



ISO/IEC 14165-133

Edition 1.0 2010-02

INTERNATIONAL STANDARD

**Information technology – Fibre channel –
Part 133: Fibre channel switch fabric-3 (FC-SW-3)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XC**

ICS 35.200

ISBN 2-8318-1076-7

Contents

FOREWORD	13
Introduction	15
1 Scope	16
2 Normative references	16
3 Terms and conventions.	17
3.1 Terms and definitions.	17
3.2 Abbreviations, acronyms, and symbols	25
3.3 Editorial conventions	26
3.4 State machine notation.	27
3.5 Definition of Compliance Terms	27
3.6 Keywords	28
4 Structure and Concepts	30
4.1 Overview	30
4.2 E_Port Operation	30
4.3 Fabric Operation.	30
4.4 Fabric Definition	31
4.5 Switch.	31
4.6 Switching characteristics	33
4.6.1 Switching overview	33
4.6.2 Synchronous switching	33
4.6.3 Asynchronous switching	33
4.7 Switch Ports and Bridge Ports	34
4.7.1 General Characteristics	34
4.7.2 F_Port	34
4.7.3 FL_Port	34
4.7.4 E_Port	34
4.7.4 B_Port	35
4.7.5 G_Ports and GL_Ports	35
4.8 Fabric Addressing	35
4.9 Class F Service	36
4.10 FSPF-Backbone Fabric	37
5 Switch Ports and Bridge Ports	38
5.1 Overview	38
5.2 Model elements	38
5.2.1 FC Transports	38
5.2.2 Switch Transport	38
5.2.3 Control Facilities	38
5.2.4 Link Services	39
5.3 F_Port Operation	39
5.4 FL_Port Operation	40
5.5 E_Port Operation	41
5.6 B_Port operation	43
5.7 Inter-Switch Link Behavior	44
5.8 Class F Service	45
5.8.1 Class F Function	45
5.8.2 Class F Rules	45

5.8.3 Class F Frame Format	47
5.8.4 Class F Flow Control	48
6 Internal Link Services	49
6.1 Switch Fabric Internal Link Services (SW_ILS)	49
6.1.1 SW_ILS overview	49
6.1.2 Switch Fabric Internal Link Service Accept (SW_ACC)	50
6.1.3 Switch Fabric Internal Link Service Reject (SW_RJT)	51
6.1.4 Exchange Link Parameters (ELP)	54
6.1.5 Exchange Fabric Parameters (EFP)	60
6.1.6 Domain Identifier Assigned (DIA)	64
6.1.7 Request Domain_ID (RDI)	65
6.1.8 Hello (HLO)	67
6.1.8.1 HLO overview	67
6.1.8.2 FSPF Header Format	69
6.1.9 Link State Update (LSU)	70
6.1.9.1 LSU overview	70
6.1.9.2 Link-State Record (LSR) Format	71
6.1.9.3 Link State Header Format	72
6.1.9.4 Link Descriptor Format	74
6.1.9.5 Summary Descriptor Format	75
6.1.10 Link State Acknowledgement (LSA)	75
6.1.11 Build Fabric (BF)	76
6.1.12 Reconfigure Fabric (RCF)	77
6.1.13 Inter-Switch Registered State Change Notification (SW_RSCN)	78
6.1.14 Distribute Registered Link Incident Records (DRLIR)	81
6.1.15 Disconnect Class 1 Connection (DSCN)	82
6.1.16 Merge Request (MR)	83
6.1.16.1 MR overview	83
6.1.16.2 Merge Request Payload	84
6.1.16.2.1 Merge Request Payload overview	84
6.1.16.2.2 Merge Request Payload in Basic Zoning	85
6.1.16.2.3 Merge Request Payload in Enhanced Zoning	86
6.1.16.3 Merge Request Reply	87
6.1.17 Acquire Change Authorization Request (ACA)	87
6.1.18 Release Change Authorization (RCA) Request	89
6.1.19 Stage Fabric Configuration Update (SFC) Request	90
6.1.19.1 SFC overview	90
6.1.19.2 SFC in Basic Zoning	92
6.1.19.3 SFC in Enhanced Zoning	93
6.1.19.3.1 Overview	93
6.1.19.3.2 Operation Request 'Activate Zone Set Enhanced'	93
6.1.19.3.3 Operation Request 'Deactivate Zone Set Enhanced'	93
6.1.19.3.4 Operation Request 'Distribute Zone Set Database'	94
6.1.19.3.5 Operation Request 'Activate Zone Set by Name'	94
6.1.19.3.6 Operation Request 'Set Zoning Policies'	95
6.1.20 Update Fabric Configuration (UFC) Request	95
6.1.21 Exchange Switch Capabilities	96
6.1.22 Exchange Switch Support (ESS)	99
6.1.22.1 ESS overview	99
6.1.22.2 ESS Request Payload	99
6.1.22.3 Interconnect Element Information Object	100
6.1.22.4 Capability Object	100
6.1.22.5 Service Specific Capability Formats	100

