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Fibre Channel Fabric Configuration Server MIB

Status of This Memo

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for information related to the Fabric Configuration Server function of a Fibre Channel network.

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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 Configuration Server function, which provides a means by which a management application can discover Fibre Channel fabric topology and attributes. Discovered topology includes Interconnect Elements (i.e., switches, hubs, bridges, etc.) and their ports, as well as "platforms" that consist of one or more Fibre Channel nodes.

This memo was previously approved by INternational Committee for Information Technology Standards (INCITS) Task Group T11.5 (http://www.t11.org); this document is a product of the IETF's IMSS working group.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [RFC2119].

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 that 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 dynamic and are 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.

The Fibre Channel Fabric Configuration Server provides a way for a management application to discover Fibre Channel fabric topology and attributes. The Fabric Configuration Server is designed so that it can be distributed among switches and accessed from any Nx_Port. However, the Fabric Configuration Server is not restricted or required to be part of/within a Fabric.

The information registered with and available from each Fabric Configuration Server is modeled as a Fabric consisting of one or more Interconnect Elements that each have some number of physical Ports, and one or more Fibre Channel nodes grouped together into Platforms to facilitate discovery and management. The Ports are connected either to other Ports on other Interconnect Elements, or to Nx_Ports. Each Interconnect Element may have attributes including its name, type, Domain Identifier, Management Identifier, Logical Name, Management Address(es), Information List, Zoning Enforcement Status, etc. Each Port may have attributes including its name, type, TX type, Module type, physical port number, attached port name(s), port state, speed, etc. Each platform may have attributes including its name, type, description, label, location, management address, etc.

The Fibre Channel Fabric Configuration Server is defined in the FC-GS specification. The Fabric Configuration Server is one of a set of functions that are collectively known as the Management Service. The latest version of the specification is [FC-GS-5].

The latest standard for an interconnecting Fabric containing multiple Fabric Switch elements is [FC-SW-4]. [FC-SW-4] carries forward the earlier specification for the operation of a single Fabric in a physical infrastructure, and augments it with the definition of Virtual Fabrics and with the specification of how multiple Virtual Fabrics can operate within one (or more) physical infrastructures. The use of Virtual Fabrics provides for each frame to be tagged in its header to indicate which one of several Virtual Fabrics that frame is being transmitted on. All frames entering a particular "Core Switch" [FC-SW-4] (i.e., a physical switch) on the same Virtual Fabric are processed by the same "Virtual Switch" within that Core Switch.

4. Relationship to Other MIBs

The first standardized MIB for Fibre Channel [RFC2837] was focused on Fibre Channel switches. It has been replaced by the more generic Fibre Channel Management MIB [RFC4044], which defines basic information for Fibre Channel hosts and switches, including extensions to the standard IF-MIB for Fibre Channel interfaces.

This MIB extends beyond [RFC4044] to cover the functionality, in Fibre Channel switches, of providing Fibre Channel's Fabric Configuration Server function.

This MIB imports some common Textual Conventions from T11-TC-MIB [RFC4439] and from T11-FC-NAME-SERVER-MIB [RFC4438]. It also imports URLString from NETWORK-SERVICES-MIB [RFC2788].

5. MIB Overview

This MIB module provides the means for monitoring the operation of, and configuring some parameters of, one or more Fabric Configuration Servers (FCS) in a Fibre Channel (FC) network. The capabilities provided include triggering a discovery of the configuration of one or more Fabrics, retrieving the results of such a discovery, as well as controlling and monitoring the operation of an FCS. The discovered configuration contains information about:

- Interconnect Elements (IEs), i.e., switches, hubs, bridges, etc.,
- Ports on IEs, and
- Platforms that consist of one or more FC nodes.

5.1. Fibre Channel Management Instance

A Fibre Channel management instance is defined in [RFC4044] as a separable managed instance of Fibre Channel functionality. Fibre Channel functionality may be grouped into Fibre Channel management instances in whatever way is most convenient for the implementation(s). For example, one such grouping accommodates a single SNMP agent having multiple AgentX [RFC2741] sub-agents, with each sub-agent implementing a different Fibre Channel management instance.

The object, fcmInstanceIndex, is IMPORTed from the FC-MGMT-MIB [RFC4044] as the index value to uniquely identify each Fibre Channel management instance, for example, within the same SNMP context ([RFC3411], section 3.3.1).

5.2. Switch Index

The FC-MGMT-MIB [RFC4044] 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

With multiple Fabrics, each Fabric has its own instances of the Fabric-related management instrumentation. Thus, this MIB defines all Fabric-related information in tables that are INDEXed by an arbitrary integer, named a "Fabric Index". The syntax of a Fabric Index is T11FabricIndex, imported from T11-TC-MIB [RFC4439]. When a device is connected to a single physical Fabric, without use of any virtual Fabrics, the value of this Fabric Index will always be 1. In an environment of multiple virtual and/or physical Fabrics, this index provides a means to distinguish one Fabric from another.

It is quite possible, and may even be likely, that a Fibre Channel switch will have ports connected to multiple virtual and/or physical Fabrics. Thus, in order to simplify a management protocol query concerning all the Fabrics to which a single switch is connected, fcmSwitchIndex will be listed before t11FcsFabricIndex when they both appear in the same INDEX clause.

5.4. The MIB Groups

This section describes the six MIB groups contained in the MIB module.

5.4.1. The t11FcsDiscoveredConfigGroup Group

This group contains the Fabric configuration information discovered by Fabric Configuration Servers.

5.4.2. The t11FcsDiscoveryStatusGroup Group

This group contains objects by which to monitor the status of discovery of Fabric configurations by Fabric Configuration Servers.

5.4.3. The t11FcsDiscoveryControlGroup Group

This group contains objects for requesting a Fabric Configuration Server to discover the configuration of one or more Fabrics.

5.4.4. The t11FcsStatisticsGroup Group

This group contains objects for Fabric Configuration Server statistics information.

5.4.5. The t11FcsNotificationGroup Group

This group contains three notifications, generated when an FCS:

- rejects a registration, deregistration, or query request;
- completes discovery on a range of Fabrics;
- learns that a management address of an Interconnect Element has changed.

5.4.5.1. Flow Control for Notifications

When defining SNMP notifications for events that occur in the data-plane, the maximum frequency of their generation needs to be considered. Unless there is some limiting factor, such notifications need to be flow-controlled in some way, e.g., defined such that after some maximum number within a specified time interval have occurred, further notifications are suppressed for some subsequent time interval. However, as and when such a suppression occurs, the Network Management System (NMS) that didn't receive the notifications (because they were suppressed) needs to be able to obtain an indication of how many were suppressed. Therefore, an additional Counter32 object needs to be defined, and/or a new type of notification needs to be defined for use at the end of the interval.

While this is extra complexity, it is necessary for notifications that need to be flow-controlled.

In contrast, for notifications such as all the ones defined in this MIB module, which are generated due to control-plane events (and are not able to start a chain reaction):

- estimating the maximum number that could possibly be generated per unit time for each type of notification is too simplistic. For example, it's unreasonable to ask how many of the t11FcsDiscoveryCompleteNotify notifications can be generated in a time interval, because it depends on several factors: how big is the network? how many Virtual Fabrics need to be discovered? how quickly can the operator ask for another discovery after the last one completes?

- the extra complexity of flow-controlling these types of notifications is not warranted.

5.4.6. The t11FcsNotificationInfoGroup Group

This group contains notification control and notification information objects for monitoring Fabric Configuration Server request rejection and discovery of topology information.

