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FIBRE CHANNEL

Simplified Configuration and Management

(FC-SCM)
REV 0.5

INCITS working draft proposed
American National Standard
for Information Technology

2 June 2009

Secretariat: Information Technology Industry Council

NOTE:

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American National Standard
for Information Technology

**Fibre Channel —
Simplified Configuration and Management (FC-SCM)**

Secretariat

Information Technology Industry Council

Approved (not yet approved)

American National Standards Institute, Inc.

Abstract

This standard describes a simplified Fibre Channel configuration and management. The Physical Interface requirements are described in Fibre Channel-Physical Interfaces - 2(FC-PI-2). The Framing and Signaling requirements are described in Fibre Channel-Physical Framing and Signaling - 2 (FC-FS-2). This standard is recommended for new implementations, but does not obsolete the existing Fibre Channel standards.

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Foreword (This Foreword is not part of American National Standard INCITS xxx-200x.)

The Fibre Channel Simplified Configuration and Management (FC-SCM) technical report describes the Fibre Channel requirements for an easy-to-use limited SAN configuration.

This technical report was developed by Task Group T11 of Accredited Standards Committee INCITS during 2007-200x. The technical report approval process started in 200x. This document includes annexes that are informative and are not considered part of the technical report.

Requests for interpretation, suggestions for improvements or addenda, or defect reports are welcome. They should be sent to the INCITS Secretariat, Information Technology Industry Council, 1250 Eye Street, NW, Suite 200, Washington, DC 20005-3922.

This technical report was processed and approved for submittal to ANSI by the International Committee for Information Technology Standards (INCITS). Committee approval of the technical report does not necessarily imply that all committee members voted for approval.

At the time it approved this technical report, INCITS had the following members:

(to be filled in by INCITS)

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Introduction

FC-SCM is one of the Fibre Channel family of documents. This family includes FC-FS, which specifies the Framing and Signalling Interface and FC-PI, which specifies the Physical Interface; i.e., cables, connectors, transceivers.

FC-SCM describes a simplified configuration and management for Fibre Channel. The primary upper layer protocol (called FC-4) used in this document is FCP (Fibre Channel Protocol for SCSI).

Acknowledgements

The technical editor would like to thank the following individuals for their special contributions to this standard (alphabetically):

- tbd

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1 Scope

The scope of this technical report includes all of the elements necessary to provide a small, easily manageable SAN environment. It is the intention of this technical report to provide a SAN environment that can be managed by one part-time person who is not skilled in IT management. This technical report is not oriented toward management of a large SAN by an IT department with SAN management experts. This technical report prohibits or requires some features that are in the referenced ANSI/INCITS standards.

This technical report identifies the mechanisms necessary for a management tool to promote successful management of a SAN by those not skilled in the management of a SAN. An additional objective of this technical report is to simplify implementations and their associated documentation, testing, and support requirements.

This technical report is applicable only to end devices that implement the SCSI-FCP FC-4. Implementations of other FC-4 protocols are not included in the scope of this technical report.

Internal characteristics of conformant implementations are not defined by this technical report. This technical report incorporates features from the standards and technical reports described in clause 2.

2 Normative References

2.1 Normative references

The following standards contain provisions that, by 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.

Copies of the following documents may be obtained from ANSI: approved ANSI standards, approved and draft international and regional standards (ISO, IEC, CEN/CENELEC, ITUT), and approved and draft foreign standards (including BSI, JIS, and DIN). For further information, contact ANSI Customer Service Department at 212-642-4900 (phone), 212-302-1286 (fax) or via the World Wide Web at <http://www.ansi.org>.

Additional availability contact information is provided below as needed.

2.2 Approved references

ASCII: ISO/IEC 646:1991, *Information technology - ISO 7-bit coded character set for information interchange (third edition)*

FC-AL-2: ISO/IEC 14165-122:2005, *Fibre Channel-Arbitrated Loop-2 (FC-AL-2)* [ANSI INCITS 332-1999 (R2004)]

FC-AL-2 AM1: ANSI INCITS 332-1999/AM1-2003, *Fibre Channel-Arbitrated Loop-2 (FC-AL-2) Amendment 1*

FC-FS-2: ANSI INCITS 424-2007, *Fibre Channel — Framing and Signalling, second generation (FC-FS-2)*

FC-GS-5: ANSI INCITS 427-2007, *Fibre Channel — Generic Services, fifth generation (FC-GS-5)*

FC-HBA: ANSI INCITS 386-2004, *Host Bus Adapter Tool Programming Interface (FC-HBA)*

FC-LS: ANSI INCITS 433-2007, *Fibre Channel — Link Services (FC-LS)*

FCP-2: ANSI INCITS 350-2003, *SCSI Fibre Channel Protocol - 2 (FCP-2)*

FCP-3: ANSI INCITS 416-2006, *SCSI Fibre Channel Protocol - 3 (FCP-3)*

FC-SP: ANSI INCITS 426-2007, *Fibre Channel - Security Protocol (FC-SP)*

FC-SW-4: ANSI INCITS 418-2006, *Fibre Channel — Switch Fabric - 4 (FC-SW-4)*

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.

FC-FS-3: ANSI INCITS xxx-200X, *Fibre Channel — Framing and Signalling, third generation (FC-FS-3)*

FC-GS-6: ANSI INCITS xxx-200X, *Fibre Channel — Generic Services, sixth generation (FC-GS-6)*

FC-LS-2: ANSI INCITS xxx-200X, *Fibre Channel — Link Services, second generation (FC-LS-2)*

FCP-4: ANSI INCITS xxx-200x, *SCSI Fibre Channel Protocol - 4(FCP-4)*

FC-SW-5: ANSI INCITS xxx-200X, *Fibre Channel — Switch Fabric - 5 (FC-SW-5)*

FC-SP-2: ANSI INCITS xxx-200X, *Fibre Channel - Security Protocol, second generation (FC-SP-2)*

SM-HBA-2: ANSI INCITS xxx-200X, *Storage Management Host Bus Adapter Application Programming Interface 2nd Generation (SM-HBA-2)*

SPC-4: ANSI INCITS xxx-200x, *SCSI Primary Commands - 4 (SPC-4)*

2.4 Other references

For information on the current status of the listed document(s), or regarding availability, contact the indicated organization.

3 Definitions, symbols, abbreviations, and conventions

3.1 Definitions

3.1.1 Default Zone: As defined in FC-GS-6.

3.1.2 Enhanced FC discovery: An optional method for performing discovery that may be supported by an N_Port compliant with this technical report to determine the 24 bit addresses of Nx_Ports not compliant with this technical report.

3.1.3 FCP_Port LUN discovery: The process used by an N_Port compliant with this technical report to discover the LUNs it can access on a particular target FCP_Port.

3.1.4 HBA: A combination of hardware, hardware-resident firmware, and Host-resident software that provides to a Host:

- a) at least one PN_Port;
- b) at least one VN_Port;
- c) the functions of FC-0, FC-1, FC-2, and FC-3 for the VN_Ports it provides; and
- d) the functions of at least one FC-4 for the VN_Ports it provides.

See FC-GS-6.

3.1.5 Initial FC discovery: The process used by an N_Port compliant with this technical report to determine the 24 bit addresses and World Wide Port Names of target FCP_Ports that are also compliant with this technical report.

3.1.6 RSCN FC discovery: The process used by an N_Port compliant with this technical report to determine the 24 bit addresses and World Wide Port Names of target FCP_Ports that are compliant with this technical report after an RSCN is received.

3.1.7 SCM FC Switch: A Fibre Channel switch that is compliant with clause 9.

3.1.8 SCSI Initiator: An initiator as defined in FCP-4.

3.1.9 SCSI Target: A target as defined in FCP-4.

3.1.10 Name Server Session Begin bit: As defined in FC-LS-2.

3.1.11 Wildcard Zone: A zone that provides any to any connectivity between FC-SCM compliant devices.

3.2 Symbols and abbreviations

3.3 Keywords

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

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

3.3.3 may: A keyword that indicates flexibility of choice with no implied preference.

3.3.4 may not: A keyword that indicates flexibility of choice with no implied preference.

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

3.3.6 option, optional: Keywords that describe features that are not required to be implemented by this standard. However, if any optional feature defined by this standard is implemented, then it shall be implemented as defined in this standard.

3.3.7 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.

3.3.8 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.

3.3.9 should: A keyword indicating flexibility of choice with a strongly preferred alternative.

3.3.10 vendor specific: Something (e.g., a bit, field, code value) that is not defined by this standard. Specification of the referenced item is determined by the device vendor and may be used differently in various implementations.

3.4 Editorial conventions

Certain words and terms used in this standard have a specific meaning beyond the normal English meaning. These words and terms are defined either in the glossary or in the text where they first appear.

Upper case is used when referring to the name of a numeric value defined in this specification or a formal attribute possessed by an entity. When necessary for clarity, names of objects, procedure calls, arguments or discrete states are capitalized or set in bold type.

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

An alphanumeric list (e.g., a, b, c) of items indicate the items in the list are unordered. A numeric list (e.g., 1, 2, 3) of items indicate the items in the list are ordered (i.e., item 1 shall occur or complete before item 2).

In case of any conflict between figures, tables, and text, the text takes precedence. Exceptions to this convention are indicated in the appropriate sections.

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 sections.

In the various ladder diagrams that show a sequence of events, the vertical axis (i.e., up and down the page) shows time from top to bottom.

Notes and examples do not constitute any requirements for implementors.

A binary number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 and 1 immediately followed by a lower-case b (e.g., 0101b). Underscores or spaces may be included in binary number representations to increase readability or delineate field boundaries (e.g., 0 0101 1010b or 0_0101_1010b).

A hexadecimal number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 through 9 and/or the upper-case English letters A through F immediately followed by a lower-case h (e.g., FA23h). Underscores or spaces may be included in hexadecimal number representations to increase readability or delineate field boundaries (e.g., B FD8C FA23h or B_FD8C_FA23h).

A decimal number is represented in this standard by any sequence of digits comprised of only the Arabic numerals 0 through 9 not immediately followed by a lower-case b or lower-case h (e.g., 25).

This standard uses the following convention for representing decimal numbers:

- a) the decimal separator (i.e., separating the integer and fractional portions of the number) is a period;
- b) the thousands separator (i.e., separating groups of three digits in the portion of a number) is a space; and
- c) the thousands separator is used in both the integer and fractional portion of a number.

Table 1 shows some examples of decimal numbers using various conventions.

Table 1 – Numbering Conventions

French	English	This Standard
0,6	0.6	0.6
3,141 592 65	3.14159265	3.141 592 65
1 000	1,000	1 000
1 323 462,95	1,323,462.95	1 323 462.95

When the value of the bit or field is not relevant, x or xx appears in place of a specific value.

3.5 Feature Set table terms, definitions, and abbreviations

3.5.1 Overview

Features that some but not all of the referenced ANSI/INCITS standards require for compliance may not be referenced in this technical report and if those features are implemented they shall not be required for compliant devices to interoperate as defined in this technical report.

