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Definitions of Managed Objects for Internet Fibre Channel Protocol (iFCP)

Status of This Memo

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Abstract

The iFCP protocol (RFC 4172) provides Fibre Channel fabric functionality on an IP network in which TCP/IP switching and routing elements replace Fibre Channel components. The iFCP protocol is used between iFCP Gateways. This document provides a mechanism to monitor and control iFCP Gateway instances, and their associated sessions, using SNMP.

Table of Contents

1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

2. Introduction

The iFCP protocol can be used by FC-to-IP-based storage gateways for Fibre Channel Protocol (FCP) storage interconnects. Figure 1 provides an example of an interconnect between iFCP gateways.

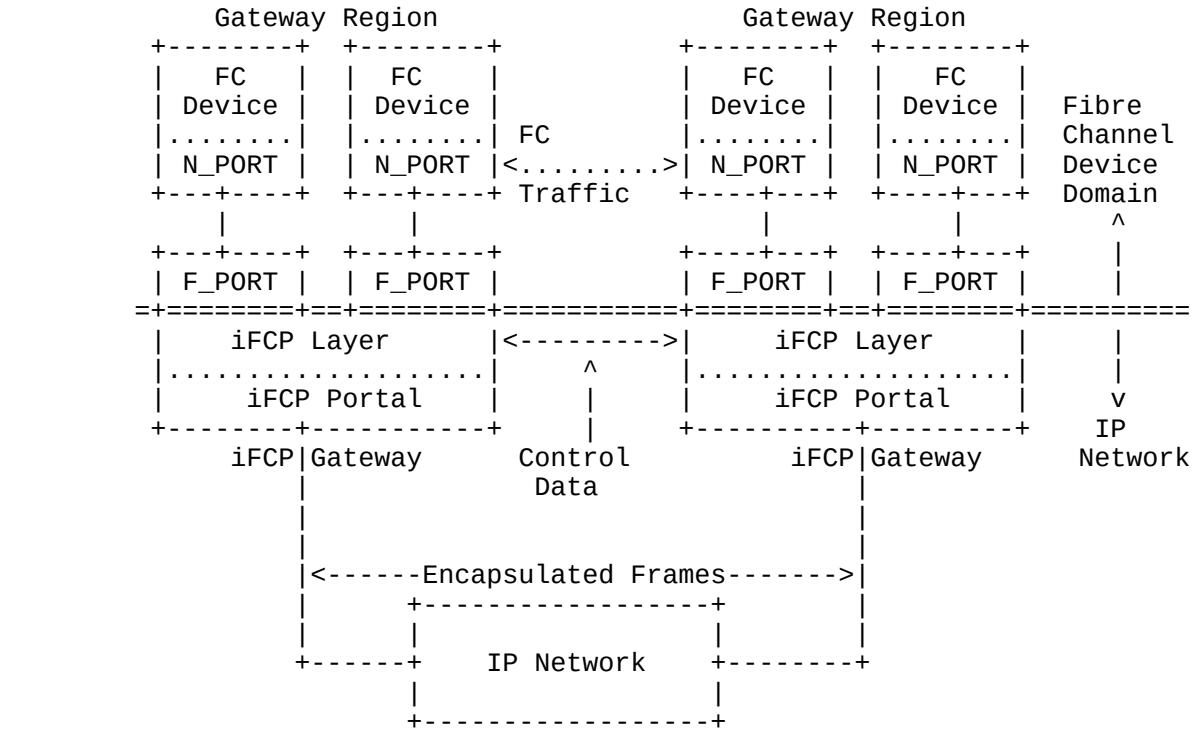

Figure 1: Interconnect between iFCP Gateways

The iFCP MIB Module is designed to allow SNMP to be used to monitor and manage local iFCP gateway instances, including the configuration of iFCP sessions between gateways.

3. Technical Description

The iFCP MIB Module is divided into sections for iFCP local gateway instance management, iFCP session management, and iFCP session statistics.

The section for iFCP gateway management provides default settings and information about each local instance. A single management entity can monitor multiple local gateway instances. Each local gateway is conceptually an independent gateway that has both Fibre Channel and IP interfaces. The default IP Time Out Value (IP_TOV) is configurable for each gateway. Other standard MIBs, such as the Fibre Management MIB [RFC4044] or Interfaces Group MIB [RFC2863], can be used to manage non-iFCP-specific gateway parameters. The local gateway instance section provides iFCP-specific information as well as optional links to other standard management MIBs.

The iFCP session management section provides information on iFCP sessions that use one of the local iFCP gateway instances. This section allows the management of specific iFCP parameters, including changing the IP_TOV from the default setting of the gateway.

The iFCP session statistics section provides statistical information on the iFCP sessions that use one of the local iFCP gateways. These tables augment the session management table. Additional statistical information for an iFCP gateway or session, that is not iFCP-specific, can be obtained using other standard MIBs. The iFCP statistics are provided in both standard and low-capacity (counter32) methods.

The following MIB module imports from RMON2-MIB [RFC2021], SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], HCNUM-TC [RFC2856], IF-MIB [RFC2863], SNMP-FRAMEWORK-MIB [RFC3411], INET-ADDRESS-MIB [RFC4001], FC-MGMT-MIB [RFC4044], and ENTITY-MIB (v3) [RFC4133].