5.5. OS Logical Unit Number (LUN) Map Entries

A "Platform" is defined in FC-GS-5 to be not only a set of zero or more FC nodes, but also a set of zero or more "OS LUN Map Entries" (see Figure 8 in [FC-GS-5]). Information on "OS LUN Map Entries" is not included in this T11-FC-FABRIC-CONFIG-SERVER-MIB. Instead, information on LUN Maps can be obtained via the scsiLunMapGroup object group defined in the SCSI-MIB [RFC4455].

6. The T11-FC-FABRIC-CONFIG-SERVER-MIB Module

```
T11-FC-FABRIC-CONFIG-SERVER-MIB  DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    NOTIFICATION-TYPE, mib-2, Counter32, Unsigned32
                  FROM SNMPv2-SMI                   -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
                  FROM SNMPv2-CONF                  -- [RFC2580]
    TEXTUAL-CONVENTION, TruthValue, TimeStamp
                  FROM SNMPv2-TC                    -- [RFC2579]
    SnmpAdminString
                  FROM SNMP-FRAMEWORK-MIB           -- [RFC3411]
    URLString
                  FROM NETWORK-SERVICES-MIB         -- [RFC2788]

    FcPortType, FcNameIdOrZero, FcDomainIdOrZero,
    fcmInstanceIndex, fcmSwitchIndex, FcAddressIdOrZero
                  FROM FC-MGMT-MIB                  -- [RFC4044]
    T11NsGs4RejectReasonCode
                  FROM T11-FC-NAME-SERVER-MIB       -- [RFC4438]
    T11FabricIndex
                  FROM T11-TC-MIB                   -- [RFC4439]
    t11FamLocalSwitchWwn
                  FROM T11-FC-FABRIC-ADDR-MGR-MIB; -- [RFC4439]


t11FcFabricConfigServerMIB   MODULE-IDENTITY
    LAST-UPDATED  "200706270000Z"
    ORGANIZATION  "For the initial versions, T11.
                   For later versions, the IETF's IMSS Working Group."
    CONTACT-INFO
             "     Claudio DeSanti
                   Cisco Systems, Inc.
                   170 West Tasman Drive
                   San Jose, CA 95134 USA
                   EMail: cds@cisco.com

                   Keith McCloghrie
                   Cisco Systems, Inc.
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                   EMail: kzm@cisco.com"
    DESCRIPTION
            "The MIB module for the management of a Fabric
            Configuration Server (FCS) in a Fibre Channel (FC)
            network.  An FCS is defined by the FC-GS-5 standard.  This
```

```
            MIB provides the capabilities to trigger a discovery of
            the configuration of one or more Fabrics, to retrieve the
            results of such a discovery, as well as to control and
            monitor the operation of an FCS.  The discovered
            configuration contains information about:

               - Interconnect Elements (IEs), i.e., switches, hubs,
                 bridges, etc.,
               - Ports on IEs, and
               - Platforms that consist of one or more FC nodes.

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           this MIB module is part of RFC 4935;  see the RFC itself for
           full legal notices."
    REVISION    "200706270000Z"
    DESCRIPTION
           "Initial version of this MIB module, published as RFC 4935."
    ::= { mib-2 162 }

t11FcsMIBObjects       OBJECT IDENTIFIER
                                   ::= { t11FcFabricConfigServerMIB 1 }
t11FcsMIBConformance   OBJECT IDENTIFIER
                                   ::= { t11FcFabricConfigServerMIB 2 }
t11FcsNotifications    OBJECT IDENTIFIER
                                   ::= { t11FcFabricConfigServerMIB 0 }

t11FcsDiscovery        OBJECT IDENTIFIER ::= { t11FcsMIBObjects 1 }
t11FcsDiscoveredConfig OBJECT IDENTIFIER ::= { t11FcsMIBObjects 2 }
t11FcsStats            OBJECT IDENTIFIER ::= { t11FcsMIBObjects 3 }
t11FcsNotificationInfo OBJECT IDENTIFIER ::= { t11FcsMIBObjects 4 }

--
-- Textual Conventions
--

T11FcListIndex ::= TEXTUAL-CONVENTION
    DISPLAY-HINT  "d"
    STATUS  current
    DESCRIPTION
            "An index that identifies a list of elements.
            All elements that belong to the same list have the
            same index value.  This syntax is used for objects
            which identify a list in the INDEX clause of a table
            of elements of that type of list."
    SYNTAX  Unsigned32 (1..4294967295)

T11FcListIndexPointerOrZero ::= TEXTUAL-CONVENTION
    DISPLAY-HINT  "d"
```

```
    STATUS  current
    DESCRIPTION
            "Objects with this syntax point to a list of elements
            contained in a table, by holding the same value as the
            object with syntax T11FcListIndex defined in the table's
            INDEX clause, or, zero to indicate an empty list.
            Note that such a table could have one row per list, or
            it could have one row per element of a list.

            The definition of an object with this syntax must
            identify the table(s) into which it points."
    SYNTAX  Unsigned32 -- the default range of (0..4294967295)

T11FcIeType ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
            "The type of Interconnect Element (IE):

                    unknown(1)  - an unknown IE.
                    other(2)    - some other type of IE.
                    switch(3)   - the IE is a switch.
                    hub(4)      - the IE is a hub.
                    bridge(5)   - the IE is a bridge."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, Table 96."
    SYNTAX  INTEGER {
                unknown(1),
                other(2),
                switch(3),
                hub(4),
                bridge(5)
            }

T11FcPortState  ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
            "The state of a port:

                    unknown(1)  - unknown state.
                    other(2)    - some other state.
                    online(3)   - port is in online state.
                    offline(4)  - port is in offline state.
                    testing(5)  - port is in testing state.
                    fault(6)    - port is faulty."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, Table 106."
```

```
    SYNTAX  INTEGER {
                unknown(1),
                other(2),
                online(3),
                offline(4),
                testing(5),
                fault(6)
            }

T11FcPortTxType ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
            "The technology of the port transceiver:

               unknown(1)         - unknown (includes the 'null' type)
               other(2)           - some other technology
               shortwave850nm(3)  - Short wave laser - SN (850 nm)
               longwave1550nm(4)  - Long wave laser - LL (1550 nm)
               longwave1310nm(5)  - Long wave laser cost
                                    reduced - LC (1310 nm)
               electrical(6)      - Electrical - EL.
               tenGbaseSr850(7)   - 10GBASE-SR 850nm laser
               tenGbaseLr1310(8)  - 10GBASE-LR 1310nm laser
               tenGbaseEr1550(9)  - 10GBASE-ER 1550nm laser
               tenGbaseLx1300(10) - 10GBASE-LX4 WWDM 1300nm laser
               tenGbaseSw850(11)  - 10GBASE-SW 850nm laser
               tenGbaseLw1310(12) - 10GBASE-LW 1310nm laser
               tenGbaseEw1550(13) - 10GBASE-EW 1550nm laser
            "
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, Table 101."
    SYNTAX  INTEGER {
                unknown(1),
                other(2),
                shortwave850nm(3),
                longwave1550nm(4),
                longwave1310nm(5),
                electrical(6),
                tenGbaseSr850(7),
                tenGbaseLr1310(8),
                tenGbaseEr1550(9),
                tenGbaseLx1300(10),
                tenGbaseSw850(11),
                tenGbaseLw1310(12),
                tenGbaseEw1550(13)
            }
```

```
T11FcsRejectReasonExplanation ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
            "The reject reason code explanation:

                  noAdditionalExplanation(1)
                       - no additional explanation.
                  invNameIdForIEOrPort(2)
                       - the format of IE or port name is invalid.
                  ieListNotAvailable(3)
                       - IE list is not available.
                  ieTypeNotAvailable(4)
                       - IE type is not available.
                  domainIdNotAvailable(5)
                       - Domain ID is not available.
                  mgmtIdNotAvailable(6)
                       - mgmt ID is not available.
                  fabNameNotAvailable(7)
                       - Fabric_Name is not available.
                  ielogNameNotAvailable(8)
                       - IE logical name is not available.
                  mgmtAddrListNotAvailable(9)
                       - mgmt address list is not available.
                  ieInfoListNotAvailable(10)
                       - IE info list is not available.
                  portListNotAvailable(11)
                       - port list is not available.
                  portTypeNotAvailable(12)
                       - port type is not available.
                  phyPortNumNotAvailable(13)
                       - physical port number is not available.
                  attPortNameListNotAvailable(14)
                       - attached port name list is not available.
                  portStateNotAvailable(15)
                       - port state is not available.
                  unableToRegIELogName(16)
                       - not able to register IE logical name.
                  platformNameNoExist(17)
                       - platform name does not exist.
                  platformNameAlreadyExists(18)
