                    Definitions of Managed Objects
          for Internet Small Computer System Interface (iSCSI)

Status of This Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in TCP/IP-based internets.
   In particular, it defines objects for managing a client using the
   Internet Small Computer System Interface (iSCSI) protocol (SCSI over
   TCP).

Table of Contents

1. Introduction

    This document defines a MIB module for iSCSI [RFC3720], used to
    manage devices that implement the iSCSI protocol.

2. Specification of Requirements

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

3. 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].

4. Relationship to Other MIB Modules

    The iSCSI MIB module is normally layered between the SCSI MIB module
    [RFC4455] and the TCP MIB module [RFC4022], and makes use of the IP
    Storage (IPS) Identity Authentication MIB module [RFC4545]. Here is
    how these modules are related:

    SCSI MIB Within systems where a SCSI layer is present, each
              iscsiNode, whether it has an initiator role, target role,
              or both, is related to one SCSI device within the SCSI MIB
              module. In this case, the iscsiNodeTransportType attribute
              points to the SCSI transport object within the SCSI MIB
              module, which in turn contains an attribute that points
              back to the iscsiNode. In this way, a management station
              can navigate between the two MIB modules. In systems where
              a SCSI layer is not present, such as within an iSCSI proxy
              device, the iscsiNodeTransportType attribute points to the
              appropriate corresponding object within the appropriate
              MIB, or is left blank.

TCP MIB   Each iSCSI connection is related to one transport-level
            connection. Currently, iSCSI uses only TCP; the iSCSI
            connection is related to a TCP connection using its normal
            (protocol, source address, source port, destination
            address, destination port) 5-tuple.

AUTH MIB   Each iSCSI node that serves a target role can have a list
            of authorized initiators. Each of the entries in this list
            points to an identity within the IPS Identity
            Authentication MIB module that will be allowed to access
            the target. iSCSI nodes that serve in an initiator role
            can also have a list of authorized targets. Each of the
            entries in this list points to an identity within the Auth
            MIB module to which the initiator should attempt to
            establish sessions. The Auth MIB module includes
            information used to identify initiators and targets by
            their iSCSI name, IP address, and/or credentials.

This MIB module imports objects from RFCs 2578 [RFC2578], 2579
[RFC2579], 2580 [RFC2580], and 3411 [RFC3411]. It also imports
textual conventions from the INET-ADDRESS-MIB [RFC4001].

5. Relationship to SNMP Contexts

Each non-scalar object in the iSCSI MIB module is indexed first by an
iSCSI Instance. Each instance is a collection of nodes, portals,
sessions, etc., that can define a physical or virtual partitioning of
an iSCSI-capable device. The use of an instance works well with
partitionable or hierarchical storage devices and fits in logically
with other management schemes. Instances do not replace SNMP
contexts, however they do provide a very simple way to assign a
virtual or physical partition of a device to one or more SNMP
contexts, without having to do so for each individual node, portal,
and session row.

6. Discussion

This MIB module structure supplies configuration, fault, and
statistics information for iSCSI devices [RFC3720]. It is structured
around the well-known iSCSI objects, such as targets, initiators,
sessions, connections, and the like.

This MIB module may also be used to configure access to iSCSI
targets, by creating iSCSI Portals and authorization list entries.

It is worthwhile to note that this is an iSCSI MIB module and as such
reflects only iSCSI objects. This module does not contain
information about the SCSI-layer attributes of a device. If a SCSI
layer is present, the SCSI MIB module, currently under development,
may be used to manage SCSI information for a device.

The iSCSI MIB module consists of several "objects", each of which is
represented by one or more tables. This section contains a brief
description of the "object" hierarchy and a description of each
object, followed by a discussion of the actual table structure within
the objects.

6.1. iSCSI MIB Object Model

The top-level object in this structure is the iSCSI instance, which
"contains" all of the other objects.

```
iscsiInstance
   -- A distinct iSCSI entity within the managed system.
   iscsiPortal
      -- An IP address used by this instance
      iscsiTargetPortal
         -- Contains portal information relevant when the portal
         -- is used to listen for connections to its targets.
      iscsiInitiatorPortal
         -- Contains portal information relevant when the portal
         -- is used to initiate connections to other targets.
   iscsiNode
      -- An iSCSI node can act as an initiator, a target, or both.
      -- Contains generic (non-role-specific) information.
      iscsiTarget
         -- Target-specific iSCSI node information.
         iscsiTgtAuth
            -- A list of initiator identities that are allowed
            -- access to this target.
      iscsiInitiator
         -- Initiator-specific iSCSI node information.
         iscsiIntrAuth
            -- A list of target identities to which this initiator
            -- is configured to establish sessions.
      iscsiSession
         -- An active iSCSI session between an initiator and target.
         -- The session's direction may be Inbound (outside
         -- initiator to our target) or Outbound (our initiator to
         -- an outside target).
         iscsiConnection
            -- An active TCP connection within an iSCSI session.
```

An iSCSI node can be an initiator, a target, or both. The iSCSI
node's portals may be used to initiate connections (initiator) or
listen for connections (target), depending on whether the iSCSI node
is acting as an initiator or target. The iSCSI MIB module assumes
that any target may be accessed via any portal that can take on a
target role, although other access controls not reflected in the
module might limit this.

