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

Status of this Memo

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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.

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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.

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6. Acknowledgements

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

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