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Fibre Channel Registered State Change Notification (RSCN) MIB
T11/06-198v0 & draft-kzm-imss-fc-rscn-mib-03.txt

Status of this Memo

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for information related to the management of Fibre Channel's Registered State Change Notifications (RSCNs).

Table of Contents

1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for information related to Registered State Change Notifications (RSCNs) [FC-LS] in a Fibre Channel network, including which Nx_Ports are registered to receive which types of RSCNs, the control and generation of SNMP notifications on registration failures, and RSCN-related statistics.

1.1. Log of Recent Changes

This section to be deleted when the document becomes approved.

1.1.1. Initial version

The initial version was submitted to T11.5 as T11/05-787v0 on 18 November 2005.

1.1.2. 6 December 2005 version

The following changes were made for the version was submitted to T11.5 as T11/05-787v1 and the IETF as: draft-ietf-imss-fc-rscn-mib-01.txt.

- added many clarifications, fixed typos, and finished previously-incomplete sections.

- fixed compile errors in the MIB module.

1.1.3. 17 December 2005 version

The following changes were made for the version was submitted to T11.5 as T11/05-787v2 and the IETF as: draft-ietf-imss-fc-rscn-mib-02.txt.

- Replaced the one (aggregated) object t11FcRscnRejectedReasonCode by the three separate objects for Reject Reason Code, Reason Code Explanation and Reason Vendor Specific Code.

- Changed the reference for definitions of RSCN and SCR to be FC-LS (instead of FC-FS).

- Added URLs for T11 specifications in the Reference section.

1.1.4. 5 March 2006 version

The following changes were made for the version was submitted to T11.5 as T11/06-198v0 and the IETF as: draft-ietf-imss-fc-rscn-mib-03.txt.

- Explained the term "SW_RSCN" on the first usage of the phrase "an SW_ILS with a SW_RSCN payload", and replaced all subsequent uses of the phrase by SW_RSCN.

- Changed "Rx" to "In" and "Tx" to "Out" in the descriptors of Counter32's, e.g., changed t11FcRscnRxRscns to t11FcRscnInRscns.

- Added ten counters for the number of sent/received RSCNs for the individual 'Event Qualifier' values defined in [FC-LS].

- Many editorial changes.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Short Overview of Fibre Channel

The Fibre Channel (FC) is logically a bidirectional point-to-point serial data channel, structured for high performance. Fibre Channel provides a general transport vehicle for higher level protocols such as Small Computer System Interface (SCSI) command sets, the High-Performance Parallel Interface (HIPPI) data framing, IP (Internet Protocol), IEEE 802.2, and others.

Physically, Fibre Channel is an interconnection of multiple

communication points, called N_Ports, interconnected either by a switching network, called a Fabric, or by a point-to-point link. A Fibre Channel "node" consists of one or more N_Ports. A Fabric may consist of multiple Interconnect Elements, some of which are switches. An N_Port connects to the Fabric via a port on a switch called an F_Port. When multiple FC nodes are connected to a single port on a switch via an "Arbitrated Loop" topology, the switch port is called an FL_Port, and the nodes' ports are called NL_Ports. The term Nx_Port is used to refer to either an N_Port or an NL_Port. The term Fx_Port is used to refer to either an F_Port or an FL_Port. A switch port, which is interconnected to another switch port via an Inter Element Link (IEL), is called an E_Port. A B_Port connects a bridge device with an E_Port on a switch; a B_Port provides a subset of E_Port functionality.

Many Fibre Channel components, including the fabric, each node, and most ports, have globally-unique names. These globally-unique names are typically formatted as World Wide Names (WWNs). More information on WWNs can be found in [FC-FS]. WWNs are expected to be persistent across agent and unit resets.

Fibre Channel frames contain 24-bit address identifiers which identify the frame's source and destination ports. Each FC port has both an address identifier and a WWN. When a fabric is in use, the FC address identifiers are dynamically assigned by a switch. Each octet of a 24-bit address represents a level in an address hierarchy, with a Domain_ID being the highest level of the hierarchy.

