Fibre Channel Fabric Address Manager MIB

Status of This Memo

This document specifies an Internet standards track protocol for the
Internet community, and requests discussion and suggestions for
improvements. Please refer to the current edition of the "Internet
Official Protocol Standards" (STD 1) for the standardization state
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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 a Fibre Channel network's Fabric Address Manager.

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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 a Fibre Channel network's Fabric Address Manager. Fabric Address Manager refers to the functionality of acquiring DomainID(s) as specified in [FC-SW-3], and managing Fibre Channel Identifiers as specified in [FC-FS].

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-Switch Link (ISL), 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.

Each switch in a Fabric is assigned one (or more) unique Domain_IDs
using a two-step process. First, one switch, called Principal
Switch, is selected from the switches of a Fabric. Then, the
Principal Switch assigns Domain_IDs to the other switches of the
Fabric. Address assignment within a domain is performed by the
switch to which that Domain_ID is granted.

4. Relationship to Other MIBs

The first standardized MIB for Fibre Channel [RFC2837] was focused on
Fibre Channel switches. It is being 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 document defines the T11-FC-FABRIC-ADDR-MGR-MIB module, which
extends beyond [FC-MGMT] to cover the functionality, in Fibre Channel
switches, which is used to manage Fabric configuration, domains, and
addresses within a domain.

This document also contains a MIB module, T11-TC-MIB, to define
textual conventions that might also be useful in other MIBs defined
by T11.

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 six 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 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 a Fibre Channel
   management instance.

5.2. Switch Index

   The FC-MGMT-MIB [FC-MGMT] defines the fcmSwitchTable as a table of
   information about Fibre Channel switches that 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 [FC-SW-3] standard for an interconnecting Fabric consisting of
   multiple Fabric Switch elements describes the operation of a single
   Fabric in a physical infrastructure. The current [FC-SW-4] standard
   also supports the operation of multiple Virtual Fabrics operating
   within one (or more) physical infrastructures. In such a scenario,
   each Fabric has, of course, its own management instrumentation. In
   order to accommodate this scenario, this MIB module defines all
   Fabric-related information in tables that are INDEXed by an arbitrary
   integer, named a "Fabric Index". In a Fabric that is conformant to
   [FC-SW-3], the value of this Fabric Index will always be 1.

It is quite possible, and may even become likely, that (a port of) a
Fibre Channel switch will be connected to multiple such Fabrics.
Thus, in order to simplify a query concerning all the Fabrics to
which a single switch is connected, fcmSwitchIndex will be listed
before t11FamFabricIndex when they both appear in the same INDEX
clause.

5.4. The t11FamGroup Group

This group contains basic information about the Fabric Address
Manager functionality within a switch, including its configuration
parameters that are per-interface (i.e., specified for a particular
Fibre Channel interface identified by an ifIndex value).

5.5. The t11FamDatabaseGroup Group

This group contains information about which switches are assigned to
which domains.

5.6. The t11FamAreaGroup Group

This group contains information about which Port-IDs have been
assigned within the areas of the local domain.

5.7. The t11FamCacheGroup Group

This conditional mandatory group contains information about all the
FC address identifier assignments that have been recently released.
This cache is kept to support the concept of Preferred Domain_ID via
a best-effort attempt for (short-term) re-assignment of the same FC
address identifiers.

5.8. The t11FamCommandGroup Group

This optional group contains objects used for initiating an operation
on a Fabric.

5.9. The t11FamNotificationGroup Group

This group contains notifications of significant events concerning
the Fabric Address management functionality within a switch.

5.10. Use of RCF and BF

Included in [FC-SW-3] is the specification of Reconfigure Fabric
(RCF) and Build Fabric (BF), both of which are command codes of the
Switch Fabric Internal Link Service (SW_ILS). [FC-SW-3] includes the
warning:

NOTE 13 - Since the RCF causes a complete reconfiguration of the
Fabric, and may cause addresses allocated to a Switch to change,
this SW_ILS should be used with caution. The BF SW_ILS allows the
Fabric to attempt reconfiguration without loss of or change of
address and therefore should be attempted before an RCF. Examples
of situations in which RCF may be appropriate include resolution
of overlapped Domains, or the failure of a Fabric Reconfiguration
initiated by a BF.

Further, [FC-MI] specifies:

A Fabric is prohibited from autonomously generating an RCF, but an
outside administrative function may request a switch to generate
an RCF. Such an administrative function is outside the scope of
this technical report.

The T11-FC-FABRIC-ADDR-MGR-MIB defined in this document is consistent
with both of the above quotes since it defines two objects,
t11FamAutoReconfigure and t11FamRestart, which are defined with a
MAX-ACCESS of read-write, and setting them to the appropriate value
is a means by which "an outside administrative function may request a
switch to generate an RCF" [FC-MI].

Note, however, the MIB specifies in its compliance section that the
minimum required level of support for these two objects is read-only.

Further, for both t11FamAutoReconfigure and t11FamRestart, the MIB
serves only as a request to generate; it does not represent the
action of the RCF or BF. That is, a successful SNMP SetRequest on
these objects will cause an RCF (or BF) to be sent, but SNMP does
not/cannot ensure the successful operation of the SW_ILS operation.

6. Definitions

6.1. The T11-TC-MIB Module

T11-TC-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, Unsigned32, mib-2
                                        FROM SNMPv2-SMI -- [RFC2578]
    TEXTUAL-CONVENTION   FROM SNMPv2-TC; -- [RFC2579]

t11TcMIB MODULE-IDENTITY
    LAST-UPDATED "200603020000Z"
    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
            "This module defines textual conventions used in T11 MIBs.

            Copyright (C) The Internet Society (2006). This version
            of this MIB module is part of RFC 4439; see the RFC
            itself for full legal notices."
    REVISION   "200603020000Z"
    DESCRIPTION
            "Initial version of this MIB module, published as RFC 4439."
    ::= { mib-2 136 }

T11FabricIndex ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS   current
    DESCRIPTION
            "A Fabric Index that is used as a unique
            index value to identify a particular Fabric within
            one (or more) physical infrastructures.

            In an environment that is conformant to FC-SW-3, where

                    there is always exactly one Fabric in a single physical
                    infrastructure, the value of this Fabric Index will
                    always be 1.

                    However, the current standard, FC-SW-4, defines
                    how multiple Fabrics, each with its own management
                    instrumentation, could operate within one (or more)
                    physical infrastructures. When such multiple Fabrics
                    are in use, this index value is used to uniquely
                    identify a particular Fabric within a physical
                    infrastructure.