4. MIB Definition

```
   IFCP-MGMT-MIB DEFINITIONS ::= BEGIN

   IMPORTS
       MODULE-IDENTITY,
       OBJECT-TYPE,
       Gauge32,
       Integer32,
       Unsigned32,
       transmission
            FROM SNMPv2-SMI

       OBJECT-GROUP,
       MODULE-COMPLIANCE
            FROM SNMPv2-CONF

       TEXTUAL-CONVENTION,
       TimeStamp,
       TruthValue,
       StorageType
            FROM SNMPv2-TC

   --  From RFC 2021
       ZeroBasedCounter32
            FROM RMON2-MIB

   --  From RFC 2856
       ZeroBasedCounter64
            FROM HCNUM-TC

   --  From RFC 2863
       InterfaceIndexOrZero
            FROM IF-MIB

   --  From RFC 3411
       SnmpAdminString
            FROM SNMP-FRAMEWORK-MIB

   --  From RFC 4001
       InetAddressType,
       InetAddress,
       InetPortNumber
            FROM INET-ADDRESS-MIB

   --  From RFC 4044
       FcNameIdOrZero,
       FcAddressIdOrZero
```

```
           FROM FC-MGMT-MIB

   --  From RFC 4133
       PhysicalIndexOrZero
            FROM ENTITY-MIB
         ;

   ifcpMgmtMIB   MODULE-IDENTITY
         LAST-UPDATED "200601170000Z"
         ORGANIZATION "IETF IPS Working Group"
         CONTACT-INFO "
           Attn: Kevin Gibbons
                 McDATA Corporation
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                 Billerica, MA 01821 USA
                 Phone: (978) 288-7708
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         DESCRIPTION
                 "This module defines management information specific
                  to internet Fibre Channel Protocol (iFCP) gateway
                  management.

                  Copyright (C) The Internet Society 2006.  This
                  version of this MIB module is part of RFC 4369; see
                  the RFC itself for full legal notices."
             REVISION    "200601170000Z"
         DESCRIPTION
```

```
                "Initial version of iFCP Management Module.
                 This MIB published as RFC 4369."
        ::=  { transmission 230 }

   --
   --  Textual Conventions
   --

     IfcpIpTOVorZero ::= TEXTUAL-CONVENTION
       DISPLAY-HINT   "d"
       STATUS         current
       DESCRIPTION    "The maximum propagation delay, in seconds,
                       for an encapsulated FC frame to traverse the
                       IP network.  A value of 0 implies fibre
                       channel frame lifetime limits will not be
                       enforced."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       SYNTAX         Unsigned32 (0..3600)

     IfcpLTIorZero ::= TEXTUAL-CONVENTION
       DISPLAY-HINT   "d"
       STATUS         current
       DESCRIPTION    "The value for the Liveness Test Interval
                       (LTI) being used in an iFCP connection, in
                       seconds.  A value of 0 implies no Liveness
                       Test Interval will be used."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       SYNTAX         Unsigned32 (0..65535)

     IfcpSessionStates ::= TEXTUAL-CONVENTION
       STATUS         current
       DESCRIPTION    "The value for an iFCP session state."
       SYNTAX         INTEGER {down(1), openPending(2), open(3)}

     IfcpAddressMode ::= TEXTUAL-CONVENTION
       STATUS         current
       DESCRIPTION    "The values for iFCP Address Translation
                       Mode."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       SYNTAX         INTEGER {addressTransparent(1),
                               addressTranslation(2)}

   --
   -- Internet Fibre Channel Protocol (iFCP)
   --

   ifcpGatewayObjects      OBJECT IDENTIFIER ::= {ifcpMgmtMIB 1}
   ifcpGatewayConformance  OBJECT IDENTIFIER ::= {ifcpMgmtMIB 2}
```

```
   --
   -- Local iFCP Gateway Instance Information ==================
   --

   ifcpLclGatewayInfo OBJECT IDENTIFIER ::= {ifcpGatewayObjects 1}

   ifcpLclGtwyInstTable OBJECT-TYPE
       SYNTAX           SEQUENCE OF IfcpLclGtwyInstEntry
       MAX-ACCESS       not-accessible
       STATUS           current
       DESCRIPTION
   "Information about all local iFCP Gateway instances that can
    be monitored and controlled.  This table contains an entry
    for each local iFCP Gateway instance that is being managed."
       ::= {ifcpLclGatewayInfo 1}

   ifcpLclGtwyInstEntry OBJECT-TYPE
       SYNTAX           IfcpLclGtwyInstEntry
       MAX-ACCESS       not-accessible
       STATUS           current
       DESCRIPTION
   "An entry in the local iFCP Gateway Instance table.
    Parameters and settings for the gateway are found here."
       INDEX { ifcpLclGtwyInstIndex }
       ::= {ifcpLclGtwyInstTable 1}

   IfcpLclGtwyInstEntry ::= SEQUENCE {
       ifcpLclGtwyInstIndex             Unsigned32,
       ifcpLclGtwyInstPhyIndex          PhysicalIndexOrZero,
       ifcpLclGtwyInstVersionMin        Unsigned32,
       ifcpLclGtwyInstVersionMax        Unsigned32,
       ifcpLclGtwyInstAddrTransMode     IfcpAddressMode,
       ifcpLclGtwyInstFcBrdcstSupport   TruthValue,
       ifcpLclGtwyInstDefaultIpTOV      IfcpIpTOVorZero,
       ifcpLclGtwyInstDefaultLTInterval IfcpLTIorZero,
       ifcpLclGtwyInstDescr             SnmpAdminString,
       ifcpLclGtwyInstNumActiveSessions Gauge32,
       ifcpLclGtwyInstStorageType       StorageType
                                    }

   ifcpLclGtwyInstIndex  OBJECT-TYPE
       SYNTAX           Unsigned32 (1..2147483647)
       MAX-ACCESS       not-accessible
       STATUS           current
       DESCRIPTION
   "An arbitrary integer value to uniquely identify this iFCP
    Gateway from other local Gateway instances."
```

```
        ::= {ifcpLclGtwyInstEntry      1}