6.1.22.5.1 Directory Server Capability	100
6.1.22.5.2 Fabric Controller Capability	101
6.1.22.5.3 ESS Fabric Configuration Server Capability Object	102
6.1.22.5.4 ESS Enhanced Zone Server Capability Object	102
6.1.22.5.5 ESS-Vendor Specific Capability Object.	103
6.1.22.6 ESS Accept Payload	104
6.1.23 Merge Request Resource Allocation (MRRA)	104
7 Fabric Configuration	107
7.1 Fabric Configuration Summary.	107
7.2 Switch Port Initialization	107
7.2.1 Basic Operation	107
7.2.2 Exchange Switch Capabilities Processing.	116
7.3 Principal Switch Selection	117
7.4 Address Distribution	123
7.4.1 Address_Distribution overview	123
7.4.2 Domain_ID Distribution by the Principal Switch.	125
7.4.3 Domain_ID Requests by the Switches	127
7.5 E_Port and Fabric Isolation	130
7.6 B_Port Operation	131
7.6.1 Differences Between E_Ports and B_Ports	131
7.6.2 B_Port Internal Link Services	131
7.6.3 B_Port Initialization	132
7.6.4 Example B_Port Configuration	132
8 Fabric Shortest Path First (FSPF).	133
8.1 Overview	133
8.1.1 Basic Components.	133
8.1.2 Fabric connectivity	133
8.1.3 Addressing.	133
8.1.4 Path Selection and Routing	134
8.1.5 Hierarchical Path Selection	134
8.1.6 FSPF Path Selection Summary.	134
8.2 FSPF Message Processing	134
8.2.1 Message transmission	134
8.2.2 Message Reception and Tests	135
8.3 Hello Protocol	135
8.3.1 Basic Functions	135
8.3.2 Hello Message Transmission.	135
8.3.3 Hello Message Parameters	136
8.3.4 Hello Message Reception	136
8.4 The Topology Database	137
8.5 Usage of LSR Fields	137
8.5.1 LSR Age	137
8.5.2 LSR Incarnation Number	138
8.5.3 LSR Instance Rules	138
8.5.4 LSR Checksum	139
8.5.5 Link Cost	141
8.6 Topology Database Synchronization	141
8.6.1 Synchronization overview	141
8.6.2 Neighborhood and Adjacency	142
8.6.3 Continuous Topology Database Synchronization	143
8.6.4 Reliable Flooding	144
8.6.4.1 Basic Operation.	144