                    Note that the value of this textual convention has a
                    range of (0..4095) so as to be consistent with FC-SW-4,
                    which says that a 'VF_ID Bitmap' is 512 bytes long, with
                    the high-order bit representing VF_ID zero, and the
                    low-order bit representing 4095."
          REFERENCE   "Fibre Channel - Switch Fabric - 4 (FC-SW-4),
                        ANSI INCITS 418-2006, section 6.1.27.2.4."
          SYNTAX   Unsigned32 (0..4095)

END

6.2. The T11-FC-FABRIC-ADDR-MGR-MIB Module

T11-FC-FABRIC-ADDR-MGR-MIB DEFINITIONS ::= BEGIN

-- the Fibre Channel Fabric Address Manager MIB
--
-- for management of the functionality, in Fibre Channel switches,
-- which is used to manage fabric configuration, domains, and
-- addresses within a domain.
--

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    NOTIFICATION-TYPE, Unsigned32,
    Counter32, Gauge32, mib-2   FROM SNMPv2-SMI   -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP,
    NOTIFICATION-GROUP   FROM SNMPv2-CONF -- [RFC2580]
    TEXTUAL-CONVENTION, TruthValue,
    RowStatus   FROM SNMPv2-TC   -- [RFC2579]
    ifIndex   FROM IF-MIB   -- [IF-MIB]
    fcmInstanceIndex, fcmSwitchIndex,
    FcDomainIdOrZero, FcNameIdOrZero   FROM FC-MGMT-MIB -- [FC-MGMT]
    T11FabricIndex   FROM T11-TC-MIB;

t11FcFabricAddrMgrMIB MODULE-IDENTITY

```
        LAST-UPDATED "200603020000Z"
        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

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                        Cisco Systems, Inc.
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                        San Jose, CA USA 95134
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                        EMail: kzm@cisco.com"
        DESCRIPTION
                "The MIB module for the Fabric Address management
                functionality defined by the Fibre Channel standards.  For
                the purposes of this MIB, Fabric Address Manager refers to
                the functionality of acquiring DomainID(s) as specified in
                FC-SW-3, and managing Fibre Channel Identifiers as specified
                in FC-FS.  An instance of 'Fabric Address Manager' software
                functionality executes in the Principal Switch, and in each
                other switch.

                After an agent reboot, the values of read-write objects
                defined in this MIB module are implementation-dependent.

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                this MIB module is part of RFC 4439;  see the RFC itself for
                full legal notices."
        REVISION    "200603020000Z"
        DESCRIPTION
                "Initial version of this MIB module, published as RFC 4439."
        ::= { mib-2 137 }

t11FamNotifications    OBJECT IDENTIFIER ::= { t11FcFabricAddrMgrMIB 0 }
t11FamMIBObjects       OBJECT IDENTIFIER ::= { t11FcFabricAddrMgrMIB 1 }
t11FamMIBConformance   OBJECT IDENTIFIER ::= { t11FcFabricAddrMgrMIB 2 }
t11FamConfiguration    OBJECT IDENTIFIER ::= { t11FamMIBObjects 1 }
t11FamInfo             OBJECT IDENTIFIER ::= { t11FamMIBObjects 2 }
t11FamNotifyControl    OBJECT IDENTIFIER ::= { t11FamMIBObjects 3 }


-- Textual Conventions

T11FamDomainPriority ::= TEXTUAL-CONVENTION
```

```
        DISPLAY-HINT  "d"
        STATUS    current
        DESCRIPTION
               "Priority of a switch.

               The Principal Switch selection is influenced by the
               priority of the switches.

               Some values of importance are:

               1   : The highest priority in Principal Switch
                     selection, which is used by the administrator
                     to establish which switch becomes the Principal
                     Switch.
               255 : Indicates that the switch is not capable of
                     acting as a Principal Switch."
        REFERENCE    "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                      ANSI INCITS 384-2004, section 6.1.5."
        SYNTAX    Unsigned32 (1..255)

T11FamDomainInterfaceRole ::= TEXTUAL-CONVENTION
        STATUS    current
        DESCRIPTION
               "The 'designated' state/role of the Inter-Switch Link (ISL)
               to which an interface connects, or (if not connected)
               the state of the interface:

               nonPrincipal (1)        - non-Principal ISL
               principalUpstream (2)   - Upstream Principal ISL
               principalDownsteam (3)  - Downstream Principal ISL
               isolated (4)            - interface is isolated
               down (5)                - interface is down
               unknown (6)             - state/role is unknown
               "
        REFERENCE    "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                      ANSI INCITS 384-2004, Sections 3.1, 5.7,
                      and Figure 9."
        SYNTAX     INTEGER {
                        nonPrincipal (1),
                        principalUpstream (2),
                        principalDownsteam (3),
                        isolated (4),
                        down (5),
                        unknown (6)
                    }

T11FamState ::= TEXTUAL-CONVENTION
        STATUS    current
```

DESCRIPTION
        "The state of the Fabric Address Manager, as described in
        Table 86 and Figure 15 of FC-SW-3.

        - 'other' represents a switch that is in a state not
          represented by any of the below enumerations.

        - 'starting' represents a switch engaged in the process
          represented by the first row in Table 86.

        - 'unconfigured' represents a switch that requires
          operator input before it can begin the process
          represented by the first row in Table 86.

        - 'principalSwitchSelection' represents a switch engaged
          in the process represented by the second row in
          Table 86, but not in states F0 or F1 of Figure 15.

        - 'domainIdDistribution' represents a switch engaged in
          the process represented by the third row in Table 86.

        - 'buildFabricPhase' represents a switch that is in
          state F0 of Figure 15.

        - 'reconfigureFabricPhase' represents a switch that is
          in state F1 of Figure 15.

        - 'stable' represents a switch that has successfully
          completed the process represented by the third row in
          Table 86 and has at least one E_Port.

        - 'stableWithNoEports' represents a switch that has
          successfully completed the process represented by the
          third row in Table 86 but has no E_Ports.

        - 'noDomains' represents a switch that has completed
          the process represented by the third row in Table 86
          but failed to obtain a Domain_ID.

        - 'disabled' represents any situation in which the
          corresponding instance of t11FamEnable has the value
          'false'.