    ifcpLclGtwyInstPhyIndex OBJECT-TYPE
        SYNTAX            PhysicalIndexOrZero
        MAX-ACCESS        read-only
        STATUS            current
        DESCRIPTION
    "An index indicating the location of this local gateway within
     a larger entity, if one exists.  If supported, this is the
     entPhysicalIndex from the Entity MIB (Version 3), for this
     iFCP Gateway.  If not supported, or if not related to a
     physical entity, then the value of this object is 0."
        REFERENCE      "Entity MIB (Version 3)"
        ::= {ifcpLclGtwyInstEntry      2}

    ifcpLclGtwyInstVersionMin OBJECT-TYPE
        SYNTAX            Unsigned32 (0..255)
        MAX-ACCESS        read-only
        STATUS            current
        DESCRIPTION
    "The minimum iFCP protocol version supported by the local iFCP
     gateway instance."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpLclGtwyInstEntry      3}

    ifcpLclGtwyInstVersionMax OBJECT-TYPE
        SYNTAX            Unsigned32 (0..255)
        MAX-ACCESS        read-only
        STATUS            current
        DESCRIPTION
    "The maximum iFCP protocol version supported by the local iFCP
     gateway instance."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpLclGtwyInstEntry      4}

    ifcpLclGtwyInstAddrTransMode OBJECT-TYPE
        SYNTAX            IfcpAddressMode
        MAX-ACCESS        read-write
        STATUS            current
        DESCRIPTION
    "The local iFCP gateway operating mode.  Changing this value
     may cause existing sessions to be disrupted."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        DEFVAL            { addressTranslation }
        ::= {ifcpLclGtwyInstEntry      5}

    ifcpLclGtwyInstFcBrdcstSupport OBJECT-TYPE
        SYNTAX            TruthValue
```

```
       MAX-ACCESS        read-write
       STATUS            current
       DESCRIPTION
   "Whether the local iFCP gateway supports FC Broadcast.
    Changing this value may cause existing sessions to be
    disrupted."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       DEFVAL            { false }
       ::= {ifcpLclGtwyInstEntry      6}

   ifcpLclGtwyInstDefaultIpTOV OBJECT-TYPE
       SYNTAX            IfcpIpTOVorZero
       MAX-ACCESS        read-write
       STATUS            current
       DESCRIPTION
   "The default IP_TOV used for iFCP sessions at this gateway.
    This is the default maximum propagation delay that will be
    used for an iFCP session.  The value can be changed on a
    per-session basis.  The valid range is 0 - 3600 seconds.
    A value of 0 implies that fibre channel frame lifetime limits
    will not be enforced."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       DEFVAL            { 6 }
       ::= {ifcpLclGtwyInstEntry      7}

   ifcpLclGtwyInstDefaultLTInterval OBJECT-TYPE
       SYNTAX            IfcpLTIorZero
       MAX-ACCESS        read-write
       STATUS            current
       DESCRIPTION
   "The default Liveness Test Interval (LTI), in seconds, used
    for iFCP sessions at this gateway.  This is the default
    value for an iFCP session and can be changed on a
    per-session basis.  The valid range is 0 - 65535 seconds.
    A value of 0 implies no Liveness Test Interval will be
    performed on a session."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       DEFVAL            { 10 }
       ::= {ifcpLclGtwyInstEntry      8}

   ifcpLclGtwyInstDescr  OBJECT-TYPE
       SYNTAX            SnmpAdminString (SIZE (0..64))
       MAX-ACCESS        read-write
       STATUS            current
       DESCRIPTION
   "A user-entered description for this iFCP Gateway."
       DEFVAL            { "" }
       ::= {ifcpLclGtwyInstEntry      9}
```

```
   ifcpLclGtwyInstNumActiveSessions OBJECT-TYPE
       SYNTAX            Gauge32 (0..4294967295)
       MAX-ACCESS        read-only
       STATUS            current
       DESCRIPTION
   "The current total number of iFCP sessions in the open or
    open-pending state."
       ::= {ifcpLclGtwyInstEntry      10}

   ifcpLclGtwyInstStorageType OBJECT-TYPE
       SYNTAX            StorageType
       MAX-ACCESS        read-only
       STATUS            current
       DESCRIPTION
   "The storage type for this row.  Parameter values defined
    for a gateway are usually non-volatile, but may be volatile
    or permanent in some configurations.  If permanent, then
    the following parameters must have read-write access:
    ifcpLclGtwyInstAddrTransMode, ifcpLclGtwyInstDefaultIpTOV,
    and ifcpLclGtwyInstDefaultLTInterval."
       DEFVAL            { nonVolatile }
       ::= {ifcpLclGtwyInstEntry      11}

   --
   -- iFCP N Port Session Information ============================
   --

   ifcpNportSessionInfo
              OBJECT IDENTIFIER ::= {ifcpGatewayObjects 2}

   ifcpSessionAttributesTable OBJECT-TYPE
       SYNTAX                          SEQUENCE OF
                                        IfcpSessionAttributesEntry
       MAX-ACCESS                      not-accessible
       STATUS                          current
       DESCRIPTION
   "An iFCP session consists of the pair of N_PORTs comprising
    the session endpoints joined by a single TCP/IP connection.
    This table provides information on each iFCP session
    currently using a local iFCP Gateway instance.  iFCP sessions
    are created and removed by the iFCP Gateway instances, which
    are reflected in this table."
       ::= {ifcpNportSessionInfo 1}

   ifcpSessionAttributesEntry OBJECT-TYPE
       SYNTAX                          IfcpSessionAttributesEntry
       MAX-ACCESS                      not-accessible