There may be some optional features of the referenced ANSI/INCITS standards that are not mutually exclusive, but are prohibited or required for the purpose of this technical report. Each specification of such a prohibited or required feature in this technical report identifies the referenced ANSI/INCITS standards in which the feature is defined.

Features in this technical report are summarized in the form of Feature Set tables. These tables indicate whether the feature is Required, Prohibited, Invocable, or Allowed for compliance with this technical report; or whether a parameter is Required to be a particular value for compliance with this technical report. Features or parameters that are not listed do not affect interoperability of Public or Private NL_Ports. In several tables within this technical report, there are references to notes associated with the table. These notes are normative and are mandatory requirements of this technical report.

3.5.2 Feature Set table terms and definitions

Terms and definitions are used to define usage of reference features or options provided by the applicable standards are described in table 2.

Table 2 – Feature Set table terms and definitions

Term	Definition
Prohibited	A feature that shall not be used between Fibre Channel devices compliant with this technical report. An implementation may use the feature to communicate with another implementation; however, if the feature is implemented it shall not be required for SCM compliant devices to interoperate as defined in this technical report. This technical report does not prohibit the implementation of features, only their use between Fibre Channel devices compliant with this technical report. Use of a prohibited feature may prevent interoperability with Fibre Channel devices complying to this technical report.
Required	A feature or parameter value that shall be used between all Fibre Channel devices compliant with this technical report. Fibre Channel devices compliant with this technical report are required to implement the feature. An implementation may use the feature to communicate with non-compliant implementations. If a Fibre Channel device does not implement a required feature that device may not be interoperable with Fibre Channel devices complying to this technical report.
Allowed	A feature or parameter value that may be used between Fibre Channel devices compliant with this technical report. Fibre Channel devices compliant with this technical report are not required to implement the feature, but if they do, the feature shall be implemented as described in the applicable standard. The potential user of a feature may determine if the recipient supports that feature via a Required discovery process or a minimal response by the recipient.
Invocable	A feature or parameter that is required to be implemented by a device to which a request may be sent, but it is not required to be used by a requesting device.

Editors Note 1 The goal is to remove Prohibited (these features will not be documented) and Allowed from this table.

4 Structure and Concepts

4.1 Interoperability environments

This technical report defines an environment in which a compliant device adheres to a set of behaviors that allow a management tool to simply manage the SAN of which this device is a component, as shown in figure 1. The SAN consists of one or more hosts (e.g., servers), one or more switches, and one or more storage devices. The management tool may reside on one of the hosts or in one of the switches. This technical report presumes that changes in the SAN configuration are performed by a single management tool. If multiple management tools are operating concurrently in a single SAN, coordination of their activities is outside the scope of this technical report.

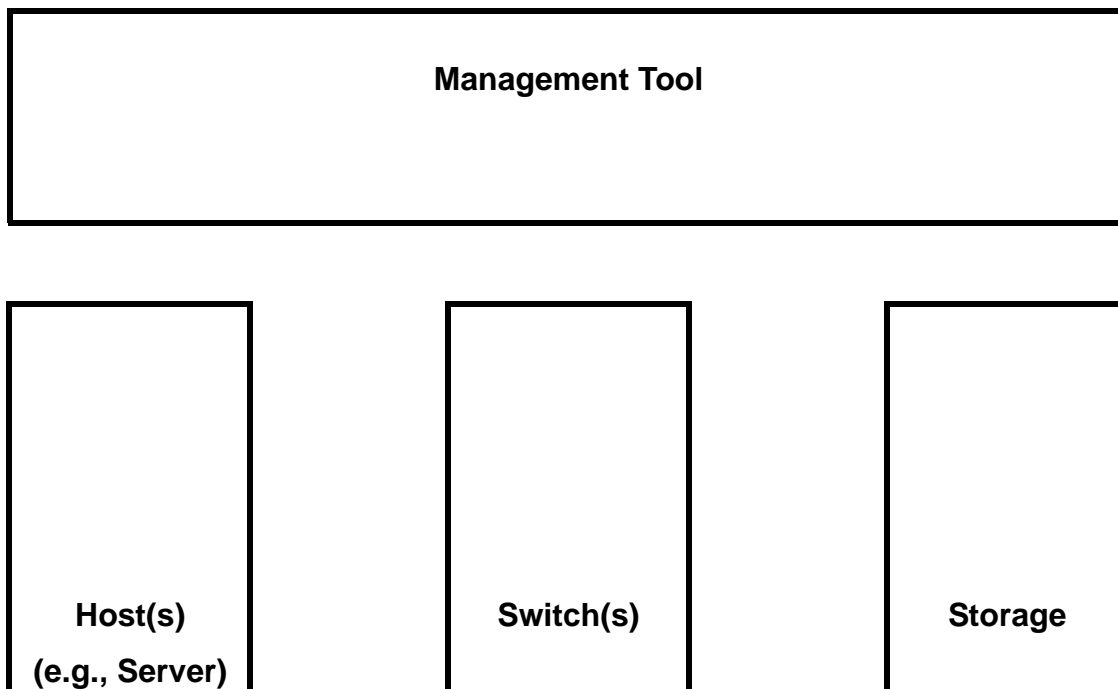


Figure 1 — Interoperability Architecture

This environment encompasses the following areas:

- a) **Management Tool Behavior:** The set of behaviors provided by a host, switch, or storage device that a management tool running locally in that host, switch, or storage device may use to manage a SAN that is composed of devices that are compliant with this technical report;
- b) **Host Behavior:** The set of behaviors required to allow a Host, including a Host Bus Adapter, to be used to manage an FC-SCM environment and be managed in a FC-SCM environment;

- c) **Fabric Behavior:** The set of behaviors required to allow a Fabric to be used to manage an FC-SCM environment and be managed in a FC-SCM environment; and
- d) **Storage Behavior:** The set of behaviors required to allow a Storage device to be managed in a FC-SCM environment.

Management Behavior is interrelated to all other behaviors (e.g., a Fabric is required not only to meet Fabric Behavior but Management Tool Behavior as well, or a Host is required to meet both Host Behavior and Management Tool Behavior).

The scope of this technical report is limited to defining the mechanisms necessary to promote successful management of a SAN by those not skilled in the management of a SAN. An SCM-compliant management tool may be unable to manage a SAN containing devices not compliant with this technical report.

Nx_Ports compliant with this technical report are defined as Simplified Behavior Nx_Ports. Simplified Behavior Nx_Ports shall indicate this by setting to one the Simplified Behavior bit in the FLOGI Common Service parameters (see FC-LS-2) and by registering the FC-4 TYPE DEh and the Simplified Behavior feature bit for FC-4 TYPE DEh in the FC Name Server (see FC-FS-3).

5 Management Tool Requirements

5.1 Overview

The Management Tool defined in this clause is critical to achieving the goals of this technical report. The Management Tool provides a consistent, user-friendly interface to operating an FC-SCM fabric.

In addition to requirements on the Management Tool, this clause identifies which of the requirements placed on other elements of the FC-SCM model (see 4.1) arise wholly or in part from Management Tool uses.

5.2 Generic Services

5.2.1 Management Tool Usage

A Management Tool compliant with this report shall be capable of managing the SAN utilizing the SM-HBA function interface to the Name Server that is provided by the Host (see Editors Note 4).

The Generic Services requests and attributes that the management tool uses shall be limited to those specified in 8.2.

5.2.2 Management Tool Requirements on Other Elements

For the management tool to be capable of managing the SAN, Switches, Hosts and Storage devices shall register Generic Service attributes as defined in 7.2, 8.2, and 9.2

5.3 HBA Requirements to support the Management tool

An HBA shall meet the compliance requirements specified in SM-HBA, and provide the following calls for the management tool:

- a) HBA_SendCTPassThruV2;
- b) SMHBA_ScsiInquiry; and
- c) SMHBA_ScsiReportLuns.

An HBA shall provide the Name Server attributes in table 5 to the management tool for each of its ports.

Table 3 – Port Name Server attributes provided to Host by HBA

Mandatory Attribute	SM-HBA Call ^a
FC-4 TYPEs	SMHBA_GetAdapterPortAttributes
Symbolic Port Name ^b	SMHBA_GetAdapterPortAttributes
Symbolic Node Name ^b	none
Port Type	SMHBA_GetPortType
FC-4 Features	SMHBA_GetAdapterPortAttributes
Discovery Type	none
^a If an SM-HBA call is named, an HBA shall provide the attribute via that call. If an SM-HBA call is not named, an HBA shall provide the attribute via vendor specific means. ^b An HBA may return a null string for this attribute, indicating it has not been administratively configured.	

An HBA shall provide the Fabric Configuration Server attributes in table 4 to the management tool for each of its ports.

Table 4 – Fabric Configuration Server attributes provided to Host by HBA (part 1 of 2)

Mandatory Attribute	SM-HBA Call ^a
Port Name	SMHBA_GetAdapterPortAttributes
Attached Port Name	none
Port State	SMHBA_GetAdapterPortAttributes
Port Speed Capabilities	SMHBA_GetFCPhyAttributes
Port Operating Speed	SMHBA_GetFCPhyAttributes
Platform Name	none
Platform Type	none
Platform Attribute Block: Vendor ID	none
Platform Attribute Block: Product ID	none
^a If an SM-HBA call is named, an HBA shall provide the attribute via that call. If an SM-HBA call is not named, an HBA shall provide the attribute via vendor specific means.	

Table 4 – Fabric Configuration Server attributes provided to Host by HBA (part 2 of 2)

Mandatory Attribute	SM-HBA Call ^a
Platform Attribute Block: Product revision level	none
Platform Attribute Block: Label	none
Platform Node Name	none
Platform Label	none
^a If an SM-HBA call is named, an HBA shall provide the attribute via that call. If an SM-HBA call is not named, an HBA shall provide the attribute via vendor specific means.	

An HBA shall provide the HBA Management Server Host Bus Adapter attributes in table 5 to the management tool.

Table 5 – HBA Management Server Host Bus Adapter attributes provided to Host by HBA

Mandatory Attribute	SM-HBA Call ^a
HBA_Identifier	none
Manufacturer	SMHBA_GetAdapterAttributes
Serial Number	SMHBA_GetAdapterAttributes
Model	SMHBA_GetAdapterAttributes
Hardware Version	SMHBA_GetAdapterAttributes
Driver Version ^b	SMHBA_GetAdapterAttributes
Option ROM Version ^b	SMHBA_GetAdapterAttributes
Firmware Version ^b	SMHBA_GetAdapterAttributes
Number of Ports	SMHBA_GetNumberOfPorts
Boot BIOS Version ^b	SMHBA_GetAdapterAttributes
Boot BIOS State ^b	none
Registered Port List	SMHBA_GetAdapterPortAttributes
^a If an SM-HBA call is named, an HBA shall provide the attribute via that call. If an SM-HBA call is not named, an HBA shall provide the attribute via vendor specific means.	
^b An HBA may return a null string for this attribute, indicating it is not supported.	

