                     Definitions of Managed Objects
              for the Fabric Element in Fibre Channel Standard

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.

Copyright Notice

Abstract

   This memo defines an extension to the Management Information Base
   (MIB) for use with network management protocols in TCP/IP-based
   internets. In particular, it defines the objects for managing the
   operations of the Fabric Element portion of the Fibre Channel
   Standards.

Table of Contents

1. The SNMP Management Framework

   The SNMP Management Framework presently consists of five major
   components:

   o An overall architecture, described in RFC 2571 [1].

   o Mechanisms for describing and naming objects and events for the
      purpose of management. The first version of this Structure of
      Management Information (SMI) is called SMIv1 and described in STD
      16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The
      second version, called SMIv2, is described in STD 58, RFC 2578
      [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].

   o Message protocols for transferring management information. The
      first version of the SNMP message protocol is called SNMPv1 and
      described in STD 15, RFC 1157 [8]. A second version of the SNMP
      message protocol, which is not an Internet standards track
      protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC
      1906 [10]. The third version of the message protocol is called
      SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574
      [12].

   o Protocol operations for accessing management information. The
      first set of protocol operations and associated PDU formats is
      described in STD 15, RFC 1157 [8]. A second set of protocol
      operations and associated PDU formats is described in RFC 1905
      [13].

   o A set of fundamental applications described in RFC 2573 [14] and
      the view-based access control mechanism described in RFC 2575
      [15].

   A more detailed introduction to the current SNMP Management Framework
   can be found in RFC 2570 [16].

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. Objects in the MIB are
   defined using the mechanisms defined in the SMI.

   This memo specifies a MIB module that is compliant to the SMIv2. A
   MIB conforming to the SMIv1 can be produced through the appropriate
   translations. The resulting translated MIB must be semantically
   equivalent, except where objects or events are omitted because no
   translation is possible (use of Counter64). Some machine readable
   information in SMIv2 will be converted into textual descriptions in
   SMIv1 during the translation process. However, this loss of machine
   readable information is not considered to change the semantics of the
   MIB.

2. Overview

   A Fibre Channel Fabric is an entity which interconnects Node Ports
   (N_Ports) or Node Loop Ports (NL_Ports). It provides transport and
   routing functions. In essence, a Fabric is a network of N_Ports
   and/or NL_Ports to communicate with one another. A Fabric is
   composed of one or more Fabric Element that are interconnected via
   Inter-element Links (IEL). A Fabric Element is the smallest unit of
   a Fabric that meets the definition of a Fabric. It must consist of
   at least three external ports to connect to either N_Ports, NL_Ports
   or other Fabric Elements. In general, a Fabric Element port may be
   of one of the following types:

   (1) F_Port, a fabric port to connect to an N_Port ([17], [21], [22]);

   (2) FL_Port, a fabric port that also supports a FC Arbitrated Loop
        consisting of one or more NL_Ports ([20], [24]).

   (3) E_Port, an expansion port to connect to another Fabric Element
        ([18], [23]);

   This memo shall define objects related to a Fabric Element, its
   F_Ports and FL_Ports. Objects related to other types of FC ports
   shall be defined in future.

   For the rest of the document, the term, "FxPort", will be used to
   refer to both F_Port and FL_Port where the distinction is not
   necessary. The term, "NxPort" will be used to refer to both N_Port
   and NL_Port in the similar fashion.

2.1. Management View of a Fabric Element

   From the management perspective, it is helpful to view a Fabric
   Element to be consisting of multiple "modules". Each module is a
   grouping, either physical or logical, of one or more ports that may
   be managed as a sub-entity within the Fabric Element.

   This module mapping is recommended but optional. A vendor may elect
   to put all ports into a single module, or to divide the ports into
   modules that do not match physical divisions.

   The object fcFeModuleCapacity indicates the maximum number of modules
   that a given Fabric Element may contain. This value must remain
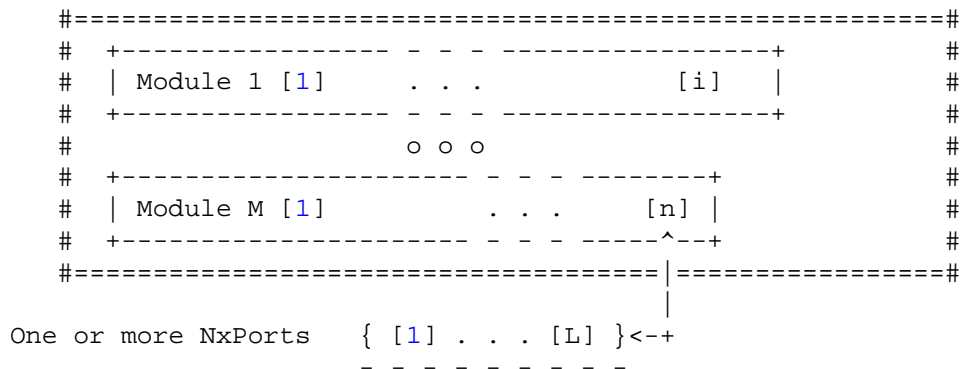   constant from one management restart to the next.

   Each module is uniquely identified by a module number in the range of
   1 through fcFeModuleCapacity inclusive. Modules may come and go
   without causing a management reset (of sysUpTime), and may be
   sparsely numbered within the Fabric Element. That is, the module
   numbering is not required to be contiguous. For instance, if a
   module is mapped physically to a field-replaceable card and in a 13-
   card cage Fabric Element, cards 3, 5, 6 and 7 may be installed. The
   vendor may choose to label them as modules 3, 5, 6 and 7
   respectively. In this example, the value of fcFeModuleCapacity is
   13. Note that the object fcFeModuleLastChange acts as the
   discontinuity indicator for all counter objects in this MIB.

   A Fabric Element may also provide a proxy management on behalf of
   another management entity by presenting it as one of its Fabric
   Element modules.

   The object fcFeModuleFxPortCapacity indicates the maximum number of
   ports that a given module may contain. The value of
   fcFeModuleFxPortCapacity must not change for a given module.
   However, a module may be deleted from the Fabric Element and replaced
   with a module containing a different number of ports. The value of
   fcFeModuleLastChange will indicate that a change took place.

   Each port within the Fabric Element is uniquely identified by a
   combination of module index and port index, where port index is an
   integer in the range (1..fcFeModuleFxPortCapacity). As with modules
   within a Fabric Element, ports within a module may be sparsely
   numbered. That is the port numbering is not required to be
   contiguous. Likewise, ports may come and go within a module without
   causing a management reset.

In terms of attachment, an F_Port will be attached to another N_Port;
and an FL_Port will be attached to one or up to 126 NL_Ports. In
general, an FxPort may be attached to one or more NxPorts. Each
NxPort associated with an FxPort will be uniquely identified by a
combination of module index, FxPort index and NxPort index. An
NxPort index is an integer in the range (1..126). The following
diagram illustrates the management view of a Fabric Element.

```
         #=======================================================#
         #   +----------------- - - - -----------------+        #
         #   | Module 1 [1]     . . .               [i]  |        #
         #   +----------------- - - - -----------------+        #
         #                    o o o                              #
         #   +--------------------- - - - --------+               #
         #   | Module M [1]         . . .    [n] |               #
         #   +--------------------- - - - -----^--+               #
         #======================================|===============#
                                                |
      One or more NxPorts   { [1] . . . [L] }<-+
                             - - - - - - - - -
```
where "i", "n", "M" and "L" are some arbitrary sample integer values,
and "L" must be less than 127.

2.2. Structure of the Fabric Element MIB

   This memo assumes that a Fabric Element has an SNMP entity associated
   with its managed objects. The managed objects are divided as follow:

          - the Configuration group
          - the Status group
          - the Error group
          - the Accounting group
          - the Capability group

   In each group, scalar objects and table entries are defined.

   The Configuration group contains configuration and service parameters
   for the Fabric Element, modules and the FxPorts.

   The Operation group contains the operational status and parameters of
   an FxPort. The group also contains the service parameters that have
   been established between the FxPort and its attached NxPort, if
   applicable.

   The Error group contains counters tracking various types of errors
   detected by each FxPort. The information may be used for diagnostics
   and/or to derive the quality of the link between an FxPort and one or
   more attached NxPorts.