```

```
      STATUS                      current
      DESCRIPTION
   "Each entry contains information about one iFCP session consisting
    of a pair of N_PORTs joined by a single TCP/IP connection.  This
    table's INDEX includes ifcpLclGtwyInstIndex, which identifies the
    local iFCP Gateway instance that created the session for the
    entry.

    Soon after an entry is created in this table for an iFCP session, it
    will correspond to an entry in the tcpConnectionTable of the TCP-MIB
    (RFC 4022).  The corresponding entry might represent a preexisting
    TCP connection, or it might be a newly-created entry.  (Note that if
    IPv4 is being used, an entry in RFC 2012's tcpConnTable may also
    correspond.)  The values of ifcpSessionLclPrtlAddrType and
    ifcpSessionRmtPrtlIfAddrType in this table and the values of
    tcpConnectionLocalAddressType and tcpConnectionRemAddressType used
    as INDEX values for the corresponding entry in the
    tcpConnectionTable should be the same; this makes it simpler to
    locate a session's TCP connection in the TCP-MIB.  (Of course, all
    four values need to be 'ipv4' if there's a corresponding entry in
    the tcpConnTable.)

    If an entry is created in this table for a session, prior to
    knowing which local and/or remote port numbers will be used for
    the TCP connection, then ifcpSessionLclPrtlTcpPort and/or
    ifcpSessionRmtPrtlTcpPort have the value zero until such time as
    they can be updated to the port numbers (to be) used for the
    connection.  (Thus, a port value of zero should not be used to
    locate a session's TCP connection in the TCP-MIB.)

    When the TCP connection terminates, the entry in the
    tcpConnectionTable and the entry in this table both get deleted
    (and, if applicable, so does the entry in the tcpConnTable)."
      INDEX { ifcpLclGtwyInstIndex, ifcpSessionIndex }
      ::= {ifcpSessionAttributesTable 1}

   IfcpSessionAttributesEntry ::= SEQUENCE {
      ifcpSessionIndex               Integer32,
      ifcpSessionLclPrtlIfIndex      InterfaceIndexOrZero,
      ifcpSessionLclPrtlAddrType     InetAddressType,
      ifcpSessionLclPrtlAddr         InetAddress,
      ifcpSessionLclPrtlTcpPort      InetPortNumber,
      ifcpSessionLclNpWwun           FcNameIdOrZero,
      ifcpSessionLclNpFcid           FcAddressIdOrZero,
      ifcpSessionRmtNpWwun           FcNameIdOrZero,
      ifcpSessionRmtPrtlIfAddrType   InetAddressType,
      ifcpSessionRmtPrtlIfAddr       InetAddress,
      ifcpSessionRmtPrtlTcpPort      InetPortNumber,
```

```
        ifcpSessionRmtNpFcid            FcAddressIdOrZero,
        ifcpSessionRmtNpFcidAlias       FcAddressIdOrZero,
        ifcpSessionIpTOV                IfcpIpTOVorZero,
        ifcpSessionLclLTIntvl           IfcpLTIorZero,
        ifcpSessionRmtLTIntvl           IfcpLTIorZero,
        ifcpSessionBound                TruthValue,
        ifcpSessionStorageType          StorageType
                                            }

    ifcpSessionIndex                    OBJECT-TYPE
        SYNTAX                          Integer32 (1..2147483647)
        MAX-ACCESS                      not-accessible
        STATUS                          current
        DESCRIPTION
    "The iFCP session index is a unique value used as an index
     to the table, along with a specific local iFCP Gateway
     instance.  This index is used because the local N Port and
     remote N Port information would create an complex index that
     would be difficult to implement."
        ::= {ifcpSessionAttributesEntry 1}

    ifcpSessionLclPrtlIfIndex           OBJECT-TYPE
        SYNTAX                          InterfaceIndexOrZero
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "This is the interface index in the IF-MIB ifTable being used
     as the local portal in this session, as described in the
     IF-MIB.  If the local portal is not associated with an entry
     in the ifTable, then the value is 0.  The ifType of the
     interface will generally be a type that supports IP, but an
     implementation may support iFCP using other protocols.  This
     object can be used to obtain additional information about the
     interface."
        REFERENCE     "RFC 2863, The Interfaces Group MIB (IF-MIB)"
        ::= {ifcpSessionAttributesEntry 2}

    ifcpSessionLclPrtlAddrType          OBJECT-TYPE
        SYNTAX                          InetAddressType
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The type of address in ifcpSessionLclIfAddr."
        ::= {ifcpSessionAttributesEntry 3}

    ifcpSessionLclPrtlAddr              OBJECT-TYPE
        SYNTAX                          InetAddress
        MAX-ACCESS                      read-only
```

```
        STATUS                          current
        DESCRIPTION
    "This is the external IP address of the interface being used
     for the iFCP local portal in this session.  The address type
     is defined in ifcpSessionLclPrtlAddrType.  If the value is a
     DNS name, then the name is resolved once, during the initial
     session instantiation."
        ::= {ifcpSessionAttributesEntry 4}

    ifcpSessionLclPrtlTcpPort           OBJECT-TYPE
        SYNTAX                          InetPortNumber
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "This is the TCP port number that is being used for the iFCP
     local portal in this session.  This is normally an ephemeral
     port number selected by the gateway.  The value may be 0
     during an initial setup period."
        ::= {ifcpSessionAttributesEntry 5}

    ifcpSessionLclNpWwun                OBJECT-TYPE