5.4 SCSI Initiator Requirements to support the Management tool

5.5 Switch requirements to support the Management tool

5.6 SCSI Target Requirements to support the management tool

6 Volume Management Support

This clause will detail what volume management requests the Management Tool may rely on.

7 Requirements for Hosts

7.1 Overview

This clause defines requirements that all compliant Hosts shall implement. Host discovery and management support is summarized in table 6.

Table 6 – Host support summary

Item	Reference
Generic Services Registration	7.2
SCR	7.3
RSCN	7.4

7.2 Generic Services Registration

A Host shall register the Name Server attributes in table 7 for each of its Nx_Ports that has completed FLOGI.

Table 7 – Name Server attributes registered by Host

Mandatory Attribute	Qualification of Registration Requirement
FC-4 TYPEs	A Host shall register an FC-4 TYPEs attribute that indicates it supports: <ul style="list-style-type: none"> a) Fibre Channel Protocol (see FCP-4); and b) Generic Fibre Channel Features (see FC-GS-6).
Symbolic Port Name	A Host shall register this attribute if it has been administratively configured for the Nx_Port.
Symbolic Node Name	A Host shall register this attribute if it has been administratively configured for the Nx_Port.
FC-4 Features	<ul style="list-style-type: none"> a) A Host shall register a TYPE before it registers FC-4 Features for that TYPE; b) A Host shall register FC-4 Features for FCP-4 with the Initiator bit set to one; and c) A Host shall register Generic Fibre Channel Features with the Simplified Behavior declared bit set to one.

A Host shall register the Fabric Configuration Server attributes in table 8.

Table 8 – Fabric Configuration Server attributes registered by Host

Mandatory Attribute	Qualification of Registration Requirement
Platform Name	none
Platform Type	none
Platform Attribute Block: Vendor ID	none
Platform Attribute Block: Product ID	none
Platform Attribute Block: Product revision level	none
Platform Attribute Block: Label	A Host shall register this attribute for itself if it has been administratively configured.
Platform Node Name	A Host shall register an instance of this attribute for each Node_Name by which at least one Nx_Port of the Host is currently logged in to the Fabric.
Platform Label	A Host shall register this attribute for itself if it has been administratively configured.

A Host shall register the HBA Management Server Host Bus Adapter attributes in table 9 for each of its HBAs.

Table 9 – HBA Management Server Host Bus Adapter attributes registered by Host (part 1 of 2)

Mandatory Attribute	Qualification of Registration Requirement
HBA_Identifier	none
Manufacturer	none
Serial Number	none
Model	none
Hardware Version	none
Driver Version	A Host shall register this attribute for an HBA if the HBA provides it.
Option ROM Version	A Host shall register this attribute for an HBA if the HBA provides it.
Firmware Version	A Host shall register this attribute for an HBA if the HBA provides it.
OS Name and Version	none

Table 9 – HBA Management Server Host Bus Adapter attributes registered by Host (part 2 of 2)

Mandatory Attribute	Qualification of Registration Requirement
Number of Ports	none
Boot BIOS Version	A Host shall register this attribute for an HBA if the HBA provides it.
Boot BIOS State	A Host shall register this attribute for an HBA if the HBA provides it.
Registered Port List	none

7.3 ~~Host Origination of SGR~~

Editors Note 2 ~~Does this become replaced by 7.6?~~

7.4 ~~Host Response to Received RSCN~~

~~When a Host receives an RSCN, the Host shall ...~~

Editors Note 3 ~~Does this become replaced by 7.6?~~

7.5 HBA Requirements

A Host HBA and associated software shall meet the compliance requirements specified in SM-HBA-2, and provide the following calls for the management tool:

- a) a) HBA_SendCTPassThruV2;
- b) b) SMHBA_ScsiInquiry; and
- c) c) SMHBA_ScsiReportLuns.

Editors Note 4 list to be expanded by future proposal.

7.6 Requirements for initiator FCP_Ports

7.6.1 Overview

This clause defines requirements that all initiator FCP_Ports ~~compliant with this technical report~~ shall implement. initiator FCP_Ports shall:

- a) set the Name Server Session Begin bit in the FLOGI request (see FC-LS-2);

- b) not transmit Request CT_IU's to any of the Well Known Addresses for reasons other than the ones specified in 7.2;
- c) register FC-4 Types using RFT_ID (see 7.6.2);
- d) register FC-4 Features using RFF_ID (see 7.6.2);
- e) register Symbolic Port Name using RSPN_ID if one is configured (see 7.6.2);
- f) register Symbolic Node Name using RSNN_NN if one is configured (see 7.6.2);
- g) [register for state change by transmitting a State Change Registration \(SCR\) ELS Request](#);
- h) use only the GPN_SD_FCP Request CT_IU specifying an FCP target function supported for SCM Initial FC discovery (see 7.6.2);
- i) use either GPN_SD_FCP or GPN_ID Request CT_IU's (i.e. not both) after RSCN reception (see 7.6.2);
- j) be capable of operation using only the Request CT_IUs listed in table 10; and
- k) implement the discovery process defined in Annex B.

7.6.2 Initiator FCP_Port operation

The initiator FCP_Port state machine is shown in figure 2. This state machine defines the interactions of an initiator FCP_Port with FC Switches and other N_Ports in the S_Zone. The state machine is not intended to replace other state machines defined in other Fibre Channel standards but it is intended to prohibit certain behaviors allowed by those state machines

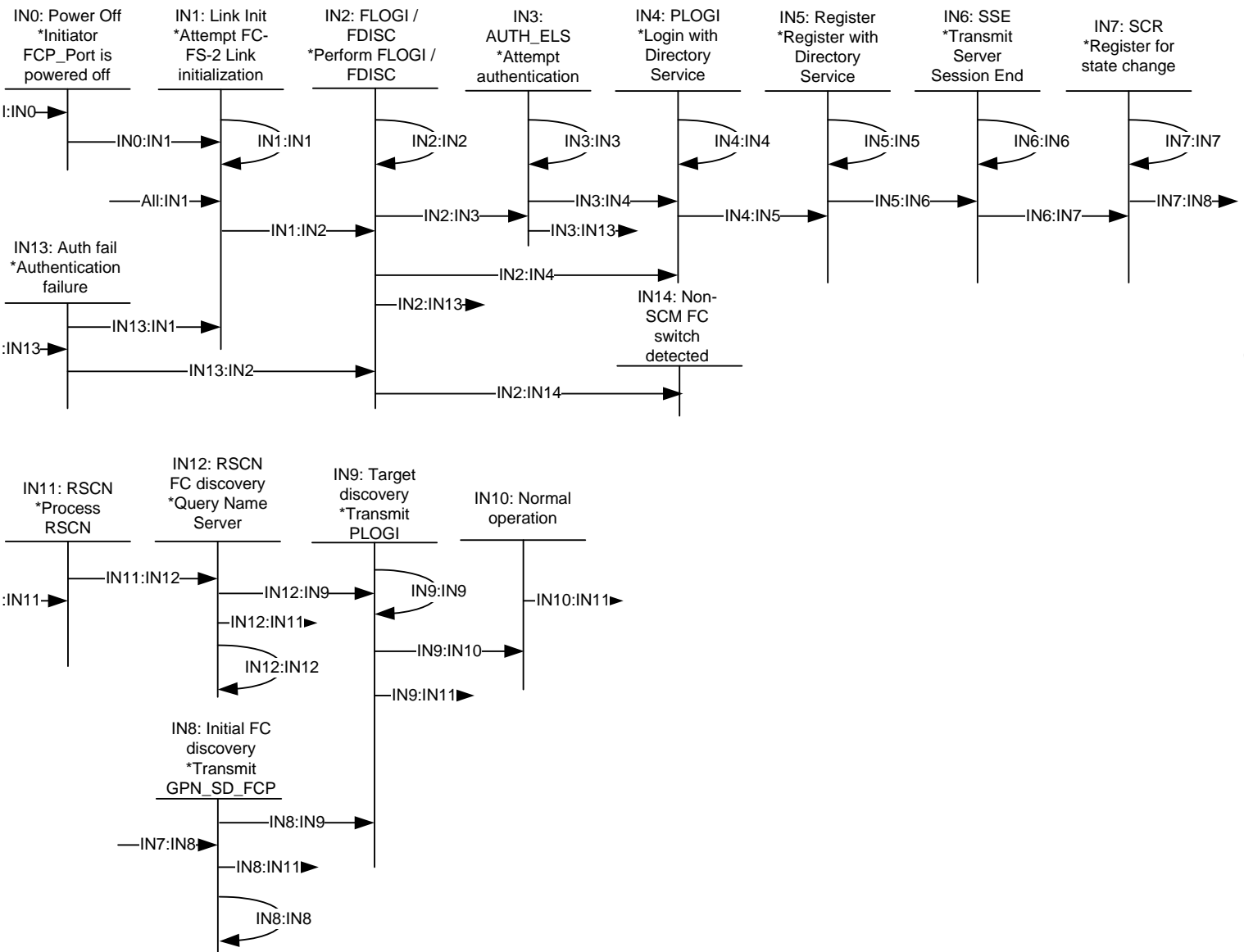


Figure 2 — Initiator FCP_Port state machine

State I0: Power off. The initiator FCP_Port is powered off.

Transition All:IN0. The initiator FCP_Port is powered off.

Transition IN0:IN1. The initiator FCP_Port is powered on.

State IN1: Link Init. Link Initialization, as defined by the Link Initialization protocol clause in FC-FS-3, executes while in this state with one exception; initiator FCP_Ports ~~compliant with this technical report~~ do not support Arbitrated Loop and do not attempt Loop initialization as outlined in FC-AL-2.

Transition All:IN1. An Initialization event occurs as defined in FC-FS-3.

Transition IN1:IN1. The Link initialization protocol as defined in FC-FS-3 was not successful within R_T_TOV. The initiator FCP_Port shall transition to State IN1 and retry the Link Initialization protocol.

Editors Note 5 "transitions to State IN1" should be "shall remain in State IN1" this needs to be fixed in all self transitions.

During Link Initialization, a compliant initiator FCP_Port shall not complete link initialization until it is capable of completing the Login and Registration process. An initiator FCP_Port that repeatedly performs the Link Initialization protocol to the Active state may be placed in the Fenced state by the Switch that the port is attached to. Refer to transitioning to P0 in the FC Switch clause of this technical report.

Transition IN1:IN2. Link Initialization has been completed and the initiator FCP_Port has reached the Active state as defined in FC-FS-3.