Registered State Change Notifications (RSCNs) are defined in [FC-LS] as a means to provide Nx_Ports which have registered to receive such notifications, with a timely indication of changes in the state of nodes attached to the fabric. Specifically, an Nx_Port may choose to register, using an State Change Registration (SCR) request [FC-LS] to receive RSCNs. A Nx_Port which has registered will receive an RSCN when an event occurs which may affect the registered port's state. For example, an Nx_Port can use RSCNs as the means by which it is informed of the failures of other nodes, of new devices coming online, or even of more network-accessible storage becoming available. The payload of the RSCN indicates the type of change and includes the address of the changed port. RSCNs are often generated by the fabric, but an Nx_Port can also generate (and send to the fabric) an RSCN if and when it detects an event not visible to the fabric. The sender of an RSCN may coalesce several events into a single RSCN message. Each RSCN is a "request" which is acknowledged by the receiver with an accept or reject.

An RSCN is received by an Nx_Port from the Fabric as an Extended Link Service (ELS) request [FC-LS]. The Fabric distributes RSCNs between Switches using an SW_ILS frame with an Inter-Switch RSCN payload, also known as an SW_RSCN [FC-SW-4]. So, when a Switch has directly attached Nx_Ports which have registered to receive RSCNs, it converts received SW_RSCNs (i.e., SW_ILS frames containing SW_RSCN payloads) into ELS requests containing the corresponding RSCN which it sends to each such Nx_Port.

4. Relationship to Other MIBs

The first standardized MIB for Fibre Channel [RFC2837] was focused on Fibre Channel switches. It was replaced by the more generic Fibre Channel Management MIB [FC-MGMT] which defines basic information for Fibre Channel hosts and switches, including extensions to the standard IF-MIB [IF-MIB] for Fibre Channel interfaces. [FC-MGMT] includes the specification of how the generic objects defined in [IF-MIB] apply to Fibre Channel interfaces.

Note that an interface's ifIndex value must be unique within an SNMP context, irrespective of how many Fibre Channel management instances (see below) and how many Fibre Channel switches are instrumented within that SNMP context.

This MIB imports some common Textual Conventions defined in the T11-TC-MIB [FC-FAM-MIB] and in the T11-FC-NAME-SERVER-MIB [FC-NS-MIB].

5. MIB Overview

This section explains the use of a Fibre Channel management instance, a Switch Index, and a Fabric Index. It also describes the four MIB groups contained in the MIB.

5.1. Fibre Channel management instance

A Fibre Channel management instance is defined in [FC-MGMT] as a separable managed instance of Fibre Channel functionality. Fibre Channel functionality may be grouped into Fibre Channel management instances in whatever way is most convenient for the implementation(s). For example, one such grouping accommodates a single SNMP agent having multiple AgentX [RFC2741] sub-agents, with each sub-agent implementing a different Fibre Channel management instance.

The object, fcmInstanceIndex, is IMPORTed from the FC-MGMT-MIB [FC-MGMT] as the index value to uniquely identify each Fibre Channel management instance within the same SNMP context ([RFC3411] section 3.3.1).

5.2. Switch Index

The FC-MGMT-MIB [FC-MGMT] defines the fcmSwitchTable as a table of information about Fibre Channel switches which are managed by Fibre Channel management instances. Each Fibre Channel management instance can manage one or more Fibre Channel switches. The Switch Index, fcmSwitchIndex, is IMPORTed from the FC-MGMT-MIB as the index value to uniquely identify a Fibre Channel switch amongst those (one or more) managed by the same Fibre Channel management instance.

5.3. Fabric Index

The latest standard for an interconnecting Fabric containing multiple Fabric Switch elements is [FC-SW-4]; it specifies the operation of both a single Fabric in a physical infrastructure, as well as the support of multiple Virtual Fabrics operating within one (or more) physical infrastructures. Whether operating on a physical Fabric (i.e., without Virtual Fabrics) or within a Virtual Fabric, the manner of operation of RSCNs within a/each Fabric is identical. Therefore, this MIB defines all Fabric-related information in tables which are INDEX-ed by an arbitrary integer, named a "Fabric Index", the syntax of which is IMPORTed from the T11-TC-MIB [FC-FAM-MIB]. When a device is connected to a single physical Fabric, without use of any virtual Fabrics, the value of this Fabric Index will always be 1. In an environment of multiple virtual and/or physical Fabrics, this index provides a means to distinguish one Fabric from another.