                       - platform name already exists.
                  platformNodeNameNoExists(19)
                       - platform node name does not exist.
                  platformNodeNameAlreadyExists(20)
                       - platform node name already exists.
                  resourceUnavailable(21)
                       - resource unavailable.
                  noEntriesInLunMap(22)
```

```
                    - zero entries in OS LUN Map.
                  invalidDeviceNameLength(23)
                    - invalid OS device name length.
                  multipleAttributes(24)
                    - multiple attributes of same type in
                      platform attribute block.
                  invalidAttribBlockLength(25)
                    - invalid platform attribute block length.
                  attributesMissing(26)
                    - required platform attributes not present."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, Table 124."
    SYNTAX  INTEGER {
                noAdditionalExplanation(1),
                invNameIdForIEOrPort(2),
                ieListNotAvailable(3),
                ieTypeNotAvailable(4),
                domainIdNotAvailable(5),
                mgmtIdNotAvailable(6),
                fabNameNotAvailable(7),
                ielogNameNotAvailable(8),
                mgmtAddrListNotAvailable(9),
                ieInfoListNotAvailable(10),
                portListNotAvailable(11),
                portTypeNotAvailable(12),
                phyPortNumNotAvailable(13),
                attPortNameListNotAvailable(14),
                portStateNotAvailable(15),
                unableToRegIELogName(16),
                platformNameNoExist(17),
                platformNameAlreadyExists(18),
                platformNodeNameNoExists(19),
                platformNodeNameAlreadyExists(20),
                resourceUnavailable(21),
                noEntriesInLunMap(22),
                invalidDeviceNameLength(23),
                multipleAttributes(24),
                invalidAttribBlockLength(25),
                attributesMissing(26)
            }

--
-- Objects for Fabric Discovery
--

t11FcsFabricDiscoveryTable OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsFabricDiscoveryEntry
```

```
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains control information for discovery
            of Fabric configuration by switches.

            Values written to objects in this table are not
            retained over agent reboots."
    ::= { t11FcsDiscovery 1 }

t11FcsFabricDiscoveryEntry OBJECT-TYPE
    SYNTAX       T11FcsFabricDiscoveryEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Control information for discovery by the switch
            identified by fcmInstanceIndex and fcmSwitchIndex."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex }
    ::= { t11FcsFabricDiscoveryTable 1 }

T11FcsFabricDiscoveryEntry ::= SEQUENCE {
    t11FcsFabricDiscoveryRangeLow   T11FabricIndex,
    t11FcsFabricDiscoveryRangeHigh  T11FabricIndex,
    t11FcsFabricDiscoveryStart      INTEGER,
    t11FcsFabricDiscoveryTimeOut    Unsigned32
}

t11FcsFabricDiscoveryRangeLow  OBJECT-TYPE
    SYNTAX       T11FabricIndex
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
            "The discovery by a particular switch operates
            within all existing Fabrics that have a Fabric
            Index within a specific inclusive range.  This
            object specifies the minimum Fabric Index value
            within that range.  This value just represents
            the lower end of the range and does not necessarily
            represent any existing Fabric."
    ::= { t11FcsFabricDiscoveryEntry 1 }

t11FcsFabricDiscoveryRangeHigh  OBJECT-TYPE
    SYNTAX       T11FabricIndex
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
            "The discovery by a particular switch operates
            within all existing Fabrics that have a Fabric
```

```
            Index within a specific inclusive range.  This
            object specifies the maximum Fabric Index value
            within that range.  This value just represents the
            higher end of the range and does not necessarily
            represent any existing Fabric."
    ::= { t11FcsFabricDiscoveryEntry 2 }

t11FcsFabricDiscoveryStart  OBJECT-TYPE
    SYNTAX       INTEGER {
                     start(1),
                     noOp(2)
                 }
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
            "This object provides the capability to trigger the start
            of a discovery by a Fabric Configuration Server.  If this
            object is set to 'start', then the discovery is started on
            those Fabrics that have their Fabric Index value in the
            range specified by t11FcsFabricDiscoveryRangeLow and
            t11FcsFabricDiscoveryRangeHigh.  It is recommended that
            whenever an instance of this object is set to 'start',
            that the desired range be specified at the same time by
            setting the corresponding instances of
            t11FcsFabricDiscoveryRangeLow and
            t11FcsFabricDiscoveryRangeHigh.

            Setting this object to 'start' will be rejected if a
            discovery is already/still in progress on any Fabrics in
            the specified range.

            No action is taken if this object is set to 'noOp'.
            The value of this object when read is always 'noOp'."
    ::= { t11FcsFabricDiscoveryEntry 3 }

t11FcsFabricDiscoveryTimeOut OBJECT-TYPE
    SYNTAX       Unsigned32 (300..86400)
    UNITS        "Seconds"
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
            "The minimum interval of time for which the discovered
            Fabric information is cached by a Fabric Configuration
            Server."
    DEFVAL { 900 }
    ::= { t11FcsFabricDiscoveryEntry 4 }

--
```

```
-- Discovery State table
--

t11FcsDiscoveryStateTable OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsDiscoveryStateEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains the status of discovery of
            locally known Fabrics."
    ::= { t11FcsDiscovery 2 }

t11FcsDiscoveryStateEntry OBJECT-TYPE
    SYNTAX       T11FcsDiscoveryStateEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The discovery status for a particular Fabric on the
            switch identified by fcmInstanceIndex and fcmSwitchIndex."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex, t11FcsFabricIndex }
    ::= { t11FcsDiscoveryStateTable 1 }

T11FcsDiscoveryStateEntry ::= SEQUENCE {
    t11FcsFabricIndex              T11FabricIndex,
    t11FcsDiscoveryStatus          INTEGER,
    t11FcsDiscoveryCompleteTime    TimeStamp
}

t11FcsFabricIndex OBJECT-TYPE
    SYNTAX       T11FabricIndex
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "A unique index value that uniquely identifies a
            particular Fabric.

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

            In a Fabric conformant to versions earlier than FC-SW-4,
            only a single Fabric could operate within a physical
            infrastructure, and thus, the value of this Fabric Index
            was defined to always be 1."
    ::= { t11FcsDiscoveryStateEntry 1 }
```

```
t11FcsDiscoveryStatus  OBJECT-TYPE
    SYNTAX       INTEGER {
                     inProgress(1),
                     completed(2),
                     localOnly(3)
                 }
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
            "The status of the discovery for the particular Fabric.

            Initially when the switch comes up, all instances of this
            object have the value: 'localOnly', and the database
            contains only local information, i.e., no information
            discovered via the Fabric Configuration Server protocol
            specified in FC-GS-5.

            If t11FcsFabricDiscoveryStart is set to 'start' for a
            range of Fabrics that includes this Fabric, then the
            value of this object transitions to 'inProgress'.  When
            the discovery completes, this object transitions to
            'completed', and the data is cached for the minimum
            interval of time specified by
            t11FcsFabricDiscoveryTimeOut.  After this interval has
            been exceeded, the data may be lost, in which case, the
            value of this object changes to 'localOnly'.

            This object cannot be set via SNMP to any value other
            than 'localOnly'.  If this object is set (via SNMP) to
            'localOnly', the cached data for the Fabric is discarded
            immediately, and if a discovery initiated from this
            switch was in progress for this Fabric, then that
            discovery is aborted."
    ::= { t11FcsDiscoveryStateEntry 2 }

t11FcsDiscoveryCompleteTime  OBJECT-TYPE
    SYNTAX       TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "This object contains the value of sysUpTime at which
            discovery was most recently completed or aborted on this
            Fabric.  This object contains the value of zero before
            the first discovery on this Fabric."
    ::= { t11FcsDiscoveryStateEntry 3 }
```

```
--
--      The Database of Fabric Configuration Information

--
-- Interconnect Element table
--

t11FcsIeTable OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsIeEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "A table of Interconnect Elements.  Interconnect
            Elements (IEs) are switches, hubs, bridges etc.

