draft proposed American National Standard
for Information Technology—

Fibre Channel —
Switch Fabric - 6 (FC-SW-6)

1 Scope

This American National Standard for FC-SW-6 describes the operation and interaction of Fibre Channel Switches.

This standard includes:

a) E_Port Operation and Fabric Configuration;

b) Path selection (FSPF);

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;

g) Virtual Fabrics Switch Support;

h) Enhanced Commit Service;

i) Virtual Channels; and

j) Distributed Switch Mmodel.

2 Normative references

2.1 Overview

The following standards contain provisions that, through reference in the text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

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Additional availability contact information is provided below as needed.

2.2   Approved references

[1]   ANSI/INCITS 332-1999, *Fibre Channel - Second Generation Arbitrated Loop - 2 (FC-AL-2)*

[2]   INCITS TR-48-2012, *Fibre Channel - Methodologies for Interconnects - 3 (FC-MI-3)*

[3]   ANSI/INCITS 479-2011, *Fibre Channel - Physical Interface - 5 (FC-PI-5)*

[4]   ANSI/INCITS 470-2011, Fibre Channel - *Framing and Signaling - 3* (FC-FS-3)

[5]   ANSI INCITS 463:2010, *Fibre Channel - Generic Services - 6 (FC-GS-6)*

[6]   INCITS TR-49-2012, *Fibre Channel - Device Attach - 2 (FC-DA-2)*

[7]   ANSI/INCITS 462-2010, *Fibre Channel - Backbone - 5 (FC-BB-5)*

[8]   ANSI/INCITS 477-2011, *Fibre Channel - Link Services - 2 (FC-LS-2)*

[9]   ANSI/INCITS 466-2011, *Fibre Channel - Single Byte Command Set- 4(FC-SB-4)*

[10] ANSI/INCITS 426-2007 *Fibre Channel - Security Protocols (FC-SP)*

[11] ANSI/INCITS 475-2011, *Fibre Channel - Inter-Fabric Routing* (FC-IFR)

2.3   References under development

At the time of publication, the following referenced Standards were still under development. For information on the current status of the document, or regarding availability, contact the relevant Standards body or other organization as indicated.

> NOTE 1 – For more information on the current status of a document, contact the INCITS Secretariat at the address listed in the front matter. To obtain copies of this document, contact Global Engineering at the address listed in the front matter, or the INCITS Secretariat.

[12] ANSI/INCITS.487-201y, *Fibre Channel - Link Services - 3 (FC-LS-3),* T11/Project 2237D/Rev 2

[13] ANSI/INCITS.xxx-201y, *Fibre Channel - Generic Services - 7 (FC-GS-7)*, T11/Project 2204D/Rev 1.0

[14] ANSI/INCITS.xxx-201y, *Fibre Channel - Security Protocols - 2 (FC-SP-2)*, T11/Project 1835D/Rev 2.7

[15] ANSI/INCITS 488-201y, *Fibre Channel - Framing and Signaling - 4* (FC-FS-4), T11/Project 2238D/Rev 1.0

[16] ANSI/INCITS 485-201y, *Fibre Channel - Single Byte Commend Sets - 5* (FC-SB-5), T11/Project 2245D/Rev 1.0

[17] ANSI INCITS xxx-201y, *Fibre Channel - Backbone- 6* (FC-BB-6), T11/Project 2159D, Rev 1.04

[18] ANSI/INCITS xxx-201y, *Fibre Channel - Physical Interface - 6 (FC-PI-6),* T11 Project 2221D, Rev 1.0

2.4   IETF references

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.

RFC 4936, *Fibre Channel Zone Server MIB,* August 2007.

3   Definitions and conventions

For FC-SW-6, the following definitions, conventions, abbreviations, acronyms, and symbols apply.

3.1   Definitions

3.1.1   Active Zone Set: The Active Zone Set is the Zone Set Definition currently in effect and enforced by the Fabric or other entity (e.g., the Name Server).

3.1.2   Address assignment: A process whereby addresses are dispensed to Switches and Switch Ports.

3.1.3   Address identifier: As defined in FC-FS-3, an unsigned 24-bit address value used to uniquely identify the source (S_ID) and destination (D_ID) of Fibre Channel frames.