5.4. The t11FcRscnRegistrationGroup group

This group contains information about the Nx_Ports which have registered to receive RSCNs.

5.5. The t11FcRscnNotifyGroup group

This group contains two notifications: one generated by when a switch rejects a SCR or RSCN; the other when a switch rejects a SW_RSCN.

5.6. The t11FcRscnNotifyControlGroup group

This group contains one object for each notification in the t11FcRscnNotifyGroup group to enable/disable that notification, as well as three objects which record information about the latest rejection of an SCR, RSCN or SW_RSCN, specifically, the content (if available) of the rejected request, the source of the rejected request, and the reason for the rejection.

5.7. The t11FcRscnStatsGroup group

This group contains RSCN-related statistics. Two levels of statistics are included:

1) counters at the message-type level, for:
   - the number of SCRs received/rejected,
   - the number of RSCNs sent/received/rejected,
   - the number of SW_RSCNs sent/received/rejected.

2) counters for each different category of sent/received RSCNs, where different categories are indicated by different values of the 'Event Qualifier' contained in an RSCN message. Note that if and when several RSCN events are coalesced into a single RSCN message, then that message may be counted in more than one of these counters. No counters are defined in this MIB for the 'Event Qualifier' value of '0001'b (meaning "Changed Name Server Object") because these types of RSCNs are counted by the t11NsInRscns and t11NsOutRscns objects already defined in [FC-NS-MIB].