        - 'unknown' represents a switch that is confused about
          what state it is in."
REFERENCE   "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
             ANSI INCITS 384-2004, Table 86 and Figure 15."
SYNTAX   INTEGER {

```
                            other(1),
                            starting(2),
                            unconfigured(3),
                            principalSwitchSelection(4),
                            domainIdDistribution(5),
                            buildFabricPhase(6),
                            reconfigureFabricPhase(7),
                            stable(8),
                            stableWithNoEports(9),
                            noDomains(10),
                            disabled(11),
                            unknown(12)
                }


--
-- t11FamTable
--

t11FamTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF T11FamEntry
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "This table contains Fabric Address Manager related
            parameters that are able to be configured and monitored
            in a Fibre Channel switch.  For each of the switches
            (identified by fcmSwitchIndex) managed by a Fibre Channel
            management instance (identified by fcmInstanceIndex),
            there is any entry for each Fabric known to that switch.
            Entries are implicitly created/removed if and when
            additional Fabrics are created/deleted."
    ::= { t11FamConfiguration 1 }

t11FamEntry OBJECT-TYPE
    SYNTAX      T11FamEntry
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "An entry provides information on the local Fabric Address
            Manager functionality for a Fabric known to a
            particular switch."
    INDEX { fcmInstanceIndex, fcmSwitchIndex, t11FamFabricIndex }
    ::= { t11FamTable 1 }

T11FamEntry ::= SEQUENCE {
    t11FamFabricIndex                       T11FabricIndex,
    t11FamConfigDomainId                    FcDomainIdOrZero,
```

```
        t11FamConfigDomainIdType                INTEGER,
        t11FamAutoReconfigure                   TruthValue,
        t11FamContiguousAllocation              TruthValue,
        t11FamPriority                          T11FamDomainPriority,
        t11FamPrincipalSwitchWwn                FcNameIdOrZero,
        t11FamLocalSwitchWwn                    FcNameIdOrZero,
        t11FamAssignedAreaIdList                OCTET STRING,
        t11FamGrantedFcIds                      Counter32,
        t11FamRecoveredFcIds                    Counter32,
        t11FamFreeFcIds                         Gauge32,
        t11FamAssignedFcIds                     Gauge32,
        t11FamAvailableFcIds                    Gauge32,
        t11FamRunningPriority                   T11FamDomainPriority,
        t11FamPrincSwRunningPriority            T11FamDomainPriority,
        t11FamState                             T11FamState,
        t11FamLocalPrincipalSwitchSlctns        Counter32,
        t11FamPrincipalSwitchSelections         Counter32,
        t11FamBuildFabrics                      Counter32,
        t11FamFabricReconfigures                Counter32,
        t11FamDomainId                          FcDomainIdOrZero,
        t11FamSticky                            TruthValue,
        t11FamRestart                           INTEGER,
        t11FamRcFabricNotifyEnable              TruthValue,
        t11FamEnable                            TruthValue,
        t11FamFabricName                        FcNameIdOrZero
    }

t11FamFabricIndex OBJECT-TYPE
    SYNTAX      T11FabricIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
            "A unique index value that uniquely identifies a
            particular Fabric known to a particular switch.

            In a Fabric conformant to FC-SW-3, only a single Fabric
            can operate within a physical infrastructure, and thus,
            the value of this Fabric Index will always be 1.

            However, the current standard, FC-SW-4, defines
            how multiple Fabrics, each with its own management
            instrumentation, could operate within one (or more)
            physical infrastructures.  When such multiple Fabrics
            are in use, this index value is used to uniquely
            identify a particular Fabric within a physical
            infrastructure."
    ::= { t11FamEntry 1 }
```

t11FamConfigDomainId OBJECT-TYPE
    SYNTAX   FcDomainIdOrZero
    MAX-ACCESS   read-write
    STATUS   current
    DESCRIPTION
            "The configured Domain_ID of the particular switch on this
            Fabric, or zero if no Domain_ID has been configured.
            The meaning of this object depends on
            t11FamConfigDomainIdType object.

            If t11FamConfigDomainIdType is 'preferred', then the
            configured Domain_ID is called the 'preferred Domain_ID'.
            Valid values are between 0 and 239. In a situation where
            this Domain_ID cannot be assigned, any other Domain_ID
            will be acceptable. A value of zero means any Domain_ID.

            If t11FamConfigDomainIdType is 'insistent', then the
            configured Domain_ID is called the 'insistent Domain_ID' and
            valid values are between 1 and 239. In a situation where
            this Domain_ID cannot be assigned, no other Domain_ID is
            acceptable.

            In both of the above cases, the switch sends an RDI (Request
            Domain_ID) to request this Domain_ID to the Principal
            Switch. If no Domain_ID is able to be granted in the case
            of 'preferred', or if an 'insistent' Domain_ID is configured
            but not able to be granted, then it is an error condition.
            When this error occurs, the switch will continue as if it
            receives a SW_RJT with a reason/explanation of 'Unable to
            perform command request'/'Domain_ID not available'. That
            is, its E_Ports on that Fabric will be isolated and the
            administrator informed via a 't11FamDomainIdNotAssigned'
            notification.

            If t11FamConfigDomainIdType is 'static', then the configured
            Domain_ID is called the 'static Domain_ID' and valid values
            are between 1 and 239. In this situation, there is no
            Principal Switch in the Fabric and the Domain_ID is simply
            assigned by configuration, together with the Fabric_Name.
            A switch configured with a static Domain_ID, on receiving
            an EFP, BF, RCF, DIA, or RDI SW_ILS, shall reply with an
            SW_RJT having Reason Code Explanation 'E_Port is Isolated'
            and shall isolate the receiving E_Port.

            For the persistence of values across reboots, see the
            MODULE-IDENTITY's DESCRIPTION clause."
    REFERENCE   "Fibre Channel - Switch Fabric - 4 (FC-SW-4),
            ANSI INCITS 418-2006, section 7."

```
    DEFVAL        { 0 }
    ::= { t11FamEntry 2 }

t11FamConfigDomainIdType OBJECT-TYPE
    SYNTAX        INTEGER {
                      preferred(1),
                      insistent(2),
                      static(3)
                  }
    MAX-ACCESS  read-write
    STATUS        current
    DESCRIPTION
          "Type of configured Domain_ID contained in
          t11FamConfigDomainId.

          For the persistence of values across reboots, see the
          MODULE-IDENTITY's DESCRIPTION clause."
    DEFVAL  { preferred }
    ::= { t11FamEntry 3 }

t11FamAutoReconfigure OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS  read-write
    STATUS        current
    DESCRIPTION
          "This object determines how a particular switch
          responds to certain error conditions.

          The condition that might cause these errors is
          the merging of two disjoint Fabrics that have
          overlapping Domain_ID lists.

          If value of this object is 'true', the switch will
          send an RCF (ReConfigureFabric) to rebuild the
          Fabric.

          If 'false', the switch will isolate the E_Ports on
          which the errors happened.

          For the persistence of values across reboots, see the
          MODULE-IDENTITY's DESCRIPTION clause."
    REFERENCE   "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                    December 2003, sections 6.1.12 & 7.3.
                    Fibre Channel - Methodologies for Interconnects
                    (FC-MI), INCITS TR-30-2002, table 14, note g."
    DEFVAL  { false }
    ::= { t11FamEntry 4 }
```

t11FamContiguousAllocation OBJECT-TYPE
    SYNTAX   TruthValue
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
            "Determines how a particular switch behaves when elected as
            the Principal Switch.