State IN2: FLOGI/FDISC. Fabric Login as defined in FC-LS-2 shall be performed. The Name Server Session Begin (NSSB) bit (i.e., Word 1 bit 26 of the Common Service Parameters) shall be set to one. In addition to what is defined in FC-LS-2, the following additional requirements shall apply:

- a) A FLOGI ELS Request shall be transmitted within E_D_TOV of the initiator FCP_Port reaching the Active state;
- b) If an LS_ACC was received in response to the FLOGI ELS Request and an additional N_Port_ID is required, then the initiator FCP_Port shall transmit an FDISC ELS Request. Each Fabric Login requested by FDISC shall set the NSSB bit to one;
- c) If the FLOGI ELS Request was completed by other than LS_ACC, refer to annex A.

Transition IN2:IN2. ~~If the FLOGI ELS Request was completed by other than LS_ACC, then the initiator FCP_Port shall follow the procedure defined in annex A and shall remain in State I2.~~ ~~transitions to State IN2 after following the procedure defined in annex A.~~

Transition IN2:IN3. The initiator FCP_Port set the security bit to one in the FLOGI ELS Request and the FLOGI LS_ACC also has the security bit set to one.

Transition IN2:IN4. The initiator FCP_Port did not set the security bit to one in the FLOGI ELS Request and the security bit is not set to one FLOGI LS_ACC.

Transition IN2:IN13: The initiator FCP_Port does not set the security bit to one in the FLOGI ELS Request and the Fabric returns an FLOGI LS_RJT as defined in FC-SP-2 because the Fabric requires authentication.

Transition IN2:IN14. This transition shall be performed if the Name Server Session Begin bit (see FC-LS-2) was not set in the FLOGI LS_ACC.

State IN3: AUTH_ELS. Authentication shall be performed as defined in FC-SP-2.

Transition IN3:IN3. Authentication does not complete within the timeout value defined in FC-SP-2.

Transition IN3:IN4. Authentication as defined in FC-SP-2 was successful.

Transition IN3:IN14. Authentication as defined in FC-SP-2 was unsuccessful.

State IN4: PLOGI. As defined in FC-GS-6, the initiator shall perform login with the Directory Service.

Transition IN4:IN4. An LS_ACC was not received in response to the PLOGI ELS Request. The initiator FCP_Port transitions to State IN4 after following the procedure defined in annex A.

Transition IN4:IN5. A PLOGI LS_ACC from the Directory Service has been received.

State IN5: Register. The initiator FCP_Port shall register with the Name Server by using the following CT_IU Requests:

- 1) Register FC-4 Type (RFT_ID) as defined in FC-GS-6. The FC-4 Types being registered shall include SCSI-FCP and Generic Fibre Channel Features;
- 2) Register FC-4 Feature (RFF_ID) as defined in FC-GS-6. The FC-4 Feature being registered for the SCSI-FCP FC-4 Type shall include Initiator (i.e., 01h) as defined in FCP-4; and
- 3) Register FC-4 Feature (RFF_ID) as defined in FC-GS-6. The FC-4 Feature being registered for the Generic Fibre Channel Features Type shall include Simplified Behavior declared.

The initiator FCP_Port should register the Symbolic Node Name and the Symbolic Port Name with the Name Server by using the following CT_IU Requests:

- a) Register Symbolic Port Name (RSPN_ID) as defined in FC-GS-6;

NOTE 1 - The type of information contained within the Symbolic Port Name is undefined. The intent is that the information be meaningful when displayed to an administrator;

and

- b) Register Symbolic Node Name (RSNN_NN) as defined in FC-GS-6.

NOTE 2 - The type of information contained within the Symbolic Node Name is undefined, but it should be identical across all interfaces connected to the same host platform. The intent is that the information be meaningful when displayed to an administrator.

If the response to the Name Server registration commands is something other than an Accept CT_IU, refer to annex A.

Transition IN5:IN5. The GPN_SD_FCP Name Server command completed by other than LS_ACC and the initiator FCP_Port has completed the procedure defined in annex A.

Transition IN5:IN6. All of the Name Server requests defined in state IN5 completed successfully.

State IN6: SSE. Initiator FCP_Ports ~~compliant with this technical report~~ shall transmit Server Session End (see FC-GS-6) to the Well Known Address of FFFFCh.

Transition IN6:IN7. An Accept CT_IU was received in response to the Server Session End transmitted in this state.

Transition IN6:IN6. The Server Session End request completed by other than LS_ACC and the initiator FCP_Port has completed the procedure defined in annex A.

State IN7: SCR. Initiator FCP_Ports ~~compliant with this technical report~~ shall register for state change by transmitting a State Change Registration (SCR) ELS Request as defined in FC-LS-2. The type of registration requested shall be "Full registration" or 03h.

Transition IN7:IN7. The SCR ELS Request was completed by other than LS_ACC. The initiator FCP_Port transitions to State IN6 after following the procedure defined in annex A.

Transition IN7:IN8. An LS_ACC was received in response to the SCR ELS Request.

State IN8: Initial FC discovery. The initiator FCP_Ports shall transmit a Get Port Names (GPN_SD_FCP) Request CT_IU as defined in FC-GS-6 to perform initial discovery of available pairings of N_Port_Names and N_Port_IDs. The FC-4 Type specified shall be as defined in annex B. The Domain_ID scope field, Area_ID scope field, and Area_ID flag shall be set to zero.

Transition IN8:IN8. The GPN_SD_FCP Request was completed by other than an Accept CT_IU. The initiator FCP_Port transitions to State IN8 after following the procedure defined in annex A.

Transition IN8:IN9. An Accept CT_IU is received in response to the GPN_FF Request CT_IU.

Transition IN8:IN11. An RSCN ELS Request is received.

State IN9: Target discovery. The Initiator FCP_Port logical unit discovery as defined in this state shall be used by initiator FCP_Ports for discovering and authenticating target FCP_Ports in a Fabric switch environment. This discovery process is not intended to be used following a Fabric event such as the reception of an Registered State Change Notification (RSCN).

NOTE 3 - ~~The Node_Name and Port_Name are Name_Identifier are Worldwide_Names, assuring that they are uniquely identifiable. Logical units are also assigned a Worldwide_Name that may be examined using the INQUIRY command with the E_VPD bit set to one and the PAGE_CODE set to 83h (i.e., the Device Identification VPD page) (see SPC-4)~~

Initiator FCP_Port logical unit discovery:

- 1) For each Port Identifier discovered via the Name Server:
 - 1) perform Port Login; and
 - 2) perform authentication if required (see FC-SP-2);
- 2) For each target FCP_Port that accepted the PLOGI ELS and (if required) performed authentication successfully (see FC-SP-2), perform Process Login, with the Enhanced discovery bit set to one (see FCP-4);

[Editors Note 6 Add FCP-4 reference](#)

NOTE 4 - An initiator FCP_Port may be configured by means not defined in this standard to not set the Enhanced discovery bit. An example of when this would need to be done is when an in-band management application needs to access a previously unconfigured target FCP_Port.

- 3) If the PRLI ELS is accepted, the initiator FCP_Port shall transmit an INQUIRY command to LUN 0 to identify the type of target (see SPC-4). If the PRLI ELS is rejected with a reason code "Unable to

- perform command requested" (i.e., 09h) and reason code explanation "No resources assigned" (i.e., 52h), then the initiator FCP_Port shall transmit a LOGO ELS to the target FCP_Port (see FC-GS-6);
- 4) If the INQUIRY command succeeds, issue a REPORT LUNS command to LUN 0 to obtain a list of the logical units accessible through the target FCP_Port (see SPC-4);
 - 5) Issue an INQUIRY command for each reported LUN to determine the type of peripheral device and supported command set for the logical unit (see SPC-4); and
 - 6) Issue an INQUIRY command with the EVPD bit set to one and the PAGE CODE set to 83h for each reported LUN to obtain the logical unit's Worldwide_Name. This allows higher level applications to identify possible redundant paths to a logical unit (see SPC-4).

NOTE 5 - [The Node_Name and Port_Name are Name_Identifiers are Worldwide_Names, assuring that they are uniquely identifiable. Logical units are also assigned a Worldwide_Name that may be examined using the INQUIRY command with the EVPD bit set to one and the PAGE CODE set to 83h \(i.e., the Device Identification VPD page\) \(see SPC-4\)](#)

Transition IN9:IN9. A target FCP_Port did not respond to or rejected the PLOGI or PRLI. The initiator FCP_Port transitions to State IN9 after following the procedure defined in annex A.

NOTE 6 - This transition applies only to target FCP_Ports that either did not respond to or rejected the PLOGI or PRLI. The initiator FCP_Port may continue with the discovery process with other target FCP_Ports that did respond to or accept the PLOGI or PRLI.

Transition IN9:IN10. For each target FCP_Port that returned an LS_ACC to the PRLI ELS Request, transition to State IN11 and initiate normal operation with that target FCP_Port.

Transition IN9:IN11. An RSCN ELS Request is received.

State IN10: Normal operation. The initiator FCP_Port may begin the SCSI discovery process as outlined in Annex B.

Transition IN10:IN11. An RSCN ELS Request is received.

State IN11: RSCN. The initiator FCP_Port has received an RSCN ELS Request and shall transmit an LS_ACC.

Transition IN11:IN12. The initiator FCP_Port transmitted LS_ACC in response to the RSCN ELS Request.

State IN12: RSCN FC discovery. After an RSCN is received the initiator FCP_Port shall:

- 1) Perform one of the following actions depending upon the format of the RSCN:
 - A) Port Address format RSCN containing one N_Port_ID in the affected port ID List. - Transmit one Get Port Name (GPN_ID) Request CT_IU as defined in FC-GS-6 to the Name Server specifying the 24 bit address of the affected port ID in the RSCN;
 - B) Port Address format RSCN containing more than one affected port ID's. - Transmit Get Port Names (GPN_SD_FCP) Request CT_IU as defined in FC-GS-6 to perform initial discovery of available 24 bit addresses. The FC-4 Type shall be dependent upon the protocol being used and the FC-4 Feature shall be Target (00h). The Domain ID scope and Area ID scope bits shall be set to include all ports in the affected port ID list; or
 - C) Domain Format RSCN - Transmit Get Port Names (GPN_SD_FCP) as defined in FC-GS-6 to perform initial discovery of available 24 bit addresses. The FC-4 Type shall be dependent upon the protocol being used and the FC-4 Feature shall be Target (00h). The Domain ID scope shall be equal to the value of the Domain in the RSCN and Area ID scope bits shall be set to zero;

and

- 2) Perform initiator FCP_Port discovery of target FCP_Ports;

How an initiator FCP_Port performs discovery after an RSCN is received depends upon:

- a) the initiator FCP_Port current login state with each target FCP_Port; and
- b) if authentication as defined in FC-SP-2 is to be performed between the two N_Ports.