            By default, the Fabric Configuration Server will
            maintain detailed information pertaining only to
            local resources.  As far as discovered topology is
            concerned, only the IE name, type, and Domain ID
            information will be maintained.  If a discovery
            cycle is triggered on a set of Fabrics, this table
            along with the Port and Platform tables will be
            populated with the discovered information.  The
            discovered data will be retained in this table for
            at least t11FcsFabricDiscoveryTimeOut seconds after
            the completion of its discovery or until the
            discovered data is invalidated."
    ::= { t11FcsDiscoveredConfig 1 }

t11FcsIeEntry OBJECT-TYPE
    SYNTAX       T11FcsIeEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about an Interconnect Element that was
            discovered on a Fabric (identified by t11FcsFabricIndex),
            by a switch (identified by fcmInstanceIndex and
            fcmSwitchIndex)."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex, t11FcsFabricIndex,
              t11FcsIeName }
    ::= { t11FcsIeTable 1 }

T11FcsIeEntry ::= SEQUENCE {
    t11FcsIeName                FcNameIdOrZero,
    t11FcsIeType                T11FcIeType,
```

```
    t11FcsIeDomainId            FcDomainIdOrZero,
    t11FcsIeMgmtId              FcAddressIdOrZero,
    t11FcsIeFabricName          FcNameIdOrZero,
    t11FcsIeLogicalName         OCTET STRING,
    t11FcsIeMgmtAddrListIndex   T11FcListIndexPointerOrZero,
    t11FcsIeInfoList            OCTET STRING
}

t11FcsIeName  OBJECT-TYPE
    SYNTAX       FcNameIdOrZero (SIZE(8 | 16))
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The WWN of an Interconnect Element.  This object
            uniquely identifies an Interconnect Element on a
            Fabric.  If the IE is a switch, then this object
            is the Switch_Name (WWN) of the switch."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.1."
    ::= { t11FcsIeEntry 1 }

t11FcsIeType  OBJECT-TYPE
    SYNTAX       T11FcIeType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The type of this Interconnect Element."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.2"
    ::= { t11FcsIeEntry 2 }

t11FcsIeDomainId  OBJECT-TYPE
    SYNTAX       FcDomainIdOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The Domain ID of this Interconnect Element."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.3."
    ::= { t11FcsIeEntry 3 }

t11FcsIeMgmtId  OBJECT-TYPE
    SYNTAX       FcAddressIdOrZero
    MAX-ACCESS   read-only
    STATUS       current
```

```
    DESCRIPTION
            "The management identifier of this Interconnect Element.
            If the Interconnect Element is a switch, this object will
            be the Domain Controller identifier of the switch.  When
            the value of the identifier is unknown, this object
            contains the all-zeros value: x'00 00 00'."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.4."
    DEFVAL { '000000'h }
    ::= { t11FcsIeEntry 4 }

t11FcsIeFabricName  OBJECT-TYPE
    SYNTAX       FcNameIdOrZero (SIZE(8 | 16))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The Fabric_Name (WWN) of this Interconnect Element.
            When the Fabric_Name is unknown, this object contains
            the all-zeros value: x'00 00 00 00 00 00 00 00'."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.5."
    DEFVAL { '0000000000000000'h }
    ::= { t11FcsIeEntry 5 }

t11FcsIeLogicalName  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (0..255))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The logical name of this Interconnect Element.
            When the logical name is unknown, this object contains
            the zero-length string."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.6."
    ::= { t11FcsIeEntry 6 }

t11FcsIeMgmtAddrListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The management address list for this Interconnect Element.
            This object points to an entry in the
            t11FcsMgmtAddrListTable."
    REFERENCE
```

```
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.7."
    ::= { t11FcsIeEntry 7 }

t11FcsIeInfoList  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (0..252))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The information list for this Interconnect Element.

            The value of this object is formatted as specified in
            FC-GS-5, i.e., it has the following substrings in order:
            vendor name, model name/number, and release code/level,
            followed by zero or more substrings of vendor-specific
            information.  Each substring is terminated with a byte
            containing a null value (x'00')."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.8"
    ::= { t11FcsIeEntry 8 }

--
-- Management Address List table
--

t11FcsMgmtAddrListTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsMgmtAddrListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains the set of management address lists
            that are currently referenced by any instance of the
            t11FcsIeMgmtAddrListIndex or
            t11FcsPlatformMgmtAddrListIndex objects."
    ::= { t11FcsDiscoveredConfig 2 }

t11FcsMgmtAddrListEntry  OBJECT-TYPE
    SYNTAX       T11FcsMgmtAddrListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about one management address in a
            management address list, which is known to a
            switch (identified by fcmInstanceIndex and
            fcmSwitchIndex)."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex,
              t11FcsMgmtAddrListIndex, t11FcsMgmtAddrIndex }
```

```
    ::= { t11FcsMgmtAddrListTable 1 }

T11FcsMgmtAddrListEntry ::= SEQUENCE {
    t11FcsMgmtAddrListIndex        T11FcListIndex,
    t11FcsMgmtAddrIndex            Unsigned32,
    t11FcsMgmtAddr                 URLString
}

t11FcsMgmtAddrListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndex
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The index value of the management address list."
    ::= { t11FcsMgmtAddrListEntry 1 }

t11FcsMgmtAddrIndex OBJECT-TYPE
    SYNTAX       Unsigned32 (1..4294967295)
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "An integer value to distinguish different
            management addresses in the same list."
    ::= { t11FcsMgmtAddrListEntry 2 }

t11FcsMgmtAddr  OBJECT-TYPE
    SYNTAX       URLString
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The management address of this entry.

            The format of this object is a Uniform Resource
            Locator (URL), e.g., for SNMP, see RFC 4088."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.2.7"
    ::= { t11FcsMgmtAddrListEntry 3 }

--
-- Ports
--

t11FcsPortTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsPortEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
```

```
            "This table contains information about the ports of IEs."
    ::= { t11FcsDiscoveredConfig 4 }

t11FcsPortEntry  OBJECT-TYPE
    SYNTAX       T11FcsPortEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about a particular port of an Interconnect
            Element (identified by t11FcsIeName).  The port is
            connected to a Fabric (identified by t11FcsFabricIndex)
            and known to a switch (identified by fcmInstanceIndex
            and fcmSwitchIndex)."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex, t11FcsFabricIndex,
              t11FcsIeName, t11FcsPortName }
    ::= { t11FcsPortTable 1 }

T11FcsPortEntry ::= SEQUENCE {
    t11FcsPortName                    FcNameIdOrZero,
    t11FcsPortType                    FcPortType,
    t11FcsPortTxType                  T11FcPortTxType,
    t11FcsPortModuleType              Unsigned32,
    t11FcsPortPhyPortNum              Unsigned32,
    t11FcsPortAttachPortNameIndex     T11FcListIndexPointerOrZero,
    t11FcsPortState                   T11FcPortState,
    t11FcsPortSpeedCapab              OCTET STRING,
    t11FcsPortOperSpeed               OCTET STRING,
    t11FcsPortZoningEnfStatus         OCTET STRING
}

t11FcsPortName  OBJECT-TYPE
    SYNTAX       FcNameIdOrZero (SIZE(8 | 16))
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The Port_Name (WWN) of the port for which this row
            contains information."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.1."
    ::= { t11FcsPortEntry 1 }

t11FcsPortType  OBJECT-TYPE
    SYNTAX       FcPortType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The Port Type of this port."
```

```
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.2."
    ::= { t11FcsPortEntry 2 }

t11FcsPortTxType  OBJECT-TYPE
    SYNTAX       T11FcPortTxType
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The Port TX Type of this port."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.3."
    ::= { t11FcsPortEntry 3 }

t11FcsPortModuleType  OBJECT-TYPE
    SYNTAX       Unsigned32 (0..255)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The port module type of this port."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.4."
    ::= { t11FcsPortEntry 4 }

t11FcsPortPhyPortNum  OBJECT-TYPE
    SYNTAX       Unsigned32 -- the default range of (0..4294967295)
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The physical number for this port.  FC-GS-5 says that
            the contents of this field, which are carried in a field
            with a size of 4 bytes, are not to be restricted due to
            vendor-specific methods for numbering physical ports."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.5."