            If true, the switch will only accept RDIs with a contiguous
            allocation; specifically, it will reject RDIs with
            non-contiguous Domain_IDs, and if an RDI for a contiguous
            Domain_ID is not able to be fulfilled, it will try to
            replace all the Domain_IDs in the list with contiguous
            Domain_IDs, and if that fails, the RDI will be rejected.

            If false, then the switch acts normally in granting
            the Domain_IDs even if they are not contiguous.

            For the persistence of values across reboots, see the
            MODULE-IDENTITY's DESCRIPTION clause."
    ::= { t11FamEntry 5 }

t11FamPriority OBJECT-TYPE
    SYNTAX   T11FamDomainPriority
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
            "The initial or configured priority of a particular switch
            to be used in Principal Switch selection process.

            For the persistence of values across reboots, see the
            MODULE-IDENTITY's DESCRIPTION clause."
    ::= { t11FamEntry 6 }

t11FamPrincipalSwitchWwn OBJECT-TYPE
    SYNTAX   FcNameIdOrZero
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The WWN of the Principal Switch on this Fabric,
            or zero-length string if the identity of the principal
            switch is unknown."
    DEFVAL { ''H }
    ::= { t11FamEntry 7 }

t11FamLocalSwitchWwn OBJECT-TYPE
    SYNTAX   FcNameIdOrZero
    MAX-ACCESS read-only

```
    STATUS        current
    DESCRIPTION
           "The WWN of the particular switch on this Fabric."
    ::= { t11FamEntry 8 }

t11FamAssignedAreaIdList    OBJECT-TYPE
    SYNTAX        OCTET STRING (SIZE(0..256))
    MAX-ACCESS read-only
    STATUS        current
    DESCRIPTION
           "The list of (zero or more) Area_IDs that have been
           assigned by a particular switch in this Fabric, formatted
           as an array of octets in ascending order.

           Each octet represents one Area_ID.  So, the list containing
           Area_IDs 23, 45, 235, and 56 would be formatted as the
           4-octet string x'172d38eb'.

           A particular area's Area_ID is used as the index into the
           t11FamAreaTable to get the statistics on that area."
    ::= { t11FamEntry 9 }

t11FamGrantedFcIds OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS read-only
    STATUS        current
    DESCRIPTION
           "The total number of Fibre Channel Address Identifiers
           granted (for local use, i.e., with a particular switch's
           Domain_ID) by the Fabric Address Manager on that switch.

           This counter has no discontinuities other than those
           that all Counter32s have when sysUpTime=0."
    ::= { t11FamEntry 10 }

t11FamRecoveredFcIds OBJECT-TYPE
    SYNTAX        Counter32
    MAX-ACCESS read-only
    STATUS        current
    DESCRIPTION
           "The total number of Fibre Channel Address Identifiers that
           have been recovered by the Fabric Address Manager on a
           particular switch since the switch has been initialized.
           A recovered Fibre Channel Address Identifier is one that is
           explicitly returned after previously being used.

           This counter has no discontinuities other than those
           that all Counter32s have when sysUpTime=0."
```

```
    ::= { t11FamEntry 11 }

t11FamFreeFcIds OBJECT-TYPE
    SYNTAX     Gauge32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
            "The number of Fibre Channel Address Identifiers that are
            currently unassigned on this Fabric and could be available
            for assignment either immediately or at some later time.

            The sum of the instances of FreeFcIds and AssignedFcIds
            corresponding to a particular Fabric is the total number of
            Fibre Channel Address Identifiers that the local Fabric
            Address Management is capable of assigning on that Fabric."
    ::= { t11FamEntry 12 }

t11FamAssignedFcIds OBJECT-TYPE
    SYNTAX     Gauge32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
            "The number of Fibre Channel Address Identifiers that are
            currently assigned on this Fabric.

            The sum of the instances of FreeFcIds and AssignedFcIds
            corresponding to a particular Fabric is the total number of
            Fibre Channel Address Identifiers that the local Fabric
            Address Management is capable of assigning on that Fabric."
    ::= { t11FamEntry 13 }

t11FamAvailableFcIds OBJECT-TYPE
    SYNTAX     Gauge32
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
            "The number of Fibre Channel Address Identifiers that are
            unassigned and currently available for immediate assignment
            on the Fabric, e.g., with the 'Clean Address' bit set to 1."
    REFERENCE
        "Fibre Channel - Framing and Signaling (FC-FS),
         ANSI INCITS 373-2003, section 15.6.2.4.2."
    ::= { t11FamEntry 14 }

t11FamRunningPriority OBJECT-TYPE
    SYNTAX     T11FamDomainPriority
    MAX-ACCESS read-only
    STATUS     current
```

        DESCRIPTION
                "The running priority of a particular switch on this Fabric.
                This value is initialized to the value of t11FamPriority,
                and subsequently altered as specified by the procedures
                defined in FC-SW-3."
        ::= { t11FamEntry 15 }

t11FamPrincSwRunningPriority OBJECT-TYPE
    SYNTAX   T11FamDomainPriority
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
                "The running priority of the Principal Switch on this
                Fabric."
        ::= { t11FamEntry 16 }

t11FamState OBJECT-TYPE
    SYNTAX   T11FamState
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
                "The state of the Fabric Address Manager on a particular
                switch on this Fabric."
        ::= { t11FamEntry 17 }

t11FamLocalPrincipalSwitchSlctns OBJECT-TYPE
    SYNTAX   Counter32
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
                "The number of times a particular switch became the
                Principal Switch on this Fabric.