8.6.4.2 The Flooding Procedure	144
8.6.4.3 Generating a New LSR	144
8.6.4.4 Transmitting an LSR	145
8.6.4.5 Receiving an LSR	145
8.7 Neighbor Finite State Machine (FSM)	146
8.8 FSPF-Backbone	149
8.8.1 FSPF-Backbone overview	149
8.8.2 Multiple Switch Connections	152
8.8.3 FSPF-Backbone Point-to-point Links.	154
8.8.4 FSPF-Backbone Routing Protocol.	154
9 Distributed Services	156
9.1 Basic Model	156
9.2 Distributed Services Framework	156
9.2.1 Goals and Characteristics of the Distributed Services Framework	156
9.2.2 Distributed Service Transport	156
9.2.2.1 Required FC-2 Parameters.	156
9.2.2.2 FC-CT Header Usage	157
9.2.2.3 Frame Distribution	157
9.2.3 Common Characteristics	157
9.2.4 Zoning Considerations.	158
9.2.5 Work Categories	158
9.2.6 Frame Formats	159
9.2.7 FC-CT Command Restrictions.	159
9.3 Distributed Name Server	159
9.3.1 General Behavior.	159
9.3.2 FC-CT for Distributed Name Servers.	160
9.3.2.1 dNS Command Codes	160
9.3.2.2 FC-CT Header usage for dNS	164
9.3.3 Name Server Objects	164
9.3.4 FC-CT requests for dNS	167
9.3.4.1 Remove All	167
9.3.4.2 Get Entry based on Port Identifier	167
9.3.4.3 Get Entry based on Port_Name	168
9.3.4.4 Get Entries based on Node_Name	169
9.3.4.5 Get Entries based on IP address (Node)	169
9.3.4.6 Get Entries based on FC-4 TYPEs	170
9.3.4.7 Get Entries based on Port Type	171
9.3.4.8 Get Entries based on Zone Member	171
9.3.4.9 Get Entries based on Zone Name	172
9.3.4.10 Get Entries based on Port IP Address	173
9.3.4.11 Get Entries based on FC-4 Features	173
9.3.4.12 Get Entries based on Fabric Port_Name	174
9.4 Distributed Management Server.	175
9.4.1 General Behavior.	175
9.4.2 FC-CT Header	175
9.4.2.1 FC-CT Header Parameters.	175
9.4.2.2 FC-CT Header Rule for Fabric Internal Requests	175
9.4.3 Fabric Configuration Service	176
9.4.4 Unzoned Name Service.	178
9.4.5 Fabric Zone Service.	178
9.4.6 Fabric-Device Management Service	178
9.4.6.1 Operational Characteristics of the FDMI Server	178
9.4.6.2 Registration Scenarios	179

9.4.6.2.1 HBA Attached to a Single Switch	179
9.4.6.2.2 HBA Attached to Multiple Switches	179
9.4.6.2.3 Resolution of the Principal HBA Manager	179
9.4.6.3 FDMI Inter-Switch Messages	180
9.4.6.3.1 General Format	180
9.4.6.3.2 FC-CT Header	180
9.4.6.3.3 FDMI Header	180
9.4.6.3.4 Payload.	181
9.4.6.4 FDMI Inter-Switch Requests	181
9.4.6.5 FDMI Inter-Switch Responses	182
9.4.6.5.1 Reject Response	182
9.4.6.5.2 Accept Response	182
9.4.6.6 FDMI Inter-Switch Operations	182
9.4.6.6.1 Registration Notification (FRN) Operation	182
9.4.6.6.2 De-Register Notification (FDRN) Operation	182
9.4.6.6.3 Update Notification (FUN) Operation.	183
9.4.6.6.4 Update Forward (FUF) Operation	183
9.4.6.6.5 De-Register Forward (FDRF) Operation	183
9.4.6.6.6 Fetch	183
9.4.6.7 GS Client Initiated FDMI Requests	184
9.4.7 Other Fabric Internal Services	185
9.4.7.1 Fabric Internal Requests	185
9.4.7.2 Get Management Server Capabilities (GCAP) Operation	186
9.4.7.2.1 Overview	186
9.4.7.2.2 Capability Entry	186
9.4.7.2.3 Subtype Capability Bit Masks	187
10 Switch Zone Exchange and Merge	188
10.1 Overview	188
10.2 Joining Switches.	188
10.3 Enhanced Zoning Support Determination	188
10.4 Zoning Framework and Data Structures	189
10.4.1 Basic Zoning Framework.	189
10.4.2 Basic Zoning Data Structures	193
10.4.2.1 Zoning Object List	193
10.4.2.2 Zoning Object Format	193
10.4.2.3 Name Entry Format	194
10.4.2.4 Zone Member Format	195
10.4.3 Enhanced Zoning Framework	196
10.4.3.1 Introduction	196
10.4.3.2 Zone Set Database	196
10.4.3.3 Active Zone Set	198
10.4.4 Enhanced Zoning Data Structures.	199
10.4.4.1 Zoning Object List	199
10.4.4.2 Zoning Object Types	199
10.4.4.3 Zone Set Object	200
10.4.4.3.1 Zone Set Object in the Zone Set Database.	200
10.4.4.3.2 Zone Set Object in the Active Zone Set	201
10.4.4.4 Zone Reference Object	201
10.4.4.5 Zone Object in the Zone Set Database	202
10.4.4.6 Zone Object in the Active Zone Set	203
10.4.4.6.1 Overview	203
10.4.4.6.2 Zone Member Format.	204
10.4.4.7 Zone Alias Object	205