6. Definitions

6.1. The T11-FC-RSCN-MIB Module

```
T11-FC-RSCN-MIB DEFINITIONS ::= BEGIN

-- The Fibre Channel RSCN MIB
--
-- for the monitoring of registrations by Nx_Ports to receive
-- Registered State Change Notifications (RSCNs), and the
-- monitoring of RSCN usage.
--

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    NOTIFICATION-TYPE,
    Counter32, mib-2                    FROM SNMPv2-SMI   -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP,
    NOTIFICATION-GROUP                  FROM SNMPv2-CONF  -- [RFC2580]
    TruthValue                          FROM SNMPv2-TC    -- [RFC2579]
    fcmInstanceIndex, fcmSwitchIndex,
    FcNameIdOrZero, FcAddressIdOrZero  FROM FC-MGMT-MIB  -- [FC-MGMT]
    T11NsGs4RejectReasonCode FROM T11-FC-NAME-SERVER-MIB -- [FC-NS-MIB]
    T11FabricIndex           FROM T11-TC-MIB;            -- [FC-FAM-MIB]

t11FcRscnMIB  MODULE-IDENTITY
    LAST-UPDATED "200602130000Z"
    ORGANIZATION "T11 "
    CONTACT-INFO
            "     Claudio DeSanti
                  Cisco Systems, Inc.
                  170 West Tasman Drive
                  San Jose, CA 95134 USA
                  Phone: +1 408 853-9172
                  EMail: cds@cisco.com

                  Keith McCloghrie
                  Cisco Systems, Inc.
                  170 West Tasman Drive
                  San Jose, CA USA 95134
                  Phone: +1 408-526-5260
                  Email: kzm@cisco.com"

    DESCRIPTION
           "The MIB module for the management of registrations
```

```
            by Nx_Ports to receive RSCNs (Registered State Change
            Notifications) on a Fibre Channel network, as defined
            in FC-LS, and for the monitoring of RSCNs sent/received
            or rejected in a Fibre Channel network.

            Copyright (C) The Internet Society (2006).  This version of
            this MIB module is part of RFC yyyy;  see the RFC itself for
            full legal notices."
-- RFC Editor: replace yyyy with actual RFC number & remove this note
    REVISION    "200602130000Z"
    DESCRIPTION
            "Initial version of this MIB module, published as RFCyyyy."
-- RFC-Editor, replace yyyy with actual RFC number & remove this note
    ::= { mib-2 nnn }  -- to be assigned by IANA
-- RFC Editor: replace XXX with IANA-assigned number & remove this note


t11FcRscnNotifications  OBJECT IDENTIFIER ::= { t11FcRscnMIB 0 }
t11FcRscnObjects        OBJECT IDENTIFIER ::= { t11FcRscnMIB 1 }
t11FcRscnConformance    OBJECT IDENTIFIER ::= { t11FcRscnMIB 2 }
t11FcRscnRegistrations  OBJECT IDENTIFIER ::= { t11FcRscnObjects 1 }
t11FcRscnStats          OBJECT IDENTIFIER ::= { t11FcRscnObjects 2 }
t11FcRscnInformation    OBJECT IDENTIFIER ::= { t11FcRscnObjects 3 }


-- State Change Registration Table

t11FcRscnRegTable  OBJECT-TYPE
    SYNTAX         SEQUENCE OF T11FcRscnRegEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
            "A table of Nx_Ports that have registered to receive
            RSCNs on all fabrics configured on one or more Fibre
            Channel switches."
    ::= { t11FcRscnRegistrations 1 }

t11FcRscnRegEntry  OBJECT-TYPE
    SYNTAX        T11FcRscnRegEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
            "An entry containing information about one Nx_Port which
            has registered with a particular switch (identified by
            values of fcmInstanceIndex and fcmSwitchIndex) for a
```

```
            particular Fabric (identified by a t11FcRscnFabricIndex
            value)."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex, t11FcRscnFabricIndex,
              t11FcRscnRegFcId }
    ::= { t11FcRscnRegTable 1 }

T11FcRscnRegEntry ::= SEQUENCE {
    t11FcRscnFabricIndex         T11FabricIndex,
    t11FcRscnRegFcId             FcAddressIdOrZero,
    t11FcRscnRegType             BITS
}

t11FcRscnFabricIndex OBJECT-TYPE
    SYNTAX      T11FabricIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
            "An index value which uniquely identifies a particular
            Fabric.

            In a Fabric conformant to FC-SW-4, multiple Virtual Fabrics
            can operate within one (or more) physical infrastructures.
            In such a case, this index value is used to uniquely
            identify a particular Fabric within a physical
            infrastructure.

            In a Fabric which has (can have) only a single Fabric
            operating within the physical infrastructure, the
            value of this Fabric Index will always be 1."
    REFERENCE
          "ANSI INCITS xxx-200n, Fibre Channel - Switch Fabric - 4
          (FC-SW-4), T11/Project 1674-D/Rev 7.1, October 2004."
    ::= { t11FcRscnRegEntry 1 }

t11FcRscnRegFcId  OBJECT-TYPE
    SYNTAX        FcAddressIdOrZero (SIZE (3))
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
            "The Fibre Channel Address Identifier (FC_ID) of the
            registering Nx_Port."