3.1.4   Address Manager: A logical entity within a Switch that is responsible for address assignment.

3.1.5   Adjacent Switch: A remote Switch that does not require intermediate Switches in order to be reached.

3.1.6   Adjacency: A relationship between two Switches that have synchronized their topology databases.

3.1.7   Adjacent: Two Switches that have synchronized their topology databases are considered Adjacent.

3.1.8   AISL (Augmented ISL): E_Port to E_Port link between two Controlling Switches (see 17).

3.1.9   AISL_Set: The set of AISLs between the Primary Controlling Switch and the Secondary Controlling Switch that connect the two Controlling Switches that are part of a Distributed Switch.

3.1.10   A_Port (Adjacent Port): The combination of one PA_Port and one VA_Port operating together.

3.1.11   ASL (A_Port Switch Link): An A_Port to A_Port link.

3.1.12   Area: The second level in the three-level address partitioning system specified by this standard (see 4.8).

3.1.13   Area Identifier: Bits 15 through 8 of an address identifier.

3.1.14   Broadcast Address: An FFFFFFh value in the D_ID field shall specify that the frame be broadcast to all Nx_Ports.

3.1.15   Broadcast Zone: A zone with the Broadcast attribute specified.

3.1.16   Broadcast Zoning Enforcement: Zoning technique where the Fabric limits broadcast distribution among zone members using frame-by-frame filtering techniques.

3.1.17   B_Port: A Bridge Port is a Fabric inter-element port used to connect Bridge devices with E_Ports on a Switch. The B_Port provides a subset of the E_port functionality.

3.1.18   Class F service: A service that multiplexes frames at frame boundaries and is used for control and coordination of the internal behavior of the Fabric.

3.1.19   Class N service: Refers to any class of service other than Class F.

3.1.20   Controlling Switch: A Switch that is able to control a set of FCDFs in order to create a Distributed Switch.

3.1.21   Controlling Switch Set: The Switch_Names of the ~~up to two~~ Controlling Switches that are part of a Distributed Switch.

3.1.22   Core Switch: A set of entities with the same Core Switch_Name that may host multiple Virtual Switches. A Core Switch may be a set of ports in a physical chassis, or in multiple physical chassis.

3.1.23   Core Switch_Name: In a Virtual Fabric capable Switch, the Switch_Name identifying the Core Switch (see 12.2).

3.1.24   Distributed Switch: A set of FCDFs associated with at least one Controlling Switch~~,~~ that controls the operations of the set of FCDFs.

3.1.25   Domain: The highest level in the three-level address partitioning system specified by this standard (see 4.8).

3.1.26   Domain Address Manager: A Switch that is responsible for address assignment to other Switches outside of its Domain.

3.1.27   Domain Identifier: Bits 23 through 16 of an address identifier.

3.1.28   Domain_ID_List: A list where each record contains a Domain_ID value and the Switch_Name of the Switch assigned the Domain_ID (see 6.1.5).

3.1.29   Downstream Principal ISL: From the point of view of the local Switch, the downstream Principal ISL is the Principal ISL to which frames may be sent from the Principal Switch to the destination Switch. All Principal ISLs on the Principal Switch are downstream Principal ISLs. A Switch that is not the Principal Switch may have zero or more downstream Principal ISLs.

3.1.30   Distributed Service: An implementation of a Generic Service operating at a well-known address (see FC-GS-6).

3.1.31   Distributed Services Time-Out Value (D_S_TOV): A value that indicates the maximum time that a distributed service requestor shall wait for a response.

3.1.32   Domain_ID Overlap: During Fabric configuration, a condition in which the Domain_ID List of a Switch and the Domain_ID List of a received EFP (see 7.3) are both non-null and have records that associate the same Domain_ID to different Switch_Names.

3.1.33   Entry Switch: A role that a Switch assumes with respect to a distributed service request. The Switch that is attached to an Nx_Port making a service request assumes the role of an Entry Switch with respect to that request.