10.4.4.8 Zone Attribute Object	206
10.4.4.8.1 Overview	206
10.4.4.8.2 Zone Attribute Entry Format	207
10.5 Merge Zone	211
10.5.1 Example Merge Operation.	211
10.5.2 Merge Zone Rules	213
10.5.2.1 Merge Rules in Basic Zoning	213
10.5.2.2 Merge Rules in Enhanced Zoning.	214
10.6 Fabric Management Session Protocol	215
10.6.1 Fabric Management Session Protocol overview	215
10.6.2 Reserving Fabric Change Authorization	216
10.6.3 Staging the Fabric Configuration	216
10.6.4 Updating the Fabric Configuration	217
10.6.5 Releasing Fabric Change Authorization	217
10.6.6 Mapping of a GS Session to a Fabric Session	217
10.6.7 Fabric Behavior to Handle the CT SFEZ Request.	219
11 Distributed broadcast	220
11.1 Overview	220
11.2 Spanning tree	220
11.2.1 Overview	220
11.2.2 Spanning tree example	220
12 Timers and Constants.	222
12.1 General Timers and Constants	222
12.2 SW_ILS Time-Out Values	223
Annex A (informative) Examples of Switch Port Initialization	224
A.1 Overview	224
A.2 Example 1: two E/F/FL_Port-capable Switch Ports	224
A.3 Example 2: two E/F/FL_Port-capable Switch Ports and one Nx_Port	225
A.4 Example 3: one E/F/FL_Port-capable Port and one E/F_Port-capable Port	226
Annex B (informative) ELP Negotiation Example	227
B.1 Overview	227
B.2 ELP Exchange Protocol	227
B.2.1 General	227
B.2.2 ELP Exchange without Parameter Negotiation	227
B.2.3 ELP Exchange with Parameter Negotiation	228
B.3 Summary of Responses to ELP.	231
Annex C (informative) Fabric Device Management interface-Sample Flows	232
C.1 Overview	232
C.2 Sample Flows	232
C.2.1 HBA Registration - Single Switch	232
C.2.2 HBA Registration - Multiple Switches - Caches Updated	232
C.2.3 HBA Registration - Multiple Switches - Caches Not Updated	233
C.2.4 HBA De-Registration - Primary HBA Manager	235
C.2.5 HBA De-Registration - Non-Primary HBA Manager	236
Bibliography	237