    ::= { t11FcRscnRegEntry 2 }

t11FcRscnRegType  OBJECT-TYPE
    SYNTAX        BITS {
```

```
                    fromFabricController(0),
                    fromNxPort(1)
                }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "This object indicates the type of registration
           desired by the registering Nx_Port, one bit per type:

           'fromFabricController' -- RSCNs generated for events
                                  detected by the Fabric Controller.

           'fromNxPorts'          -- RSCNs generated for events
                                  detected by the affected Nx_Port."
    REFERENCE
          "ANSI INCITS xxx-200n, Fibre Channel - Link Services
          (FC-LS), Rev 1.2, table 44, June 2005."
    ::= { t11FcRscnRegEntry 3 }


-- Statistics

t11FcRscnStatsTable  OBJECT-TYPE
    SYNTAX         SEQUENCE OF T11FcRscnStatsEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
           "The RSCN-related statistics on all fabrics configured
           on one or more Fibre Channel switches.

           Two levels of statistics are included:

              1) counters at the message-type level, for:
                 - the number of SCRs received/rejected,
                 - the number of RSCNs sent/received/rejected,
                 - the number of SW_RSCNs sent/received/rejected.

              2) counters of sent/received RSCNs per 'Event
                 Qualifier' value.  Note that if and when several
                 RSCN events are coalesced into a single RSCN
                 message, then that message may be counted in
                 more than one of these counters."
    ::= { t11FcRscnStats 1 }

t11FcRscnStatsEntry  OBJECT-TYPE
```

```
    SYNTAX        T11FcRscnStatsEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
           "An entry containing statistics for a particular Fabric
           (identified by a t11FcRscnFabricIndex value) on a particular
           switch (identified by values of fcmInstanceIndex and
           fcmSwitchIndex)."
    INDEX  { fcmInstanceIndex, fcmSwitchIndex, t11FcRscnFabricIndex }
    ::= { t11FcRscnStatsTable 1 }

T11FcRscnStatsEntry ::= SEQUENCE {
    t11FcRscnInScrs                   Counter32,
    t11FcRscnInRscns                  Counter32,
    t11FcRscnOutRscns                 Counter32,
    t11FcRscnInSwRscns                Counter32,
    t11FcRscnOutSwRscns               Counter32,
    t11FcRscnScrRejects               Counter32,
    t11FcRscnRscnRejects              Counter32,
    t11FcRscnSwRscnRejects            Counter32
    t11FcRscnInUnspecifiedRscns       Counter32,
    t11FcRscnOutUnspecifiedRscns      Counter32,
    t11FcRscnInChangedAttribRscns     Counter32,
    t11FcRscnOutChangedAttribRscns    Counter32,
    t11FcRscnInChangedServiceRscns    Counter32,
    t11FcRscnOutChangedServiceRscns   Counter32,
    t11FcRscnInChangedSwitchRscns     Counter32,
    t11FcRscnOutChangedSwitchRscns    Counter32,
    t11FcRscnInRemovedRscns           Counter32,
    t11FcRscnOutRemovedRscns          Counter32
}

t11FcRscnInScrs  OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
           "The number of SCRs received from Nx_Ports
           by this switch on this fabric."
    ::= { t11FcRscnStatsEntry 1 }


t11FcRscnInRscns  OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
```

```
    STATUS        current
    DESCRIPTION
           "The number of RSCNs received from Nx_Ports
           by this switch on this fabric."
    ::= { t11FcRscnStatsEntry 2 }

t11FcRscnOutRscns  OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "The number of RSCNs transmitted to Nx_Ports
           by this switch on this fabric."
    ::= { t11FcRscnStatsEntry 3 }


t11FcRscnInSwRscns  OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "The number of SW_RSCNs received by this switch from
           other switches on this fabric."
    ::= { t11FcRscnStatsEntry 4 }

t11FcRscnOutSwRscns  OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "The number of SW_RSCNs transmitted by this switch
           from other switches on this fabric."
    ::= { t11FcRscnStatsEntry 5 }

t11FcRscnScrRejects  OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "The number of SCRs rejected by this switch on
           this fabric."
    ::= { t11FcRscnStatsEntry 6 }

t11FcRscnRscnRejects OBJECT-TYPE
    SYNTAX        Counter32
```

```
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
           "The number of RSCNs rejected by this switch on this
           fabric."
    ::= { t11FcRscnStatsEntry 7 }

t11FcRscnSwRscnRejects  OBJECT-TYPE
    SYNTAX         Counter32
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
           "The number of SW_RSCN rejected by this switch on this
           fabric."
    ::= { t11FcRscnStatsEntry 8 }

t11FcRscnInUnspecifiedRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) received by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0000'b