3.1.34   E_Port: A Fabric "Expansion" Port that attaches to another Interconnect_Port to create an Inter-Switch Link. An E_Port is the combination of one PE_Port and one VE_Port operating together.

3.1.35 E_Port Index: An index value associated with an E_Port used by the Fabric Shortest Path First Protocol.

3.1.36 Error_Detect_Timeout ~~v~~Value (E_D_TOV): A time constant defined in FC-FS-3.

3.1.37 F_Port: The combination of one PF_Port and one VF_Port operating together.

3.1.38 Fabric: As defined in FC-FS-3 an entity that interconnects various Nx_Ports attached to it, and is capable of routing frames using only the D_ID information in an FC-2 frame header.

3.1.39 Fabric Controller: The logical entity responsible for operation of the Fabric identified by the well-known address FFFFFDh.

3.1.40 Fabric Element: The smallest unit of a Fabric that meets the definition of a Fabric. From the point of view of an attached Nx_Port, a Fabric consisting of multiple Fabric Elements is indistinguishable from a Fabric consisting of a single Fabric Element.

3.1.41 FCDF (FC Data-Plane Forwarder): A simplified FC switching entity that forwards FC frames among VA_Ports and VF_Ports through a FCDF Switching Element (see 17.3).

3.1.42 FCDF_-Set: The Switch_Names of the FCDFs that are part of a Distributed Switch.

3.1.43 F_Port Controller: The entity at the well-known address FFFFFEh.

3.1.44 Flood: To cause information to be sent to all Switches within the Fabric.

3.1.45 FL_Port: An L_Port that is able to perform the function of an F_Port, attached via a link to one or more NL_Ports in an Arbitrated Loop topology (see FC-AL-2). The AL_PA of an FL_Port is 00h. In this Standard, an FL_Port is assumed to always refer to a port to which NL_Ports are attached to a Fabric, and does not include F_Ports.

3.1.46 Fx_Port: A Switch Port capable of operating as an F_Port or FL_Port.

3.1.47 Fabric_Stability_Timeout value (F_S_TOV): A time constant used to ensure that Fabric stability has been achieved during Fabric Configuration.

3.1.48 Fabric Shortest Path First (FSPF): The link state protocol used for Path Selection.

3.1.49 G_Port: A generic Fabric Port that may function either as an E_Port, or as an F_Port.

3.1.50 GL_Port: A generic Fabric Port that may function either as an E_Port, or as an Fx_Port.

3.1.51 Hard Zone: A zone with the Hard Zone attribute specified.

3.1.52 Hard Zoning Enforcement: Zoning technique in which the Fabric limits frame exchange by frame-by-frame filtering.

3.1.53 Interconnect_Port: A generic reference to an E_Port or a B_Port.

3.1.54 Inter-Switch Link (ISL): A Link directly connecting the E_Port of one Switch to the E_Port of another Switch.

3.1.55 Isolated: A condition in which it has been determined that no Class N traffic may be transmitted across an ISL (see 7.6).

3.1.56 L_Port: An FC_Port that contains Arbitrated Loop functions associated with the Arbitrated Loop topology.

3.1.57 Link Descriptor: Contains information about an Inter-Switch Link including link type, the Domain_ID of the remote Switch it is connected to, the local and remote Port IDs, and the cost of the link itself.

3.1.58 Link State Record: A collection of Link Descriptors that completely describes the connectivity of a Switch to all Switches to which it is directly attached.

3.1.59 Locally-Enabled VF_ID List: the configured list of VF_IDs that an FC_Port supporting Virtual Fabrics is able to enable on a link.

3.1.60 Link: As defined in FC-FS-3.

3.1.61 Loop Fabric Address (LFA): An address identifier used to address an FL_Port (see table 1) for the purpose of loop management (see FC-LS).

3.1.62 Multiplexer: An instance of the FC-2M sublevel, multiplexing and demultiplexing frames between physical and virtual ports based on the D_ID/S_ID and/or VF_ID (see FC-FS-3).

3.1.63 N_Port: As defined in FC-FS-3, an N_Port is assumed to always refer to an Nx_Port in a direct Fabric-attached PN_Port, and does not include NL_Ports.