~~The following set of conditions define how an initiator FCP_Port shall discover target FCP_Ports after the reception of an RSCN. Either a previously unknown target FCP_Port referred to as a New target FCP_Port, or a previously known target FCP_Port referred to as an Existing target FCP_Port is discovered by the initiator FCP_Port.~~

New target FCP_Port that the initiator FCP_Port discovers via the Name Server:

If after the reception of an RSCN a previously unknown target FCP_Port referred to as a New target FCP_Port, or a previously known target FCP_Port referred to as an Existing target FCP_Port is discovered by the initiator FCP_Port as follows:

- a) a previously unknown target FCP_Port WWPN;
- b) a target FCP_Port WWPN the initiator FCP_Port does not have an active login with;
- c) a previously known target FCP_Port WWPN that is associated with a 24 bit address that is different from the address identifier previously associated with that target FCP_Port WWPN;
- d) a previously known target FCP_Port WWPN and the initiator FCP_Port received a logout from the target FCP_Port; or
- e) a previously known target FCP_Port WWPN and the RSCN contains an Event Qualifier of "CHANGED PORT ATTRIBUTE" (see FC-LS-2).

~~For all of the cases above,~~ then the initiator FCP_Port shall perform the initiator FCP_Port logical unit discovery process.

Existing target FCP_Port that the initiator FCP_Port discovers via the Name Server:

- a) a target FCP_Port the initiator FCP_Port has successfully discovered via Target Discovery as defined in State IN9 and the address identifier of the target FCP_Port was present in the payload of the RSCN. The initiator FCP_Port shall not perform discovery as defined in the New target FCP_Port section;
- b) a target FCP_Port the initiator FCP_Port has successfully discovered via Target Discovery as defined in State IN9 and the address identifier of the target FCP_Port was present in the payload of the RSCN. The initiator FCP_Port shall transmit ADISC to the target FCP_Port. If the response to ADISC is LOGO, perform the initiator FCP_Port LUN discovery process;
- c) a target FCP_Port the initiator FCP_Port has successfully discovered via Target Discovery as defined in State IN9 and that target FCP_Port is no longer present in the Name Server. The initiator FCP_Port shall wait R_A_TOV. If the Port ID/WWPN combination is not rediscovered within R_A_TOV, the initiator FCP_Port shall consider itself logged out of the target FCP_Port and terminate all open exchanges with the target FCP_Port no longer listed in the Name Server; or
- d) a target FCP_Port returns a LOGO ELS sequence or an LS_RJT ELS sequence with the reason code set to "Unable to perform command requested" and the reason code explanation set to "N_Port Login required", perform the initiator FCP_Port logical unit discovery process.

Transition IN12:IN9. RSCN FC Discovery completed

Transition IN12:IN11. An RSCN ELS Request is received.

Transition IN12:IN12. RSCN FC Discovery did not complete. The initiator FCP_Port transitions to State IN12 after following the procedure defined in annex A.

State IN13: Auth fail - An initiator FCP_Port is in this state if authentication failed. ~~shall transition to this state for two reasons:-~~

Editors Note 7 All of this was re-written; however, item b) below is not documented in any transition yet. It needs to be documented in a state transition somewhere.

- a) ~~the initiator FCP_Port has not set the security bit in the FLOGI/FDISC and the FLOGI/FDISC LS ACC has the security bit set; or~~
- b) authentication as defined in FC-SP-2 was unsuccessful and the maximum number of authentication retries had been reached.

~~For either of these reasons, the initiator FCP_Port shall transition to State IN13 and not exit until one of the following conditions has been met:~~

- a) ~~A transition through the Loss of Signal or Loss of Synchronization states as defined in FC-FS-3 has been performed. The intention of this clause is to allow for a state reset, that is to say that it is not expected an initiator FCP_Port retains state across link failure conditions; or~~
- b) ~~If the initiator FCP_Port did not set the security bit in the FLOGI/FDISC, it shall not attempt to perform Login again unless an internal configuration change has been made to the initiator FCP_Port that would result in the authentication bit in the FLOGI/FDISC being set.~~

Transition IN13:IN1. This transition shall be performed if:

- a) a transition through the Loss of Signal or Loss of Synchronization states as defined in FC-FS-3 has been ~~experienced~~performed; or

NOTE – The intention of this transition is to allow for a state reset (i.e., an initiator FCP_Port is not expected to retain state across link failure conditions.)

- b) a change to the authentication configuration of the Switch has been made. The Switch shall initiate the Link Initialization process as defined in FC-FS-3.

Editors Note 8 The shall for the switch in the FCP_Port section is not correct.

Transition IN13:IN2. This transition shall be performed if:

- a) A change in the initiator FCP_Ports internal configuration results in support of the authentication protocol;
or
- b) A change in the N_Ports internal configuration has been made to the initiator FCP_Port that may result in authentication being successful.

State IN14: Non-SCM switch - A switch that is not compliant with this technical report was detected and the initiator FC_Port may perform discovery of target FCP_Ports by a means not defined within this technical report.

8 Requirements for Fabrics

8.1 Overview

This clause defines requirements that all compliant Fabrics shall implement.

A Fibre Channel switch ~~compliant with this technical report~~ shall:

- a) not allow shared resources to be disproportionately consumed by one or more N_Ports or E_Ports that are transmitting ELS Requests or Request CT_IU's to any of the Well Known Addresses for reasons other than the ones specified in the initiator FCP_Port Operation or target FCP_Port Operation clauses;
- b) support the Name Server Session Begin (NSSB) bit (i.e., Word1, bit 26 of the Common Service Parameters) in the FLOGI ELS Request as defined in FC-LS-2;
- c) support the Wildcard Zone Member Type as defined in FCP-4; and
- d) generate RSCNs to N_Ports based on FC-4 Feature type.

8.2 Generic Service requirements for a Fabric

8.2.1 Mandatory Name Server Features

All Switches shall support registering with and querying a Name Server. A Switch shall support at least 256 entries in its Name Server database. There shall be a mechanism to determine the size of the database that each component supports.

Editors Note 9 A behavior must be specified for determining of the capability of the Fabric, and for dealing with excess devices.

A Switch shall support the Name Server requests in table 10. This table includes requests required for support of management tools (see 5.2.1).

Table 10 – Name Server requests supported by Switch (part 1 of 2)

Mandatory Request	Qualification of Support Requirement
Get Port Name (GPN_ID)	none
Get Node Name (GNN_ID)	none
Get FC-4 TYPEs (GFT_ID)	none
Get Symbolic Port Name (GSPN_ID)	none
Get Fabric Port Name (GFPN_ID)	none
Get FC-4 Features (GFF_ID)	none
Get Port Identifier (GID_PN)	none
Get Port Names (GPN_NN)	none
Get Symbolic Node Name (GSNN_NN)	none

Table 10 – Name Server requests supported by Switch (part 2 of 2)

Mandatory Request	Qualification of Support Requirement
Get Port Names (GPN_FT)	none
Get Node Names (GNN_FF)	none
Get Port Names (GPN_FF)	none
Get Permanent Port Name - Port Identifier (GPPN_ID)	none
Register FC-4 TYPEs (RFT_ID)	none
Register Symbolic Port Name (RSPN_ID)	none
Register FC-4 Features (RFF_ID)	none
Register Symbolic Node Name (RSNN_NN)	none

8.2.2 Mandatory Fabric Configuration Server attributes and requests

All Switches shall support registering with and querying a Fabric Configuration Server. A Switch shall support at least 256 entries in its Fabric Configuration Server database. There shall be a mechanism to determine the size of the database that each component supports.

A Switch shall support the Fabric Configuration Server attributes in table 11. This table includes attributes required for support of management tools (see 5.2.1).

Table 11 – Fabric Configuration Server attributes supported by Switch (part 1 of 2)

Mandatory Attribute	Qualification of Registration Requirement
Interconnect Element Name	A Switch shall implicitly register this attribute for itself.
Interconnect Element Type	A Switch shall implicitly register this attribute for itself.
Interconnect Element Domain Identifier	A Switch shall implicitly register this attribute for itself.
Interconnect Element Fabric Name	A Switch shall implicitly register this attribute for itself.
Interconnect Element Logical Name	A Switch shall implicitly register this attribute for itself if it has been administratively configured.
Interconnect Element Information List: Vendor Name	A Switch shall implicitly register this attribute for itself.
Interconnect Element Information List: Model name/Number	A Switch shall implicitly register this attribute for itself.
Interconnect Element Information List: Release code	A Switch shall implicitly register this attribute for itself.
Port Name	A Switch shall implicitly register this attribute for each of its FC_Ports.

Table 11 – Fabric Configuration Server attributes supported by Switch (part 2 of 2)

Mandatory Attribute	Qualification of Registration Requirement
Attached Port Name	A Switch shall implicitly register this attribute for a) each of its F_Ports that has completed FLOGI LS_ACC; and b) each of its E_Ports that has completed E_Port initialization.
Port State	A Switch shall implicitly register this attribute for each of its FC_Ports.
Port Speed Capabilities	A Switch shall implicitly register this attribute for each of its FC_Ports.
Port Operating Speed	A Switch shall implicitly register this attribute for each of its FC_Ports that has completed link initialization.

A Switch shall support the Fabric Configuration Server requests in table 12. This table includes requests required for support of management tools (see 5.2.1).

Table 12 – Fabric Configuration Server requests supported by Switch (part 1 of 2)

Mandatory Request	Qualification of Support Requirement
Get Interconnect Element List (GIEL)	none
Get Interconnect Element Type (GIET)	none
Get Interconnect Element Domain Identifier (GDID)	none
Get Interconnect Element Fabric Name (GFN)	none
Get Interconnect Element Logical Name (GIELN)	none
Get Interconnect Element Information List (GIEIL)	none
Get Port List (GPL)	none
Get Attached Port Name List (GAPNL)	none
Get Port State (GPS)	none
Get Port Speed Capabilities (GPSC)	none
Get Platform Node Name List (GPLNL)	none
Get Platform Type (GPLT)	none
Get PLATFORM Attribute Block (GPAB)	none
Get Platform Name - Node Name (GNPL)	none
Get Platform Name List (GPNL)	none
Register Interconnect Element Logical Name (RIELN)	none

Table 12 – Fabric Configuration Server requests supported by Switch (part 2 of 2)

Mandatory Request	Qualification of Support Requirement
Register Platform (RPL)	none
Register Platform Node Name (RPLN)	none
Register Platform Type (RPLT)	none
Register Platform Attribute Block (RPAB)	none
Deregister Platform (DPL)	none
Deregister Platform Node Name (DPLN)	none
Deregister Platform Attribute Block (DPAB)	none
De-Register All Platform Information (DPALL)	none

8.2.3 Mandatory Unzoned Name Server requests

All Switches shall provide support for registering with and querying an Unzoned Name Server. A Switch shall support at least 256 entries in its Unzoned Name Server database. There shall be a mechanism to determine the size of the database that each Switch supports.

A Switch shall support the attributes in table 11 and the requests in table 12 via the Unzoned Name Server. These tables include attributes and requests required for support of management tools (see 5.2.1).

