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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 and status of this protocol. Distribution of this memo is unlimited.

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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 t1lFamFabricIndex when they both appear in the same INDEX clause.

5.4. The t1lFamGroup 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 t1lFamDatabaseGroup Group

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

5.6. The t1lFamAreaGroup Group

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

5.7. The t1lFamCacheGroup 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 t1lFamCommandGroup Group

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

5.9. The t1lFamNotificationGroup 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

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DESCRIPTION

"This module defines textual conventions used in T11 MIBs.

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 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"

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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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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
principalDownstream (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),
 principalDownstream (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,

```

```

t1lFamConfigDomainIdType      INTEGER,
t1lFamAutoReconfigure         TruthValue,
t1lFamContiguousAllocation    TruthValue,
t1lFamPriority                 T1lFamDomainPriority,
t1lFamPrincipalSwitchWwn      FcNameIdOrZero,
t1lFamLocalSwitchWwn          FcNameIdOrZero,
t1lFamAssignedAreaIdList      OCTET STRING,
t1lFamGrantedFcIds            Counter32,
t1lFamRecoveredFcIds          Counter32,
t1lFamFreeFcIds               Gauge32,
t1lFamAssignedFcIds           Gauge32,
t1lFamAvailableFcIds          Gauge32,
t1lFamRunningPriority          T1lFamDomainPriority,
t1lFamPrincSwRunningPriority   T1lFamDomainPriority,
t1lFamState                   T1lFamState,
t1lFamLocalPrincipalSwitchSlctns Counter32,
t1lFamPrincipalSwitchSelections Counter32,
t1lFamBuildFabrics            Counter32,
t1lFamFabricReconfigures      Counter32,
t1lFamDomainId                FcDomainIdOrZero,
t1lFamSticky                  TruthValue,
t1lFamRestart                 INTEGER,
t1lFamRcFabricNotifyEnable    TruthValue,
t1lFamEnable                  TruthValue,
t1lFamFabricName              FcNameIdOrZero
}

```

```

t1lFamFabricIndex OBJECT-TYPE
    SYNTAX      T1lFabricIndex
    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."

```
::= { t1lFamEntry 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 t1lFamIfRcfReject

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT t1lFamIfRowStatus

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

OBJECT t1lFamRcFabricNotifyEnable

MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

GROUP t1lFamCacheGroup

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 t1lFamCommandGroup

DESCRIPTION

"This group is optional."

::= { t1lFamMIBCompliances 1 }

-- Units of Conformance

t1lFamGroup OBJECT-GROUP

OBJECTS { t1lFamConfigDomainId,
t1lFamConfigDomainIdType,
t1lFamAutoReconfigure,
t1lFamContiguousAllocation,
t1lFamPriority,
t1lFamPrincipalSwitchWwn,
t1lFamLocalSwitchWwn,
t1lFamAssignedAreaIdList,
t1lFamGrantedFcIds,
t1lFamRecoveredFcIds,
t1lFamFreeFcIds,
t1lFamAssignedFcIds,

```

        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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8. Normative References

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9. Informative References

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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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