   The Accounting group contains statistic data suitable for deriving
   accounting and performance information.

   The Capability group contains parameters indicating the inherent
   capability of the Fabric Element and each FxPort.

3. Object Definitions

```
FIBRE-CHANNEL-FE-MIB DEFINITIONS ::= BEGIN
  IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    Unsigned32, Counter32, Gauge32, Integer32, mib-2
      FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, TruthValue, TimeStamp
      FROM SNMPv2-TC
    SnmpAdminString
      FROM SNMP-FRAMEWORK-MIB                       -- rfc2571
    MODULE-COMPLIANCE, OBJECT-GROUP
      FROM SNMPv2-CONF;

  fcFeMIB MODULE-IDENTITY
    LAST-UPDATED "200005180000Z"
    ORGANIZATION "IETF IPFC Working Group"
    CONTACT-INFO "Kha Sin Teow
                  Brocade Communications Systems,
                  1901 Guadalupe Parkway,
                  San Jose, CA 95131
                  U.S.A
                  Tel: +1 408 487 8180
                  Fax: +1 408 487 8190
                  Email: khasin@Brocade.COM

                  WG Mailing list:ipfc@standards.gadzoox.com
                  To Subscribe: ipfc-request@standards.gadzoox.com
                  In Body: subscribe"

    DESCRIPTION "The MIB module for Fibre Channel Fabric Element."
    REVISION "200005180000Z"
    DESCRIPTION "Initial revision, published as RFC 2837."
    ::= { mib-2 75 }

  fcFeMIBObjects OBJECT IDENTIFIER ::= { fcFeMIB 1 }

  --   Note:
  --   fcFeMIBConformance OBJECT IDENTIFIER ::= { fcFeMIB 2 }
  --   see at the end of the module

  -- Groups under fcFeMIBObjects
```

```
 fcFeConfig        OBJECT IDENTIFIER ::= { fcFeMIBObjects 1 }
 fcFeStatus        OBJECT IDENTIFIER ::= { fcFeMIBObjects 2 }
 fcFeError         OBJECT IDENTIFIER ::= { fcFeMIBObjects 3 }
 fcFeAccounting    OBJECT IDENTIFIER ::= { fcFeMIBObjects 4 }
 fcFeCapabilities  OBJECT IDENTIFIER ::= { fcFeMIBObjects 5 }

 -- Textual Conventions
 MilliSeconds ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents time unit value in milliseconds."
   SYNTAX        Unsigned32

 MicroSeconds ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents time unit value in microseconds."
   SYNTAX        Unsigned32

 FcNameId ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents the Worldwide Name associated with
                  a Fibre Channel (FC) entity."
   SYNTAX        OCTET STRING (SIZE (8))

 FcAddressId ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents Fibre Channel Address ID, a 24-bit
                  value unique within the address space of a Fabric."
   SYNTAX        OCTET STRING (SIZE (3))

 FcRxDataFieldSize ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents the receive data field size of an
                  NxPort or FxPort."
   SYNTAX        Integer32 (128..2112)

 FcBbCredit ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents the buffer-to-buffer credit of an
                  NxPort or FxPort."
   SYNTAX        Integer32 (0..32767)

 FcphVersion ::= TEXTUAL-CONVENTION
   STATUS        current
   DESCRIPTION   "Represents the version of FC-PH supported by an
                  NxPort or FxPort."
   SYNTAX        Integer32 (0..255)

 FcStackedConnMode ::= TEXTUAL-CONVENTION
```

                STATUS   current
                DESCRIPTION   "Represents an enumerated value used to indicate
                                  the Class 1 Stacked Connect Mode supported by
                                  an NxPort or FxPort."
                SYNTAX   INTEGER {
                                      none(1),
                                      transparent(2),
                                      lockedDown(3)
                }

        FcCosCap ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the class of service capability of an
                                  NxPort or FxPort."
                SYNTAX   BITS { classF(0), class1(1), class2(2), class3(3),
                                       class4(4), class5(5), class6(6) }

        FcFeModuleCapacity ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the maximum number of modules within
                                  a Fabric Element."
                SYNTAX   Unsigned32

        FcFeFxPortCapacity ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the maximum number of FxPorts within
                                  a module."
                SYNTAX   Unsigned32

        FcFeModuleIndex ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the module index within a conceptual table."
                SYNTAX   Unsigned32

        FcFeFxPortIndex ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the FxPort index within a conceptual table."
                SYNTAX   Unsigned32

        FcFeNxPortIndex ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the NxPort index within a conceptual table."
                SYNTAX   Integer32 (1..126)

        FcBbCreditModel ::= TEXTUAL-CONVENTION
                STATUS   current
                DESCRIPTION   "Represents the BB_Credit model of an FxPort."
                SYNTAX   INTEGER { regular(1), alternate (2) }

   -- The Configuration group

   -- This group consists of scalar objects and tables.
   -- It contains the configuration and service parameters
   -- of the Fabric Element and the FxPorts.
   -- The group represents a set of parameters associated with
   -- the Fabric Element or an FxPort to support its NxPorts.

   fcFeFabricName OBJECT-TYPE
       SYNTAX   FcNameId
       MAX-ACCESS read-write
       STATUS   current
       DESCRIPTION
          "The Name_Identifier of the Fabric to which this Fabric
           Element belongs."
   ::= { fcFeConfig 1 }

   fcFeElementName OBJECT-TYPE
       SYNTAX   FcNameId
       MAX-ACCESS read-write
       STATUS   current
       DESCRIPTION
          "The Name_Identifier of the Fabric Element."
   ::= { fcFeConfig 2 }

   fcFeModuleCapacity OBJECT-TYPE
       SYNTAX   FcFeModuleCapacity
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The maximum number of modules in the Fabric Element,
           regardless of their current state."
   ::= { fcFeConfig 3 }

   -- The Module Table.
   -- This table contains one entry for each module,
   -- information of the modules.

   fcFeModuleTable OBJECT-TYPE
       SYNTAX   SEQUENCE OF FcFeModuleEntry
       MAX-ACCESS not-accessible
       STATUS   current
       DESCRIPTION
          "A table that contains, one entry for each module in the
           Fabric Element, information of the modules."
   ::= { fcFeConfig 4 }

   fcFeModuleEntry OBJECT-TYPE

        SYNTAX   FcFeModuleEntry
        MAX-ACCESS not-accessible
        STATUS   current
        DESCRIPTION
           "An entry containing the configuration parameters of a
            module."
        INDEX { fcFeModuleIndex }
     ::= { fcFeModuleTable 1 }

     FcFeModuleEntry ::=
         SEQUENCE {
             fcFeModuleIndex
                 FcFeModuleIndex,
             fcFeModuleDescr
                 SnmpAdminString,
             fcFeModuleObjectID
                 OBJECT IDENTIFIER,
             fcFeModuleOperStatus
                 INTEGER,
             fcFeModuleLastChange
                 TimeStamp,
             fcFeModuleFxPortCapacity
                 FcFeFxPortCapacity,
             fcFeModuleName
                 FcNameId
         }

     fcFeModuleIndex OBJECT-TYPE
         SYNTAX   FcFeModuleIndex
         MAX-ACCESS not-accessible
         STATUS   current
         DESCRIPTION
            "This object identifies the module within the Fabric Element
             for which this entry contains information. This value is
             never greater than fcFeModuleCapacity."
     ::= { fcFeModuleEntry 1 }