3.1.64 N_Port Identifier: An address identifier assigned to an N_Port.

3.1.65 Name_Identifier: As defined in FC-FS-3, a 64-bit identifier.

3.1.66 NL_Port: An Nx_Port in a PN_Port that is operating a Loop Port State machine (see FC-AL_2). It may be attached via a link to one or more NL_Ports and zero or more FL_Ports in an Arbitrated Loop topology. In this Standard, an NL_Port is assumed to always refer to a loop-attached port, and does not include N_Ports.

3.1.67 Non-zero Domain_ID_List: A Domain_ID_List that contains at least one record (see 7.3).

3.1.68 Nx_Port: An end point for Fibre Channel frame communication (see FC-FS-3).

3.1.69 PA_Port (Physical A_Port): The LCF within the Fabric that attaches to another PA_Port through a link.

3.1.70 Path: A route through the Fabric between a source and a destination.

3.1.71 Path Selection: A process whereby paths are selected.

3.1.72 PE_Port (Physical E_Port): The LCF within the Fabric that attaches to another PE_Port or to a B_Port through a link.

3.1.73 PF_Port (Physical F_Port): the LCF within the Fabric that attaches to a PN_Port (see FC-FS-3) through a link.

3.1.74 PN_Port: An entity not within a topology that includes an LCF and one or more Nx_Ports (see FC-FS-3).

3.1.75   Port: 1. A generic reference to an N_Port, NL_Port, F_Port, FL_Port, B_Port, or E_Port. 2. The lowest level in The lowest level in the three-level address partitioning system specified by this standard (see 4.8).

3.1.76   Port VF_ID: A configurable VF_ID that is associated with any untagged frame received by a VF capable PE_Port or PF_Port.

3.1.77   Point-to-Point Link: A Fibre Channel link connecting two ports.

3.1.78   Port Identifier: Bits 7 through 0 of an address identifier.

3.1.79   Port Index: A three byte value used by FSPF to identify Switch ports.

3.1.80   Port Mode: A generic reference to E_Port, B_Port, F_Port or FL_Port operation.

3.1.81   Preferred Domain_ID: A Domain_ID previously granted to a Switch by the Domain Address Manager or through administrative means.

3.1.82   Principal ISL: An Inter-Switch Link that is used to communicate with the Principal Switch.

3.1.83   Principal Switch: A Switch that has been selected to perform certain Fabric Configuration duties.

3.1.84   Primary Controlling Switch: A Controlling Switch (see 3.1.20) that operates as the primary (see 17.11.2) for a Distributed Switch (see 3.1.24).

3.1.85   Reliable Flood: Flooding where all Switches are guaranteed to receive the flooded message.

3.1.86   Remote Switch: A Switch that may be reached via one or more ISLs. A remote Switch may be adjacent to the local Switch, or may reached via one or more intermediate Switches.

3.1.87   Resource_Allocation_Timeout value (R_A_TOV): A time constant defined in FC-FS-3.

3.1.88   Router: An entity within a Switch responsible for the routing of connectionless frames.

3.1.89   Routing: A process whereby the appropriate Switch Port(s) to deliver a connectionless frame towards its destination is identified.

3.1.90   Secondary Controlling Switch: A Controlling Switch (see 3.1.20) that operates as the secondary (see 17.11.2) for a Distributed Switch (see 3.1.24).

3.1.91   Soft Zoning Enforcement: Zoning technique in which the Fabric enforces membership through name server visibility.

3.1.92   Switch: 1. A Fabric Element conforming to this Standard. 2. A member of the Fabric collective.

3.1.93   Switch Construct: An entity within a Switch responsible for transporting frames between Switch Ports.

3.1.94   Switching Element: The set of functions performed by the Path Selector, The Router, The Switch Construct, the Address Manager and the Fabric Controller.

3.1.95   Switch_Name: A Name_Identifier that identifies a Switch or a Bridge device. The format of the name is specified in FC-FS-3. Each Switch and Bridge device shall provide a unique Switch_Name within the Fabric.