6.2. iSCSI MIB Table Structure

Each iSCSI object exports one or more tables: an attributes table,
and zero or more statistics tables, which augment the attributes
table. Since iSCSI is an evolving standard, it is much cleaner to
provide statistics and attributes as separate tables, allowing
attributes and statistics to be added independently. In a few cases,
there are multiple categories of statistics that will likely grow; in
this case, an object will contain multiple statistics tables.

```
iscsiObjects
  iscsiDescriptors
  iscsiInstance
    iscsiInstanceAttributesTable
    iscsiInstanceSsnErrorStatsTable
      -- Counts abnormal session terminations
  iscsiPortal
    iscsiPortalAttributesTable
  iscsiTargetPortal
    iscsiTgtPortalAttributesTable
  iscsiInitiatorPortal
    iscsiIntrPortalAttributesTable
  iscsiNode
    iscsiNodeAttributesTable
  iscsiTarget
    iscsiTargetAttributesTable
    iscsiTargetLoginStatsTable
      -- Counts successful and unsuccessful logins
    iscsiTargetLogoutStatsTable
      -- Counts normal and abnormal logouts
  iscsiTgtAuthorization
    iscsiTgtAuthAttributesTable
  iscsiInitiator
    iscsiInitiatorAttributesTable
    iscsiInitiatorLoginStatsTable
      -- Counts successful and unsuccessful logins
    iscsiInitiatorLogoutStatsTable
      -- Counts normal and abnormal logouts
  iscsiIntrAuthorization
    iscsiIntrAuthAttributesTable
```

```
   iscsiSession
     iscsiSessionAttributesTable
     iscsiSessionStatsTable
       -- Performance-related counts (requests, responses, bytes)
     iscsiSessionCxnErrorStatsTable
       -- Counts digest errors, connection errors, etc.
   iscsiConnection
     iscsiConnectionAttributesTable
```

   Note that this module does not attempt to count everything that could
   be counted; it is designed to include only those counters that would
   be useful for identifying performance, security, and fault problems
   from a management station.

6.3. iscsiInstance

   The iscsiInstanceAttributesTable is the primary table of the iSCSI
   MIB module. Every table entry in this module is "owned" by exactly
   one iSCSI instance; all other table entries in the module include
   this table's index as their primary index.

   Most implementations will include just one iSCSI instance row in this
   table. However, this table exists to allow for multiple virtual
   instances. For example, many IP routing products now allow multiple
   virtual routers. The iSCSI MIB module has the same premise; a large
   system could be "partitioned" into multiple, distinct virtual
   systems.

   This also allows a single SNMP agent to proxy for multiple
   subsystems, perhaps a set of stackable devices, each of which has one
   or even more instances.

   The instance attributes include the iSCSI vendor and version, as well
   as information on the last target or initiator at the other end of a
   session that caused a session failure.

   The iscsiInstanceSsnErrorStatsTable augments the attributes table and
   provides statistics on session failures due to digest, connection, or
   iSCSI format errors.

6.4. iscsiPortal

   The iscsiPortalAttributesTable lists iSCSI portals that can be used
   to listen for connections to targets, to initiate connections to
   other targets, or to do both.

Each row in the table includes an IP address (either v4 or v6), and a
transport protocol (currently only TCP is defined). Each portal may
have additional attributes, depending on whether it is an initiator
portal, a target portal, or both. Initiator portals also have portal
tags; these are placed in corresponding rows in the
iscsiIntrPortalAttributesTable. Target portals have both portal tags
and ports (e.g., TCP listen ports if the transport protocol is TCP);
these are placed in rows in the iscsiTgtPortalAttributesTable.

Portal rows, along with their initiator and target portal
counterparts, may be created and destroyed through this MIB module by
a management station. Rows in the initiator and target portal tables
are created and destroyed automatically by the agent, whenever a row
is created or destroyed in the iscsiPortalAttributesTable, or if the
value of iscsiPortalRoles changes. Attributes in these tables may
then be modified by the management station if the agent
implementation allows.