        SYNTAX                          FcNameIdOrZero
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "World Wide Unique Name of the local N Port.  For an unbound
     session, this variable will be a zero-length string."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        DEFVAL                          { "" }
        ::= {ifcpSessionAttributesEntry 6}

    ifcpSessionLclNpFcid                OBJECT-TYPE
        SYNTAX                          FcAddressIdOrZero
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "Fibre Channel Identifier of the local N Port.  For an unbound
     session, this variable will be a zero-length string."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpSessionAttributesEntry 7}

    ifcpSessionRmtNpWwun                OBJECT-TYPE
        SYNTAX                          FcNameIdOrZero
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "World Wide Unique Name of the remote N Port.  For an unbound
     session, this variable will be a zero-length string."
```

```
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        DEFVAL                          { "" }
        ::= {ifcpSessionAttributesEntry 8}

    ifcpSessionRmtPrtlIfAddrType        OBJECT-TYPE
        SYNTAX                          InetAddressType
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The type of address in ifcpSessionRmtPrtlIfAddr."
        ::= {ifcpSessionAttributesEntry 9}

    ifcpSessionRmtPrtlIfAddr            OBJECT-TYPE
        SYNTAX                          InetAddress
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "This is the remote gateway IP address being used for the
     portal on the remote iFCP gateway.  The address type is
     defined in ifcpSessionRmtPrtlIfAddrType.  If the value is a
     DNS name, then the name is resolved once, during the initial
     session instantiation."
        ::= {ifcpSessionAttributesEntry 10}

    ifcpSessionRmtPrtlTcpPort           OBJECT-TYPE
        SYNTAX                          InetPortNumber
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "This is the TCP port number being used for the portal on the
     remote iFCP gateway.  Generally, this will be the iFCP
     canonical port.  The value may be 0 during an initial setup
     period."
        DEFVAL                          { 3420 }
        ::= {ifcpSessionAttributesEntry 11}

    ifcpSessionRmtNpFcid                OBJECT-TYPE
        SYNTAX                          FcAddressIdOrZero
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "Fibre Channel Identifier of the remote N Port.  For an
     unbound session, this variable will be a zero-length string."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpSessionAttributesEntry 12}

    ifcpSessionRmtNpFcidAlias           OBJECT-TYPE
        SYNTAX                          FcAddressIdOrZero
```

```
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "Fibre Channel Identifier Alias assigned by the local gateway
     for the remote N Port.  For an unbound session, this variable
     will be a zero-length string."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpSessionAttributesEntry 13}

    ifcpSessionIpTOV                OBJECT-TYPE
        SYNTAX                      IfcpIpTOVorZero
        MAX-ACCESS                  read-write
        STATUS                      current
        DESCRIPTION
    "The IP_TOV being used for this iFCP session.  This is the
     maximum propagation delay that will be used for the iFCP
     session.  The value can be changed on a per-session basis
     and initially defaults to ifcpLclGtwyInstDefaultIpTOV for
     the local gateway instance.  The valid range is 0 - 3600
     seconds.  A value of 0 implies fibre channel frame lifetime
     limits will not be enforced."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpSessionAttributesEntry 14}

    ifcpSessionLclLTIntvl           OBJECT-TYPE
        SYNTAX                      IfcpLTIorZero
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The Liveness Test Interval (LTI) used for this iFCP session.
     The value can be changed on a per-session basis and initially
     defaults to ifcpLclGtwyInstDefaultLTInterval for the local
     gateway instance.  The valid range is 0 - 65535 seconds.
     A value of 0 implies that the gateway will not originate
     Liveness Test messages for the session."
        REFERENCE      "RFC 4172, iFCP Protocol Specification"
        ::= {ifcpSessionAttributesEntry 15}

    ifcpSessionRmtLTIntvl           OBJECT-TYPE
        SYNTAX                      IfcpLTIorZero
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The Liveness Test Interval (LTI) as requested by the remote
     gateway instance to use for this iFCP session.  This value may
     change over the life of the session.  The valid range is 0 -
     65535 seconds.  A value of 0 implies that the remote gateway
     has not been requested to originate Liveness Test messages for
```

```
    the session."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       ::= {ifcpSessionAttributesEntry 16}

   ifcpSessionBound                    OBJECT-TYPE
       SYNTAX                          TruthValue
       MAX-ACCESS                      read-only
       STATUS                          current
       DESCRIPTION
   "This value indicates whether this session is bound to a
    specific local and remote N Port.  Sessions by default are
    unbound and ready for future assignment to a local and remote
    N Port."
       REFERENCE      "RFC 4172, iFCP Protocol Specification"
       ::= {ifcpSessionAttributesEntry 17}

   ifcpSessionStorageType              OBJECT-TYPE