3.1.96   Switch Port: An E_Port, F_Port, or FL_Port.

3.1.97   Switch_Priority: A value used during Principal Switch selection to cause one Switch to be favored over another.

3.1.98   T10 Vendor ID: A character string that uniquely identifies a vendor.

3.1.99   Topology: The communication infrastructure that provides Fibre Channel communication among a set of PN_Ports (e.g., a Fabric, an Arbitrated Loop, or a combination of the two).

3.1.100   Upstream Principal ISL: From the point of view of the local Switch, the upstream Principal ISL is the Principal ISL to which frames may be sent from the local Switch to the Principal Switch. A Switch that is not the Principal Switch always has exactly one upstream Principal ISL. The Principal Switch does not have an upstream Principal ISL.

3.1.101   VA_Port (Virtual A_Port): An instance of the FC-2V sublevel of Fibre Channel that connects to another VA_Port.

3.1.102   Virtual Fabric: An interconnected set of Virtual Switches and/or Switches identified by a Virtual Fabric ID (VF_ID).

3.1.103   Virtual Fabric Tagging Header (VFT_Header): as defined in FC-FS-3.

3.1.104   VE_Port (Virtual E_Port): An instance of the FC-2V sublevel that connects to another VE_Port or to a B_Port to create an Inter-Switch Link. A VE_Port is addressable by the VE_Port or B_Port connected to it through the Fabric Controller well-known address identifier (i.e., FF FF FD).

3.1.105   VF_Port (Virtual F_Port): An instance of the FC-2V sublevel that connects to one or more VN_Ports (see FC-FS-3). A VF_Port is addressable by a VN_Port connected to it through the F_Port Controller well-known address identifier (i.e., FF FF FE).

3.1.106   Zero Domain_ID_List: A Domain_ID_List that is empty (see 7.3).

3.1.107   Zone: A group of Zone Members. Members of a Zone are made aware of each other, but not made aware of Zone Members outside the Zone.

3.1.108   Zone Definition: The parameters that define a Zone.

3.1.109   Zone Member: The specification of a device to be included in a Zone.

3.1.110   Zone Member Definition: The parameters that define a Zone Member including the Zone Member Type and Zone Member Information.

3.1.111   Zone Name: The name assigned to a Zone.

3.1.112   Zone Set: A set of Zones that are used in combination.

3.1.113   Zone Set Database: The database that contains the Zone Sets not enforced by the Fabric.

3.1.114   Zone Set Name: The name assigned to a Zone Set.

3.1.115   Zone Set State: The state of a Switch Zone Set (*Activated* or *Deactivated*).

3.1.116   Zoning Configuration: A set of Zoning data including the Zone Set state, and Zone definitions.

3.1.117   Zoning Database: A generic term used to indicate both the Active Zone Set and the Zone Set Database.

3.2   Editorial conventions

In FC-SW-6, a number of conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., Exchange, Sequence). Any lowercase uses of these words have the normal technical English meanings.

Lists sequenced by letters (e.g., a-red, b-blue, c-green) show no ordering relationship between the listed items. Numbered lists (e.g., 1-red, 2-blue, 3-green) show an ordering relationship between the listed items.

In case of any conflict between figure, table, and text, the text, then tables, and finally figures take precedence. Exceptions to this convention are indicated in the appropriate clauses.

In all of the figures, tables, and text of this document, the most significant bit of a binary quantity is shown on the left side. Exceptions to this convention are indicated in the appropriate clauses.

Data structures in this standard are displayed in Fibre Channel format (i.e., "big-endian"), while specifications originating in IEEE and IETF may display data structures in Ethernet format (i.e., "little-endian").

When the value of the bit or field is not relevant, x or xx appears in place of a specific value. If a field or a control bit in a frame is specified as not meaningful, the entity that receives the frame shall not check that field or control bit.

Numbers that are not immediately followed by lower-case b or h are decimal values.

Numbers immediately followed by lower-case b (xxb) are binary values.

Numbers or upper case letters immediately followed by lower-case h (xxh) are hexadecimal values.

