP-4, and iSCSI SCSI transport protocols	204
Table B.2 — SCSI Initiator Port attributes and SCSI Target Port attributes that are supported by SOP, SAS SSP, SRP, and UAS SCSI transport protocols.....	206
Table C.1 — Terminology mapping to SAM-3	207
Table C.2 — Terminology mapping to SAM-4	207

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/IEC 14776-415:2019](#)

<https://standards.iteh.ai/catalog/standards/sist/b4485a54-71a5-4edf-94c9-38894847e342/iso-iec-14776-415-2019>

Figure 1 — SCSI document structure	14
Figure 2 — Examples of association relationships in class diagrams.....	37
Figure 3 — Examples of aggregation relationships in class diagrams.....	38
Figure 4 — Example of generalization relationships in class diagrams	39
Figure 5 — Example of a dependency relationship in class diagrams.....	39
Figure 6 — Examples of link relationships for object diagrams	41
Figure 7 — State machine conventions	42
Figure 8 — Example description for one state machine	43
Figure 9 — Requirements precedence	48
Figure 10 — Client-server model	49
Figure 11 — SCSI client-server model.....	50
Figure 12 — SCSI I/O system and SCSI domain model.....	52
Figure 13 — SCSI Domain class diagram overview	53
Figure 14 — SCSI Domain class diagram	54
Figure 15 — SCSI Domain object diagram	54
Figure 16 — SCSI Device class diagram.....	55
Figure 17 — SCSI Port class diagram	57
Figure 18 — SCSI Target Device class diagram	64
Figure 19 — Level 1 Hierarchical Logical Unit class.....	66
Figure 20 — Logical Unit class diagram	70
Figure 21 — SCSI Initiator Device class diagram.....	80
Figure 22 — Hierarchical LUN structure adjustments.....	93
Figure 23 — Logical unit selection using the peripheral device addressing format	97
Figure 24 — Logical unit selection using the logical unit addressing format.....	99
Figure 25 — SCSI device functional models.....	105
Figure 26 — SCSI device with multiple SCSI target ports structure model	106
Figure 27 — SCSI initiator device with multiple SCSI initiator ports structure model	107
Figure 28 — SCSI device with multiple SCSI ports structure model.....	108
Figure 29 — SCSI target device configured in a single SCSI domain	109
Figure 30 — SCSI target device configured in multiple SCSI domains	110
Figure 31 — SCSI target device and SCSI initiator device configured in a single SCSI domain	111
Figure 32 — Protocol service reference model.....	112
Figure 33 — SCSI transport protocol service mode.....	113
Figure 34 — Request-Response SAL transaction and related STPL services	114
Figure 35 — SCSI transport protocol service model for data transfers.....	114
Figure 36 — Device server data transfer transaction and related STPL services	115
Figure 37 — SCSI transport protocol service model for Terminate Data Transfer	115
Figure 38 — Device server Terminate Data Transfer transaction and related STPL services	116
Figure 39 — Model for Data-In and Data-Out data transfers	127
Figure 40 — Command processing events.....	139
Figure 41 — Events and event notifications for SCSI target devices.....	152
Figure 42 — Events and event notifications for SCSI initiator devices	153
Figure 43 — Task management processing events.....	169
Figure 44 — LU (logical unit) state machines (part 1).....	175
Figure 45 — LU (logical unit) state machines (part 2).....	176
Figure 46 — Commands having the HEAD OF QUEUE task attribute and blocking boundaries (example 1)...	193
Figure 47 — Commands having the HEAD OF QUEUE task attribute and blocking boundaries (example 2)...	194
Figure 48 — Commands having ORDERED task attributes and blocking boundaries.....	195
Figure 49 — Commands having ACA task attributes example	196

**INFORMATION TECHNOLOGY –
SMALL COMPUTER SYSTEM INTERFACE (SCSI) –**

Part 415: SCSI Architecture Model - 5 (SAM-5)

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.
*ISO/IEC 14776-415:2019
<https://standards.iec.ch/catalog/standards/sist/64483a54/145-4edt-94c9-18894847e342/iso-iec-14776-415-2019>*
- 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 14776-415 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14776 series, under the general title *Information technology – Small computer system interface (SCSI)*, can be found on the ISO and IEC web sites.

The text of this document is based on the following documents:

CDV	Report on voting
JTC1-SC25/2828/CDV	JTC1-SC25/2862/RVC