       SYNTAX                          StorageType
       MAX-ACCESS                      read-only
       STATUS                          current
       DESCRIPTION
   "The storage type for this row.  Parameter values defined
    for a session are usually non-volatile, but may be volatile
    or permanent in some configurations.  If permanent, then
    ifcpSessionIpTOV must have read-write access."
       DEFVAL            { nonVolatile }
       ::= {ifcpSessionAttributesEntry 18}

   --
   -- Local iFCP Gateway Instance Session Statistics =============
   --

   ifcpSessionStatsTable               OBJECT-TYPE
       SYNTAX                          SEQUENCE OF
                                          IfcpSessionStatsEntry
       MAX-ACCESS                      not-accessible
       STATUS                          current
       DESCRIPTION
   "This table provides statistics on an iFCP session."
       ::= {ifcpNportSessionInfo 2}

   ifcpSessionStatsEntry               OBJECT-TYPE
       SYNTAX                          IfcpSessionStatsEntry
       MAX-ACCESS                      not-accessible
       STATUS                          current
       DESCRIPTION
   "Provides iFCP-specific statistics per session."
       AUGMENTS {ifcpSessionAttributesEntry}
```

```
        ::= {ifcpSessionStatsTable 1}

    IfcpSessionStatsEntry ::= SEQUENCE {
        ifcpSessionState               IfcpSessionStates,
        ifcpSessionDuration            Unsigned32,
        ifcpSessionTxOctets            ZeroBasedCounter64,
        ifcpSessionRxOctets            ZeroBasedCounter64,
        ifcpSessionTxFrames            ZeroBasedCounter64,
        ifcpSessionRxFrames            ZeroBasedCounter64,
        ifcpSessionStaleFrames         ZeroBasedCounter64,
        ifcpSessionHeaderCRCErrors     ZeroBasedCounter64,
        ifcpSessionFcPayloadCRCErrors  ZeroBasedCounter64,
        ifcpSessionOtherErrors         ZeroBasedCounter64,
        ifcpSessionDiscontinuityTime   TimeStamp
                                       }

    ifcpSessionState                   OBJECT-TYPE
        SYNTAX                         IfcpSessionStates
        MAX-ACCESS                     read-only
        STATUS                         current
        DESCRIPTION
    "The current session operating state."
        ::= {ifcpSessionStatsEntry 1}

    ifcpSessionDuration                OBJECT-TYPE
        SYNTAX                         Unsigned32 (0..4294967295)
        MAX-ACCESS                     read-only
        STATUS                         current
        DESCRIPTION
    "This indicates, in seconds, how long the iFCP session has
     been in an open or open-pending state.  When a session is
     down, the value is reset to 0."
        ::= {ifcpSessionStatsEntry 2}

    ifcpSessionTxOctets                OBJECT-TYPE
        SYNTAX                         ZeroBasedCounter64
        MAX-ACCESS                     read-only
        STATUS                         current
        DESCRIPTION
    "The total number of octets transmitted by the iFCP gateway
     for this session.  Discontinuities in the value of this
     counter can occur at reinitialization of the management
     system, and at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 3}

    ifcpSessionRxOctets                OBJECT-TYPE
        SYNTAX                         ZeroBasedCounter64
```

```
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The total number of octets received by the iFCP gateway for
     this session.  Discontinuities in the value of this
     counter can occur at reinitialization of the management
     system, and at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 4}

    ifcpSessionTxFrames             OBJECT-TYPE
        SYNTAX                      ZeroBasedCounter64
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The total number of iFCP frames transmitted by the gateway
     for this session.  Discontinuities in the value of this
     counter can occur at reinitialization of the management
     system, and at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 5}

    ifcpSessionRxFrames             OBJECT-TYPE
        SYNTAX                      ZeroBasedCounter64
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The total number of iFCP frames received by the gateway
     for this session.  Discontinuities in the value of this
     counter can occur at reinitialization of the management
     system, and at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 6}

    ifcpSessionStaleFrames          OBJECT-TYPE
        SYNTAX                      ZeroBasedCounter64
        MAX-ACCESS                  read-only
        STATUS                      current
        DESCRIPTION
    "The total number of received iFCP frames that were stale and
     discarded by the gateway for this session.  Discontinuities
     in the value of this counter can occur at reinitialization
     of the management system, and at other times as indicated by
     the value of ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 7}

    ifcpSessionHeaderCRCErrors      OBJECT-TYPE
        SYNTAX                      ZeroBasedCounter64
```

```
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The total number of CRC errors that occurred in the frame
     header, detected by the gateway for this session.  Usually,
     a single Header CRC error is sufficient to terminate an
     iFCP session.  Discontinuities in the value of this
     counter can occur at reinitialization of the management
     system, and at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 8}

    ifcpSessionFcPayloadCRCErrors       OBJECT-TYPE