                This counter has no discontinuities other than those
                that all Counter32s have when sysUpTime=0."
        ::= { t11FamEntry 18 }

t11FamPrincipalSwitchSelections OBJECT-TYPE
    SYNTAX   Counter32
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
                "The number of Principal Switch selections on this Fabric.

                This counter has no discontinuities other than those
                that all Counter32s have when sysUpTime=0."
        ::= { t11FamEntry 19 }

```
t11FamBuildFabrics OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
            "The number of non-disruptive fabric reconfigurations (BFs)
            that have occurred on this Fabric.

            This counter has no discontinuities other than those
            that all Counter32s have when sysUpTime=0."
    ::= { t11FamEntry 20 }

t11FamFabricReconfigures OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
            "The number of disruptive fabric reconfigurations (RCFs)
            that have occurred on this Fabric.

            This counter has no discontinuities other than those
            that all Counter32s have when sysUpTime=0."
    ::= { t11FamEntry 21 }

t11FamDomainId OBJECT-TYPE
    SYNTAX      FcDomainIdOrZero
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "The Domain_ID of a particular switch on this Fabric or
            zero if no Domain_ID has been assigned."
    ::= { t11FamEntry 22 }

t11FamSticky   OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "An indication of whether a particular switch is supporting
            the concept of Preferred Domain_IDs via a best-effort
            attempt to re-assign the same Fibre Channel Address
            Identifier value to a port on the next occasion when a port
            requests an assignment on this Fabric.

            If the value of this object is 'true', then the switch is
            maintaining rows in the t11FamFcIdCacheTable for this
            Fabric."
    ::= { t11FamEntry 23 }
```

```
t11FamRestart  OBJECT-TYPE
    SYNTAX      INTEGER {
                        nonDisruptive(1),
                        disruptive(2),
                        noOp(3)
                }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
            "This object tells the Fabric Address Manager to
            request a Fabric reconfiguration.

            If this object is set to 'disruptive', then an RCF
            (ReConfigure Fabric) is generated in the Fabric
            in order for the Fabric to recover from the errors.

            If this object is set to 'nonDisruptive', then a
            BF (Build Fabric) is generated in the Fabric.

            No action is taken if this object is set to 'noOp'.
            The value of the object when read is always 'noOp'.

            For the persistence of values across reboots, see the
            MODULE-IDENTITY's DESCRIPTION clause."
    REFERENCE   "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                 ANSI INCITS 384-2004, section 7.3."
    ::= { t11FamEntry 24 }

t11FamRcFabricNotifyEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS read-write
    STATUS      current
    DESCRIPTION
            "An indication of whether or not a particular switch
            should issue a t11FamFabricChangeNotify notification on
            sending or receiving ReConfigureFabric (RCF) on a Fabric.

            If the value of the object is 'true', then the
            notification is generated.  If the value is 'false',
            notification is not generated.

            If an implementation requires all Fabrics to have the
            same value, then setting one instance of this object
            to a new object will result in all corresponding
            instances being set to that same new value.

            For the persistence of values across reboots, see the
            MODULE-IDENTITY's DESCRIPTION clause."
```

```
        DEFVAL { false }
        ::= { t11FamEntry 25 }

t11FamEnable OBJECT-TYPE
        SYNTAX       TruthValue
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
                "Enables the Fabric Address Manager on this switch
                on this Fabric.

                If enabled on a Fabric, the switch will participate in
                Principal Switch selection, and Domain_IDs are assigned
                dynamically.  If disabled, the switch will not participate
                in Principal Switch selection, and Domain_IDs are
                assigned statically.  Thus, the corresponding value of
                t11FamConfigDomainIdType needs to be 'static'.

                For the persistence of values across reboots, see the
                MODULE-IDENTITY's DESCRIPTION clause."
      REFERENCE    "Fibre Channel - Switch Fabric - 4 (FC-SW-4),
                  ANSI INCITS 418-2006, sections 7.1 and 7.3."
      DEFVAL  { true }
      ::= { t11FamEntry 26 }

t11FamFabricName  OBJECT-TYPE
        SYNTAX       FcNameIdOrZero
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
                "The WWN that is configured on this switch to be used as
                the name of this Fabric when the value of t11FamEnable is
                'false'.

                If the value of t11FamEnable is 'true', this value is not
                used.

                Fibre Channel requires that:
                    a) all switches in an operational Fabric be
                       configured with the same Fabric name; and
                    b) each Fabric have a unique Fabric name.
                If either of these is violated, either by switches within a
                single Fabric being configured with different Fabric names,
                or by multiple Fabrics that share management applications
                or interact in other ways having the same Fabric name,
                then the behavior of the switches and associated management
                functions is not specified by Fibre Channel or Internet
                standards.
```

                For the persistence of values across reboots, see the
                MODULE-IDENTITY's DESCRIPTION clause."
        REFERENCE   "Fibre Channel - Switch Fabric - 4 (FC-SW-4),
                      ANSI INCITS 418-2006, section 7.1."
        ::= { t11FamEntry 27 }

--
-- t11FamIfTable - Interface configuration
--

t11FamIfTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF T11FamIfEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "This table contains those Fabric Address Manager parameters
            and status values that are per-interface (identified
            by an ifIndex value), per-Fabric (identified by a
            t11FamFabricIndex value), and per-switch (identified by
            values of fcmInstanceIndex and fcmSwitchIndex).

            An entry in this table is automatically created when
            an E_Port becomes non-isolated on a particular Fabric.

            An entry is deleted automatically from this table if:
            a) the corresponding interface is no longer an E_Port (e.g.,
               a G_Port that is dynamically determined to be an F_Port),
               and all configuration parameter(s) have default values; or
            b) the interface identified by ifIndex no longer exists
               (e.g., because a line-card is physically removed); or
            c) the row in the t11FamTable corresponding the fabric
               identified by t11FamFabricID no longer exists.