     fcFeModuleDescr OBJECT-TYPE
         SYNTAX   SnmpAdminString
         MAX-ACCESS read-only
         STATUS   current
         DESCRIPTION
            "A textual description of the module. This value should
             include the full name and version identification of the
             module."
     ::= { fcFeModuleEntry 2 }

```
  fcFeModuleObjectID OBJECT-TYPE
      SYNTAX       OBJECT IDENTIFIER
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The vendor's authoritative identification of the module.
          This value may be allocated within the SMI enterprises
          subtree (1.3.6.1.4.1) and provides a straight-forward and
          unambiguous means for determining what kind of module is
          being managed.

          For example, this object could take the value
          1.3.6.1.4.1.99649.3.9 if vendor 'Neufe Inc.' was assigned
          the subtree 1.3.6.1.4.1.99649, and had assigned the
          identifier 1.3.6.1.4.1.99649.3.9 to its 'FeFiFo-16
          PlugInCard.'"
  ::= { fcFeModuleEntry 3 }

  fcFeModuleOperStatus    OBJECT-TYPE
      SYNTAX       INTEGER {
                      online  (1), -- functional
                      offline (2), -- not available
                      testing (3), -- under testing
                      faulty  (4)  -- defective
                   }
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "This object indicates the operational status of the module:
          online(1)   the module is functioning properly;
          offline(2)  the module is not available;
          testing(3)  the module is under testing; and
          faulty(4)   the module is defective in some way."
  ::= { fcFeModuleEntry 4 }

  fcFeModuleLastChange OBJECT-TYPE
      SYNTAX       TimeStamp
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "This object contains the value of sysUpTime when the module
          entered its current operational status. A value of zero
          indicates that the operational status of the module has not
          changed since the agent last restarted."
  ::= { fcFeModuleEntry 5 }

  fcFeModuleFxPortCapacity OBJECT-TYPE
      SYNTAX       FcFeFxPortCapacity
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
           "The number of FxPort that can be contained within the
            module. Within each module, the ports are uniquely numbered
            in the range from 1 to fcFeModuleFxPortCapacity inclusive.
            However, the numbers are not required to be contiguous."
  ::= { fcFeModuleEntry 6 }

  fcFeModuleName OBJECT-TYPE
        SYNTAX      FcNameId
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
           "The Name_Identifier of the module."
  ::= { fcFeModuleEntry 7 }

  -- the FxPort Configuration Table.
  -- This table contains, one entry for each FxPort,
  -- configuration parameters of the ports.

  fcFxPortTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF FcFxPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
           "A table that contains, one entry for each FxPort in the
            Fabric Element, configuration and service parameters of the
            FxPorts."
  ::= { fcFeConfig 5 }

  fcFxPortEntry OBJECT-TYPE
        SYNTAX      FcFxPortEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
           "An entry containing the configuration and service parameters
            of a FxPort."
        INDEX { fcFeModuleIndex, fcFxPortIndex }
  ::= { fcFxPortTable 1 }


  FcFxPortEntry ::=
        SEQUENCE {
            fcFxPortIndex
                FcFeFxPortIndex,
            fcFxPortName
                FcNameId,
```

```
        -- FxPort common service parameters
        fcFxPortFcphVersionHigh
            FcphVersion,
        fcFxPortFcphVersionLow
            FcphVersion,
        fcFxPortBbCredit
            FcBbCredit,
        fcFxPortRxBufSize
            FcRxDataFieldSize,
        fcFxPortRatov
            MilliSeconds,
        fcFxPortEdtov
            MilliSeconds,
        -- FxPort class service parameters
        fcFxPortCosSupported
            FcCosCap,
        fcFxPortIntermixSupported
            TruthValue,
        fcFxPortStackedConnMode
            FcStackedConnMode,
        fcFxPortClass2SeqDeliv
            TruthValue,
        fcFxPortClass3SeqDeliv
            TruthValue,
        -- other configuration parameters
        fcFxPortHoldTime
            MicroSeconds
    }

 fcFxPortIndex OBJECT-TYPE
     SYNTAX       FcFeFxPortIndex
     MAX-ACCESS   not-accessible
     STATUS       current
     DESCRIPTION
        "This object identifies the FxPort within the module.  This
         number ranges from 1 to the value of fcFeModulePortCapacity
         for the associated module. The value remains constant for
         the identified FxPort until the module is re-initialized."
 ::= { fcFxPortEntry 1 }

 fcFxPortName OBJECT-TYPE
     SYNTAX       FcNameId
     MAX-ACCESS   read-only
     STATUS       current
     DESCRIPTION
        "The World_wide Name of this FxPort.  Each FxPort has a
         unique Port World_wide Name within the Fabric."
 ::= { fcFxPortEntry 2 }
```

   -- FxPort common service parameters

   fcFxPortFcphVersionHigh OBJECT-TYPE
       SYNTAX   FcphVersion
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The highest or most recent version of FC-PH that the FxPort
           is configured to support."
   ::= { fcFxPortEntry 3 }

   fcFxPortFcphVersionLow OBJECT-TYPE
       SYNTAX   FcphVersion
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The lowest or earliest version of FC-PH that the FxPort is
           configured to support."
   ::= { fcFxPortEntry 4 }

   fcFxPortBbCredit OBJECT-TYPE
       SYNTAX   FcBbCredit
       UNITS   "buffers"
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The total number of receive buffers available for holding
           Class 1 connect-request, Class 2 or 3 frames from the
           attached NxPort. It is for buffer-to-buffer flow control
           in the direction from the attached NxPort (if applicable)
           to FxPort."
       ::= { fcFxPortEntry 5 }

   fcFxPortRxBufSize OBJECT-TYPE
       SYNTAX   FcRxDataFieldSize
       UNITS   "bytes"
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The largest Data_Field Size (in octets) for an FT_1 frame
           that can be received by the FxPort."
   ::= { fcFxPortEntry 6 }

   fcFxPortRatov OBJECT-TYPE
       SYNTAX   MilliSeconds
       UNITS   "milliseconds"
       MAX-ACCESS read-only
       STATUS   current

      DESCRIPTION
         "The Resource_Allocation_Timeout Value configured for the
          FxPort. This is used as the timeout value for determining
          when to reuse an NxPort resource such as a
          Recovery_Qualifier. It represents E_D_TOV (see next
          object) plus twice the maximum time that a frame may be
          delayed within the Fabric and still be delivered."
      ::= { fcFxPortEntry 7 }

   fcFxPortEdtov OBJECT-TYPE
      SYNTAX   MilliSeconds
      UNITS   "milliseconds"
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
         "The E_D_TOV value configured for the FxPort. The
          Error_Detect_Timeout Value is used as the timeout value for
          detecting an error condition."
   ::= { fcFxPortEntry 8 }

   -- FxPort class service parameters

   fcFxPortCosSupported OBJECT-TYPE
      SYNTAX   FcCosCap
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
         "A value indicating the set of Classes of Service supported
          by the FxPort."
   ::= { fcFxPortEntry 9 }

   fcFxPortIntermixSupported OBJECT-TYPE
      SYNTAX   TruthValue
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
         "A flag indicating whether or not the FxPort supports an
          Intermixed Dedicated Connection."
   ::= { fcFxPortEntry 10 }

   fcFxPortStackedConnMode OBJECT-TYPE
      SYNTAX   FcStackedConnMode
      MAX-ACCESS   read-only
      STATUS   current
      DESCRIPTION
         "A value indicating the mode of Stacked Connect supported by
          the FxPort."

```
   ::= { fcFxPortEntry 11 }

 fcFxPortClass2SeqDeliv OBJECT-TYPE
     SYNTAX       TruthValue
     MAX-ACCESS  read-only
     STATUS       current
     DESCRIPTION
        "A flag indicating whether or not Class 2 Sequential
         Delivery is supported by the FxPort."
 ::= { fcFxPortEntry 12 }

 fcFxPortClass3SeqDeliv OBJECT-TYPE
     SYNTAX       TruthValue
     MAX-ACCESS  read-only
     STATUS       current
     DESCRIPTION
        "A flag indicating whether or not Class 3 Sequential
         Delivery is supported by the FxPort."
 ::= { fcFxPortEntry 13 }


 -- other FxPort parameters

 fcFxPortHoldTime OBJECT-TYPE
     SYNTAX       MicroSeconds
     UNITS        "microseconds"
     MAX-ACCESS  read-only
     STATUS       current
     DESCRIPTION
        "The maximum time (in microseconds) that the FxPort shall
         hold a frame before discarding the frame if it is unable to
         deliver the frame. The value 0 means that the FxPort does
         not support this parameter."
 ::= { fcFxPortEntry 14 }


 -- the Status group

 -- This group consists of tables that contains operational
 -- status and established service parameters for the Fabric
 -- Element and the attached NxPorts.

 -- The FxPort Status table
 -- This table contains, one entry for each FxPort,
 -- the operational status and parameters of the FxPorts.

 fcFxPortStatusTable OBJECT-TYPE
     SYNTAX       SEQUENCE OF FcFxPortStatusEntry
```