3.3 State Machine notation

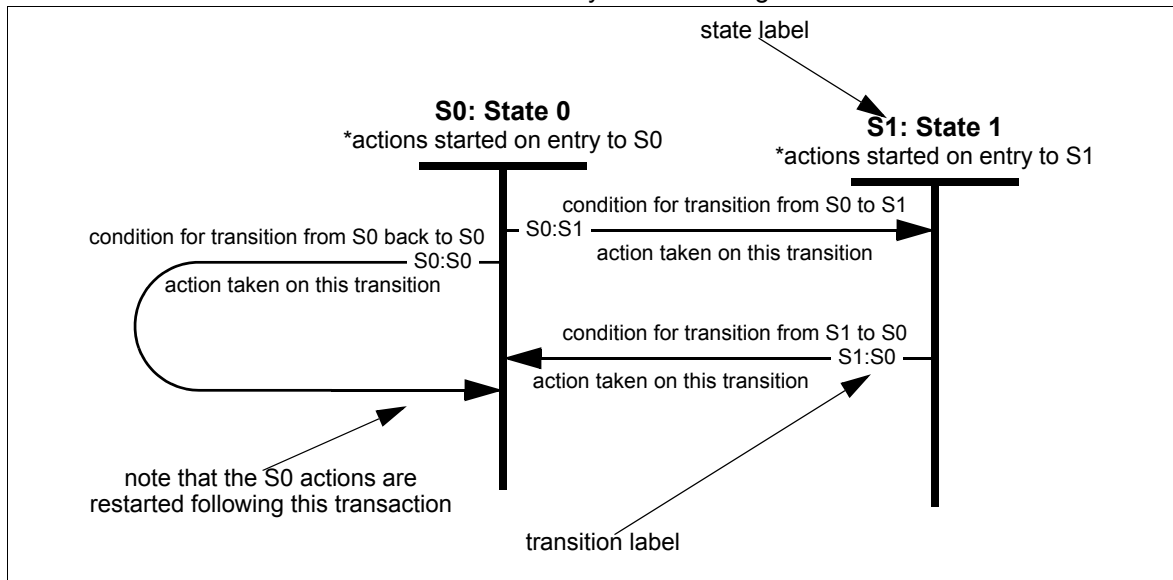State machines in this standard should use the style shown in figure 1.

Figure 1 – Sample State Machine

These state machines make three assumptions:

a) Time elapses only within discrete states.

b) State transitions are logically instantaneous, so the only actions taken during a transition are setting flags and variables and sending signals. These actions complete before the next state is entered.

c) Every time a state is entered, the actions of that state are started. Note that this means that a transition that points back to the same state repeats the actions from the beginning. All the actions started upon entry complete before any tests are made to exit the state.

3.4 Abbreviations, acronyms, and symbols

Abbreviations and acronyms applicable to this International Standard are listed below. Definitions of several of these items are included in 3.1. Abbreviations used that are not listed below are defined in FC-FS-3.

Area_ID	Area Identifier
CT	Common Transport
Domain_ID	Domain Identifier
DS_ILS	Distributed Switch Internal Link Service
DS_RJT	Distributed Switch Link Service Reject
D_S_TOV	Distributed_Services_Timeout Value
E_D_TOV	Error_Detect_Timeout Value
ELS	Extended Link Service
FAN	Fabric Address Notification Extended Link Service
FSM	Finite State Machine
FC-AL-2	Fibre Channel Arbitrated Loop-2, reference [1]