            Creating an entry in this table via t11FamIfRowStatus
            provides the means to specify non-default parameter value(s)
            for an interface at a time when the relevant row in this
            table does not exist, i.e., because the interface is either
            down or it is not an E_Port."
        ::= { t11FamConfiguration 2 }

t11FamIfEntry OBJECT-TYPE
    SYNTAX   T11FamIfEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "An entry containing information on the interface
            configuration on the Fabric identified by

```
            t11FamFabricIndex."
    INDEX { fcmInstanceIndex, fcmSwitchIndex,
            t11FamFabricIndex, ifIndex}
    ::= { t11FamIfTable 1 }

T11FamIfEntry ::= SEQUENCE {
    t11FamIfRcfReject    TruthValue,
    t11FamIfRole         T11FamDomainInterfaceRole,
    t11FamIfRowStatus    RowStatus
}

t11FamIfRcfReject    OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS read-create
    STATUS      current
    DESCRIPTION
            "This object determines if the incoming ReConfigure
            Fabric (RCF) messages on this interface on this
            Fabric is accepted or not.  If this object is 'true', then
            the incoming RCF is rejected.  If 'false', incoming RCF is
            accepted.

            Note that this object does not apply to the outgoing
            RCFs generated by this interface.

            Implementations that support write-access to this object
            can do so under whatever conditions they choose."
    DEFVAL {false}
    ::= { t11FamIfEntry 1 }

t11FamIfRole    OBJECT-TYPE
    SYNTAX      T11FamDomainInterfaceRole
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
            "The role of this interface."
    ::= { t11FamIfEntry 2 }

t11FamIfRowStatus    OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS read-create
    STATUS      current
    DESCRIPTION
            "The status of this row."
    ::= { t11FamIfEntry 3 }


--
```

```
-- t11FamAreaTable
--

t11FamAreaTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF T11FamAreaEntry
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "This table contains area assignments per-Fabric by a
            switch's Fabric Address Manager.  Each octet in
            t11FamAssignedAreaList is able to be used to index into
            this table to find information on each area."
    REFERENCE   "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                 ANSI INCITS 384-2004, section 4.8."
    ::= { t11FamInfo 1 }

t11FamAreaEntry OBJECT-TYPE
    SYNTAX      T11FamAreaEntry
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "An entry gives information on the Area_ID and all
            Port_IDs that have been assigned within an area for
            the Fabric identified by t11FamFabricIndex, by the
            Fabric Address Manager in the switch identified by
            fcmInstanceIndex and fcmSwitchIndex."
    INDEX { fcmInstanceIndex, fcmSwitchIndex,
            t11FamFabricIndex, t11FamAreaAreaId}
    ::= { t11FamAreaTable 1 }

T11FamAreaEntry ::= SEQUENCE {
    t11FamAreaAreaId                Unsigned32,
    t11FamAreaAssignedPortIdList    OCTET STRING
}

t11FamAreaAreaId    OBJECT-TYPE
    SYNTAX      Unsigned32 (0..255)
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "The Area_ID of this area."
    ::= { t11FamAreaEntry 1 }

t11FamAreaAssignedPortIdList    OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE(0..256))
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
```

                "The list of Port_IDs which have been assigned in
                this area and Fabric, formatted as an array of
                octets in ascending order. There could be zero or more
                Port_IDs assigned on this area and Fabric.

                Each octet represents one Port_ID. So, the list containing
                the Port_IDs 23, 45, 235, and 56 would be formatted as the
                4-octet string x'172d38eb'."
        ::= { t11FamAreaEntry 2 }

--
-- t11FamDatabaseTable
--

t11FamDatabaseTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF T11FamDatabaseEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "This table contains all information known by
            a switch about all the domains that have been
            assigned in each Fabric."
    REFERENCE   "Fibre Channel - Switch Fabric - 3 (FC-SW-3),
                ANSI INCITS 384-2004, section 4.8."
    ::= { t11FamInfo 2 }

t11FamDatabaseEntry OBJECT-TYPE
    SYNTAX   T11FamDatabaseEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "An entry (conceptual row) in the t11FamDatabaseTable
            containing information about one Domain_ID in the
            Fabric identified by t11FamFabricIndex, and known by
            the switch identified by t11FamFabricIndex and
            t11FamDatabaseDomainId."
    INDEX { fcmInstanceIndex, fcmSwitchIndex,
            t11FamFabricIndex , t11FamDatabaseDomainId}
    ::= { t11FamDatabaseTable 1 }

T11FamDatabaseEntry ::= SEQUENCE {
    t11FamDatabaseDomainId   FcDomainIdOrZero,
    t11FamDatabaseSwitchWwn   FcNameIdOrZero
}