      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
         "A table that contains, one entry for each FxPort in the
          Fabric Element, operational status and parameters of the
          FxPorts."
   ::= { fcFeStatus 1 }

   fcFxPortStatusEntry OBJECT-TYPE
      SYNTAX   FcFxPortStatusEntry
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
         "An entry containing operational status and parameters of a
          FxPort."
      AUGMENTS { fcFxPortEntry }
   ::= { fcFxPortStatusTable 1 }

   FcFxPortStatusEntry ::=
      SEQUENCE {
          fcFxPortID
              FcAddressId,
          fcFxPortBbCreditAvailable
              Gauge32,
          fcFxPortOperMode
              INTEGER,
          fcFxPortAdminMode
              INTEGER
      }

   fcFxPortID   OBJECT-TYPE
      SYNTAX   FcAddressId
      MAX-ACCESS read-only
      STATUS   current
      DESCRIPTION
         "The address identifier by which this FxPort is identified
          within the Fabric. The FxPort may assign its address
          identifier to its attached NxPort(s) during Fabric Login."
   ::= { fcFxPortStatusEntry 1 }

   fcFxPortBbCreditAvailable OBJECT-TYPE
      SYNTAX   Gauge32
      UNITS   "buffers"
      MAX-ACCESS read-only
      STATUS   current
      DESCRIPTION
         "The number of buffers currently available for receiving

```
         frames from the attached port in the buffer-to-buffer flow
         control. The value should be less than or equal to
         fcFxPortBbCredit."
 ::= { fcFxPortStatusEntry 2 }

fcFxPortOperMode    OBJECT-TYPE
    SYNTAX              INTEGER { unknown(1), fPort(2), flPort(3) }
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION
       "The current operational mode of the FxPort."
 ::= { fcFxPortStatusEntry 3 }

fcFxPortAdminMode   OBJECT-TYPE
    SYNTAX              INTEGER { fPort(2), flPort(3) }
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION
       "The desired operational mode of the FxPort."
 ::= { fcFxPortStatusEntry 4 }


-- the FxPort Physical Level table
-- This table contains, one entry for each FxPort in the
-- Fabric Element, the physical level status and parameters
-- of the FxPorts.

fcFxPortPhysTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF FcFxPortPhysEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
       "A table that contains, one entry for each FxPort in the
        Fabric Element, physical level status and parameters of the
        FxPorts."
 ::= { fcFeStatus 2 }

fcFxPortPhysEntry OBJECT-TYPE
    SYNTAX      FcFxPortPhysEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
       "An entry containing physical level status and parameters of
        a FxPort."
    AUGMENTS { fcFxPortEntry }
 ::= { fcFxPortPhysTable 1 }

FcFxPortPhysEntry ::=
```

```
      SEQUENCE {
          fcFxPortPhysAdminStatus
              INTEGER,
          fcFxPortPhysOperStatus
              INTEGER,
          fcFxPortPhysLastChange
              TimeStamp,
          fcFxPortPhysRttov
              MilliSeconds
      }

  fcFxPortPhysAdminStatus OBJECT-TYPE
      SYNTAX       INTEGER {
                      online  (1),  -- place port online
                      offline (2),  -- take port offline
                      testing (3)   -- initiate test procedures
                  }
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
         "The desired state of the FxPort.  A management station may
          place the FxPort in a desired state by setting this object
          accordingly.  The testing(3) state indicates that no
          operational frames can be passed.  When a Fabric Element
          initializes, all FxPorts start with fcFxPortPhysAdminStatus
          in the offline(2) state.  As the result of either explicit
          management action or per configuration information
          accessible by the Fabric Element, fcFxPortPhysAdminStatus
          is then changed to either the online(1) or testing(3)
          states, or remains in the offline state."
   ::= { fcFxPortPhysEntry 1 }

  fcFxPortPhysOperStatus   OBJECT-TYPE
      SYNTAX       INTEGER {
          online      (1), -- Login may proceed
          offline     (2), -- Login cannot proceed
          testing     (3), -- port is under test
          linkFailure (4)  -- failure after online/testing
      }
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The current operational status of the FxPort.  The
          testing(3) indicates that no operational frames can be
          passed.  If fcFxPortPhysAdminStatus is offline(2) then
          fcFxPortPhysOperStatus should be offline(2). If
          fcFxPortPhysAdminStatus is changed to online(1) then
          fcFxPortPhysOperStatus should change to online(1) if the
```

          FxPort is ready to accept Fabric Login request from the
          attached NxPort; it should proceed and remain in the link-
          failure(4) state if and only if there is a fault that
          prevents it from going to the online(1) state."
    ::= { fcFxPortPhysEntry 2 }

  fcFxPortPhysLastChange OBJECT-TYPE
      SYNTAX   TimeStamp
      MAX-ACCESS read-only
      STATUS   current
      DESCRIPTION
         "The value of sysUpTime at the time the FxPort entered its
          current operational status. A value of zero indicates that
          the FxPort's operational status has not changed since the
          agent last restarted."
    ::= { fcFxPortPhysEntry 3 }

  fcFxPortPhysRttov OBJECT-TYPE
      SYNTAX   MilliSeconds
      UNITS   "milliseconds"
      MAX-ACCESS read-write
      STATUS   current
      DESCRIPTION
         "The Receiver_Transmitter_Timeout value of the FxPort. This
          is used by the receiver logic to detect Loss of
          Synchronization."
    ::= { fcFxPortPhysEntry 4 }

  -- The FxPort Fabric Login table
  --
  -- This table contains, one entry for each FxPort in the
  -- Fabric Element, the Service Parameters that have been
  -- established from the most recent Fabric Login,
  -- implicit or explicit.

  fcFxLoginTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF FcFxLoginEntry
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
         "A table that contains, one entry for each NxPort attached
          to a particular FxPort in the Fabric Element, services
          parameters established from the most recent Fabric Login,
          explicit or implicit. Note that an FxPort may have one or
          more NxPort attached to it."
    ::= { fcFeStatus 3 }

```
  fcFxLoginEntry OBJECT-TYPE
      SYNTAX      FcFxLoginEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "An entry containing service parameters established from a
          successful Fabric Login."
      INDEX { fcFeModuleIndex, fcFxPortIndex, fcFxPortNxLoginIndex }
  ::= { fcFxLoginTable 1 }

  FcFxLoginEntry ::=
      SEQUENCE {
          fcFxPortNxLoginIndex
              FcFeNxPortIndex,
          fcFxPortFcphVersionAgreed
              FcphVersion,
          fcFxPortNxPortBbCredit
              FcBbCredit,
          fcFxPortNxPortRxDataFieldSize
              FcRxDataFieldSize,
          fcFxPortCosSuppAgreed
              FcCosCap,
          fcFxPortIntermixSuppAgreed
              TruthValue,
          fcFxPortStackedConnModeAgreed
              FcStackedConnMode,
          fcFxPortClass2SeqDelivAgreed
              TruthValue,
          fcFxPortClass3SeqDelivAgreed
              TruthValue,
          --
          fcFxPortNxPortName
              FcNameId,
          fcFxPortConnectedNxPort
              FcAddressId,
          fcFxPortBbCreditModel
              FcBbCreditModel
      }

  fcFxPortNxLoginIndex OBJECT-TYPE
      SYNTAX      FcFeNxPortIndex
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "The object identifies the associated NxPort in the
          attachment for which the entry contains information."
  ::= { fcFxLoginEntry 1 }
```

   fcFxPortFcphVersionAgreed OBJECT-TYPE
       SYNTAX   FcphVersion
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
          "The version of FC-PH that the FxPort has agreed to support
           from the Fabric Login"
   ::= { fcFxLoginEntry 2 }

   fcFxPortNxPortBbCredit OBJECT-TYPE
       SYNTAX   FcBbCredit
       UNITS   "buffers"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
          "The total number of buffers available for holding Class 1
           connect-request, Class 2 or Class 3 frames to be
           transmitted to the attached NxPort. It is for buffer-to-
           buffer flow control in the direction from FxPort to NxPort.
           The buffer-to-buffer flow control mechanism is indicated in
           the respective fcFxPortBbCreditModel."
   ::= { fcFxLoginEntry 3 }