FC-BB-5	Fibre Channel Backbone-5, reference [7]
FC-BB-6	Fibre Channel Backbone-6, reference [17]
FC-DA-2	Fibre Channel- Device Attach-2, reference [6]
FC-FS-3	Fibre Channel - Framing and Signaling - 3, reference [4]
FC-FS-4	Fibre Channel - Framing and Signaling - 4, reference [15]
FC-GS-6	Fibre Channel - Generic Services-6, reference [5]
FC-GS-7	Fibre Channel - Generic Services-7, reference [13]
FC-IFR	Fibre Channel - Inter-Fabric Routing, reference [11]
FC-LS-2	Fibre Channel - Link Services-2, reference [8]
FC-LS-3	Fibre Channel - Link Services-3, reference [12]
FC-MI-3	Fibre Channel - Methodologies for Interconnects -3, reference [2]
FC-PI-5	Fibre Channel -Physical Interface - 5, reference [3]
FC-SB-4	Fibre Channel - Single Byte Command Sets - 4 reference [9]
FC-SB-5	Fibre Channel - Single Byte Command Sets - 5 reference [16]
FC-SP	Fibre Channel - Security Protocols reference [10]
FC-SP-2	Fibre Channel - Security Protocols - 2 reference [14]
F_S_TOV	Fabric_Stability_Timeout value
FDMI	Fabric Device Management Interface
FSPF	Fabric Shortest Path First
ISL	Inter-Switch Link
IU	Information Unit
LCF	Link Control Facility
LFA	Loop Fabric Address
LSR	Link State Record
R	Reserved
R_A_TOV	Resource_Allocation_Timeout value
RFC	Request For Comment
SM	State Machine
SW_ACC	Switch Fabric Link Service Accept
SW_ILS	Switch Internal Link Service
SWN	Switch Name
SWP	Switch Priority
SW_RJT	Switch Fabric Link Service Reject
VF_ID	Virtual Fabric Identifier
WKA	Well-Known Address
WWN	World Wide Name
1xAL_TIME	One times the AL_TIME
1xF_S_TOV	One times the F_S_TOV
2xAL_TIME	Two times the AL_TIME
2xF_S_TOV	Two times the F_S_TOV
3xAL_TIME	Three times the AL_TIME
=	Is equal to

3.5 Definition of Compliance Terms

The usual definitions of the following terms do not apply in this standard and therefore they are defined below:

Prohibited: If a feature or parameter value is Prohibited, it means that it shall not be used between compliant implementations.

Required: If a feature or parameter value is Required, it means that it shall be used between compliant implementations.

Allowed: If a feature or parameter value is Allowed, it means that it may be used between compliant implementations.

3.6   Keywords

3.6.1   ignored: A keyword used to describe an unused bit, byte, word, field or code value. The contents or value of an ignored bit, byte, word, field or code value shall not be examined by the receiving device and may be set to any value by the transmitting device.

3.6.2   invalid: A keyword used to describe an illegal or unsupported bit, byte, word, field or code value. Receipt of an invalid bit, byte, word, field or code value shall be reported as an error.

3.6.3   mandatory: A keyword indicating an item that is required to be implemented as defined in this standard.

3.6.4   may: A keyword that indicates flexibility of choice with no implied preference (equivalent to "may or may not").

3.6.5   may not: A keyword that indicates flexibility of choice with no implied preference (equivalent to "may or may not").

3.6.6   obsolete: A keyword indicating that an item was defined in prior Fibre Channel standards but has been removed from this standard.

3.6.7   optional: A keyword that describes features that are not required to be implemented by this standard. However, if any optional feature defined by this standards is implemented, then it shall be implemented as defined in this standard.

3.6.8   reserved: A keyword referring to bits, bytes, words, fields and code values that are set aside for future standardization. A reserved bit, byte, word or field shall be set to zero, or in accordance with a future extension to this standard. Recipients are not required to check reserved bits, bytes, words or fields for zero values. Receipt of reserved code values in defined fields shall be reported as error.

3.6.9   restricted: A keyword referring to bits, bytes, words, and fields that are set aside for use in other Fibre Channel standards. A restricted bit, byte, word, or field shall be treated as a reserved bit, byte, word or field for the purposes of the requirements defined in this standard.

3.6.10   shall: A keyword indicating a mandatory requirement. Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this standard.

3.6.11   should: A keyword indicating flexibility of choice with a strongly preferred alternative; equivalent to the phrase "it is strongly recommended.

3.7   T10 Vendor ID Fields

A T10 Vendor ID shall be a string of one to eight characters that is recorded in an informal list of Vendor IDs maintained by INCITS Technical Committee T10 (see http://www.t10.org).

A field described as containing a T10 Vendor ID shall contain the first character of the T10 Vendor ID in the highest order byte of the field, and successive characters of the T10 Vendor ID in successively lower order bytes of the field. Any bytes of the field not filled by characters of the T10 Vendor ID shall be filled with ASCII space characters (20h).