When created by a management station, the iscsiPortalRoles attribute
is used to control row creation in the initiator and target portal
tables. Creating a row with the targetTypePortal bit set in
iscsiPortalRoles will cause the implementation to start listening for
iSCSI connections on the portal. Creating a row with the
initiatorTypePortal bit set in iscsiPortalRoles will not necessarily
cause connections to be established; it is left to the implementation
whether and when to make use of the portal. Both bits may be set if
the portal is to be used by both initiator and target nodes.

When deleting a row in the iscsiPortalAttributesTable, all connections
associated with that row are terminated. The implementation may
either terminate the connection immediately or request a clean
shutdown as specified in [RFC3720]. An outbound connection (when an
iscsiInitiatorPortal is deleted) matches the portal if its
iscsiCxnLocalAddr matches the iscsiPortalAddr. An inbound connection
(when an iscsiTargetPortal is deleted) matches the portal if its
iscsiCxnLocalAddr matches the iscsiPortalAddr, and its
iscsiCxnLocalPort matches the iscsiTargetPortalPort.

Individual objects within a row in this table may not be modified
while the row is active. For instance, changing the IP address of a
portal requires that the rows associated with the old IP address be
deleted, and new rows be created (in either order).

6.5. iscsiTargetPortal

   The iscsiTgtPortalAttributesTable contains target-specific attributes
   for iSCSI portals. Rows in this table use the same indices as their
   corresponding rows in the iscsiPortalAttributesTable, with the
   addition of iscsiNodeIndex.

   Rows in this table are created when the targetTypePortal bit is set
   in the iscsiPortalRoles attribute of the corresponding
   iscsiPortalAttributesEntry; they are destroyed when this bit is
   cleared.

   This table contains the TCP (or other protocol) port on which the
   socket is listening for incoming connections. It also includes a
   portal group aggregation tag; iSCSI target portals within this
   instance sharing the same tag can contain connections within the same
   session.

   This table will be empty for iSCSI instances that contain only
   initiators (such as iSCSI host driver implementations).

   Many implementations use the same target portal tag and protocol port
   for all nodes accessed via a portal. These implementations will
   create a single row in the iscsiTgtPortalAttributeTable, with an
   iscsiNodeIndex of zero.

   Other implementations do not use the same tag and/or port for all
   nodes; these implementations will create a row in this table for each
   (portal, node) tuple, using iscsiNodeIndex to designate the node for
   this portal tag and port.

6.6. iscsiInitiatorPortal

   The iscsiIntrPortalAttributesTable contains initiator-specific
   objects for iSCSI portals. Rows in this table use the same indices
   as their corresponding entries in the iscsiPortalAttributesTable. A
   row in this table is created when the initiatorTypePortal bit is set
   in the iscsiPortalRoles attribute; it is destroyed when this bit is
   cleared.

   Each row in this table contains a portal group aggregation tag,
   indicating which portals an initiator may use together within a
   multiple-connection session.

   This table will be empty for iSCSI instances that contain only
   targets (such as most iSCSI devices).

Many implementations use the same initiator tag for all nodes
accessing targets via a given portal. These implementations will
create a single row in iscsiIntrPortalAttributeTable, with an
iscsiNodeIndex of zero.

Other implementations do not use the same tag and/or port for all
nodes; these implementations will create a row in this table for each
(portal, node) tuple, using iscsiNodeIndex to designate the node for
this portal tag and port.

6.7. iscsiNode

The iscsiNodeAttributesTable contains a list of iSCSI nodes, each of
which may have an initiator role, a target role, or both.

This table contains the node's attributes that are common to both
roles, such as its iSCSI name and alias string. Attributes specific
to initiators or targets are available in the iscsiTarget and
iscsiInitiator objects. Each row in this table that can fulfill a
target role has a corresponding row in the iscsiTarget table; each
entry that fulfills an initiator role has a row in the iscsiInitiator
table. Nodes such as copy managers that can take on both roles have
a corresponding row in each table.

This table also contains the login negotiations preferences for this
node. These objects indicate the values this node will offer or
prefer in the operational negotiation phase of the login process.

For most implementations, each entry in the table also contains a
RowPointer to the transport table entry in the SCSI MIB module that
this iSCSI node represents. For implementations without a standard
SCSI layer above iSCSI, such as an iSCSI proxy or gateway, this
RowPointer can point to a row in an implementation-specific table
that this iSCSI node represents.

6.8. iscsiTarget

The iscsiTargetAttributesTable contains target-specific attributes
for iSCSI nodes. Each entry in this table uses the same index values
as its corresponding iscsiNode entry.

This table contains attributes used to indicate the last failure that
was (or should have been) sent as a notification.

This table is augmented by the iscsiTargetLoginStatsTable and the
iscsiTargetLogoutStatsTable, which count the numbers of normal and
abnormal logins and logouts to this target.