8.2.4 Mandatory Zone Server requests

All Switches shall provide support for registering with and querying a Zone Server. A switch shall default its configuration to operate in Enhanced Zoning mode. A Switch shall support at least 256 zones and an active zone set. There shall be a mechanism to determine the size of the database that each Switch supports.

A Switch shall support the Zone Server attributes in table 13. This table includes attributes required for support of management tools (see 5.2.1).

Table 13 – Zone Server Attributes supported by Switch

Mandatory Attribute	Qualification of Support Requirement
Enhanced Zoning Objects.	
Zone Set Object for Active Zone Set	none
Zone Member Object	A Switch shall support zone members with Zone Member Types of Port_Name, Node_Name, and Automagic.

A Switch shall support the Zone Server requests in table 14. This table includes requests required for support of management tools (see 5.2.1).

Table 14 – Zone Server requests supported by Switch

Mandatory Request	Qualification of Support Requirement
Session Commands	
Server Session Begin (SSB)	none
Server Session End (SSE)	none
Commit Zone Changes (CMIT)	none
Enhanced Zoning Commands	
Get Active Zone Set - Enhanced (GAZSE)	none
Activate Zone Set Direct - Enhanced (AZSDE)	none
Deactivate Zone Set - Enhanced (DZSE)	none

8.2.5 Mandatory HBA Management Server attributes and requests

All Switches shall provide support for registering with and querying an HBA Management Server. A Switch shall support at least 256 HBAs in its HBA Management Server database. There shall be a mechanism to determine the size of the database that each Switch supports.

A Switch shall support the HBA Management Server Host Bus Adapter attributes in table 15. This table includes attributes required for support of management tools (see 5.2.1).

Table 15 – HBA Management Server Host Bus Adapter attributes supported by Switch (part 1 of 2)

Mandatory Attribute	Qualification of Support Requirement
HBA_Identifier	none
Manufacturer	none
Serial Number	none
Model	none
Hardware Version	none
Driver Version	none
Option ROM Version	none
Firmware Version	none

Table 15 – HBA Management Server Host Bus Adapter attributes supported by Switch (part 2 of 2)

Mandatory Attribute	Qualification of Support Requirement
OS Name and Version	none
Number of Ports	none
Boot BIOS Version	none
Boot BIOS State	none
Registered Port List	none

A Switch shall support the HBA Management Server requests in table 16. This table includes requests required for support of management tools (see 5.2.1).

Table 16 – HBA Management Server requests supported by Switch

Mandatory Request	Qualification of Support Requirement
Get Registered HBA List (GRHL)	none
Get HBA Attributes (GHAT)	A switch may not accept registration of attributes that are not mandatory in table 15. A switch may not return attributes that are not mandatory in table 15.
Get Registered Port List (GRPL)	none
Register HBA (RHBA)	none
Register HBA Attributes (RHAT)	A switch may not accept registration of attributes that are not mandatory in table 15. A switch may not return attributes that are not mandatory in table 15.
Register Port (RPRT)	none
Deregister HBA (DHBA)	none
Deregister HBA Attributes (DHAT)	none
Deregister Port (DPRT)	none

8.3 Switch operation

The switch state machine is shown in figure 3. The purpose of the state machine is to define the set of behaviors that an FC Switch **compliant with this technical report** shall adhere to when interacting with initiator and target FCP_Ports as well as other switches that are **compliant with this technical report**. The state machine is not intended to completely replace other state machines defined in other Fibre Channel standards but it does define certain behaviors that shall not be performed even though they are allowed by state machines in other standards.

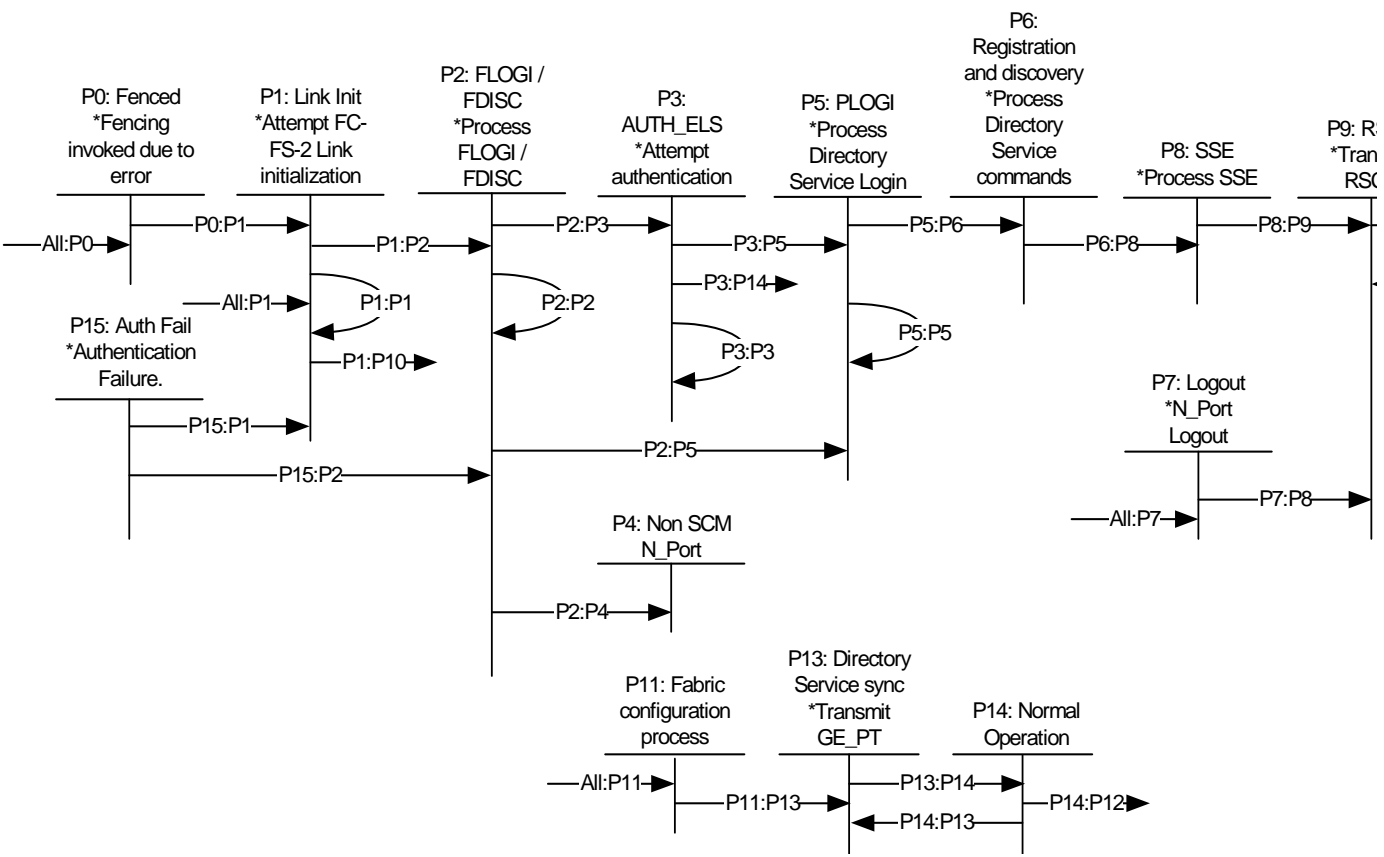


Figure 3 — Switch state machine

State P0: Fencing invoked due to error. A Switch ~~that is compliant with this technical report~~ may transition a port to State P0 if the attached initiator or target FCP_Port performs an action not allowed by either this technical report or by another FC standard. The switch may hold the attached initiator or target FCP_Port at State P0 for an indefinite amount of time. This action may require user intervention to resolve. Refer to Transitioning to State P0 below for more information.

Transition All:P0. If the initiator FCP_Port or target FCP_Port performed an action not allowed either by this technical report or by another FC standard ~~then and as a result~~ the Switch port shall transition ~~ed the initiator FCP_Port~~ to State P0 ~~and by either:~~

Editors Note 10 Is the above paragraph covered by all of the second a, b list below?

- a) transmitt~~ing~~ the Offline Sequence (OLS); or
- b) disabl~~ing~~ the transmitter of the optic that the FCP_Port is connected to on the FC Switch.

This transition may be performed for any one of the following reasons:

- a) The Link Initialization protocol as defined in FC-FS-3 is performed more than 3 times in E_D_TOV;
- b) The Switch port receives a Request and the Request is identical, not including Exchange and Sequence context, to a previous Request that has not yet been responded to and the timeout value for that request has not elapsed since the original Request was received;
- c) The Switch port receives a Request that is identical, not including Exchange and Sequence context, to a previous Request, the response to the previous Request was not LS_ACC, the reason code was retryable as specified in annex C and the value of E_D_TOV has not elapsed since the original Request was received;
- d) The Switch port receives a Request that is identical, not including Exchange and Sequence context, to a previous Request, the response to the previous Request was not LS_ACC and the reason code was not retryable as specified in annex C; or
- e) The Switch port receives repetitive Requests and the Requests, as determined by a means not defined in the technical report, are consuming a disproportionate amount of Switch resources.

Transitioning a port to State P0 may be performed by a switch port as a proactive counter measure to prevent denial of service types of attacks against the Well Known Addresses. The number of events each platform may process without negatively impacting the platform responsiveness varies from one platform to another; therefore, the number of events or the exact manner that a switch protects itself are not limited to what is defined in the state machine. The steps to recover from a proactive counter measure being invoked shall not be explicitly defined but may include the expiration of a timer, processor threshold or manual intervention to resolve the condition. Some port behaviors, especially repetitive requests, are universally considered to be detrimental to overall fabric stability and shall not be performed by initiator or target FCP Ports.

The specific cases where a transition to State P0 shall be performed are defined in Transition All:P0 of this clause. The list of events provided is not intended to be all inclusive but rather serve as a guideline for what initiator and target FCP_Ports shall not do.

[Editors Note 11 The above paragraph needs to be re-worded. Can the paragraph just be removed?](#)

Transition P0:P1. If an initiator or target FCP_Port is determined to be non-defective by means not defined in this technical report and through user intervention or some action automatically performed by the switch, the initiator or target FCP_Port is allowed to initialize, then the switch port shall transition to State P1.

Transition All:P1. If an initialization event, as defined in the Link Initialization Protocol (see FC-FS-3), is detected, then the switch port shall transition to State P1.

State P1: Link Init. The Link Initialization Protocol as defined in FC-FS-3 is performed with one exception, a switch port may transition an attached port to State P0 for reasons defined in Transition All:P0.

During Link Initialization, Switch ports shall only exit the OL1 state as defined in FC-FS and attempt to achieve the Active state when [the switch port is](#) capable of servicing Login and Registration requests.

Transition P1:P1. If the Link Initialization protocol was not successful within R_T_TOV, then the switch port shall remain in State P1.

Transition P1:P2. If the switch port has reached the Active state as defined in FC-FS-3 and a FLOGI ELS Request is received, then the switch port shall transition to State P2.