    ::= { t11FcsPortEntry 5 }

t11FcsPortAttachPortNameIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The attached port name list for this port.  This object
            points to an entry in the t11FcsAttachPortNameListTable."
```

```
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.6."
    ::= { t11FcsPortEntry 6 }

t11FcsPortState  OBJECT-TYPE
    SYNTAX       T11FcPortState
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The state of this port."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.7."
    ::= { t11FcsPortEntry 7 }

t11FcsPortSpeedCapab  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (2))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The port speed capabilities of this port.  The two octets
            of the value are formatted as described in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.8."
    ::= { t11FcsPortEntry 8 }

t11FcsPortOperSpeed  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (2))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The operating speed of this port.  The two octets
            of the value are formatted as described in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.9."
    ::= { t11FcsPortEntry 9 }

t11FcsPortZoningEnfStatus  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (12))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The zoning enforcement status of this port.  The 12
            octets of the value are formatted as described in FC-GS-5."
    REFERENCE
```

```
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.10."
    ::= { t11FcsPortEntry 10 }

--
-- Attached Port List table
--

t11FcsAttachPortNameListTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsAttachPortNameListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains all the lists of attach port
            names."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.6"
    ::= { t11FcsDiscoveredConfig 5 }

t11FcsAttachPortNameListEntry  OBJECT-TYPE
    SYNTAX       T11FcsAttachPortNameListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about the name of a particular attached port,
            which is known to a switch (identified by fcmInstanceIndex
            and fcmSwitchIndex)."
    INDEX   { fcmInstanceIndex,  fcmSwitchIndex,
              t11FcsAttachPortNameListIndex, t11FcsAttachPortName }
    ::= { t11FcsAttachPortNameListTable 1 }

T11FcsAttachPortNameListEntry ::= SEQUENCE {
    t11FcsAttachPortNameListIndex        T11FcListIndex,
    t11FcsAttachPortName                 OCTET STRING
}

t11FcsAttachPortNameListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndex
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The index value of the attach port name list."
    ::= { t11FcsAttachPortNameListEntry 1 }

t11FcsAttachPortName  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (12))
    MAX-ACCESS   read-only
```

```
    STATUS       current
    DESCRIPTION
            "The attached port name.  Zero or more of these names
            may be associated with a port object.
            The first 8 bytes of this object contain the WWN of
            the port followed by 2 reserved bytes.  Following
            this is one byte of Port flags and one byte of
            Port type, as described in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.3.6"
    ::= { t11FcsAttachPortNameListEntry 2 }

--
-- Platforms
--

t11FcsPlatformTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsPlatformEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains information on platforms.

            By default, this table only contains local (e.g., for a
            local switch) information.  If a discovery is triggered,
            this table will also contain information gathered by the
            discovery process.  The discovered information is retained
            in this table for at least t11FcsFabricDiscoveryTimeOut
            seconds after the completion of its discovery or until
            the discovered cache is invalidated."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4"
    ::= { t11FcsDiscoveredConfig 6 }

t11FcsPlatformEntry  OBJECT-TYPE
    SYNTAX       T11FcsPlatformEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about a particular platform, which is
            known to a switch (identified by fcmInstanceIndex and
            fcmSwitchIndex).

            A platform can contain multiple nodes.  Information on
            nodes is contained in the t11FcsNodeNameListTable.  The
            t11FcsPlatformNodeNameListIndex object in this table
```

```
            points to the list of nodes contained in this platform.
            Similarly, the t11FcsPlatformMgmtAddrListIndex object in
            this table points to the list of management addresses
            associated with this platform."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex,
              t11FcsFabricIndex, t11FcsPlatformIndex }
    ::= { t11FcsPlatformTable 1 }

T11FcsPlatformEntry ::= SEQUENCE {
    t11FcsPlatformIndex              Unsigned32,
    t11FcsPlatformName               OCTET STRING,
    t11FcsPlatformType               OCTET STRING,
    t11FcsPlatformNodeNameListIndex  T11FcListIndexPointerOrZero,
    t11FcsPlatformMgmtAddrListIndex  T11FcListIndexPointerOrZero,
    t11FcsPlatformVendorId           SnmpAdminString,
    t11FcsPlatformProductId          SnmpAdminString,
    t11FcsPlatformProductRevLevel    SnmpAdminString,
    t11FcsPlatformDescription        SnmpAdminString,
    t11FcsPlatformLabel              SnmpAdminString,
    t11FcsPlatformLocation           SnmpAdminString,
    t11FcsPlatformSystemID           SnmpAdminString,
    t11FcsPlatformSysMgmtAddr        T11FcListIndexPointerOrZero,
    t11FcsPlatformClusterId          SnmpAdminString,
    t11FcsPlatformClusterMgmtAddr    T11FcListIndexPointerOrZero,
    t11FcsPlatformFC4Types           OCTET STRING
}

t11FcsPlatformIndex OBJECT-TYPE
    SYNTAX       Unsigned32 (1..4294967295)
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "An integer value to distinguish one platform from
            other platforms in the same Fabric."
    ::= { t11FcsPlatformEntry 1 }

t11FcsPlatformName  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (1..255))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The name of this platform.  The last byte of the value
            indicates the format of the name (even if the name itself
            is the zero-length string) as specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.2"
    ::= { t11FcsPlatformEntry 2 }
```

```
t11FcsPlatformType  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (4))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The type(s) of this platform, encoded in 4 bytes as
            specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.3"
    ::= { t11FcsPlatformEntry 3 }

t11FcsPlatformNodeNameListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The list of nodes for this platform.  This object points
            to an entry in the t11FcsNodeNameListTable."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.6"
    ::= { t11FcsPlatformEntry 4 }

t11FcsPlatformMgmtAddrListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The list of management addresses for this platform.  This
            object points to an entry in the t11FcsMgmtAddrListTable."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.7"
    ::= { t11FcsPlatformEntry 5 }

t11FcsPlatformVendorId  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 12))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The identifier of the vendor of this platform, in the
            format specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 6 }
```

```
t11FcsPlatformProductId  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 20))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The vendor's product and/or model identifier for this
            platform, in the format specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 7 }

t11FcsPlatformProductRevLevel  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..32))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The product revision level for this platform, in the
            format specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 8 }

t11FcsPlatformDescription  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..128))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The description of this platform, in the
            format specified in FC-GS-5.  This value should
            include the full name and version identification of the
            platform's hardware type and software operating system."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.10"
    ::= { t11FcsPlatformEntry 9 }

t11FcsPlatformLabel  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..64))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "An administratively assigned symbolic name for the
            platform, in the format specified in FC-GS-5."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.11"
```

```
    ::= { t11FcsPlatformEntry 10 }

t11FcsPlatformLocation  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..128))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The physical location of the platform, in the format
            specified in FC-GS-5 (e.g., 'telephone closet, 3rd floor')."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.12"
    ::= { t11FcsPlatformEntry 11 }

t11FcsPlatformSystemID  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..64))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "An identifier for a hosting system that this platform is