6.9. iscsiTgtAuthorization

   The iscsiTgtAuthAttributesTable contains an entry for each initiator
   identifier that will be allowed to access the target under which it
   appears. Each entry contains a RowPointer to a user identity in the
   IPS Authorization MIB module, which contains the name, address, and
   credential information necessary to authenticate the initiator.

6.10. iscsiInitiator

   The iscsiInitiatorAttributesTable contains a list of initiator-
   specific attributes for iSCSI nodes. Each entry in this table uses
   the same index values as its corresponding iscsiNode entry.

   Most implementations will include a single entry in this table,
   regardless of the number of physical interfaces the initiator may
   use.

   This table is augmented by the iscsiInitiatorLoginStatsTable and the
   iscsiInitiatorLogoutStatsTable, which count the numbers of normal and
   abnormal logins and logouts from this initiator.

6.11. iscsiIntrAuthorization

   The iscsiIntrAuthAttributesTable contains an entry for each target
   identifier to which the initiator is configured to establish a
   session.

   Each entry contains a RowPointer to a user identity in the IPS
   Authorization MIB module, which contains the name, address, and
   credential information necessary to identify (for discovery purposes)
   and authenticate the target.

6.12. iscsiSession

   The iscsiSessionAttributesTable contains a set of rows that list the
   sessions known to be existing locally for each node in each iSCSI
   instance.

   The session type for each session indicates whether the session is
   used for normal SCSI commands or for discovery using the SendTargets
   text command. Discovery sessions that do not belong to any
   particular node have a node index attribute of zero.

The session direction for each session indicates whether it is an
Inbound session or an Outbound session. Inbound sessions are from
some other initiator to the target node under which the session
appears. Outbound sessions are from the initiator node under which
the session appears to a target outside this iSCSI instance.

Many attributes may be negotiated when starting an iSCSI session.
Most of these attributes are included in the session object.

Some attributes, such as the integrity and authentication schemes,
have some standard values that can be extended by vendors to include
their own schemes. These contain an object identifier, rather than
the expected enumerated type, to allow these values to be extended by
other MIB modules, such as an enterprise MIB module.

The iscsiSessionStatsTable includes statistics related to
performance; it counts iSCSI data bytes and PDUs.

For implementations that support error recovery without terminating a
session, the iscsiSessionCxnErrorStatsTable contains counters for the
numbers of digest and connection errors that have occurred within the
session.

6.13. iscsiConnection

The iscsiConnectionAttributesTable contains a list of active
connections within each session. It contains the IP addresses and
TCP (or other protocol) ports of both the local and remote sides of
the connection. These may be used to locate other connection-related
information and statistics in the TCP MIB module [RFC4022].

The attributes table also contains a connection state. This state is
not meant to directly map to the state tables included within the
iSCSI specification; they are meant to be simplified, higher-level
definitions of connection state that provide information more useful
to a user or network manager.

No statistics are kept for connections.

6.14. IP Addresses and TCP Port Numbers

The IP addresses in this module are represented by two attributes,
one of type InetAddressType, and the other of type InetAddress.
These are taken from [RFC4001], which specifies how to support
addresses that may be either IPv4 or IPv6.

The TCP port numbers that appear in a few of the structures are
described as simply port numbers, with a protocol attribute
indicating whether they are TCP ports or something else. This will
allow the module to be compatible with iSCSI over transports other
than TCP in the future.

6.15. Descriptors: Using OIDs in Place of Enumerated Types

The iSCSI MIB module has a few attributes, namely, the digest method
attributes, where an enumerated type would work well, except that an
implementation may need to extend the attribute and add types of its
own. To make this work, this MIB module defines a set of object
identities within the iscsiDescriptors subtree. Each of these object
identities is basically an enumerated type.

Attributes that make use of these object identities have a value that
is an Object Identifier (OID) instead of an enumerated type. These
OIDs can indicate either the object identities defined in this module
or object identities defined elsewhere, such as in an enterprise MIB
module. Those implementations that add their own digest methods
should also define a corresponding object identity for each of these
methods within their own enterprise MIB module, and return its OID
whenever one of these attributes is using that method.

6.16. Notifications

Three notifications are provided. One is sent by an initiator
detecting a critical login failure, another is sent by a target
detecting a critical login failure, and the third is sent upon a
session being terminated due to an abnormal connection or digest
failure. Critical failures are defined as those that may expose
security-related problems that may require immediate action, such as
failures due to authentication, authorization, or negotiation
problems. Attributes in the initiator, target, and instance objects
provide the information necessary to send in the notification, such
as the initiator or target name and IP address at the other end that
may have caused the failure.

To avoid sending an excessive number of notifications due to multiple
errors counted, an SNMP agent implementing the iSCSI MIB module
SHOULD NOT send more than three iSCSI notifications in any 10-second
period.