   fcFxPortNxPortRxDataFieldSize OBJECT-TYPE
       SYNTAX   FcRxDataFieldSize
       UNITS   "bytes"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
          "The Receive Data Field Size of the attached NxPort. This
           object specifies the largest Data Field Size for an FT_1
           frame that can be received by the NxPort."
   ::= { fcFxLoginEntry 4 }

   fcFxPortCosSuppAgreed OBJECT-TYPE
       SYNTAX   FcCosCap
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
          "A variable indicating that the attached NxPort has
           requested the FxPort for the support of classes of services
           and the FxPort has granted the request."
   ::= { fcFxLoginEntry 5 }

   fcFxPortIntermixSuppAgreed OBJECT-TYPE
       SYNTAX   TruthValue
       MAX-ACCESS   read-only
       STATUS   current

```
    DESCRIPTION
        "A variable indicating that the attached NxPort has
         requested the FxPort for the support of Intermix and the
         FxPort has granted the request. This flag is only valid if
         Class 1 service is supported."
  ::= { fcFxLoginEntry 6 }

  fcFxPortStackedConnModeAgreed OBJECT-TYPE
      SYNTAX        FcStackedConnMode
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
        "A variable indicating whether the FxPort has agreed to
         support stacked connect from the Fabric Login. This is only
         meaningful if Class 1 service has been agreed."
  ::= { fcFxLoginEntry 7 }

  fcFxPortClass2SeqDelivAgreed OBJECT-TYPE
      SYNTAX        TruthValue
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
        "A variable indicating whether the FxPort has agreed to
         support Class 2 sequential delivery from the Fabric Login.
         This is only meaningful if Class 2 service has been
         agreed."
  ::= { fcFxLoginEntry 8 }

  fcFxPortClass3SeqDelivAgreed OBJECT-TYPE
      SYNTAX        TruthValue
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
        "A flag indicating whether the FxPort has agreed to support
         Class 3 sequential delivery from the Fabric Login. This is
         only meaningful if Class 3 service has been agreed."
  ::= { fcFxLoginEntry 9 }

  fcFxPortNxPortName OBJECT-TYPE
      SYNTAX        FcNameId
      MAX-ACCESS    read-only
      STATUS        current
      DESCRIPTION
        "The port name of the attached NxPort."
  ::= { fcFxLoginEntry 10 }

  fcFxPortConnectedNxPort OBJECT-TYPE
      SYNTAX        FcAddressId
```

```
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
          "The address identifier of the destination NxPort with which
           this FxPort is currently engaged in a either a Class 1 or
           loop connection. If this FxPort is not engaged in a
           connection, then the value of this object is '000000'H."
    ::= { fcFxLoginEntry 11 }

    fcFxPortBbCreditModel OBJECT-TYPE
       SYNTAX      FcBbCreditModel
       MAX-ACCESS  read-write
       STATUS      current
       DESCRIPTION
          "This object identifies the BB_Credit model used by the
           FxPort."
    ::= { fcFxLoginEntry 12 }


    -- the Error group
    -- This group consists of tables that contain information about
    -- the various types of errors detected.  The management station
    -- may use the information in this group to determine the
    -- quality of the link between the FxPort and its attached NxPort.

    -- the FxPort Error table
    -- This table contains, one entry for each FxPort in the Fabric
    -- Element, counters recording numbers of errors detected
    -- since the management agent re-initialized.
    -- The first 6 columnar objects after the port index corresponds
    -- to the counters in the Link Error Status Block.

    fcFxPortErrorTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF FcFxPortErrorEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
          "A table that contains, one entry for each FxPort, counters
           that record the numbers of errors detected."
    ::= { fcFeError 1 }

    fcFxPortErrorEntry OBJECT-TYPE
       SYNTAX      FcFxPortErrorEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
          "An entry containing error counters of a FxPort."
       AUGMENTS { fcFxPortEntry }
```

   ::= { fcFxPortErrorTable 1 }

   FcFxPortErrorEntry ::=
       SEQUENCE {
           fcFxPortLinkFailures
               Counter32,
           fcFxPortSyncLosses
               Counter32,
           fcFxPortSigLosses
               Counter32,
           fcFxPortPrimSeqProtoErrors
               Counter32,
           fcFxPortInvalidTxWords
               Counter32,
           fcFxPortInvalidCrcs
               Counter32,
           fcFxPortDelimiterErrors
               Counter32,
           fcFxPortAddressIdErrors
               Counter32,
           fcFxPortLinkResetIns
               Counter32,
           fcFxPortLinkResetOuts
               Counter32,
           fcFxPortOlsIns
               Counter32,
           fcFxPortOlsOuts
               Counter32
       }

   fcFxPortLinkFailures OBJECT-TYPE
       SYNTAX   Counter32
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The number of link failures detected by this FxPort."
   ::= { fcFxPortErrorEntry 1 }

   fcFxPortSyncLosses OBJECT-TYPE
       SYNTAX   Counter32
       MAX-ACCESS read-only
       STATUS   current
       DESCRIPTION
          "The number of loss of synchronization detected by the
           FxPort."
   ::= { fcFxPortErrorEntry 2 }

```
fcFxPortSigLosses OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of loss of signal detected by the FxPort."
::= { fcFxPortErrorEntry 3 }

fcFxPortPrimSeqProtoErrors OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of primitive sequence protocol errors detected
        by the FxPort."
::= { fcFxPortErrorEntry 4 }

fcFxPortInvalidTxWords OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of invalid transmission word detected by the
        FxPort."
::= { fcFxPortErrorEntry 5 }

fcFxPortInvalidCrcs OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of invalid CRC detected by this FxPort."
::= { fcFxPortErrorEntry 6 }

fcFxPortDelimiterErrors OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of Delimiter Errors detected by this FxPort."
::= { fcFxPortErrorEntry 7 }

fcFxPortAddressIdErrors OBJECT-TYPE
    SYNTAX       Counter32
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
       "The number of address identifier errors detected by this
```

```
         FxPort."
  ::= { fcFxPortErrorEntry 8 }

  fcFxPortLinkResetIns OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Link Reset Protocol received by this FxPort
          from the attached NxPort."
  ::= { fcFxPortErrorEntry 9 }

  fcFxPortLinkResetOuts OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Link Reset Protocol issued by this FxPort to
          the attached NxPort."
  ::= { fcFxPortErrorEntry 10 }

  fcFxPortOlsIns OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Offline Sequence received by this FxPort."
  ::= { fcFxPortErrorEntry 11 }

  fcFxPortOlsOuts OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Offline Sequence issued by this FxPort."
  ::= { fcFxPortErrorEntry 12 }



  -- Accounting Groups:
  -- (1) Class 1 Accounting Group,
  -- (2) Class 2 Accounting Group, and
  -- (3) Class 3 Accounting Group.
  -- Each group consists of a table that contains accounting
  -- information for the FxPorts in the Fabric Element.

  -- the Class 1 Accounting table
  -- This table contains, one entry for each FxPort in the Fabric
```

```
   -- Element, Counter32s for certain types of events occurred in the
   -- the FxPorts since the the management agent has re-initialized.

   fcFxPortC1AccountingTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF FcFxPortC1AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "A table that contains, one entry for each FxPort in the
           Fabric Element, Class 1 accounting information recorded
           since the management agent has re-initialized."
   ::= { fcFeAccounting 1 }

   fcFxPortC1AccountingEntry OBJECT-TYPE
       SYNTAX       FcFxPortC1AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "An entry containing Class 1 accounting information for each
           FxPort."
       AUGMENTS { fcFxPortEntry }
   ::= { fcFxPortC1AccountingTable 1 }


   FcFxPortC1AccountingEntry ::=
       SEQUENCE {
           fcFxPortC1InFrames
               Counter32,
           fcFxPortC1OutFrames
               Counter32,
           fcFxPortC1InOctets
               Counter32,
           fcFxPortC1OutOctets
               Counter32,
           fcFxPortC1Discards
               Counter32,
           fcFxPortC1FbsyFrames
               Counter32,
           fcFxPortC1FrjtFrames
               Counter32,
           fcFxPortC1InConnections
               Counter32,
           fcFxPortC1OutConnections
               Counter32,
           fcFxPortC1ConnTime
               MilliSeconds
       }
```

```
fcFxPortC1InFrames OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The number of Class 1 frames (other than Class 1 connect-
        request) received by this FxPort from its attached NxPort."
::= { fcFxPortC1AccountingEntry 1 }

fcFxPortC1OutFrames OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The number of Class 1 frames (other than Class 1 connect-
        request) delivered through this FxPort to its attached
        NxPort."
::= { fcFxPortC1AccountingEntry 2 }

fcFxPortC1InOctets OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The number of Class 1 frame octets, including the frame
        delimiters,  received by this FxPort from its attached
        NxPort."
::= { fcFxPortC1AccountingEntry 3 }

fcFxPortC1OutOctets OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The number of Class 1 frame octets, including the frame
        delimiters, delivered through this FxPort its attached
        NxPort."
::= { fcFxPortC1AccountingEntry 4 }

fcFxPortC1Discards OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The number of Class 1 frames discarded by this FxPort."
::= { fcFxPortC1AccountingEntry 5 }

fcFxPortC1FbsyFrames OBJECT-TYPE
```