Figures

Figure 1 State Machine Example.	27
Figure 2 Switch Model	31
Figure 3 Multiple Switch Fabric Example.	32
Figure 4 Domain, Area, and Port Address Partitioning	35
Figure 5 F_Port Model	39
Figure 6 FL_Port Model	41
Figure 7 E_Port Model	42
Figure 8 B_Port Model.	43
Figure 9 Principal Inter-Switch Links	45
Figure 10 Class F Frame Format.	47
Figure 11 Switch Port Mode Initialization State Machine.	108
Figure 12 Switch Port Mode Initialization State Machine - Continued	109
Figure 13 Example of Simultaneous ELP Processing- Parameters Acceptable to Both Switches . .	113
Figure 14 ESC Processing.	116
Figure 15 Principal Switch Selection State Machine	118
Figure 16 Example Propagation of BF and RCF SW_ILS requests	120
Figure 17 Address Distribution State Machines	124
Figure 18 RDI Request Processing by Principal Switch	126
Figure 19 RDI Request Processing by non-Principal Switch.	129
Figure 20 Example B_Port Configuration - Virtual ISL.	132
Figure 21 Neighbor Finite State Machine	149
Figure 22 FSPF-Backbone Architecture	150
Figure 23 Point-to-point FSPF-Backbone Links.	151
Figure 24 AR0 Consisting of Two ISW-0 Switching Devices.	151
Figure 25 Internal Service Supported By a BSW.	152
Figure 26 Dual BSW connectivity	153
Figure 27 Physically Contiguous FSPF-Backbone with dual BSWs (Allowed)	153
Figure 28 Physically Non-Contiguous FSPF-Backbone with dual BSWs (Disallowed)	154
Figure 29 FSPF-Backbone Routing Protocol overview.	155
Figure 30 Basic Zoning Framework.	190
Figure 31 Basic Zoning Hierarchy	192
Figure 32 Basic Zoning Object Structure.	192
Figure 33 Logical Structure of the Zone Set Database	197
Figure 34 Logical Structure of the Active Zone Set	198
Figure 35 Merge Operation Between Two Switches	211
Figure 36 Merge Operation Among Several Switches	213
Figure 37 Broadcast path selection example.	221
Annex Figure A.1 Initialization example 1	224
Annex Figure A.2 Initialization example 2	225
Annex Figure A.3 Initialization example 3	226
Annex Figure B.1 Reference ELP Configuration	227
Annex Figure B.2 A Successful and Complete ELP Exchange	228
Annex Figure B.3 An Unsuccessful but Complete ELP Exchange	228
Annex Figure B.4 A successful ELP Exchange Protocol Parameter Negotiation	229
Annex Figure B.5 An Unsuccessful ELP Exchange Protocol Parameter Negotiation	230
Annex Figure C.1 Registration of HBA Information - Single Switch.	232
Annex Figure C.2 Registration of HBA Information - Multiple Switches Caches Updated.	233
Annex Figure C.3 Registration of HBA Information - Multiple Switches Caches Not Updated	234
Annex Figure C.4 HBA De-Registration - Primary HBA Manager	235
Annex Figure C.5 HBA De-Registration - Non-Primary HBA Manager	236