           meaning 'Event is not specified'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 9 }

t11FcRscnOutUnspecifiedRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) sent by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0000'b
           meaning 'Event is not specified'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 10 }

t11FcRscnInChangedAttribRscns  OBJECT-TYPE
```

```
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) received by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0002'b
           meaning 'Changed Port Attribute'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 11 }

t11FcRscnOutChangedAttribRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) sent by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0002'b
           meaning 'Changed Port Attribute'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 12 }

t11FcRscnInChangedServiceRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) received by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0003'b
           meaning 'Changed Service Object'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 13 }

t11FcRscnOutChangedServiceRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
```

```
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) sent by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0003'b
           meaning 'Changed Service Object'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 14 }

t11FcRscnInChangedSwitchRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) received by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0004'b
           meaning 'Changed Switch Configuration'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 15 }

t11FcRscnOutChangedSwitchRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) sent by this switch on this fabric which
           contained an RSCN Event Qualifier value of '0004'b
           meaning 'Changed Switch Configuration'."
    REFERENCE
           "ANSI INCITS xxx-200n, Fibre Channel - Link Services
           (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 16 }

t11FcRscnInRemovedRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registered State Change Notifications
           (RSCNs) received by this switch on this fabric which
```

```
            contained an RSCN Event Qualifier value of '0005'b
            meaning 'Removed Object'."
    REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 17 }

t11FcRscnOutRemovedRscns  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
             "The number of Registered State Change Notifications
            (RSCNs) sent by this switch on this fabric which
            contained an RSCN Event Qualifier value of '0005'b
            meaning 'Removed Object'."
    REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, table 40."
    ::= { t11FcRscnStatsEntry 18 }


--
-- Notification Control Table
--
t11FcRscnNotifyControlTable OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcRscnNotifyControlEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "A table of control information for notifications
            generated due to the rejection of an SCR or RSCN."
    ::= { t11FcRscnInformation 1 }

t11FcRscnNotifyControlEntry OBJECT-TYPE
    SYNTAX       T11FcRscnNotifyControlEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Each entry contains notification control information
            concerning the rejection of RSCN/SCRs for a particular
            fabric (identified by the value of t11FcRscnFabricIndex)
            by a particular switch (identified by values of
            fcmInstanceIndex and fcmSwitchIndex)."
    INDEX  { fcmInstanceIndex, fcmSwitchIndex, t11FcRscnFabricIndex }
```

```
    ::= { t11FcRscnNotifyControlTable 1 }

T11FcRscnNotifyControlEntry ::= SEQUENCE {
     t11FcRscnIlsRejectNotifyEnable     TruthValue,
     t11FcRscnElsRejectNotifyEnable     TruthValue,
     t11FcRscnRejectedRequestString     OCTET STRING,
     t11FcRscnRejectedRequestSource     FcNameIdOrZero,
     t11FcRscnRejectReasonCode          T11NsGs4RejectReasonCode,
     t11FcRscnRejectReasonCodeExp       OCTET STRING,
     t11FcRscnRejectReasonVendorCode    OCTET STRING
}

t11FcRscnIlsRejectNotifyEnable OBJECT-TYPE
    SYNTAX       TruthValue
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
           "This object specifies if a t11FcRscnIlsRejectReqNotify
           notification should be generated when this switch
           rejects an SW_RSCN on this fabric."
    DEFVAL { false }
    ::= { t11FcRscnNotifyControlEntry 1 }

t11FcRscnElsRejectNotifyEnable OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-write
    STATUS        current
    DESCRIPTION
           "This object specifies if a t11FcRscnElsRejectReqNotify
           notification should be generated when this switch
           rejects an RSCN or SCR on this fabric."
    DEFVAL { false }
    ::= { t11FcRscnNotifyControlEntry 2 }

