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C. DeSanti
H.K. Vivek
K. McCloghrie
Cisco Systems
S. Gai
Nuova Systems
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Fibre Channel Fabric Configuration Server 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 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 t1lFcsDiscoveredConfigGroup Group

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

5.4.2. The t1lFcsDiscoveryStatusGroup Group

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

5.4.3. The t1lFcsDiscoveryControlGroup Group

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

5.4.4. The t1lFcsStatisticsGroup Group

This group contains objects for Fabric Configuration Server statistics information.

5.4.5. The t1lFcsNotificationGroup 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 `t1lFcsDiscoveryCompleteNotify` 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 `t1lFcsNotificationInfoGroup` 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 T1l-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.
  170 West Tasman Drive
  San Jose, CA 95134 USA
  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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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."

```
::= { t1lFcsFabricDiscoveryEntry 2 }
```

t1lFcsFabricDiscoveryStart 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 t1lFcsFabricDiscoveryRangeLow and t1lFcsFabricDiscoveryRangeHigh. 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 t1lFcsFabricDiscoveryRangeLow and t1lFcsFabricDiscoveryRangeHigh.

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'."

```
::= { t1lFcsFabricDiscoveryEntry 3 }
```

t1lFcsFabricDiscoveryTimeOut 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 }
```

```
::= { t1lFcsFabricDiscoveryEntry 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 }
```

t1lFcsDiscoveryStatus 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 t1lFcsFabricDiscoveryStart 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 t1lFcsFabricDiscoveryTimeOut. 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."

::= { t1lFcsDiscoveryStateEntry 2 }

t1lFcsDiscoveryCompleteTime 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."

::= { t1lFcsDiscoveryStateEntry 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 fcmInstanceId and fcmSwitchIndex)."
 INDEX { fcmInstanceId, 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 fcmInstanceId and
        fcmSwitchIndex)."
```

INDEX { fcmInstanceId, 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
fcmInstanceId 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 fcmInstanceId and fcmSwitchIndex)."

INDEX { fcmInstanceId, 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."
 ::= { t1lFcsNotifyControlEntry 8 }
--
-- Notifications
--

t1lFcsRqRejectNotification NOTIFICATION-TYPE
  OBJECTS { t1lFamLocalSwitchWwn,
            t1lFcsRejectReasonCode,
            t1lFcsRejectReasonCodeExp,
            t1lFcsRejectReasonVendorCode }
  STATUS current
  DESCRIPTION
    "This notification is generated whenever the Fabric
    Configuration Server on a switch (indicated by the
    value of t1lFamLocalSwitchWwn) rejects a Fabric
    Configuration Server request.

    The Fabric Configuration Server should update the
    t1lFcsRejectReasonCode, t1lFcsRejectReasonCodeExp
    and t1lFcsRejectReasonVendorCode objects with the
    corresponding reason code, explanation and vendor
    specific code before sending the notification."
 ::= { t1lFcsNotifications 1 }

t1lFcsDiscoveryCompleteNotify NOTIFICATION-TYPE
  OBJECTS {t1lFcsFabricDiscoveryRangeLow}
  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
    t1lFcsFabricDiscoveryRangeLow at its low end."
 ::= { t1lFcsNotifications 2 }

t1lFcsMgmtAddrChangeNotify NOTIFICATION-TYPE
  OBJECTS { t1lFcsMgmtAddrChangeFabricIndex,
            t1lFcsMgmtAddrChangeIeName }
  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 t1lFcsMgmtAddrListTable 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    t1lFcsDiscoveryStatus
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    t1lFcsReqRejectNotifyEnable
MIN-ACCESS    read-only
DESCRIPTION
    "Write access is not required."
```

```

OBJECT    t1lFcsDiscoveryCompNotifyEnable
MIN-ACCESS    read-only
DESCRIPTION
    "Write access is not required."
```

```

OBJECT    t1lFcsMgmtAddrChangeNotifyEnable
MIN-ACCESS    read-only
DESCRIPTION
    "Write access is not required."
```

```
 ::= { t1lFcsMIBCompliances 1 }
```

-- Units of Conformance

```

t1lFcsDiscoveryControlGroup OBJECT-GROUP
    OBJECTS { t1lFcsFabricDiscoveryRangeLow,
               t1lFcsFabricDiscoveryRangeHigh,
               t1lFcsFabricDiscoveryStart,
               t1lFcsFabricDiscoveryTimeOut }
    STATUS    current
    DESCRIPTION
        "A collection of objects for requesting a Fabric
        Configuration Server to discover the configuration
        of one or more Fabrics."
    ::= { t1lFcsMIBGroups 1 }
```

```

t1lFcsDiscoveryStatusGroup OBJECT-GROUP
    OBJECTS { t1lFcsDiscoveryStatus,
               t1lFcsDiscoveryCompleteTime }
    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,
```

```
        t1lFcsOutRegReqs,
        t1lFcsInDeregReqs,
        t1lFcsOutDeregReqs,
        t1lFcsRejects }
STATUS    current
DESCRIPTION
    "A collection of objects for Fabric Configuration Server
    statistics information."
 ::= { t1lFcsMIBGroups 4 }

t1lFcsNotificationInfoGroup OBJECT-GROUP
OBJECTS { t1lFcsReqRejectNotifyEnable,
          t1lFcsDiscoveryCompNotifyEnable,
          t1lFcsMgmtAddrChangeNotifyEnable,
          t1lFcsRejectCtCommandString,
          t1lFcsRejectRequestSource,
          t1lFcsRejectReasonCode,
          t1lFcsRejectReasonCodeExp,
          t1lFcsRejectReasonVendorCode,
          t1lFcsMgmtAddrChangeFabricIndex,
          t1lFcsMgmtAddrChangeIeName }
STATUS    current
DESCRIPTION
    "A collection of notification control and notification
    information objects for monitoring Fabric
    Configuration Servers."
 ::= { t1lFcsMIBGroups 5 }

t1lFcsNotificationGroup NOTIFICATION-GROUP
NOTIFICATIONS { t1lFcsRqRejectNotification,
               t1lFcsDiscoveryCompleteNotify,
               t1lFcsMgmtAddrChangeNotify }
STATUS    current
DESCRIPTION
    "A collection of notifications for monitoring Fabric
    Configuration Servers."
 ::= { t1lFcsMIBGroups 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:

```
t1lFcsFabricDiscoveryRangeLow
t1lFcsFabricDiscoveryRangeHigh
t1lFcsFabricDiscoveryTimeOut
t1lFcsFabricDiscoveryStart -- the ability to specify parameters
                           for, and trigger the start of,
                           a topology discovery.
t1lFcsDiscoveryStatus      -- the ability to abort a discovery, or
                           invalidate discovered information.
t1lFcsReqRejectNotifyEnable
t1lFcsDiscoveryCompNotifyEnable
t1lFcsMgmtAddrChangeNotifyEnable -- 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:

```
t1lFcsIeTable
t1lFcsMgmtAddrListTable
t1lFcsPortTable
t1lFcsAttachPortNameListTable
t1lFcsPlatformTable
```

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.

Authors' Addresses

Claudio DeSanti
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134 USA
Phone: +1 408 853-9172
EMail: cds@cisco.com

H.K. Vivek
Cisco Systems, Inc.
71 Millers Rd
Bangalore, India
Phone: +91 80 2289933x5117
EMail: hvivek@cisco.com

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

Silvano Gai
Nuova Systems
3 West Plumeria Drive
San Jose, CA 95134
Phone: +1 408 387-6123
EMail: sgai@nuovasystems.com

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