Tables

Table 1 ISO and American Conventions	26
Table 2 Address Identifier Values	36
Table 3 SW_ILS Command Codes	49
Table 4 SW_RJT Payload	51
Table 5 SW_RJT Reason Codes	52
Table 6 SW_RJT Reason Code Explanation	53
Table 7 ELP Request Payload	55
Table 8 Interconnect_Port Class F Service Parameters	56
Table 9 Class 1 Interconnect_Port Parameters	57
Table 10 Class 2 Interconnect_Port Parameters	58
Table 11 Class 3 Interconnect_Port Parameters	58
Table 12 ISL Flow Control Mode Values	59
Table 13 Flow Control Parameters	59
Table 14 ELP Accept Payload	60
Table 15 EFP Request Payload	61
Table 16 Switch_Priority Field Values	62
Table 17 Domain_ID_List Record Format	62
Table 18 Record_Type Field Values	63
Table 19 Multicast_ID_List Record Format	63
Table 20 EFP Accept Payload	64
Table 21 DIA Request Payload	65
Table 22 DIA Accept Payload	65
Table 23 RDI Request Payload	66
Table 24 RDI Accept Payload	67
Table 25 HLO Request Payload	68
Table 26 FSPF Header	69
Table 27 FSPF Command Codes	69
Table 28 LSU Request Payload	70
Table 29 Flags Field Bit Map	71
Table 30 Link State Record - Link Descriptor Format	71
Table 31 Link State Record - Summary Descriptor Format	72
Table 32 Link State Header Format	72
Table 33 Link State Record Type Field Values	73
Table 34 Link Descriptor Format	74
Table 35 Link Type Values	74
Table 36 Summary Descriptor Format	75
Table 37 LSA Request Payload	76
Table 38 BF Request Payload	77
Table 39 BF Accept Payload	77
Table 40 RCF Request Payload	78
Table 41 RCF Accept Payload	78
Table 42 SW_RSCN Request Payload	79
Table 43 Device Entry Format	80
Table 44 SW_RSCN Accept Payload	81
Table 45 DRLIR Request Payload	81
Table 46 DRLIR Accept Payload	82
Table 47 DSCN Request Payload	82
Table 48 DSCN Reason Codes	83
Table 49 DSCN Accept Payload	83
Table 50 Merge Request Payload	84
Table 51 Protocol Version Values	84
Table 52 Basic Zoning Payload	85

Table 53 Enhanced Zoning Payload	86
Table 54 Merge Request Accept Payload	87
Table 55 ACA Request Payload	88
Table 56 Acquire Change Authorization Accept Payload	89
Table 57 RCA Request Payload	89
Table 58 Release Change Authorization Accept Payload	90
Table 59 SFC Request Payload	91
Table 60 Operation Request Value	91
Table 61 Stage Fabric Configuration Update Accept Payload.	92
Table 62 Payload for Operation Request Values 03 and 04	92
Table 63 Payload for Operation Request 'Activate Zone Set Enhanced'	93
Table 64 Payload for Operation Request 'Deactivate Zone Set Enhanced'	93
Table 65 Payload for Operation Request 'Distribute Zone Set Database'.	94
Table 66 Payload for Operation Request 'Activate Zone Set by Name'	94
Table 67 Payload for Operation Request 'Set Zoning Policies'	95
Table 68 Update Fabric Configuration Request Payload.	96
Table 69 Update Fabric Configuration Accept Payload	96
Table 70 ESC Request Payload	97
Table 71 Protocol Descriptor Format.	97
Table 72 Protocol ID Values	98
Table 73 ESC Accept Payload.	98
Table 74 ESS Request Payload	99
Table 75 Capability Object Format	100
Table 76 Name Server Capability Flags	101
Table 77 Fabric Controller Capability Flags.	101
Table 78 Fabric Configuration Server Capability flags.	102
Table 79 Enhanced Zone Server Capability flags	102
Table 80 Vendor Specific Capability Object.	103
Table 81 ESS Accept Payload.	104
Table 82 MRRA Request Payload	105
Table 83 Vendor Specific Field	105
Table 84 MRRA Response Payload	106
Table 85 MRRA Response Values	106
Table 86 Fabric Configuration Summary	107
Table 87 Responses to ELP Request for Originating Interconnect_Port.	111
Table 88 Recommended BF and RCF Usage Summary.	117
Table 89 B_Port - ILS Support.	131
Table 90 Bridge Port Initialization Summary	132
Table 91 Path Selection (FSPF) Operation Summary.	134
Table 92 Checksum Byte Order Calculation	140
Table 93 Neighbor Finite State Machine	147
Table 94 FC-CT Command Codes for DNS.	160
Table 95 Name Server Entry Object	164
Table 96 FC-4 Descriptor Format for Name Server Object	165
Table 97 Entry Object Format Indicator.	166
Table 98 Name Server Entry Object Description	166
Table 99 RA request payload	167
Table 100 RA Accept payload	167
Table 101 GE_ID request payload.	167
Table 102 GE_ID Accept payload	168
Table 103 GE_PN request payload	168
Table 104 GE_PN Accept payload	168
Table 105 GE_NN request payload	169
Table 106 GE_NN Accept payload	169