t11FamDatabaseDomainId OBJECT-TYPE
    SYNTAX   FcDomainIdOrZero (1..239)

```
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
            "The Domain_ID for which this row contains information.
             The value must be non-zero."
    ::= { t11FamDatabaseEntry 1 }

t11FamDatabaseSwitchWwn  OBJECT-TYPE
    SYNTAX      FcNameIdOrZero
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "The node name (WWN) of the switch to which the
             corresponding value of t11FamDatabaseDomainId is currently
             assigned for the particular Fabric."
    ::= { t11FamDatabaseEntry 2 }


--
-- Fibre Channel Address Identifier cache information
--
-- The cached information allows the Fabric Address Manager to
-- implement the concept of a Preferred Domain_ID, whereby after a port
-- releases a Fibre Channel Address Identifier value, a switch makes an
-- attempt to re-assign the same Fibre Channel Address Identifier value
-- on the next occasion when that port requests an assignment.
--

t11FamMaxFcIdCacheSize  OBJECT-TYPE
    SYNTAX      Unsigned32 (0..4294967295)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
            "The maximum number of Fibre Channel Address Identifiers
             that are able to be cached in the t11FamFcIdCacheTable.
             If the number is unknown, the value of this object is
             zero."
    ::= { t11FamInfo 3 }


--
-- t11FamFcIdCacheTable
--

t11FamFcIdCacheTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF T11FamFcIdCacheEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

        DESCRIPTION
                "This table contains all the Fibre Channel Address
                Identifiers that have recently been released by the
                Fabric Address Manager in a switch. So, it lists
                all the Fibre Channel Address Identifiers that have valid
                WWN-to-Fibre Channel Address Identifier mappings and are
                currently not assigned to any ports. These Fibre Channel
                Address Identifiers were assigned to ports but have since
                been released. These cached Fibre Channel Address
                Identifiers contain only Area_ID and Port_ID information.
                This cache is kept to provide best-effort re-assignment of
                same Fibre Channel Address Identifiers; i.e., when an
                Nx_Port asks for a Fibre Channel Address Identifier, soon
                after releasing one, the same value is re-assigned, if
                possible."
        ::= { t11FamInfo 4 }

t11FamFcIdCacheEntry OBJECT-TYPE
    SYNTAX   T11FamFcIdCacheEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
                "An entry (conceptual row) in the t11FamFcIdCacheTable
                containing information about one Fibre Channel Address
                Identifier that was released from a WWN, corresponding to a
                range of one or more ports connected to the switch
                (identified by t11FamFabricIndex and t11FamFcIdCacheWwn) in
                the Fabric (identified by t11FamFabricIndex). An entry is
                created when a Fibre Channel Address Identifier is released
                by the last port in the range. The oldest entry is deleted
                if the number of rows in this table reaches
                t11FamMaxFcIdCacheSize, and its space is required for a new
                entry. An entry is also deleted when its Fibre Channel
                Address Identifier is assigned to a port."
    INDEX { fcmInstanceIndex, fcmSwitchIndex,
            t11FamFabricIndex, t11FamFcIdCacheWwn}
    ::= { t11FamFcIdCacheTable 1 }

T11FamFcIdCacheEntry ::= SEQUENCE {
    t11FamFcIdCacheWwn   FcNameIdOrZero,
    t11FamFcIdCacheAreaIdPortId   OCTET STRING,
    t11FamFcIdCachePortIds   Unsigned32
}

t11FamFcIdCacheWwn OBJECT-TYPE
    SYNTAX   FcNameIdOrZero
    MAX-ACCESS not-accessible
    STATUS   current

       DESCRIPTION
               "The N_Port_Name (WWN) of the port associated with this
               entry."
       ::= { t11FamFcIdCacheEntry 1 }

t11FamFcIdCacheAreaIdPortId OBJECT-TYPE
       SYNTAX   OCTET STRING (SIZE (2))
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
               "The combination of this object and t11FamFcIdCachePortIds
               represent one range of Fibre Channel Address Identifiers,
               which were assigned and later released. This object
               contains the Area_ID and Port_ID of the first Fibre
               Channel Address Identifier in the range.

               Note that this object is only 2 bytes."
       ::= { t11FamFcIdCacheEntry 2 }

t11FamFcIdCachePortIds OBJECT-TYPE
       SYNTAX   Unsigned32 (0..65535)
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
               "The combination of t11FamFcIdCacheAreaIdPortId and this
               object represent one range of Fibre Channel Address
               Identifiers, which were assigned and later released. This
               object contains the number of (consecutive) Fibre Channel
               Address Identifiers in the range."
       ::= { t11FamFcIdCacheEntry 3 }

-- Objects for use in notifications

t11FamNotifyFabricIndex OBJECT-TYPE
       SYNTAX   T11FabricIndex
       MAX-ACCESS accessible-for-notify
       STATUS   current
       DESCRIPTION
               "A unique index value that identifies a particular
               Fabric for which a particular notification is generated.

               In a Fabric conformant to SW-3, only a single Fabric
               can operate within a physical infrastructure, and thus,
               the value of this Fabric Index will always be 1.

               However, the current standard, FC-SW-4, defines
               how multiple Fabrics, each with its own management

instrumentation, could operate within one (or more)
physical infrastructures. In order to accommodate this
scenario, this index value is used to uniquely identify a
particular Fabric within a physical infrastructure."
    ::= { t11FamNotifyControl 1 }

-- Notifications

t11FamDomainIdNotAssignedNotify NOTIFICATION-TYPE
    OBJECTS   { t11FamLocalSwitchWwn, t11FamNotifyFabricIndex }
    STATUS   current
    DESCRIPTION
            "This notification indicates that a Domain_ID has not
            been configured or assigned for a particular Fabric,
            identified by t11FamNotifyFabricIndex, on a particular
            switch identified by t11FamLocalSwitchWwn. This could
            happen under the following conditions, and results in the
            switch isolating E_Ports on the Fabric:

              - if the switch's request for a configured static
                Domain_ID is rejected or no other Domain_ID is
                assigned, then the E_Ports are isolated."
    ::= { t11FamNotifications 1 }

t11FamNewPrincipalSwitchNotify NOTIFICATION-TYPE
    OBJECTS   { t11FamLocalSwitchWwn, t11FamNotifyFabricIndex }
    STATUS   current
    DESCRIPTION
            "This notification indicates that a particular switch,
            identified by t11FamLocalSwitchWwn, has become the new
            Principal Switch on the Fabric identified by
            t11FamNotifyFabricIndex.

            This notification is sent soon after its election as
            the new Principal Switch, i.e., upon expiration of a
            Principal Switch selection timer that is equal to
            twice the Fabric Stability Timeout value (F_S_TOV)."
    ::= { t11FamNotifications 2 }

t11FamFabricChangeNotify NOTIFICATION-TYPE
    OBJECTS   { t11FamLocalSwitchWwn, t11FamNotifyFabricIndex }
    STATUS   current
    DESCRIPTION
            "This notification is sent whenever a particular switch,
            identified by t11FamLocalSwitchWwn, sends or
            receives a Build Fabric (BF) or a ReConfigure Fabric
            (RCF) message on the Fabric identified by

                t11FamNotifyFabricIndex.

                This notification is not sent if a
                't11FamNewPrincipalSwitchNotify' notification is sent
                for the same event."
       ::= { t11FamNotifications 3 }

--
-- Conformance
--

t11FamMIBCompliances OBJECT IDENTIFIER ::= { t11FamMIBConformance 1 }
t11FamMIBGroups OBJECT IDENTIFIER ::= { t11FamMIBConformance 2 }

t11FamMIBCompliance MODULE-COMPLIANCE
      STATUS   current
      DESCRIPTION
            "The compliance statement for Fibre Channel switches
            that implement Fabric Address Manager functionality."
      MODULE
      MANDATORY-GROUPS { t11FamGroup,
                         t11FamDatabaseGroup,
                         t11FamAreaGroup,
                         t11FamNotificationGroup
                       }

        OBJECT t11FamConfigDomainId
        MIN-ACCESS read-only
        DESCRIPTION
              "Write access is not required."

        OBJECT t11FamConfigDomainIdType
        MIN-ACCESS read-only
        DESCRIPTION
              "Write access is not required."

        OBJECT t11FamAutoReconfigure
        MIN-ACCESS read-only
        DESCRIPTION
              "Write access is not required."

        OBJECT t11FamContiguousAllocation
        MIN-ACCESS read-only
        DESCRIPTION
              "Write access is not required."

        OBJECT t11FamPriority

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

        OBJECT t11FamIfRcfReject
        MIN-ACCESS read-only
        DESCRIPTION
                "Write access is not required."

        OBJECT t11FamIfRowStatus
        MIN-ACCESS read-only
        DESCRIPTION
                "Write access is not required."

        OBJECT t11FamRcFabricNotifyEnable
        MIN-ACCESS read-only
        DESCRIPTION
                "Write access is not required."

        GROUP   t11FamCacheGroup
        DESCRIPTION
                "This group is mandatory only for switches that
                support the concept of Preferred Domain_ID via a best-
                effort attempt for (short-term) re-assignment of the
                same FC address identifiers."

        GROUP   t11FamCommandGroup
        DESCRIPTION
                "This group is optional."

    ::= { t11FamMIBCompliances 1 }


-- Units of Conformance

t11FamGroup OBJECT-GROUP
    OBJECTS  { t11FamConfigDomainId,
               t11FamConfigDomainIdType,
               t11FamAutoReconfigure,
               t11FamContiguousAllocation,
               t11FamPriority,
               t11FamPrincipalSwitchWwn,
               t11FamLocalSwitchWwn,
               t11FamAssignedAreaIdList,
               t11FamGrantedFcIds,
               t11FamRecoveredFcIds,
               t11FamFreeFcIds,
               t11FamAssignedFcIds,
```

```
                    t11FamAvailableFcIds,
                    t11FamRunningPriority,
                    t11FamPrincSwRunningPriority,
                    t11FamState,
                    t11FamLocalPrincipalSwitchSlctns,
                    t11FamPrincipalSwitchSelections,
                    t11FamBuildFabrics,
                    t11FamFabricReconfigures,
                    t11FamDomainId,
                    t11FamSticky,
                    t11FamRestart,
                    t11FamRcFabricNotifyEnable,
                    t11FamEnable,
                    t11FamFabricName,
                    t11FamIfRcfReject,
                    t11FamIfRole,
                    t11FamIfRowStatus,
                    t11FamNotifyFabricIndex
                  }
    STATUS    current
    DESCRIPTION
            "A collection of general objects for displaying and
            configuring Fabric Address management."
    ::= { t11FamMIBGroups 1 }

t11FamCommandGroup OBJECT-GROUP
    OBJECTS  { t11FamRestart }
    STATUS    current
    DESCRIPTION
            "A collection of objects used for initiating an
            operation on the Fabric."
    ::= { t11FamMIBGroups 2 }

t11FamDatabaseGroup OBJECT-GROUP
    OBJECTS  { t11FamDatabaseSwitchWwn }
    STATUS    current
    DESCRIPTION
            "A collection of objects containing information about
            Domain-IDs assignments."
    ::= { t11FamMIBGroups 3 }

t11FamAreaGroup OBJECT-GROUP
    OBJECTS  { t11FamAreaAssignedPortIdList }
    STATUS    current
    DESCRIPTION
            "A collection of objects containing information about
            currently assigned addresses within a domain."
    ::= { t11FamMIBGroups 4 }
```

```
t11FamCacheGroup OBJECT-GROUP
    OBJECTS  { t11FamMaxFcIdCacheSize,
               t11FamFcIdCacheAreaIdPortId,
               t11FamFcIdCachePortIds
             }
    STATUS   current
    DESCRIPTION
           "A collection of objects containing information about
            recently-released Fibre Channel Address Identifiers."
    ::= { t11FamMIBGroups 5 }

t11FamNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS  { t11FamDomainIdNotAssignedNotify,
                     t11FamNewPrincipalSwitchNotify,
                     t11FamFabricChangeNotify }
    STATUS   current
    DESCRIPTION
           "A collection of notifications for status monitoring
            and notification."
    ::= { t11FamMIBGroups 6 }
END
```