t11FcRscnRejectedRequestString OBJECT-TYPE
    SYNTAX        OCTET STRING (SIZE (0..255))
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
           "The binary content of the RSCN or SCR or SW_RSCN which
           was most recently rejected by this switch on this fabric.
           The value is formatted as an octet string (in network
           byte order) containing the payload of the rejected
           RSCN or SCR as described in FC-LS, or the rejected
           SW_RSCN as described in FC-SW-4.
```

```
            This object contains the zero-length string if and when
            the RSCN/SCR/SW_RSCN payload is unavailable.  When the
            length of this object is 255 octets, it contains the
            first 255 octets of the payload (in network-byte order)."
        REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, tables 38 & 43.
            ANSI INCITS xxx-200n, Fibre Channel - Switch Fabric - 4
            (FC-SW-4), T11/Project 1674-D/Rev 7.1, October 2004,
            table 45."
        ::= { t11FcRscnNotifyControlEntry 3 }

t11FcRscnRejectedRequestSource OBJECT-TYPE
        SYNTAX       FcNameIdOrZero
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
            "The WWN which was the source of the RSCN, SCR or
            SW_RSCN which was most recently rejected by this switch
            on this fabric."
        ::= { t11FcRscnNotifyControlEntry 4 }

t11FcRscnRejectReasonCode OBJECT-TYPE
        SYNTAX        T11NsGs4RejectReasonCode
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "This object contains the Reason Code of the most recent
            rejection by this switch of an RSCN, SCR or SW_RSCN on
            this fabric."
        REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, table 148.
            ANSI INCITS xxx-200n, Fibre Channel - Switch Fabric - 4
            (FC-SW-4), T11/Project 1674-D/Rev 7.1, October 2004,
            table 5."
        ::= { t11FcRscnNotifyControlEntry 5 }

t11FcRscnRejectReasonCodeExp OBJECT-TYPE
        SYNTAX        OCTET STRING (SIZE(1))
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "This object contains the Reason Code Explanation
            of the most recent rejection by this switch of an
```

```
            RSCN, SCR or SW_RSCN on this fabric."
    REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, table 149.
            ANSI INCITS xxx-200n, Fibre Channel - Switch Fabric - 4
            (FC-SW-4), T11/Project 1674-D/Rev 7.1, October 2004,
            table 6."
    ::= { t11FcRscnNotifyControlEntry 6 }

t11FcRscnRejectReasonVendorCode OBJECT-TYPE
    SYNTAX        OCTET STRING (SIZE(1))
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
            "This object contains the Reason Vendor Specific
            Code of the most recent rejection by this switch
            of an RSCN, SCR or SW_RSCN on this fabric."
    REFERENCE
            "ANSI INCITS xxx-200n, Fibre Channel - Link Services
            (FC-LS), Rev 1.2, June 2005, table 148.
            ANSI INCITS xxx-200n, Fibre Channel - Switch Fabric - 4
            (FC-SW-4), T11/Project 1674-D/Rev 7.1, October 2004,
            section 6.1.3."
    ::= { t11FcRscnNotifyControlEntry 7 }


-- Notifications

t11FcRscnElsRejectReqNotify NOTIFICATION-TYPE
    OBJECTS { t11FcRscnRejectedRequestString,
              t11FcRscnRejectedRequestSource,
              t11FcRscnRejectReasonCode,
              t11FcRscnRejectReasonCodeExp,
              t11FcRscnRejectReasonVendorCode }
    STATUS  current
    DESCRIPTION
            "This notification is generated when a switch rejects
            an SCR or RSCN.

            The value of t11FcRscnRejectedRequestString indicates the
            binary content of the rejected request if available, or
            the zero-length string otherwise.  The source of the
            rejected request is given by t11FcRscnRejectedRequestSource,
            and the reason for rejection is given by the values of
            t11FcRscnRejectReasonCode, t11FcRscnRejectReasonCodeExp
```

```
            and t11FcRscnRejectReasonVendorCode."
    ::= { t11FcRscnNotifications 1 }

t11FcRscnIlsRejectReqNotify NOTIFICATION-TYPE
    OBJECTS { t11FcRscnRejectedRequestString,
              t11FcRscnRejectedRequestSource,
              t11FcRscnRejectReasonCode,
              t11FcRscnRejectReasonCodeExp,
              t11FcRscnRejectReasonVendorCode }
    STATUS  current
    DESCRIPTION
           "This notification is generated when a switch rejects
           an SW_RSCN.

           The value of t11FcRscnRejectedRequestString indicates the
           binary content of the rejected request if available, or
           the zero-length string otherwise.  The source of the
           rejected request is given by t11FcRscnRejectedRequestSource,
           and the reason for rejection is given by the values of
           t11FcRscnRejectReasonCode, t11FcRscnRejectReasonCodeExp