        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of F_BSY frames generated by this FxPort against
             Class 1 connect-request."
     ::= { fcFxPortC1AccountingEntry 6 }

   fcFxPortC1FrjtFrames OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of F_RJT frames generated by this FxPort against
             Class 1 connect-request."
     ::= { fcFxPortC1AccountingEntry 7 }

   fcFxPortC1InConnections OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of Class 1 connections successfully established
             in which the attached NxPort is the source of the connect-
             request."
     ::= { fcFxPortC1AccountingEntry 8 }

   fcFxPortC1OutConnections OBJECT-TYPE
        SYNTAX   Counter32
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of Class 1 connections successfully established
             in which the attached NxPort is the destination of the
             connect-request."
     ::= { fcFxPortC1AccountingEntry 9 }

   fcFxPortC1ConnTime OBJECT-TYPE
        SYNTAX   MilliSeconds
        UNITS   "milliseconds"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The cumulative time that this FxPort has been engaged in
             Class 1 connection. The amount of time is counted from
             after a connect-request has been accepted until the
             connection is disengaged, either by an EOFdt or Link
             Reset."

```
   ::= { fcFxPortC1AccountingEntry 10 }


   -- the Class 2 Accounting table
   -- This table contains, one entry for each FxPort in the Fabric
   -- Element, Counter32s for certain types of events occurred in the
   -- the FxPorts since the the management agent has re-initialized.


   fcFxPortC2AccountingTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF FcFxPortC2AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "A table that contains, one entry for each FxPort in the
           Fabric Element, Class 2 accounting information recorded
           since the management agent has re-initialized."
   ::= { fcFeAccounting 2 }

   fcFxPortC2AccountingEntry OBJECT-TYPE
       SYNTAX       FcFxPortC2AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "An entry containing Class 2 accounting information for each
           FxPort."
       AUGMENTS { fcFxPortEntry }
   ::= { fcFxPortC2AccountingTable 1 }

   FcFxPortC2AccountingEntry ::=
       SEQUENCE {
           fcFxPortC2InFrames
               Counter32,
           fcFxPortC2OutFrames
                   Counter32,
           fcFxPortC2InOctets
                   Counter32,
           fcFxPortC2OutOctets
                   Counter32,
           fcFxPortC2Discards
                   Counter32,
           fcFxPortC2FbsyFrames
                   Counter32,
           fcFxPortC2FrjtFrames
                   Counter32
       }

   fcFxPortC2InFrames OBJECT-TYPE
```

```
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
        "The number of Class 2 frames received by this FxPort from
         its attached NxPort."
  ::= { fcFxPortC2AccountingEntry 1 }

  fcFxPortC2OutFrames OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
        "The number of Class 2 frames delivered through this FxPort
         to its attached NxPort."
  ::= { fcFxPortC2AccountingEntry 2 }

  fcFxPortC2InOctets OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
        "The number of Class 2 frame octets, including the frame
         delimiters, received by this FxPort from its attached
         NxPort."
  ::= { fcFxPortC2AccountingEntry 3 }

  fcFxPortC2OutOctets OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
        "The number of Class 2 frame octets, including the frame
         delimiters, delivered through this FxPort to its attached
         NxPort."
  ::= { fcFxPortC2AccountingEntry 4 }

  fcFxPortC2Discards OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
        "The number of Class 2 frames discarded by this FxPort."
  ::= { fcFxPortC2AccountingEntry 5 }

  fcFxPortC2FbsyFrames OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
```

```
       STATUS       current
       DESCRIPTION
          "The number of F_BSY frames generated by this FxPort against
           Class 2 frames."
    ::= { fcFxPortC2AccountingEntry 6 }

  fcFxPortC2FrjtFrames OBJECT-TYPE
       SYNTAX       Counter32
       MAX-ACCESS   read-only
       STATUS       current
       DESCRIPTION
          "The number of F_RJT frames generated by this FxPort against
           Class 2 frames."
    ::= { fcFxPortC2AccountingEntry 7 }

  -- the Class 3 Accounting Group
  -- This table contains, one entry for each FxPort in the Fabric
  -- Element, Counter32s for certain types of events occurred in the
  -- the FxPorts since the management agent has re-initialized.

  fcFxPortC3AccountingTable OBJECT-TYPE
       SYNTAX       SEQUENCE OF FcFxPortC3AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "A table that contains, one entry for each FxPort in the
           Fabric Element, Class 3 accounting information recorded
           since the management agent has re-initialized."
    ::= { fcFeAccounting 3 }

  fcFxPortC3AccountingEntry OBJECT-TYPE
       SYNTAX       FcFxPortC3AccountingEntry
       MAX-ACCESS   not-accessible
       STATUS       current
       DESCRIPTION
          "An entry containing Class 3 accounting information for each
           FxPort."
       AUGMENTS { fcFxPortEntry }
    ::= { fcFxPortC3AccountingTable 1 }


  FcFxPortC3AccountingEntry ::=
       SEQUENCE {
           fcFxPortC3InFrames
               Counter32,
           fcFxPortC3OutFrames
               Counter32,
           fcFxPortC3InOctets
```

```
                    Counter32,
              fcFxPortC3OutOctets
                    Counter32,
              fcFxPortC3Discards
                    Counter32
          }
```

```
  fcFxPortC3InFrames OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Class 3 frames received by this FxPort from
          its attached NxPort."
  ::= { fcFxPortC3AccountingEntry 1 }
```

```
  fcFxPortC3OutFrames OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Class 3 frames delivered through this FxPort
          to its attached NxPort."
  ::= { fcFxPortC3AccountingEntry 2 }
```

```
  fcFxPortC3InOctets OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Class 3 frame octets, including the frame
          delimiters, received by this FxPort from its attached
          NxPort."
  ::= { fcFxPortC3AccountingEntry 3 }
```

```
  fcFxPortC3OutOctets OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The number of Class 3 frame octets, including the frame
          delimiters, delivered through this FxPort to its attached
          NxPort."
  ::= { fcFxPortC3AccountingEntry 4 }
```

```
  fcFxPortC3Discards OBJECT-TYPE
      SYNTAX       Counter32
      MAX-ACCESS   read-only
```

                 STATUS   current
                 DESCRIPTION
                     "The number of Class 3 frames discarded by this FxPort."
             ::= { fcFxPortC3AccountingEntry 5 }

          -- The Capability Group - consists of a table describing
          -- information about what each FxPort is inherently capable
          -- of operating or supporting.
          -- A capability may be used, as expressed in its respective
          -- object value in the Configuration group.

          fcFxPortCapTable OBJECT-TYPE
              SYNTAX   SEQUENCE OF FcFxPortCapEntry
              MAX-ACCESS not-accessible
              STATUS   current
              DESCRIPTION
                  "A table that contains, one entry for each FxPort, the
                   capabilities of the port within the Fabric Element."
          ::= { fcFeCapabilities 1 }

          fcFxPortCapEntry OBJECT-TYPE
              SYNTAX   FcFxPortCapEntry
              MAX-ACCESS not-accessible
              STATUS   current
              DESCRIPTION
                  "An entry containing the Cap of a FxPort."
              AUGMENTS { fcFxPortEntry }
          ::= { fcFxPortCapTable 1 }