7. Acknowledgements

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T11.5. We wish to acknowledge the many contributions and comments
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```
    T11 Chair: Robert Snively, Brocade
    T11 Vice Chair: Claudio DeSanti, Cisco Systems
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```

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8. Normative References

[RFC2578]   McCloghrie, K., Perkins, D., and J. Schoenwaelder,
            "Structure of Management Information Version 2 (SMIv2)",
            STD 58, RFC 2578, April 1999.

[RFC2579]   McCloghrie, K., Perkins, D., and J. Schoenwaelder,
            "Textual Conventions for SMIv2", STD 58, RFC 2579, April
            1999.

[RFC2580]   McCloghrie, K., Perkins, D., and J. Schoenwaelder,
            "Conformance Statements for SMIv2", STD 58, RFC 2580,
            April 1999.

[IF-MIB]   McCloghrie, K. and F. Kastenholz, "The Interfaces Group
            MIB", RFC 2863, June 2000.

[FC-MGMT]   McCloghrie, K., "Fibre Channel Management MIB", RFC 4044,
            May 2005.

[FC-SW-3]   "Fibre Channel - Switch Fabric - 3 (FC-SW-3)", ANSI INCITS
            384-2004, June 2004.

[FC-SW-4]   "Fibre Channel - Switch Fabric - 4 (FC-SW-4)", ANSI INCITS
            418-2006, 2006.

[FC-FS]   "Fibre Channel - Framing and Signaling (FC-FS)" ANSI
            INCITS 373-2003, April 2003.

9. Informative References

[RFC2837]   Teow, K., "Definitions of Managed Objects for the Fabric
            Element in Fibre Channel Standard", RFC 2837, May 2000.

[RFC3410]   Case, J., Mundy, R., Partain, D., and B. Stewart,
            "Introduction and Applicability Statements for Internet-
            Standard Management Framework", RFC 3410, December 2002.

[FC-MI]   "Fibre Channel - Methodologies for Interconnects (FC-MI)",
            INCITS TR-30-2002, November 2002.

10. IANA Considerations

IANA has made two MIB OID assignments, one for the T11-TC-MIB module
and one for the T11-FC-FABRIC-ADDR-MGR-MIB module, under the
appropriate subtree(s).

11. 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 are the tables and objects and their
sensitivity/vulnerability:

   t11FamConfigDomainId, t11FamConfigDomainIdType and
   t11FamContiguousAllocation -- ability to change the address
   allocation policy.

   t11FamRestart and t11FamAutoReconfigure -- ability to cause a
   fabric reconfiguration, e.g., on certain error conditions.

   t11FamPriority -- ability to affect which switch becomes the
   Principal Switch.

   t11FamRcFabricNotifyEnable -- ability to enable/disable a
   notification.

   t11FamIfRcfReject -- ability to change the switch's behavior on
   receipt of an RCF.

   t11FamIfRowStatus -- ability to change an interface
   configuration parameter.

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:

   t11FamTable and t11FamIfTable -- contain the configuration,
   status, and statistics of the Fabric Address Manager.

          t11FamAreaTable, t11FamDatabaseTable and t11FamFcIdCacheTable
          -- contain information on currently assigned or recently-
          released addresses.

   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.

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