        SYNTAX                          ZeroBasedCounter64
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The total number of CRC errors that occurred in the Fibre
     Channel frame payload, detected by the gateway for this
     session.  Discontinuities in the value of this counter can
     occur at reinitialization of the management system, and
     at other times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 9}

    ifcpSessionOtherErrors              OBJECT-TYPE
        SYNTAX                          ZeroBasedCounter64
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The total number of errors, other than errors explicitly
     measured, detected by the gateway for this session.
     Discontinuities in the value of this counter can occur at
     reinitialization of the management system, and at other
     times as indicated by the value of
     ifcpSessionDiscontinuityTime."
        ::= {ifcpSessionStatsEntry 10}

    ifcpSessionDiscontinuityTime        OBJECT-TYPE
        SYNTAX                          TimeStamp
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The value of sysUpTime on the most recent occasion at which
     any one (or more) of the ifcpSessionStatsTable counters
     suffered a discontinuity.  The relevant counters are the
     specific Counter64-based instances associated with the
     ifcpSessionStatsTable: ifcpSessionTxOctets,
```

```
    ifcpSessionRxOctets, ifcpSessionTxFrames,
    ifcpSessionRxFrames, ifcpSessionStaleFrames,
    ifcpSessionHeaderCRCErrors, ifcpSessionFcPayloadCRCErrors,
    and ifcpSessionOtherErrors.  If no such discontinuities have
    occurred since the last reinitialization of the local
    management subsystem, then this object contains a zero value."
       ::= {ifcpSessionStatsEntry 11}

   --
   -- Low Capacity Statistics
   --

   ifcpSessionLcStatsTable            OBJECT-TYPE
       SYNTAX                         SEQUENCE OF
                                        IfcpSessionLcStatsEntry
       MAX-ACCESS                     not-accessible
       STATUS                         current
       DESCRIPTION
   "This table provides low capacity statistics for an iFCP
    session.  These are provided for backward compatibility with
    systems that do not support Counter64-based objects.  At
    1-Gbps rates, a Counter32-based object can wrap as often as
    every 34 seconds.  Counter32-based objects can be sufficient
    for many situations.  However, when possible, it is
    recommended to use the high capacity statistics in
    ifcpSessionStatsTable based on Counter64 objects."
       ::= {ifcpNportSessionInfo 3}

   ifcpSessionLcStatsEntry            OBJECT-TYPE
       SYNTAX                         IfcpSessionLcStatsEntry
       MAX-ACCESS                     not-accessible
       STATUS                         current
       DESCRIPTION
   "Provides iFCP-specific statistics per session."
       AUGMENTS {ifcpSessionAttributesEntry}
       ::= {ifcpSessionLcStatsTable 1}

   IfcpSessionLcStatsEntry ::= SEQUENCE {
       ifcpSessionLcTxOctets            ZeroBasedCounter32,
       ifcpSessionLcRxOctets            ZeroBasedCounter32,
       ifcpSessionLcTxFrames            ZeroBasedCounter32,
       ifcpSessionLcRxFrames            ZeroBasedCounter32,
       ifcpSessionLcStaleFrames         ZeroBasedCounter32,
       ifcpSessionLcHeaderCRCErrors     ZeroBasedCounter32,
       ifcpSessionLcFcPayloadCRCErrors  ZeroBasedCounter32,
       ifcpSessionLcOtherErrors         ZeroBasedCounter32
                                      }
```

```
   ifcpSessionLcTxOctets              OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
       STATUS                         current
       DESCRIPTION
   "The total number of octets transmitted by the iFCP gateway
    for this session."
       ::= {ifcpSessionLcStatsEntry 1}

   ifcpSessionLcRxOctets              OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
       STATUS                         current
       DESCRIPTION
   "The total number of octets received by the iFCP gateway for
    this session."
       ::= {ifcpSessionLcStatsEntry 2}

   ifcpSessionLcTxFrames              OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
       STATUS                         current
       DESCRIPTION
   "The total number of iFCP frames transmitted by the gateway
    for this session."
       ::= {ifcpSessionLcStatsEntry 3}

   ifcpSessionLcRxFrames              OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
       STATUS                         current
       DESCRIPTION
   "The total number of iFCP frames received by the gateway
    for this session."
       ::= {ifcpSessionLcStatsEntry 4}

   ifcpSessionLcStaleFrames           OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
       STATUS                         current
       DESCRIPTION
   "The total number of received iFCP frames that were stale and
    discarded by the gateway for this session."
       ::= {ifcpSessionLcStatsEntry 5}

   ifcpSessionLcHeaderCRCErrors       OBJECT-TYPE
       SYNTAX                         ZeroBasedCounter32
       MAX-ACCESS                     read-only
```

```
        STATUS                          current
        DESCRIPTION
    "The total number of CRC errors that occurred in the frame
     header, detected by the gateway for this session.  Usually,
     a single Header CRC error is sufficient to terminate an
     iFCP session."
        ::= {ifcpSessionLcStatsEntry 6}

    ifcpSessionLcFcPayloadCRCErrors    OBJECT-TYPE
        SYNTAX                          ZeroBasedCounter32
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The total number of CRC errors that occurred in the Fibre