The 3-in-10 rule was chosen because one notification every three
seconds was deemed often enough, but should two or three different
notifications happen at the same time, it would not be desirable to
suppress them. Three notifications in 10 seconds is a happy medium,

   where a short burst of notifications is allowed, without inundating
   the network and/or notification host with a large number of
   notifications.

7. MIB Definitions

ISCSI-MIB DEFINITIONS ::= BEGIN

    IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, OBJECT-IDENTITY, NOTIFICATION-TYPE,
    Unsigned32, Counter32, Counter64, Gauge32,
    mib-2
    FROM SNMPv2-SMI

    TEXTUAL-CONVENTION, TruthValue, RowPointer, TimeStamp, RowStatus,
    AutonomousType, StorageType
    FROM SNMPv2-TC

    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
    FROM SNMPv2-CONF

    SnmpAdminString
    FROM SNMP-FRAMEWORK-MIB -- RFC 3411

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

iscsiMibModule MODULE-IDENTITY
    LAST-UPDATED "200605220000Z" -- May 22, 2006
    ORGANIZATION "IETF IPS Working Group"
    CONTACT-INFO
    "
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     DESCRIPTION
         "The iSCSI Protocol MIB module.
          Copyright (C) The Internet Society (2006). This version of
          this MIB module is part of RFC 4544; see the RFC itself for
          full legal notices."
     REVISION "200605220000Z" -- May 22, 2006
     DESCRIPTION
         "Initial version of the iSCSI Protocol MIB module"

::= { mib-2 142 }

iscsiNotifications OBJECT IDENTIFIER ::= { iscsiMibModule 0 }
iscsiObjects   OBJECT IDENTIFIER ::= { iscsiMibModule 1 }
iscsiConformance   OBJECT IDENTIFIER ::= { iscsiMibModule 2 }
iscsiAdmin   OBJECT IDENTIFIER ::= { iscsiMibModule 3 }

-- Textual Conventions

IscsiTransportProtocol ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS   current
    DESCRIPTION
        "This data type is used to define the transport
        protocols that will carry iSCSI PDUs."
    REFERENCE
        "RFC791, RFC1700

        The presently known, officially delegated numbers
        can be found at:
        http://www.iana.org/assignments/protocol-numbers"

```
    SYNTAX         Unsigned32 (0..255)


IscsiDigestMethod ::= TEXTUAL-CONVENTION
    STATUS         current
    DESCRIPTION
        "This data type represents the methods possible
        for digest negotiation.
        none     - a placeholder for a secondary digest method
                    that means only the primary method can be
                    used.
        other    - a digest method other than those defined below.
        noDigest - does not support digests (will operate without
                    a digest (Note: implementations must support
                    digests to be compliant with the RFC3720).
        CRC32c   - require a CRC32C digest."
    REFERENCE
        "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
    SYNTAX         INTEGER {
                       none(1),
                       other(2),
                       noDigest(3),
                       crc32c(4)
                   }

IscsiName ::= TEXTUAL-CONVENTION
    DISPLAY-HINT   "223t"
    STATUS         current
    DESCRIPTION
        "This data type is used for objects whose value is an
        iSCSI name with the properties described in RFC 3720
        section 3.2.6.1, and encoded as specified in RFC 3720
        section 3.2.6.2.  A zero-length string indicates the
        absence of an iSCSI name."
    REFERENCE
        "RFC 3720, Section 3.2.6, iSCSI Names."
    SYNTAX         OCTET STRING (SIZE(0 | 16..223))


--*********************************************************************

iscsiDescriptors OBJECT IDENTIFIER ::= { iscsiAdmin 1 }

iscsiHeaderIntegrityTypes OBJECT IDENTIFIER ::= { iscsiDescriptors 1 }

iscsiHdrIntegrityNone OBJECT-IDENTITY
    STATUS     current
    DESCRIPTION
        "The authoritative identifier when no integrity
        scheme (for either the header or data) is being
```

         used."
    REFERENCE
         "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
::= { iscsiHeaderIntegrityTypes 1 }

iscsiHdrIntegrityCrc32c OBJECT-IDENTITY
    STATUS   current
    DESCRIPTION
         "The authoritative identifier when the integrity
         scheme (for either the header or data) is CRC32c."
    REFERENCE
         "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
::= { iscsiHeaderIntegrityTypes 2 }

iscsiDataIntegrityTypes OBJECT IDENTIFIER ::= { iscsiDescriptors 2 }

iscsiDataIntegrityNone OBJECT-IDENTITY
    STATUS   current
    DESCRIPTION
         "The authoritative identifier when no integrity
         scheme (for either the header or data) is being
         used."
    REFERENCE
         "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
::= { iscsiDataIntegrityTypes 1 }

iscsiDataIntegrityCrc32c OBJECT-IDENTITY
    STATUS   current
    DESCRIPTION
         "The authoritative identifier when the integrity
         scheme (for either the header or data) is CRC32c."
    REFERENCE
         "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
::= { iscsiDataIntegrityTypes 2 }