Transition P1:P10. If the switch port has reached the Active state and an Exchange Link Parameters (ELP) SW_ILS Request is received (see FCP-4), then the switch port shall transition to State P10.

If E_D_TOV has elapsed since the switch port reached the Active state and neither an FLOGI ELS Request nor ELP SW_ILS Request has been received, then the switch port shall transition to State P10 and if the switch port is capable of becoming an E_Port, then the switch port shall transmit an ELP SW_ILS Request.

State P2: FLOGI/FDISC. Upon receiving a FLOGI ELS Request as defined in FC-LS, the Fabric Login Server shall process the FLOGI as follows:

- 1) the Fabric Login Server shall determine if the Name Server Session Begin (NSSB) bit (i.e., Word 1, bit 26 of the Common Service Parameters) in the FLOGI ELS Request has been set to one and process the FLOGI ELS Request as follows:

- A) if the bit is set to one, the FC switch shall initiate a Name Server Session (see FC-GS-6) and continue with step 2; or
- B) if the bit is set to zero, the process for handling the FLOGI request is not defined by this technical report;
- 2) the Fabric Login Server shall determine if the security bit (i.e., Word 1, bit 21 of the Common Service Parameters) in the FLOGI ELS Request is set to one and continue with fabric login s follows:
 - A) if Authentication is required by the fabric and the security bit in the FLOGI is not set, the FLOGI shall be rejected as defined in FC-SP-2, the Name Server Session shall be terminated and the Switch port shall transition to State P14;
 - B) if Authentication is supported by the N_Port but not required by the fabric, continue with step 3;
 - C) if Authentication is not required by both the attaching port as well as the Switch port, continue with step 3; or
 - D) if Authentication is required by both the attaching port as well as the Switch port, continue with step 3;
- 3) the Fabric Login Server shall transmit either:
 - A) an FLOGI LS_ACC with:
 - a) the Name Server Session Started (NSSS) bit (i.e., Word1, bit 27 of the Common Service Parameters) in the FLOGI LS_ACC is set to 1; and
 - b) the security bit set to either 0 or 1 depending upon the current configuration of the Switch port;
 - or
 - B) an LS_RJT with an appropriate reason code and reason code explanation as defined in FC-LS;
- 4) if an FLOGI LS_ACC was transmitted, the Name Server shall be automatically populated with all information contained in the FLOGI ELS Request; and
- 5) the initiator or target FCP_Ports shall not be discoverable via Name Server commands nor accessible to any other FCP_Ports that are currently logged into the switch until after an accept CT_IU has been transmitted by the switch in response to the Server Session End (SSE) command (see State P8).

Transition P2:P2. In addition to what is defined in FC-LS-2, the following additional requirements shall apply:

- a) after receiving an FLOGI ELS Request, reception of anything other than primitives by a switch port until a response to the FLOGI has been transmitted is unexpected unless 2 x R_A_TOV has elapsed since the FLOGI has been received. If the response to the FLOGI has not been transmitted within 2 x R_A_TOV and a second FLOGI has been received, the switch port shall remain in State P2; or

Editors Note 12 The first sentence implies a different operation and needs to be defined. Proposed wording: after receiving a FLOGI ELS Request the switch shall ... until a response to the FLOGI has been transmitted or 2 x R_A_TOV has expired. If this is a requirement on the FCP_Port then move to that subclause.

- b) if the response to the FLOGI ELS Request is LS_RJT and the reason for the LS_RJT is retryable as defined in annex C, then the FLOGI may be retried by the initiator or target FCP_Port after E_D_TOV has elapsed.

Transition P2:P3. If the initiator or target FCP_Port set the security bit (i.e., Word 1, bit 21 of the Common Service Parameters) in the FLOGI ELS Request and the switch supports authentication as defined in FC-SP-2, then the switch port shall transition to State P3.

Transition P2:P4. If the Name Server Session Begin (NSSB) bit is not set in the FLOGI ELS Request, then the switch port shall transition to State P4.

Transition P2:P5. If the initiator or target FCP_Port did not set the security bit (i.e., Word 1, bit 21 of the Common Service Parameters) in the FLOGI ELS Request and the switch does not require authentication, then the switch port shall transition to State P5.

State P3: Auth_ELS. Authentication shall be performed as defined in FC-SP-2.

Transition P3:P3. If a timeout occurs during authentication ~~was not successful~~, then the switch port shall remain in State P3.

Transition P3:P5. If authentication was successful, then the switch port shall transition to State P5.

Transition P3:P14. If ~~A~~ authentication failure as defined in FC-SP-2 occurs, then ~~the~~ switch port shall transition to State P14.

State P4: Non SCM N_Port. The commands and process used by a switch to support initiator and target FCP_Ports that are not compliant with this technical report is not defined in this technical report.

State P5: PLOGI. In this state the switch shall process Login requests to the Name Server as defined in FC-LS-2.

Transition P5:P5. if an LS_RJT was returned in response to the PLOGI ELS Request, the response indicates a retryable condition as defined in annex A, a time period of E_D_TOV has elapsed since the response was transmitted and another PLOGI ELS Request has been received by the switch port, then the switch port shall remain in this state.

Transition P5:P6. If an LS_ACC was transmitted in response to the PLOGI request, then the switch port shall transition to State P6.

State P6: Registration and discovery. In addition to what is defined in FC-GS-6:

- a) switches ~~compliant with this technical report~~ shall respond to each Name Server Request CT_IU within R_A_TOV; and
- b) Registration shall be considered complete for an initiator or target FCP_Port after an Accept CT_IU has been transmitted in response ~~to the Server Session End (SSE) command. to the Register FC-4 Feature with the Generic Fibre Channel Features Type of Simplified Behavior declared.~~

Transition P6:P8. If a Server Session End (SSE) request was received, then the switch port shall transition to State P8.

State P7: N_Port Logout. Explicit or implicit Fabric logout as defined in FC-LS.

Transition P7:P9. after a successful explicit or implicit Fabric logout the switch port shall transition to State P9.

State P8: SSE. In this state, the switch shall process incoming Server Session End (SSE) requests. If the SSE is addressed to the WKA of the Name Server (FFFFFCh), after transmitting the Accept CT_IU to the SSE request, the initiator or target FCP port shall be discoverable via the Name Server and accessible to other FCP_Ports that are currently logged into the switch.

Transition P8:P9. If an Accept CT_IU was transmitted in response to the SSE request, then the switch port shall transition to State P9.

State P9: RSCN. A Registered State Change Notification (RSCN) ELS Request shall be transmitted as defined in FC-LS-2 with the following restrictions:

- a) The transmission of RSCN to initiator and target FCP_Ports shall depend upon zone membership, SCR usage and the registration of FC-4 Features (e.g., RSCNs shall only be transmitted to initiator FCP_Ports for target FCP_Port events and RSCNs shall only be transmitted to target FCP_Ports for initiator FCP_Port events);
- b) RSCN usage shall be dependent upon the Event type as follows:

[Editors Note 13 This nested list needs to be fixed. Is the first one correct?](#)

- A) if the event type is Local N_Port Logout / Login, then an RSCN shall be generated as follows:
 - a) the Address Format shall be Port Address (i.e., 00h);
 - b) the Payload shall contain the Affected N_Port IDs;
 - c) The RSCN shall be transmitted to the following registered N_Ports:
 - A) if the affected N_Port is not compliant with this technical report, then all N_Ports that are members of the same zone as the device for which the event has been detected;
 - B) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Initiator, then all N_Ports that are a member of the same zone as the affected N_Port and all target FCP_Ports that are compliant with this technical report and in the wildcard zone. (i.e., FCP_Ports that set the Name Server Session Begin (NSSB) bit in the FLOGI, registered an FC-4 Feature of Target and registered a Generic Fibre Channel Featured type of Simplified Behavior declared);
 - C) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Target, then all N_Ports that are member of the same zone as the affected N_Port and all initiator FCP_Ports that are compliant with this technical report. (i.e., FCP_Ports that set the Name Server Session Begin (NSSB) bit in the FLOGI, registered an FC-4 Feature of Initiator and registered a Generic Fibre Channel Featured type of Simplified Behavior declared);
- B) **Event type:** Local N_Port Logout / Login
 - a) **Description:** An N_Port attached to the local Domain is logged out either explicitly or implicitly; or a locally attached N_Port logs in.
 - b) **Address Format:** Port Address (00h)
 - c) **Payload:** Affected N_Port IDs
 - d) **Distribution:**

- A) ~~if the affected N_Port is not compliant with this technical report, an RSCN ELS Request shall be transmitted to all N_Ports that are members of the same zone as the device for which the event has been detected.~~
- B) ~~if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Initiator, an RSCN ELS Request shall be transmitted to all N_Ports that are a member of the same zone as the affected N_Port as well as all target FCP_Ports that are compliant with this technical report and in the wildcard zone. (i.e. set the Name Server Session Begin (NSSB) bit in the FLOGI, registered an FC-4 Feature of Target and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.~~
- C) ~~if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Target, an RSCN ELS Request shall be transmitted to all N_Ports that are member of the same zone as the affected N_Port as well as all initiator FCP_Ports that are compliant with this technical report. (i.e. set the Name Server Session Begin (NSSB) bit in the FLOGI, registered an FC-4 Feature of Initiator and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.~~
- C) **Event type:** Remote Domain DNS change.
 - a) **Description:** The contents of a remote domain's Name Server has changed.
 - b) **Address Format:** SW_RSCN - As defined in FC-SW-5
 - c) **Payload:** As defined in FC-SW-5
 - d) **Distribution:** As defined in FC-SW-5
- D) **Event type:** Remote N_Port logout or login
 - a) **Description:** An N_Port attached to a remote Domain logs out either explicitly or implicitly; or a remotely attached N_Port logs in.

NOTE 7 - The addition or removal of a remote N_Port can be detected in two ways; via SW_RSCN from the Domain containing affected N_Port or during periodic polling with GE_PT. The SW_RSCN would be the expected mechanism to for one Domain to notify another of a change in Name Server content, however, if a previously unknown N_Port is detected, or a previously known N_Port is no longer listed as a member of the name server via a response to a GE_PT, this shall have the same impact to the local name server as receiving a SW_RSCN and results in RSCN generation as described in the distribution section below.