            associated with.  This identifier is used to associate
            platforms of logical types (e.g., logical partitions) with
            a physical system."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 12 }

t11FcsPlatformSysMgmtAddr  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "A list of management addresses for the platform."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, sections 6.2.3.4.5 and 6.2.3.2.7."
    ::= { t11FcsPlatformEntry 13 }

t11FcsPlatformClusterId  OBJECT-TYPE
    SYNTAX       SnmpAdminString (SIZE (0 | 4..64))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "An identifier for a cluster that this platform is
             associated with, where a cluster is a set of independent
             platforms that are managed together to provide increased
             performance capabilities, failover, etc."
```

```
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 14 }

t11FcsPlatformClusterMgmtAddr  OBJECT-TYPE
    SYNTAX       T11FcListIndexPointerOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "A list of management addresses for the cluster identified
            in the corresponding instance of t11FcsPlatformClusterId."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, sections 6.2.3.4.5 and 6.2.3.2.7."
    ::= { t11FcsPlatformEntry 15 }

t11FcsPlatformFC4Types  OBJECT-TYPE
    SYNTAX       OCTET STRING (SIZE (0 | 32))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The FC-4 types supported by this platform, formatted as
            a bit mask as specified in FC-GS-5.  If this object
            contains the zero-length string, the types are unknown."
    REFERENCE
            "ANSI INCITS 427-2007, Fibre Channel - Generic Services 5,
            FC-GS-5, section 6.2.3.4.5"
    ::= { t11FcsPlatformEntry 16 }

--
-- Node Name List table
--

t11FcsNodeNameListTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsNodeNameListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains all the lists of nodes."
    ::= { t11FcsDiscoveredConfig 7 }

t11FcsNodeNameListEntry  OBJECT-TYPE
    SYNTAX       T11FcsNodeNameListEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Information about a node, which is known to a
```

```
            switch (identified by fcmInstanceIndex and
            fcmSwitchIndex)."
    INDEX   { fcmInstanceIndex,  fcmSwitchIndex,
              t11FcsNodeNameListIndex, t11FcsNodeName }
    ::= { t11FcsNodeNameListTable 1 }

T11FcsNodeNameListEntry ::= SEQUENCE {
    t11FcsNodeNameListIndex       T11FcListIndex,
    t11FcsNodeName                FcNameIdOrZero
}

t11FcsNodeNameListIndex  OBJECT-TYPE
    SYNTAX       T11FcListIndex
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "The index value of the node name list."
    ::= { t11FcsNodeNameListEntry 1 }

t11FcsNodeName  OBJECT-TYPE
    SYNTAX       FcNameIdOrZero (SIZE(8 | 16))
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The name of this node."
    ::= { t11FcsNodeNameListEntry 2 }

--
-- Statistics
--

t11FcsStatsTable  OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsStatsEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "This table contains all the statistics related
            to the Fabric Configuration Server."
    ::= { t11FcsStats 1 }

t11FcsStatsEntry  OBJECT-TYPE
    SYNTAX       T11FcsStatsEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "A set of statistics for a particular Fabric (identified
            by t11FcsFabricIndex) on a switch (identified by
            fcmInstanceIndex and fcmSwitchIndex)."
```

```
    INDEX   { fcmInstanceIndex, fcmSwitchIndex, t11FcsFabricIndex }
    ::= { t11FcsStatsTable 1 }

T11FcsStatsEntry ::= SEQUENCE {
    t11FcsInGetReqs                 Counter32,
    t11FcsOutGetReqs                Counter32,
    t11FcsInRegReqs                 Counter32,
    t11FcsOutRegReqs                Counter32,
    t11FcsInDeregReqs               Counter32,
    t11FcsOutDeregReqs              Counter32,
    t11FcsRejects                   Counter32
}

t11FcsInGetReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Get Requests received by the Fabric
            Configuration Server on this Fabric.

            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 1 }


t11FcsOutGetReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Get Requests sent by the Fabric
            Configuration Server on this Fabric to other
            servers in the Fabric.

            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 2 }


t11FcsInRegReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registration Requests received by the
            Fabric Configuration Server on this Fabric.
```

```
            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 3 }

t11FcsOutRegReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Registration Requests sent by the
            Fabric Configuration Server on this Fabric.

            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 4 }


t11FcsInDeregReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Deregistration Requests received by
            the Fabric Configuration Server on this Fabric.

            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 5 }

t11FcsOutDeregReqs  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The number of Deregistration Requests sent by
            the Fabric Configuration Server on this Fabric.

            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 6 }

t11FcsRejects  OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The total number of requests rejected by the Fabric
            Configuration Server on this Fabric.
```

```
            This counter has no discontinuities other than
            those that all Counter32s have when sysUpTime=0."
    ::= { t11FcsStatsEntry 7 }

--
-- Notification Control Table
--

t11FcsNotifyControlTable OBJECT-TYPE
    SYNTAX       SEQUENCE OF T11FcsNotifyControlEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "A table of control information for notifications
            generated due to Fabric Configuration Server events.

            Values written to objects in this table should be
            persistent/retained over agent reboots."
    ::= { t11FcsNotificationInfo 1 }

t11FcsNotifyControlEntry OBJECT-TYPE
    SYNTAX       T11FcsNotifyControlEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
            "Each entry contains notification control information
            for a Fabric Configuration Server on a particular Fabric
            (identified by t11FcsFabricIndex) on a particular
            switch (identified by fcmInstanceIndex and
            fcmSwitchIndex)."
    INDEX   { fcmInstanceIndex, fcmSwitchIndex,
              t11FcsFabricIndex }
    ::= { t11FcsNotifyControlTable 1 }

T11FcsNotifyControlEntry ::= SEQUENCE {
     t11FcsReqRejectNotifyEnable        TruthValue,
     t11FcsDiscoveryCompNotifyEnable    TruthValue,
     t11FcsMgmtAddrChangeNotifyEnable   TruthValue,
     t11FcsRejectCtCommandString        OCTET STRING,
     t11FcsRejectRequestSource          FcNameIdOrZero,
     t11FcsRejectReasonCode             T11NsGs4RejectReasonCode,
     t11FcsRejectReasonCodeExp          T11FcsRejectReasonExplanation,
     t11FcsRejectReasonVendorCode       OCTET STRING
}

t11FcsReqRejectNotifyEnable OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-write
```

```
    STATUS        current
    DESCRIPTION
            "This object specifies if the Fabric Configuration
            Server should generate 't11FcsRqRejectNotification'
            notifications.

            If the value of this object is 'true', then the
            notification is issued.  If the value of this object
            is 'false', then the notification is not issued."
    DEFVAL { false }
    ::= { t11FcsNotifyControlEntry 1 }

t11FcsDiscoveryCompNotifyEnable OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-write
    STATUS        current
    DESCRIPTION
            "This object specifies if the Fabric Configuration
            Server should generate 't11FcsDiscoveryCompleteNotify'
            notifications.

            If the value of this object is 'true', then the
            notification is issued.  If the value of this object
            is 'false', then the notification is not issued."
    DEFVAL { false }
    ::= { t11FcsNotifyControlEntry 2 }

t11FcsMgmtAddrChangeNotifyEnable OBJECT-TYPE
    SYNTAX        TruthValue
    MAX-ACCESS    read-write
    STATUS        current
    DESCRIPTION
            "This object specifies if the Fabric Configuration
            Server should generate 't11FcsMgmtAddrChangeNotify'
            notifications.

            If the value of this object is 'true', then the
            notification is issued.  If the value of this object
            is 'false', then the notification is not issued."
    DEFVAL { false }
    ::= { t11FcsNotifyControlEntry 3 }

t11FcsRejectCtCommandString OBJECT-TYPE
    SYNTAX        OCTET STRING (SIZE (0..255))
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
            "The binary content of the Fabric Configuration Server
```

```
            request, formatted as an octet string (in network byte
            order) containing the Common Transport Information Unit
            (CT_IU), as described in Table 2 of FC-GS-5 (including
            the preamble), which was most recently rejected by the
            Fabric Configuration Server for this Fabric.

            This object contains the zero-length string if and when the