     Channel frame payload, detected by the gateway for this
     session."
        ::= {ifcpSessionLcStatsEntry 7}

    ifcpSessionLcOtherErrors           OBJECT-TYPE
        SYNTAX                          ZeroBasedCounter32
        MAX-ACCESS                      read-only
        STATUS                          current
        DESCRIPTION
    "The total number of errors, other than errors explicitly
     measured, detected by the gateway for this session."
        ::= {ifcpSessionLcStatsEntry 8}

    --=========================================================

    ifcpCompliances
            OBJECT IDENTIFIER ::= {ifcpGatewayConformance 1}

    ifcpGatewayCompliance MODULE-COMPLIANCE
        STATUS current
        DESCRIPTION
    "Implementation requirements for iFCP MIB compliance."
        MODULE       -- this module
        MANDATORY-GROUPS {
            ifcpLclGatewayGroup,
            ifcpLclGatewaySessionGroup,
            ifcpLclGatewaySessionStatsGroup,
            ifcpLclGatewaySessionLcStatsGroup
                        }

            OBJECT      ifcpSessionLclPrtlAddrType
            SYNTAX      InetAddressType { ipv4(1), ipv6(2) }
            DESCRIPTION
                   "Support is only required for global IPv4
```

```
                and IPv6 address types."

            OBJECT      ifcpSessionRmtPrtlIfAddrType
            SYNTAX      InetAddressType { ipv4(1), ipv6(2) }
            DESCRIPTION
                   "Support is only required for global IPv4
                   and IPv6 address types."

        ::= {ifcpCompliances 1}

    ifcpGroups OBJECT IDENTIFIER ::= {ifcpGatewayConformance 2}

    ifcpLclGatewayGroup OBJECT-GROUP
        OBJECTS {
        ifcpLclGtwyInstPhyIndex,
        ifcpLclGtwyInstVersionMin,
        ifcpLclGtwyInstVersionMax,
        ifcpLclGtwyInstAddrTransMode,
        ifcpLclGtwyInstFcBrdcstSupport,
        ifcpLclGtwyInstDefaultIpTOV,
        ifcpLclGtwyInstDefaultLTInterval,
        ifcpLclGtwyInstDescr,
        ifcpLclGtwyInstNumActiveSessions,
        ifcpLclGtwyInstStorageType
               }
        STATUS current
        DESCRIPTION
    "iFCP local device info group.  This group provides
     information about each gateway."
        ::= {ifcpGroups 1}

    ifcpLclGatewaySessionGroup OBJECT-GROUP
        OBJECTS {
        ifcpSessionLclPrtlIfIndex,
        ifcpSessionLclPrtlAddrType,
        ifcpSessionLclPrtlAddr,
        ifcpSessionLclPrtlTcpPort,
        ifcpSessionLclNpWwun,
        ifcpSessionLclNpFcid,
        ifcpSessionRmtNpWwun,
        ifcpSessionRmtPrtlIfAddrType,
        ifcpSessionRmtPrtlIfAddr,
        ifcpSessionRmtPrtlTcpPort,
        ifcpSessionRmtNpFcid,
        ifcpSessionRmtNpFcidAlias,
        ifcpSessionIpTOV,
        ifcpSessionLclLTIntvl,
        ifcpSessionRmtLTIntvl,
```

```
        ifcpSessionBound,
        ifcpSessionStorageType
                }
        STATUS current
        DESCRIPTION
    "iFCP Session group.  This group provides information
     about each iFCP session currently active between iFCP
     gateways."
        ::= {ifcpGroups 4}

    ifcpLclGatewaySessionStatsGroup OBJECT-GROUP
        OBJECTS {
        ifcpSessionState,
        ifcpSessionDuration,
        ifcpSessionTxOctets,
        ifcpSessionRxOctets,
        ifcpSessionTxFrames,
        ifcpSessionRxFrames,
        ifcpSessionStaleFrames,
        ifcpSessionHeaderCRCErrors,
        ifcpSessionFcPayloadCRCErrors,
        ifcpSessionOtherErrors,
        ifcpSessionDiscontinuityTime
                }
        STATUS current
        DESCRIPTION
    "iFCP Session Statistics group.  This group provides
     statistics with 64-bit counters for each iFCP session
     currently active between iFCP gateways.  This group
     is only required for agents that can support Counter64-
     based data types."
        ::= {ifcpGroups 5}

    ifcpLclGatewaySessionLcStatsGroup OBJECT-GROUP
        OBJECTS {
        ifcpSessionLcTxOctets,
        ifcpSessionLcRxOctets,
        ifcpSessionLcTxFrames,
        ifcpSessionLcRxFrames,
        ifcpSessionLcStaleFrames,
        ifcpSessionLcHeaderCRCErrors,
        ifcpSessionLcFcPayloadCRCErrors,
        ifcpSessionLcOtherErrors
                }
        STATUS current
        DESCRIPTION
    "iFCP Session Low Capacity Statistics group.  This group
     provides statistics with low-capacity 32-bit counters
```

```
    for each iFCP session currently active between iFCP
    gateways.  This group is only required for agents that
    do not support Counter64-based data types, or that need
    to support SNMPv1 applications."
       ::= {ifcpGroups 6}

END
```

5. IANA Considerations

The IANA has made a unique MIB OID assignment under the transmission branch for IFCP-MGMT-MIB.

6. Security Considerations

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

Changing the following object values, with a MAX-ACCESS of read-write, may cause disruption in storage traffic:

- ifcpLclGtwyInstAddrTransMode
- ifcpLclGtwyInstFcBrdcstSupport
- ifcpLclGtwyInstDefaultIpTOV
- ifcpLclGtwyInstDefaultLTInterval
- ifcpSessionIpTOV

Changing the following object value, with a MAX-ACCESS of read-write, may cause a user to lose track of the iFCP gateway:

- ifcpLclGtwyInstDescr

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

The following object tables provide information about storage traffic sessions, and can indicate to a user who is communicating and exchanging storage data:

ifcpLclGtwyInstTable
ifcpSessionAttributesTable

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

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