- b) **Address Format:** Port Address (00h)
- c) **Payload:** Affected N_Port IDs
- d) **Distribution:**
 - A) if the affected N_Port is not compliant with this technical report, an RSCN ELS Request shall be transmitted to all N_Ports that are members of the same zone as the device for which the event has been detected.
 - B) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Initiator, an RSCN ELS Request shall be transmitted to all N_Ports that are a member of the same zone as the affected N_Port as well as all target FCP_Ports that are compliant with this technical report. (i.e. set the Name Server Session Begin bit in the FLOGI, registered an FC-4 Feature of Target and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.)
 - C) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Target, an RSCN ELS Request shall be transmitted to all N_Ports that are member of the same zone as the affected N_Port as well as all initiator FCP_Ports that are compliant with this technical report. (i.e. set the Name Server Session Begin bit in the FLOGI, registered an FC-4 Feature of Initiator and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.
- E) **Event type:** ISL addition or removal
 - a) **Description:** RSCN ELS Requests are not generated for the addition or removal of ISLs. The exception being the first ISL added between two separate fabrics or the last ISL removed between

- two domains and the result is that two separate fabrics are formed. Both of these conditions are covered in the Domain added and Domain removed sections that follow.
- b) **Address Format:** N/A
 - c) **Payload:** N/A
 - d) **Distribution:** N/A
- F) **Event type:** Domain addition or removal
- a) **Description:** After the Fabric Configuration process as described in FC-SW-5 has completed, if a change in the domain count of the fabric is detected, an RSCN shall be transmitted to all N_Ports that have registered for Domain Address Format RSCN's
 - b) **Address Format:** Domain Address Format
 - c) **Payload:** Affected Domain ID list.
 - d) **Distribution:** RSCN ELS Request shall be transmitted to all N_Ports that have registered to receive Domain Address Format RSCN's
- G) **Event type:** Zone Set activation
- a) **Description:** If a Zone set activation results in an increase or a decrease in the number of 24 bit addresses available to an N_Port, then the Fabric Controller shall transmit RSCN to that N_Port as defined in distribution below.
 - b) **Address Format:** Port Address Format 0x00
 - c) **Payload:** Affected N_Port ID's
 - d) **Distribution:**
 - A) if the affected N_Port is not compliant with this technical report, an RSCN ELS Request shall be transmitted to all N_Ports that are members of the same zone as the device for which the event has been detected.
 - B) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Initiator, an RSCN ELS Request shall be transmitted to all N_Ports that are a member of the same zone as the affected N_Port as well as all target FCP_Ports that are compliant with this technical report. (i.e. set the Name Server Session Begin bit in the FLOGI, registered an FC-4 Feature of Target and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.
 - C) if the affected N_Port is compliant with this technical report and has registered an FC-4 Feature of Target, an RSCN ELS Request shall be transmitted to all N_Ports that are member of the same zone as the affected N_Port as well as all initiator FCP_Ports that are compliant with this technical report. (i.e. set the Name Server Session Begin bit in the FLOGI, registered an FC-4 Feature of Initiator and registered a Generic Fibre Channel Featured type of Simplified Behavior declared.

NOTE 8 - While in this state, the switch continues to deliver frames to N_Ports for which a route exists.

Transition P9:P10. After RSCN's have been transmitted to the appropriate N_Ports, the switch port shall transition to State P10.

State P10: Normal F_Port Operation. In this state the F_Port transmits and receives Frames.

Transition P10:P7. The switch port shall transition to State p7 if:

- a) link failure;
- b) transition to the offline state;
- c) transition to the not operational state; or
- d) the switch intentionally transitioning the port to P0 due to excessive utilization of switch resources.

Editors Note 14 How does item d fit in this list? this should be to P0 not P7. Erik's response - I see what you are saying but part of being transitioned to state P0 is being logged out of the fabric. Would adding a transition P10:P0 make sense?

Transition P10:P9. If one of the conditions defined in state P8 was met that requires an RSCN to be transmitted, then the switch port shall transition to State P9.

State P11: Fabric Configuration process. Perform the Fabric Configuration process as defined in FCP-4.

Transition P11:P13. If Fabric Configuration is successful resulting in a non-isolated E_Port, then the switch port shall transition to State P13.

State P12: SW_RSCN. Transmit LS_ACC in response to the SW_RSCN Request.

Transition P12:P9. If an LS_ACC was transmitted in response to a SW_RSCN Request, then the switch port shall transition to State P9.

Transition P12:P13. If an SW_RSCN is received, then the switch port shall transition to State P13.

State P13: GE_PT Name Server Synchronization. As a part of:

- a) the fabric configuration process;
- b) the reaction to a SW_RSCN; or
- c) due to periodic polling,

GE_PT shall be used to synchronize the distributed Name Server databases. To facilitate the sharing of FC-4 Features as well as indicate each individual N_Ports compliance with this technical report, responses to GE_PT from an SCM compliant switch shall take the following form when responding to a remote switch for which an ESS has been successfully exchanged and the remote switch has indicated support for FC-4 Features. This is accomplished by ensuring that a Directory Service capability entry has set either bit 2 or bit 3 set in either the ESS command or response.

Editors Note 15 The above paragraph should be re-worded.

GE_PT response format:

- a) Name Server Entry Object:
 - A) The Entry Object Format Indicator shall have bit 1 set indicating the FC-4 Features are Included in the Entry Object.

- B) The FC-4 Features array shall include the FC-4 Feature bits registered by the Initiator, Target or Multi-purpose FCP_Port.
- b) If the remote switch supports the Large Name Server object as determined via ESS, bit 0 of the Entry Format Object Indicator shall not be set to indicate that the Entry Object contains the Symbolic port Name and the Symbolic Node Name.
- c) All other fields shall be populated as specified in FC-GS-6 or FC-SW-5.

Transition P13:P9. If GE_PT is successful and a difference was detected between local and remote DNS instances, then the switch port shall transition to State P9.

Transition P13:P13. If GE_PT was not successful within R_A_TOV, then the switch port shall remain in this state.

Transition P13:P14. If GE_PT is successful and no difference is detected between local and remote Name Servers, then the switch port shall transition to State P14.

State P14: Normal Operation. The E_Port shall forward FC Frames in accordance with the current switch configuration.

Transition P14:P12. If a SW_RSCN is received, then the switch port shall transition to State P12.

Transition P14:P13. A GE_PT may be periodically transmitted to ensure DNS synchronization.

[Editors Note 16 How is this a transition? Erik agreed - needs to be removed from diagram as well.](#)

State 15: Authentication Failure - A Switch ~~compliant with this technical report~~ shall transition a port to this state for two reasons:

- a) the attached initiator FCP_Port, target FCP_Port or Switch port has set not set the security bit in the FLOGI/FDISC and the Fabric requires authentication; or
- b) authentication as defined in FC-SP-2 was unsuccessful and the maximum number of authentication retries had been reached.

For either of these reasons, the Switch port shall transition to State P14 and not exit until one of the following conditions has been met:

- a) a transition through the Loss of Signal or Loss of Synchronization states as defined in FC-FS-3 has been performed.

NOTE – The intention of this clause is to allow for a state reset, that is to say that it is not expected that a Switch port retains state across link failure conditions.

- b) A change in the Switch ports internal authentication configuration has been made. In this case, the switch port shall transition to State P1.

Transition P15:P1. The switch port shall transition to state P1 if:

- a) a transition through the Loss of Signal or Loss of Synchronization states as defined in FC-FS-3 has occurred; or
- b) a change to the authentication configuration of the SCM Switch has been made. The SCM Switch shall initiate the Link Initialization process as defined in FC-FS-3.

Transition P15:P2. The switch port shall transition to State P2 if:

- a) a change in the Switch ports internal configuration results in support of the authentication protocol; or
- b) a change in the ~~initiator FCP_Port, target FCP_Port or~~ Switch ports internal configuration has been made that may result in authentication being successful.

9 Requirements for Storage

9.1 Overview

This clause defines requirements that all compliant Storage Devices shall implement. Storage Device discovery and management support is summarized in table 17.

Table 17 – Storage Device support summary

Item	Reference
Generic Services Registration	9.2
SCR	9.3
RSCN	9.4

9.2 2 June 2009 Generic Services Registration

A Storage Device shall register the Name Server attributes in table 18 for each of its Nx_Ports that has completed FLOGI.

Table 18 – Name Server attributes registered by Storage Device

Mandatory Attribute	Qualification of Registration Requirement
FC-4 TYPEs	A Storage Device shall register an FC-4 TYPEs attribute that indicates it supports: <ul style="list-style-type: none"> a) Fibre Channel Protocol (see FCP-4); and b) Generic Fibre Channel Features (see FC-GS-6).
Symbolic Port Name	A Storage Device shall register this attribute if it has been administratively configured for the Nx_Port.
Symbolic Node Name	A Storage Device shall register this attribute if it has been administratively configured for the Nx_Port.
FC-4 Features	A Storage Device shall register a TYPE before it registers FC-4 Features for that TYPE. A Storage Device shall register FC-4 Features for FCP-4 as follows: <ul style="list-style-type: none"> a) The Target bit set shall be to one; b) Bit 2 shall be set to one if the Storage Device acts as a Target for at least one device that is peripheral device type other than 00h (see SPC-4); c) Bit 2 shall be set to zero if the Storage Device acts as a Target for no devices that are peripheral device type other than 00h. A Storage Device shall register Generic Fibre Channel Features with the Simplified Behavior declared bit set to one.

A Storage Device shall register the Fabric Configuration Server attributes in table 19.

Table 19 – Fabric Configuration Server attributes registered by Storage Device

Mandatory Attribute	Qualification of Registration Requirement
Port Name	A Storage Device shall register this attribute for each of its Nx_Ports that has completed FLOGI.
Attached Port Name	A Storage Device shall register this attribute for each of its Nx_Ports that has completed FLOGI.
Port State	A Storage Device shall register this attribute for each of its Nx_Ports that has completed FLOGI.
Port Speed Capabilities	A Storage Device shall register this attribute for each of its Nx_Ports that has completed FLOGI.
Port Operating Speed	A Storage Device shall register this attribute for each of its Nx_Ports that has completed FLOGI.
Platform Name	none
Platform Type	none
Platform Attribute Block: Vendor ID	none
Platform Attribute Block: Product ID	none
Platform Attribute Block: Product revision level	none
Platform Attribute Block: Label	A Storage Device shall register this attribute for itself if it has been administratively configured.
Platform Node Name	A Storage Device shall register an instance of this attribute for each Node_Name by which at least one Nx_Port of the Storage Device is currently logged in to the Fabric.
Platform Label	A Storage Device shall register this attribute for itself if it has been administratively configured.

9.3 Storage Registration for RSCN

[Editors Note 17 Waiting on outcome of RSCN discussions](#)

9.4 Storage Response to Received RSCN

[Editors Note 18 Waiting on outcome of RSCN discussion](#)

10 Requirements for Multi-purpose N_Ports

10.1 SCM Multi-purpose N_Ports overview

In some instances N_Ports act as both an initiator FCP_Port and a target FCP_Port (e.g., Remote replication of storage volumes and data migration from one array to another). FC-SCM allows for these Multi-purpose N_Ports to function by allowing them to set both the initiator FCP_Port and FC-4 Features bits in the RFF_ID request.

[Editors Note 19 What about target FCP_Port and FC-4 Features bits?](#)

10.2 SCM Multi-purpose N_Port operation

Depending upon the role the Multi-purpose N_Port is operating in, the behavior is either identical to what is defined for the SCSI initiator FCP_Port, target FCP_Port, or both.