Table 107 GE_IP request payload	169
Table 108 GE_IP Accept payload	170
Table 109 GE_FT request payload	170
Table 110 GE_FT Accept payload	170
Table 111 GE_PT request payload	171
Table 112 GE_PT Accept payload	171
Table 113 GE_ZM request payload	171
Table 114 GE_ZM Accept payload	172
Table 115 GE_ZN request payload	172
Table 116 GE_ZN Accept payload	172
Table 117 GE_IPP request payload	173
Table 118 GE_IPP Accept payload	173
Table 119 GE_FF request payload	173
Table 120 GE_FF Accept payload	174
Table 121 GE_FPN request payload	174
Table 122 GE_FPN Accept payload	174
Table 123 Fabric Configuration Service Command Codes for dMS	176
Table 124 FDMI Inter-Switch Message	180
Table 125 FDMI Header	180
Table 126 Vendor Specified	181
Table 127 FDMI Fabric Internal Command Codes	181
Table 128 Reason Code Explanation	182
Table 129 Registered HBA/Port List	183
Table 130 HBA Entry	184
Table 131 Port Entry	184
Table 132 Fabric Device Management Interface CT Commands for the dMS	185
Table 133 Fabric Internal Management Server Operations	185
Table 134 GCAP Request Payload	186
Table 135 GCAP CT_ACC Payload	186
Table 136 Capability Entry	186
Table 137 Fabric Configuration Server (CT_Subtype 01h)	187
Table 138 Unzoned Name Server (CT_Subtype 02h)	187
Table 139 Zoning Object List	193
Table 140 Zoning Object	193
Table 141 Zoning Object Types	194
Table 142 Protocol Format	194
Table 143 Zone Member Format	195
Table 144 Zone Member Type and Identifier Formats	195
Table 145 Zoning Object List	199
Table 146 Zoning Object Types	199
Table 147 Zone Set Object Format in the Zone Set Database	200
Table 148 Zone Set Object Format in the Active Zone Set	201
Table 149 Zone Reference Object Format	201
Table 150 Zone Object Format in the Zone Set Database	202
Table 151 Zone Object Format in the Active Zone Set	203
Table 152 Zone Member Format	204
Table 153 Zone Member Type and Identifier Formats	204
Table 154 Zone Member Identifier Format - Vendor Specified	205
Table 155 Zone Alias Object Format	205
Table 156 Zone Attribute Object Format	206
Table 157 Zone Attribute Block Format	206
Table 158 Zone Attribute Entry Format	207
Table 159 Zone Attribute Types	207
Table 160 Protocol Attribute Value	208

Table 161 Vendor Specified Attribute Value	210
Table 162 Basic Zoning Merge Rules	214
Table 163 Enhanced Zoning Merge Rules	215
Table 164 Timers and Constants for FC-SW-3	222
Table 165 SW_ILS Time-Out Values.	223
Annex Table B.1 Responses to an ELP Request Initiator	231

INFORMATION TECHNOLOGY – FIBRE CHANNEL –

Part 133: Fibre Channel Switch Fabric-3 (FC-SW-3)

FOREWORD

- 1) ISO (International Organization for Standardization) and IEC (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. Their preparation is entrusted to technical committees; any ISO and IEC member body interested in the subject dealt with may participate in this preparatory work. International governmental and non-governmental organizations liaising with ISO and IEC also participate in this preparation.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
- 3) 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 and ISO member bodies.
- 4) IEC, ISO and ISO/IEC publications have the form of recommendations for international use and are accepted by IEC 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.
- 5) In order to promote international uniformity, IEC 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 publication and the corresponding national or regional publication should be clearly indicated in the latter.
- 6) ISO and IEC provide no marking procedure to indicate their approval and cannot be rendered responsible for any equipment declared to be in conformity with an ISO/IEC publication.
- 7) All users should ensure that they have the latest edition of this publication.
- 8) 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 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.
- 9) 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.