            CT-IU's content is unavailable.

            When the length of this object is 255 octets, it contains
            the first 255 octets of the CT-IU (in network byte order)."
    ::= { t11FcsNotifyControlEntry 4 }

t11FcsRejectRequestSource OBJECT-TYPE
    SYNTAX       FcNameIdOrZero
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
            "The WWN that was the source of the CT_IU contained in
            the corresponding instance of t11FcsRejectCtCommandString."
    ::= { t11FcsNotifyControlEntry 5 }

t11FcsRejectReasonCode OBJECT-TYPE
    SYNTAX        T11NsGs4RejectReasonCode
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
            "This object contains the reason code corresponding
            to the latest Fabric Configuration Server request
            rejected by the local system."
    ::= { t11FcsNotifyControlEntry 6 }

t11FcsRejectReasonCodeExp OBJECT-TYPE
    SYNTAX        T11FcsRejectReasonExplanation
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
            "When the corresponding instance of
            t11FcsRejectReasonCode has the value: 'unable to
            perform command request', this object contains the
            corresponding reason code explanation."
    ::= { t11FcsNotifyControlEntry 7 }

t11FcsRejectReasonVendorCode OBJECT-TYPE
    SYNTAX        OCTET STRING (SIZE(1))
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
```

```
            "A registration reject vendor-specific code.  This
            object contains the vendor-specific code of the most
            recently rejected Fabric Configuration Server
            Registration request for the particular port on
            the particular Fabric."
    ::= { t11FcsNotifyControlEntry 8 }
--
-- Notifications
--

t11FcsRqRejectNotification NOTIFICATION-TYPE
    OBJECTS { t11FamLocalSwitchWwn,
              t11FcsRejectReasonCode,
              t11FcsRejectReasonCodeExp,
              t11FcsRejectReasonVendorCode }
    STATUS  current
    DESCRIPTION
            "This notification is generated whenever the Fabric
            Configuration Server on a switch (indicated by the
            value of t11FamLocalSwitchWwn) rejects a Fabric
            Configuration Server request.

            The Fabric Configuration Server should update the
            t11FcsRejectReasonCode, t11FcsRejectReasonCodeExp
            and t11FcsRejectReasonVendorCode objects with the
            corresponding reason code, explanation and vendor
            specific code before sending the notification."
    ::= { t11FcsNotifications 1 }

t11FcsDiscoveryCompleteNotify NOTIFICATION-TYPE
    OBJECTS {t11FcsFabricDiscoveryRangeLow}
    STATUS  current
    DESCRIPTION
            "This notification is generated by the Fabric
            Configuration Server on the completion of the
            discovery of Fabrics in the range that has
            t11FcsFabricDiscoveryRangeLow at its low end."
    ::= { t11FcsNotifications 2 }

t11FcsMgmtAddrChangeNotify NOTIFICATION-TYPE
    OBJECTS { t11FcsMgmtAddrChangeFabricIndex,
              t11FcsMgmtAddrChangeIeName }
    STATUS  current
    DESCRIPTION
            "This notification is generated by the Fabric
            Configuration Server whenever the management
            address of an IE changes, i.e., whenever an
            entry in the t11FcsMgmtAddrListTable changes."
```

```
    ::= { t11FcsNotifications 3 }

t11FcsMgmtAddrChangeFabricIndex OBJECT-TYPE
    SYNTAX        T11FabricIndex
    MAX-ACCESS    accessible-for-notify
    STATUS        current
    DESCRIPTION
            "The index value that identifies the Fabric on which
            a management address change has been detected."
    ::= { t11FcsNotificationInfo 2 }

t11FcsMgmtAddrChangeIeName OBJECT-TYPE
    SYNTAX        FcNameIdOrZero
    MAX-ACCESS    accessible-for-notify
    STATUS        current
    DESCRIPTION
            "The IE for which a management address change has been
            detected."
    ::= { t11FcsNotificationInfo 3 }


-- Conformance

t11FcsMIBCompliances OBJECT IDENTIFIER ::= { t11FcsMIBConformance 1 }
t11FcsMIBGroups      OBJECT IDENTIFIER ::= { t11FcsMIBConformance 2 }

t11FcsMIBCompliance MODULE-COMPLIANCE
    STATUS        current
    DESCRIPTION
            "The compliance statement for entities that
            implement the Fabric Configuration Server."
    MODULE MANDATORY-GROUPS { t11FcsDiscoveredConfigGroup,
                              t11FcsDiscoveryStatusGroup,
                              t11FcsNotificationInfoGroup,
                              t11FcsNotificationGroup }

    GROUP   t11FcsDiscoveryControlGroup
    DESCRIPTION
            "This group is mandatory only for those systems that
            allow discovery of configuration by Fabric Configuration
            Servers to be controlled via a MIB."

    GROUP   t11FcsStatisticsGroup
    DESCRIPTION
            "These counters, containing Fabric Configuration
            Server statistics, are mandatory only for those systems
            that count such events."
```

```
    OBJECT   t11FcsDiscoveryStatus
    WRITE-SYNTAX INTEGER { localOnly(3) }
    MIN-ACCESS   read-only
    DESCRIPTION
            "Write access is not required.
             However, if write access is supported, then the only
             writable value is 'localOnly'."

    OBJECT   t11FcsReqRejectNotifyEnable
    MIN-ACCESS   read-only
    DESCRIPTION
            "Write access is not required."

    OBJECT   t11FcsDiscoveryCompNotifyEnable
    MIN-ACCESS   read-only
    DESCRIPTION
            "Write access is not required."

    OBJECT   t11FcsMgmtAddrChangeNotifyEnable
    MIN-ACCESS   read-only
    DESCRIPTION
            "Write access is not required."

    ::= { t11FcsMIBCompliances 1 }


-- Units of Conformance

t11FcsDiscoveryControlGroup OBJECT-GROUP
    OBJECTS { t11FcsFabricDiscoveryRangeLow,
              t11FcsFabricDiscoveryRangeHigh,
              t11FcsFabricDiscoveryStart,
              t11FcsFabricDiscoveryTimeOut }
    STATUS   current
    DESCRIPTION
            "A collection of objects for requesting a Fabric
            Configuration Server to discover the configuration
            of one or more Fabrics."
    ::= { t11FcsMIBGroups 1 }

t11FcsDiscoveryStatusGroup OBJECT-GROUP
    OBJECTS { t11FcsDiscoveryStatus,
              t11FcsDiscoveryCompleteTime }
    STATUS   current
    DESCRIPTION
            "A collection of objects with which to monitor the
            status of discovery (of Fabric configurations) by
            Fabric Configuration Servers."
```

```
    ::= { t11FcsMIBGroups 2 }

t11FcsDiscoveredConfigGroup OBJECT-GROUP
    OBJECTS {
              t11FcsIeType,
              t11FcsIeDomainId,
              t11FcsIeMgmtId,
              t11FcsIeFabricName,
              t11FcsIeLogicalName,
              t11FcsIeMgmtAddrListIndex,
              t11FcsIeInfoList,
              t11FcsMgmtAddr,
              t11FcsPortType,
              t11FcsPortTxType,
              t11FcsPortModuleType,
              t11FcsPortPhyPortNum,
              t11FcsPortAttachPortNameIndex,
              t11FcsPortState,
              t11FcsPortSpeedCapab,
              t11FcsPortOperSpeed,
              t11FcsPortZoningEnfStatus,
              t11FcsAttachPortName,
              t11FcsPlatformName,
              t11FcsPlatformType,
              t11FcsPlatformNodeNameListIndex,
              t11FcsPlatformMgmtAddrListIndex,
              t11FcsPlatformVendorId,
              t11FcsPlatformProductId,
              t11FcsPlatformProductRevLevel,
              t11FcsPlatformDescription,
              t11FcsPlatformLabel,
              t11FcsPlatformLocation,
              t11FcsPlatformSystemID,
              t11FcsPlatformSysMgmtAddr,
              t11FcsPlatformClusterId,
              t11FcsPlatformClusterMgmtAddr,
              t11FcsPlatformFC4Types,
              t11FcsNodeName }
    STATUS   current
    DESCRIPTION
            "A collection of objects to contain the Fabric configuration
            information discovered by Fabric Configuration Servers."
    ::= { t11FcsMIBGroups 3 }

t11FcsStatisticsGroup OBJECT-GROUP
    OBJECTS { t11FcsInGetReqs,
              t11FcsOutGetReqs,
              t11FcsInRegReqs,
```

```
              t11FcsOutRegReqs,
              t11FcsInDeregReqs,
              t11FcsOutDeregReqs,
              t11FcsRejects }
    STATUS  current
    DESCRIPTION
            "A collection of objects for Fabric Configuration Server
            statistics information."
    ::= { t11FcsMIBGroups 4 }

t11FcsNotificationInfoGroup OBJECT-GROUP
    OBJECTS { t11FcsReqRejectNotifyEnable,
              t11FcsDiscoveryCompNotifyEnable,
              t11FcsMgmtAddrChangeNotifyEnable,
              t11FcsRejectCtCommandString,
              t11FcsRejectRequestSource,
              t11FcsRejectReasonCode,
              t11FcsRejectReasonCodeExp,
              t11FcsRejectReasonVendorCode,
              t11FcsMgmtAddrChangeFabricIndex,
              t11FcsMgmtAddrChangeIeName }
    STATUS  current
    DESCRIPTION
            "A collection of notification control and notification
            information objects for monitoring Fabric
            Configuration Servers."
    ::= { t11FcsMIBGroups 5 }

t11FcsNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS { t11FcsRqRejectNotification,
                    t11FcsDiscoveryCompleteNotify,
                    t11FcsMgmtAddrChangeNotify }
    STATUS  current
    DESCRIPTION
            "A collection of notifications for monitoring Fabric
            Configuration Servers."
    ::= { t11FcsMIBGroups 6 }

END
```