          FcFxPortCapEntry ::=
              SEQUENCE {
                  fcFxPortCapFcphVersionHigh
                      FcphVersion,
                  fcFxPortCapFcphVersionLow
                      FcphVersion,
                  fcFxPortCapBbCreditMax
                      FcBbCredit,
                  fcFxPortCapBbCreditMin
                      FcBbCredit,
                  fcFxPortCapRxDataFieldSizeMax
                      FcRxDataFieldSize,
                  fcFxPortCapRxDataFieldSizeMin
                      FcRxDataFieldSize,
                  fcFxPortCapCos
                      FcCosCap,
                  fcFxPortCapIntermix

```
              TruthValue,
          fcFxPortCapStackedConnMode
              FcStackedConnMode,
          fcFxPortCapClass2SeqDeliv
              TruthValue,
          fcFxPortCapClass3SeqDeliv
              TruthValue,
          fcFxPortCapHoldTimeMax
              MicroSeconds,
          fcFxPortCapHoldTimeMin
              MicroSeconds
      }

  fcFxPortCapFcphVersionHigh OBJECT-TYPE
      SYNTAX      FcphVersion
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The highest or most recent version of FC-PH that the FxPort
          is capable of supporting."
  ::= { fcFxPortCapEntry 1 }

  fcFxPortCapFcphVersionLow OBJECT-TYPE
      SYNTAX      FcphVersion
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The lowest or earliest version of FC-PH that the FxPort is
          capable of supporting."
  ::= { fcFxPortCapEntry 2 }

  fcFxPortCapBbCreditMax OBJECT-TYPE
      SYNTAX      FcBbCredit
      UNITS       "buffers"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The maximum number of receive buffers available for holding
          Class 1 connect-request, Class 2 or Class 3 frames from the
          attached NxPort."
  ::= { fcFxPortCapEntry 3 }

  fcFxPortCapBbCreditMin OBJECT-TYPE
      SYNTAX      FcBbCredit
      UNITS       "buffers"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
```

```
         "The minimum number of receive buffers available for holding
          Class 1 connect-request, Class 2 or Class 3 frames from the
          attached NxPort."
  ::= { fcFxPortCapEntry 4 }

  fcFxPortCapRxDataFieldSizeMax OBJECT-TYPE
      SYNTAX      FcRxDataFieldSize
      UNITS       "bytes"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The maximum size in bytes of the Data Field in a frame that
          the FxPort is capable of receiving from its attached
          NxPort."
  ::= { fcFxPortCapEntry 5 }

  fcFxPortCapRxDataFieldSizeMin OBJECT-TYPE
      SYNTAX      FcRxDataFieldSize
      UNITS       "bytes"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The minimum size in bytes of the Data Field in a frame that
          the FxPort is capable of receiving from its attached
          NxPort."
  ::= { fcFxPortCapEntry 6 }

  fcFxPortCapCos OBJECT-TYPE
      SYNTAX      FcCosCap
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "A value indicating the set of Classes of Service that the
          FxPort is capable of supporting."
  ::= { fcFxPortCapEntry 7 }

  fcFxPortCapIntermix OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "A flag indicating whether or not the FxPort is capable of
          supporting the intermixing of Class 2 and Class 3 frames
          during a Class 1 connection. This flag is only valid if the
          port is capable of supporting Class 1 service."
  ::= { fcFxPortCapEntry 8 }

  fcFxPortCapStackedConnMode OBJECT-TYPE
```

```
    SYNTAX      FcStackedConnMode
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "A value indicating the mode of Stacked Connect request that
        the FxPort is capable of supporting."
 ::= { fcFxPortCapEntry 9 }

 fcFxPortCapClass2SeqDeliv OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "A flag indicating whether or not the FxPort is capable of
        supporting Class 2 Sequential Delivery."
 ::= { fcFxPortCapEntry 10 }

 fcFxPortCapClass3SeqDeliv OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "A flag indicating whether or not the FxPort is capable of
        supporting Class 3 Sequential Delivery."
 ::= { fcFxPortCapEntry 11 }

 fcFxPortCapHoldTimeMax OBJECT-TYPE
    SYNTAX      MicroSeconds
    UNITS       "microseconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The maximum holding time (in microseconds) that the FxPort
        is capable of supporting."
 ::= { fcFxPortCapEntry 12 }

 fcFxPortCapHoldTimeMin OBJECT-TYPE
    SYNTAX      MicroSeconds
    UNITS       "microseconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
       "The minimum holding time (in microseconds) that the FxPort
        is capable of supporting."
 ::= { fcFxPortCapEntry 13 }

 -- conformance information
```

```
fcFeMIBConformance OBJECT IDENTIFIER  ::= { fcFeMIB 2 }
fcFeMIBCompliances  OBJECT IDENTIFIER ::= { fcFeMIBConformance 1 }
fcFeMIBGroups        OBJECT IDENTIFIER ::= { fcFeMIBConformance 2 }


-- compliance statements
fcFeMIBMinimumCompliance   MODULE-COMPLIANCE
    STATUS    current
    DESCRIPTION
       "The minimum compliance statement for SNMP entities
        which implement the FIBRE-CHANNEL-FE-MIB."
    MODULE  -- this module
    MANDATORY-GROUPS { fcFeConfigGroup, fcFeStatusGroup,
                       fcFeErrorGroup }


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


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


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


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


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


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


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

     ::= { fcFeMIBCompliances 1 }

   fcFeMIBFullCompliance   MODULE-COMPLIANCE
       STATUS   current
       DESCRIPTION
          "The full compliance statement for SNMP entities
           which implement the FIBRE-CHANNEL-FE-MIB."
       MODULE -- this module
       MANDATORY-GROUPS { fcFeConfigGroup, fcFeStatusGroup,
                          fcFeErrorGroup, fcFeCapabilitiesGroup }

       GROUP fcFeClass1AccountingGroup
       DESCRIPTION
          "This group is mandatory for all fibre channel fabric
           elements which support class 1 frames."

       GROUP fcFeClass2AccountingGroup
       DESCRIPTION
          "This group is mandatory for all fibre channel fabric
           elements which support class 2 frames."

       GROUP fcFeClass3AccountingGroup
       DESCRIPTION
          "This group is mandatory for all fibre channel fabric
           elements which support class 3 frames."

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

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

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

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

       OBJECT   fcFxPortPhysAdminStatus
       MIN-ACCESS   read-only

```
      DESCRIPTION
         "Write access is not required."

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

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

   ::= { fcFeMIBCompliances 2 }

   -- units of conformance
   fcFeConfigGroup  OBJECT-GROUP
      OBJECTS { fcFeFabricName, fcFeElementName, fcFeModuleCapacity,
                fcFeModuleDescr, fcFeModuleObjectID,
                fcFeModuleOperStatus, fcFeModuleLastChange,
                fcFeModuleFxPortCapacity, fcFeModuleName,
                fcFxPortName, fcFxPortFcphVersionHigh,
                fcFxPortFcphVersionLow, fcFxPortBbCredit,
                fcFxPortRxBufSize, fcFxPortRatov, fcFxPortEdtov,
                fcFxPortCosSupported, fcFxPortIntermixSupported,
                fcFxPortStackedConnMode, fcFxPortClass2SeqDeliv,
                fcFxPortClass3SeqDeliv, fcFxPortHoldTime }
      STATUS    current
      DESCRIPTION
         "A collection of objects providing the configuration and service
          parameters of the Fabric Element, the modules, and FxPorts."
   ::= { fcFeMIBGroups 1 }

   fcFeStatusGroup  OBJECT-GROUP
      OBJECTS { fcFxPortID, fcFxPortBbCreditAvailable,
                fcFxPortOperMode, fcFxPortAdminMode,
                fcFxPortPhysAdminStatus, fcFxPortPhysOperStatus,
                fcFxPortPhysLastChange, fcFxPortPhysRttov,
                fcFxPortFcphVersionAgreed, fcFxPortNxPortBbCredit,
                fcFxPortNxPortRxDataFieldSize, fcFxPortCosSuppAgreed,
                fcFxPortIntermixSuppAgreed,
                fcFxPortStackedConnModeAgreed,
                fcFxPortClass2SeqDelivAgreed,
                fcFxPortClass3SeqDelivAgreed,
                fcFxPortNxPortName, fcFxPortConnectedNxPort,
                fcFxPortBbCreditModel }
      STATUS    current
      DESCRIPTION
```