International Standard ISO/IEC 14165-133 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 14165 series, under the general title *Information technology – Fibre Channel*, 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.

Introduction

This International Standard describes the requirements for an interconnecting Fabric consisting of multiple Fabric Switch elements to support the ISO/IEC Fibre Channel - Framing and Signaling (FC-FS) and ISO/IEC Fibre Channel - Physical Interface (FC-PI) standards.

FC-SW-3 is one of the Fibre Channel family of standards. ISO/IEC FC-GS-4, is a standard related to Generic Fabric Services and is closely tied to FC-SW-3. ISO/IEC FC-BB-2 describes how Fabrics are extended over transports complementary to Fibre Channel. ANSI/INCITS FC-MI-2 and ANSI/INCITS FC-DA describe interoperability profiles that assists in the interoperability of Switches. ISO/IEC FC-AL-2 specifies the arbitrated loop topology. ISO/IEC FC-SP describes the Security requirements and protocols associated with Fibre Channel networks.

FC-SW-3 describes how switches communicate and interact with one another to form a Fabric of switches. Included are Fabric initialization and configuration, routing, server communication, event distribution and repository exchanges (e.g., zoning information).

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.

The International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents as indicated below.

ISO and IEC take no position concerning the evidence, validity and scope of the putative patent rights. The holders of the putative patent rights have assured IEC and ISO that they are willing to negotiate free licences or licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of the putative patent rights are registered with IEC and ISO.

Brocade Communications Systems Inc. has informed IEC and ISO that it has patent applications or granted patents as listed below.

6 765 919, 6 980 525 and 10/780 147

Information may be obtained from:
Brocade Communications Systems, Inc.
1745 Technology Drive
USA - San Jose, CA 95110

Cisco Systems Inc. has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:
Cisco Systems Inc.
170 West Tasman Drive
USA - San Jose, CA 95134

McData Corporation has informed IEC and ISO that it has patent applications or granted patents.

Information may be obtained from:
McData Corporation
11802 Ridge Parkway
USA - Broomfield, Colorado 80021

INFORMATION TECHNOLOGY

Fibre Channel —

Part 133: Fibre Channel Switch Fabric - 3 (FC-SW-3)

1 Scope

This part of ISO/IEC 14165-133 describes the operation and interaction of Fibre Channel Switches.

This part of ISO/IEC 14165-133 includes:

- a) E_Port Operation and Fabric Configuration;
- b) Path selection (FSPF and FSPF-Backbone);
- c) Bridge Port (B_Port) Operation;
- d) distributed server interaction and communication;
- e) exchange of information between Switches to support zoning;
- f) distribution of Event Notifications between Switches.

2 Normative references

The following referenced documents 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.

The provisions of the referenced specifications other than ISO/IEC, IEC, ISO and ITU documents, as identified in this clause, are valid within the context of this International Standard. The reference to such a specification within this International Standard does not give it any further status within ISO or IEC. In particular, it does not give the referenced specification the status of an International Standard.

ISO/IEC 14165-122, *Information technology - Fibre channel - Part 122: Arbitrated loop-2 (FC-AL-2)*

ISO/IEC 14165-241, *Information technology - Fibre channel - Part 241: Backbone-2 (FC-BB-2)*

ISO/IEC 14165-251, *Information technology - Fibre channel - Part 251: Framing and signalling (FC-FS)*

ISO/IEC 14165-414, *Information technology - Fibre channel - Part 414: Generic services-4 (FC-GS-4)*

Copies of the following approved IETF standards may be obtained through the Internet Engineering Task Force (IETF) at www.ietf.org.

RFC 905, *ISO Transport Protocol Specification, ISO DP 8073*, April 1984.

RFC 1008, *Implementation Guide for the ISO Transport Protocol*, June 1987.