--**

iscsiInstance OBJECT IDENTIFIER ::= { iscsiObjects 1 }

-- Instance Attributes Table

iscsiInstanceAttributesTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IscsiInstanceAttributesEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
         "A list of iSCSI instances present on the system."
::= { iscsiInstance 1 }

```
iscsiInstanceAttributesEntry OBJECT-TYPE
    SYNTAX          IscsiInstanceAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular iSCSI instance."
    INDEX { iscsiInstIndex }
::= { iscsiInstanceAttributesTable 1 }

IscsiInstanceAttributesEntry ::= SEQUENCE {
    iscsiInstIndex               Unsigned32,
    iscsiInstDescr               SnmpAdminString,
    iscsiInstVersionMin          Unsigned32,
    iscsiInstVersionMax          Unsigned32,
    iscsiInstVendorID            SnmpAdminString,
    iscsiInstVendorVersion       SnmpAdminString,
    iscsiInstPortalNumber        Unsigned32,
    iscsiInstNodeNumber          Unsigned32,
    iscsiInstSessionNumber       Unsigned32,
    iscsiInstSsnFailures         Counter32,
    iscsiInstLastSsnFailureType  AutonomousType,
    iscsiInstLastSsnRmtNodeName  IscsiName,
    iscsiInstDiscontinuityTime   TimeStamp
}

iscsiInstIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (1..4294967295)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a particular
        iSCSI instance.  This index value must not be modified or
        reused by an agent unless a reboot has occurred.  An agent
        should attempt to keep this value persistent across reboots."
::= { iscsiInstanceAttributesEntry 1 }

iscsiInstDescr OBJECT-TYPE
    SYNTAX          SnmpAdminString
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A UTF-8 string, determined by the implementation to
        describe the iSCSI instance.  When only a single instance
        is present, this object may be set to the zero-length
        string; with multiple iSCSI instances, it may be used in
        an implementation-dependent manner to describe the purpose
        of the respective instance."
```

```
    ::= { iscsiInstanceAttributesEntry 2 }

    iscsiInstVersionMin OBJECT-TYPE
        SYNTAX         Unsigned32 (0..255)
        MAX-ACCESS     read-only
        STATUS         current
        DESCRIPTION
            "The minimum version number of the iSCSI specification
            such that this iSCSI instance supports this minimum
            value, the maximum value indicated by the corresponding
            instance in iscsiInstVersionMax, and all versions in
            between."
        REFERENCE
            "RFC 3720, Section 10.12, Login Request"
    ::= { iscsiInstanceAttributesEntry 3 }

    iscsiInstVersionMax OBJECT-TYPE
        SYNTAX         Unsigned32 (0..255)
        MAX-ACCESS     read-only
        STATUS         current
        DESCRIPTION
            "The maximum version number of the iSCSI specification
            such that this iSCSI instance supports this maximum
            value, the minimum value indicated by the corresponding
            instance in iscsiInstVersionMin, and all versions in
            between."
        REFERENCE
            "RFC 3720, Section 10.12, Login Request"
    ::= { iscsiInstanceAttributesEntry 4 }

    iscsiInstVendorID OBJECT-TYPE
        SYNTAX         SnmpAdminString
        MAX-ACCESS     read-only
        STATUS         current
        DESCRIPTION
            "A UTF-8 string describing the manufacturer of the
            implementation of this instance."
    ::= { iscsiInstanceAttributesEntry 5 }

    iscsiInstVendorVersion OBJECT-TYPE
        SYNTAX         SnmpAdminString
        MAX-ACCESS     read-only
        STATUS         current
        DESCRIPTION
            "A UTF-8 string set by the manufacturer describing the
            version of the implementation of this instance.  The
            format of this string is determined solely by the
            manufacturer, and is for informational purposes only.
```