```
        "A collection of objects providing the operational status and
         established service parameters for the Fabric Element and the
         attached NxPorts."
   ::= { fcFeMIBGroups 2 }

   fcFeErrorGroup  OBJECT-GROUP
      OBJECTS { fcFxPortLinkFailures, fcFxPortSyncLosses,
                fcFxPortSigLosses, fcFxPortPrimSeqProtoErrors,
                fcFxPortInvalidTxWords, fcFxPortInvalidCrcs,
                fcFxPortDelimiterErrors, fcFxPortAddressIdErrors,
                fcFxPortLinkResetIns, fcFxPortLinkResetOuts,
                fcFxPortOlsIns, fcFxPortOlsOuts }
      STATUS    current
      DESCRIPTION
         "A collection of objects providing various error
          statistics detected by the FxPorts."
   ::= { fcFeMIBGroups 3 }

   fcFeClass1AccountingGroup  OBJECT-GROUP
      OBJECTS { fcFxPortC1InFrames, fcFxPortC1OutFrames,
                fcFxPortC1InOctets, fcFxPortC1OutOctets,
                fcFxPortC1Discards, fcFxPortC1FbsyFrames,
                fcFxPortC1FrjtFrames, fcFxPortC1InConnections,
                fcFxPortC1OutConnections, fcFxPortC1ConnTime
      }
      STATUS    current
      DESCRIPTION
         "A collection of objects providing various class 1
 performance statistics detected by the FxPorts."
   ::= { fcFeMIBGroups 4 }

   fcFeClass2AccountingGroup  OBJECT-GROUP
      OBJECTS { fcFxPortC2InFrames, fcFxPortC2OutFrames,
                fcFxPortC2InOctets, fcFxPortC2OutOctets,
                fcFxPortC2Discards, fcFxPortC2FbsyFrames,
                fcFxPortC2FrjtFrames
      }
      STATUS    current
      DESCRIPTION
         "A collection of objects providing various class 2
 performance statistics detected by the FxPorts."
   ::= { fcFeMIBGroups 5 }

   fcFeClass3AccountingGroup  OBJECT-GROUP
      OBJECTS { fcFxPortC3InFrames, fcFxPortC3OutFrames,
                fcFxPortC3InOctets, fcFxPortC3OutOctets,
                fcFxPortC3Discards
      }
```

```
        STATUS     current
        DESCRIPTION
           "A collection of objects providing various class 3
            performance statistics detected by the FxPorts."
     ::= { fcFeMIBGroups 6 }


   fcFeCapabilitiesGroup  OBJECT-GROUP
      OBJECTS { fcFxPortCapFcphVersionHigh, fcFxPortCapFcphVersionLow,
                fcFxPortCapBbCreditMax, fcFxPortCapBbCreditMin,
                fcFxPortCapRxDataFieldSizeMax,
                fcFxPortCapRxDataFieldSizeMin,
                fcFxPortCapCos, fcFxPortCapIntermix,
                fcFxPortCapStackedConnMode, fcFxPortCapClass2SeqDeliv,
                fcFxPortCapClass3SeqDeliv, fcFxPortCapHoldTimeMax,
                fcFxPortCapHoldTimeMin
      }
      STATUS     current
      DESCRIPTION
         "A collection of objects providing the inherent
          capability of each FxPort within the Fabric Element."
     ::= { fcFeMIBGroups 7 }



   END
   -- End of Object Definitions
```

4. Security Considerations

   There are a number of management objects defined in this MIB that
   have a MAX-ACCESS clause of read-write. 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.

   SNMPv1 by itself is not a secure environment. 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.

   It is recommended that the implementers consider the security
   features as provided by the SNMPv3 framework. Specifically, the use
   of the User-based Security Model RFC 2574 [12] and the View-based
   Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP
entity giving access to an instance of this MIB, is properly
configured to give access to the objects only to those principals
(users) that have legitimate rights to indeed GET or SET
(change/delete) them.

5. Intellectual Property

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

The IETF invites any interested party to bring to its attention any
copyrights, patents or patent applications, or other proprietary
rights which may cover technology that may be required to practice
this standard. Please address the information to the IETF Executive
Director.

6. Acknowledgements

The editors would like to thank the following individuals for their
assistance and constructive comments:

7. References

7.1. IETF References

    [1] Harrington, D., Presuhn, R. and B. Wijnen, "An Architecture for
         Describing SNMP Management Frameworks", RFC 2571, April 1999.

    [2] Rose, M. and K. McCloghrie, "Structure and Identification of
         Management Information for TCP/IP-based Internets", STD 16, RFC
         1155, May 1990.

    [3] Rose, M. and K. McCloghrie, "Concise MIB Definitions", STD 16,
         RFC 1212, March 1991.

    [4] Rose, M., "A Convention for Defining Traps for use with the
         SNMP", RFC 1215, March 1991.

    [5] 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.

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

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

    [8] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple
         Network Management Protocol", STD 15, RFC 1157, May 1990.

    [9] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser,
         "Introduction to Community-based SNMPv2", RFC 1901, January
         1996.

    [10] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Transport
         Mappings for Version 2 of the Simple Network Management Protocol
         (SNMPv2)", RFC 1906, January 1996.

    [11] Case, J., Harrington D., Presuhn R. and B. Wijnen, "Message
         Processing and Dispatching for the Simple Network Management
         Protocol (SNMP)", RFC 2572, April 1999.

    [12] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM)
         for version 3 of the Simple Network Management Protocol
         (SNMPv3)", RFC 2574, April 1999.

[13] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Protocol
     Operations for Version 2 of the Simple Network Management
     Protocol (SNMPv2)", RFC 1905, January 1996.

[14] Levi, D., Meyer, P. and B. Stewart, "SNMPv3 Applications", RFC
     2573, April 1999.

[15] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access
     Control Model (VACM) for the Simple Network Management Protocol
     (SNMP)", RFC 2575, April 1999.

[16] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction
     to Version 3 of the Internet-standard Network Management
     Framework", RFC 2570, April 1999.

7.2. Approved ANSI/NCITS References

[17] Fibre Channel Physical and Signaling Interface (FC-PH), American
     National Standard for Information Systems X3.230:1994, Computer
     and Business Equipment Manufacturers Association, Washington,
     DC.

[18] Fibre Channel Fabric Generic (FC-FG), American National Standard
     for Information Systems X3.289:1996, Computer and Business
     Equipment Manufacturers Association, Washington, DC.

[19] Fibre Channel Generic Services (FC-GS), American National
     Standard for Information Systems X3.288:1996, Computer and
     Business Equipment Manufacturers Association, Washington, DC.

[20] Fibre Channel Arbitrated Loop (FC-AL), American National
     Standard for Information Systems X3.272:1996, Computer and
     Business Equipment Manufacturers Association, Washington, DC.

[21] Fibre Channel Physical and Signaling Interface-2 (FC-PH-2),
     American National Standard for Information Systems, X3.297:1997,
     Computer and Business Equipment Manufacturers Association,
     Washington, DC.

[22] Fibre Channel Physical and Signaling Interface-3 (FC-PH-3),
     American National Standard for Information Systems, X3.303:1998,
     Computer and Business Equipment Manufacturers Association,
     Washington, DC.

[23] Fibre Channel Switch Fabric (FC-SW), American National Standard
     for Information Systems, NCITS 321:1998, Computer and Business
     Equipment Manufacturers Association, Washington, DC.

7.3. ANSI/NCITS References Under Development

   [24] Fibre Channel Arbitrated Loop-2 (FC-AL-2), American National
        Standard for Information Systems, X3T11/1133D Rev 5.2, Computer
        and Business Equipment Manufacturers Association, Washington,
        DC.

8. Editor's Address

   Kha Sin Teow
   Brocade Communications Systems, Inc.
   1901 Guadalupe Parkway,
   San Jose, CA 95131
   U.S.A.

   Phone: +1 408-487-8180
   Email: khasin@Brocade.COM

9. Full Copyright Statement

Acknowledgement