7. IANA Considerations

IANA has assigned a MIB OID (162) under the mib-2 subtree.

8. Security Considerations

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

```
t11FcsFabricDiscoveryRangeLow
t11FcsFabricDiscoveryRangeHigh
t11FcsFabricDiscoveryTimeOut
t11FcsFabricDiscoveryStart -- the ability to specify parameters
                              for, and trigger the start of,
                              a topology discovery.
t11FcsDiscoveryStatus      -- the ability to abort a discovery, or
                              invalidate discovered information.
t11FcsReqRejectNotifyEnable
t11FcsDiscoveryCompNotifyEnable
t11FcsMgmtAddrChangeNotifyEnable -- the ability to enable/disable
                                    notifications.
```

Such objects may be considered sensitive or vulnerable in some network environments. For example, the ability to invalidate discovered topology may afford an attacker the ability to hide the presence of unauthorized equipment on the network. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may 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:

```
t11FcsIeTable
t11FcsMgmtAddrListTable
t11FcsPortTable
t11FcsAttachPortNameListTable
t11FcsPlatformTable
```

t11FcsNodeNameListTable -- contains information about the topology of the Fibre Channel network.

t11FcsStatsTable -- contains statistics information about the operation of the Fabric Configuration Server.

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.

9. Acknowledgements

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

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10. Normative References

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

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

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

[RFC2788] Freed, N. and S. Kille, "Network Services Monitoring MIB", RFC 2788, March 2000.

[RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", STD 58, RFC 3411, December 2002.

[FC-FS] "Fibre Channel - Framing and Signaling (FC-FS)" ANSI INCITS 373-2003, http://www.t11.org/t11/stat.nsf/upnum/1331-d, April 2003.

[FC-GS-5] "Fibre Channel - Generic Services - 5 (FC-GS-5)", ANSI INCITS 427-2007, http://www.t11.org/t11/stat.nsf/upnum/1677-d, 2007.

[FC-SW-4] "Fibre Channel - Switch Fabric - 4 (FC-SW-4)", ANSI INCITS 418-2006, http://www.t11.org/t11/stat.nsf/upnum/1674-d, December 2006.

[RFC4044] McCloghrie, K., "Fibre Channel Management MIB", RFC 4044, May 2005.

[RFC4438] DeSanti, C., Gaonkar, V., Vivek, H.K., McCloghrie, K., and S. Gai, "Fibre Channel Name Server MIB", RFC 4438, March 2006.

[RFC4439] DeSanti, C., Gaonkar, V., McCloghrie, K., and S. Gai, "Fibre Channel Fabric Address Manager MIB", RFC 4439, March 2006.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

11. Informative References

[RFC2741] Daniele, M., Wijnen, B., Ellison, M., and D. Francisco, "Agent Extensibility (AgentX) Protocol Version 1", RFC 2741, January 2000.

[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.

[RFC4455] Hallak-Stamler, M., Bakke, M., Lederman, Y., Krueger, M., and K. McCloghrie, "Definition of Managed Objects for Small Computer System Interface (SCSI) Entities", RFC 4455, April 2006.

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