        It is unrelated to the iSCSI specification version numbers."
    ::= { iscsiInstanceAttributesEntry 6 }

    iscsiInstPortalNumber OBJECT-TYPE
        SYNTAX   Unsigned32
        UNITS   "transport endpoints"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of rows in the iscsiPortalAttributesTable
            that are currently associated with this iSCSI instance."
    ::= { iscsiInstanceAttributesEntry 7 }

    iscsiInstNodeNumber OBJECT-TYPE
        SYNTAX   Unsigned32
        UNITS   "iSCSI nodes"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of rows in the iscsiNodeAttributesTable
            that are currently associated with this iSCSI instance."
    ::= { iscsiInstanceAttributesEntry 8 }

    iscsiInstSessionNumber OBJECT-TYPE
        SYNTAX   Unsigned32
        UNITS   "sessions"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The number of rows in the iscsiSessionAttributesTable
            that are currently associated with this iSCSI instance."
    ::= { iscsiInstanceAttributesEntry 9 }

    iscsiInstSsnFailures OBJECT-TYPE
        SYNTAX   Counter32
        UNITS   "sessions"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "This object counts the number of times a session belonging
            to this instance has been failed. If this counter has
            suffered a discontinuity, the time of the last discontinuity
            is indicated in iscsiInstDiscontinuityTime."
        REFERENCE
            "RFC 3720, Section 12.1, HeaderDigest and DataDigest"
    ::= { iscsiInstanceAttributesEntry 10 }

    iscsiInstLastSsnFailureType OBJECT-TYPE

    SYNTAX   AutonomousType
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The counter object in the iscsiInstSsnErrorStatsTable
        that was incremented when the last session failure occurred.

        If the reason for failure is not found in the
        iscsiInstSsnErrorStatsTable, the value { 0.0 } is
        used instead."
::= { iscsiInstanceAttributesEntry 11 }

iscsiInstLastSsnRmtNodeName OBJECT-TYPE
    SYNTAX   IscsiName
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The iSCSI name of the remote node from the failed
        session."
::= { iscsiInstanceAttributesEntry 12 }

iscsiInstDiscontinuityTime 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 this instance's counters
        suffered a discontinuity.

        If no such discontinuities have occurred since the last
        re-initialization of the local management subsystem,
        then this object contains a zero value."
::= { iscsiInstanceAttributesEntry 13 }

-- Instance Session Failure Stats Table

iscsiInstanceSsnErrorStatsTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IscsiInstanceSsnErrorStatsEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
        "Statistics regarding the occurrences of error types
        that result in a session failure."
::= { iscsiInstance 2 }

iscsiInstanceSsnErrorStatsEntry OBJECT-TYPE

```
     SYNTAX         IscsiInstanceSsnErrorStatsEntry
     MAX-ACCESS     not-accessible
     STATUS         current
     DESCRIPTION
         "An entry (row) containing management information applicable
         to a particular iSCSI instance."
     AUGMENTS { iscsiInstanceAttributesEntry }
 ::= { iscsiInstanceSsnErrorStatsTable 1 }

 IscsiInstanceSsnErrorStatsEntry ::= SEQUENCE {
     iscsiInstSsnDigestErrors       Counter32,
     iscsiInstSsnCxnTimeoutErrors   Counter32,
     iscsiInstSsnFormatErrors       Counter32
 }

 iscsiInstSsnDigestErrors OBJECT-TYPE
     SYNTAX         Counter32
     UNITS          "sessions"
     MAX-ACCESS     read-only
     STATUS         current
     DESCRIPTION
         "The count of sessions that were failed due to receipt of
         a PDU containing header or data digest errors.  If this
         counter has suffered a discontinuity, the time of the last
         discontinuity is indicated in iscsiInstDiscontinuityTime."
     REFERENCE
         "RFC 3720, Section 6.7, Digest Errors"
 ::= { iscsiInstanceSsnErrorStatsEntry 1 }

 iscsiInstSsnCxnTimeoutErrors OBJECT-TYPE
     SYNTAX         Counter32
     UNITS          "sessions"
     MAX-ACCESS     read-only
     STATUS         current
     DESCRIPTION
         "The count of sessions that were failed due to a sequence
         exceeding a time limit.  If this counter has suffered a
         discontinuity, the time of the last discontinuity
         is indicated in iscsiInstDiscontinuityTime."
     REFERENCE
         "RFC 3720, Section 6.4, Connection Timeout Management"
 ::= { iscsiInstanceSsnErrorStatsEntry 2 }

 iscsiInstSsnFormatErrors OBJECT-TYPE
     SYNTAX         Counter32
     UNITS          "sessions"
     MAX-ACCESS     read-only
     STATUS         current
```

     DESCRIPTION
         "The count of sessions that were failed due to receipt of
         a PDU that contained a format error. If this counter has
         suffered a discontinuity, the time of the last discontinuity
         is indicated in iscsiInstDiscontinuityTime."
     REFERENCE
         "RFC 3720, Section 6.6, Format Errors"
::= { iscsiInstanceSsnErrorStatsEntry 3 }