           and t11FcRscnRejectReasonVendorCode."
    ::= { t11FcRscnNotifications 2 }

-- Conformance
t11FcRscnCompliances OBJECT IDENTIFIER ::= { t11FcRscnConformance 1 }
t11FcRscnGroups      OBJECT IDENTIFIER ::= { t11FcRscnConformance 2 }

t11FcRscnCompliance MODULE-COMPLIANCE
    STATUS    current
    DESCRIPTION
           "The compliance statement for entities which implement
           this MIB."
    MODULE
        MANDATORY-GROUPS { t11FcRscnRegistrationGroup,
                           t11FcRscnNotifyControlGroup,
                           t11FcRscnNotifyGroup }

    GROUP   t11FcRscnStatsGroup
    DESCRIPTION
            "These counters, containing RSCN-related statistics, are
            mandatory only for those systems which count such events."

    OBJECT       t11FcRscnIlsRejectNotifyEnable
    MIN-ACCESS   read-only
    DESCRIPTION
```

```
            "Write access is not required."

    OBJECT       t11FcRscnElsRejectNotifyEnable
    MIN-ACCESS   read-only
    DESCRIPTION
            "Write access is not required."

    ::= { t11FcRscnCompliances 1 }


-- Units of conformance

t11FcRscnRegistrationGroup  OBJECT-GROUP
    OBJECTS { t11FcRscnRegType }
    STATUS  current
    DESCRIPTION
           "A collection of objects for monitoring RSCN
           registrations."
    ::= { t11FcRscnGroups 1 }

t11FcRscnStatsGroup   OBJECT-GROUP
    OBJECTS { t11FcRscnInScrs,
              t11FcRscnInRscns,
              t11FcRscnOutRscns,
              t11FcRscnInSwRscns,
              t11FcRscnOutSwRscns,
              t11FcRscnScrRejects,
              t11FcRscnRscnRejects,
              t11FcRscnSwRscnRejects,
              t11FcRscnInUnspecifiedRscns,
              t11FcRscnOutUnspecifiedRscns,
              t11FcRscnInChangedAttribRscns,
              t11FcRscnOutChangedAttribRscns,
              t11FcRscnInChangedServiceRscns,
              t11FcRscnOutChangedServiceRscns,
              t11FcRscnInChangedSwitchRscns,
              t11FcRscnOutChangedSwitchRscns,
              t11FcRscnInRemovedRscns,
              t11FcRscnOutRemovedRscns
            }
    STATUS  current
    DESCRIPTION
           "A collection of objects for collecting RSCN-related
           statistics."
    ::= { t11FcRscnGroups 2 }
```

```
t11FcRscnNotifyControlGroup  OBJECT-GROUP
    OBJECTS { t11FcRscnIlsRejectNotifyEnable,
              t11FcRscnElsRejectNotifyEnable,
              t11FcRscnRejectedRequestString,
              t11FcRscnRejectedRequestSource,
              t11FcRscnRejectReasonCode,
              t11FcRscnRejectReasonCodeExp,
              t11FcRscnRejectReasonVendorCode
            }
    STATUS  current
    DESCRIPTION
           "A collection of notification control and
           notification information objects."
    ::= { t11FcRscnGroups 3 }

t11FcRscnNotifyGroup   NOTIFICATION-GROUP
    NOTIFICATIONS { t11FcRscnIlsRejectReqNotify,
                    t11FcRscnElsRejectReqNotify
                  }
    STATUS        current
    DESCRIPTION
           "A collection of notifications for monitoring
           ILS and ELS rejections by the RSCN module."
    ::= { t11FcRscnGroups 4 }

END
```

7. Intellectual Property

"The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in BCP-11. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat."

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8. Acknowledgements

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T11 Chair: Robert Snively, Brocade
T11 Vice Chair: Claudio DeSanti, Cisco Systems
T11.5 Chair: Roger Cummings, Symantec
T11.5 Vice Chair: Scott Kipp, McData
and T11.5 members.

9. Normative References

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10. Informative References

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Teow, K., "Definitions of Managed Objects for the Fabric Element in Fibre Channel Standard", RFC 2837, May 2000.

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Framework", RFC 3410, December 2002.

11. IANA Considerations

IANA is requested to make a MIB OID assignment for the T11-FC-RSCN-MIB module, under the appropriate subtree.

12. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These objects and their sensitivity/vulnerability are:

```
t11FcRscnIlsRejectNotifyEnable
t11FcRscnElsRejectNotifyEnable
   -- ability to enable/disable a notification.
```

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may also be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

t11FcRscnRegTable -- contains a list of Nx_Ports which are currently registered to received RSCNs.

t11FcRscnStatsTable -- contains RSCN-related statistics.

t11FcRscnNotifyControlTable -- contains control and logging information for notifications which are concerned with the rejection of RSCN-related requests.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementors consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

13. Authors' Addresses

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