--**

iscsiPortal OBJECT IDENTIFIER ::= { iscsiObjects 2 }

-- Portal Attributes Table

iscsiPortalAttributesTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IscsiPortalAttributesEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
        "A list of transport endpoints (using TCP or another transport
        protocol) used by this iSCSI instance. An iSCSI instance may
        use a portal to listen for incoming connections to its targets,
        to initiate connections to other targets, or both."
::= { iscsiPortal 1 }

iscsiPortalAttributesEntry OBJECT-TYPE
    SYNTAX   IscsiPortalAttributesEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular portal instance."
    INDEX { iscsiInstIndex, iscsiPortalIndex }
::= { iscsiPortalAttributesTable 1 }

IscsiPortalAttributesEntry ::= SEQUENCE {
    iscsiPortalIndex   Unsigned32,
    iscsiPortalRowStatus   RowStatus,
    iscsiPortalRoles   BITS,
    iscsiPortalAddrType   InetAddressType,
    iscsiPortalAddr   InetAddress,
    iscsiPortalProtocol   IscsiTransportProtocol,
    iscsiPortalMaxRecvDataSegLength Unsigned32,
    iscsiPortalPrimaryHdrDigest   IscsiDigestMethod,
    iscsiPortalPrimaryDataDigest   IscsiDigestMethod,
    iscsiPortalSecondaryHdrDigest IscsiDigestMethod,
    iscsiPortalSecondaryDataDigest IscsiDigestMethod,

```
    iscsiPortalRecvMarker          TruthValue,
    iscsiPortalStorageType         StorageType
}

iscsiPortalIndex OBJECT-TYPE
    SYNTAX        Unsigned32 (1..4294967295)
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a particular
        transport endpoint within this iSCSI instance.  This index
        value must not be modified or reused by an agent unless a
        reboot has occurred.  An agent should attempt to keep this
        value persistent across reboots."
::= { iscsiPortalAttributesEntry 1 }

iscsiPortalRowStatus OBJECT-TYPE
    SYNTAX        RowStatus
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This field allows entries to be dynamically added and
        removed from this table via SNMP.  When adding a row to
        this table, all non-Index/RowStatus objects must be set.
        When the value of this object is 'active', the values of
        the other objects in this table cannot be changed.
        Rows may be discarded using RowStatus.

        Note that creating a row in this table will typically
        cause the agent to create one or more rows in
        iscsiTgtPortalAttributesTable and/or
        iscsiIntrPortalAttributesTable."
::= { iscsiPortalAttributesEntry 2 }

iscsiPortalRoles OBJECT-TYPE
    SYNTAX        BITS {
                     targetTypePortal(0),
                     initiatorTypePortal(1)
                  }
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "A portal can operate in one or both of two roles:
        as a target portal and/or an initiator portal.  If
        the portal will operate in both roles, both bits
        must be set.

        This object will define a corresponding row that
```

        will exist or must be created in the
        iscsiTgtPortalAttributesTable, the
        iscsiIntrPortalAttributesTable or both. If the
        targetTypePortal bit is set, one or more corresponding
        iscsiTgtPortalAttributesEntry rows will be found or
        created. If the initiatorTypePortal bit is set,
        one or more corresponding iscsiIntrPortalAttributesEntry
        rows will be found or created. If both bits are set, one
        or more corresponding rows will be found or created in
        one of the above tables."
::= { iscsiPortalAttributesEntry 3 }

iscsiPortalAddrType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS   read-create
    STATUS   current
    DESCRIPTION
        "The type of Internet Network Address contained in the
        corresponding instance of the iscsiPortalAddr."
    DEFVAL   { ipv4 }
::= { iscsiPortalAttributesEntry 4 }

iscsiPortalAddr OBJECT-TYPE
    SYNTAX   InetAddress
    MAX-ACCESS   read-create
    STATUS   current
    DESCRIPTION
        "The portal's Internet Network Address, of the type
        specified by the object iscsiPortalAddrType. If
        iscsiPortalAddrType has the value 'dns', this address
        gets resolved to an IP address whenever a new iSCSI
        connection is established using this portal."
::= { iscsiPortalAttributesEntry 5 }

iscsiPortalProtocol OBJECT-TYPE
    SYNTAX   IscsiTransportProtocol
    MAX-ACCESS   read-create
    STATUS   current
    DESCRIPTION
        "The portal's transport protocol."
    DEFVAL   { 6 } -- TCP
::= { iscsiPortalAttributesEntry 6 }

iscsiPortalMaxRecvDataSegLength OBJECT-TYPE
    SYNTAX   Unsigned32 (512..16777215)
    UNITS   "bytes"
    MAX-ACCESS   read-create
    STATUS   current

        DESCRIPTION
            "The maximum PDU length this portal can receive.
            This may be constrained by hardware characteristics
            and individual implementations may choose not to
            allow this object to be changed."
        REFERENCE
            "RFC 3720, Section 12.12, MaxRecvDataSegmentLength"
        DEFVAL { 8192 }
    ::= { iscsiPortalAttributesEntry 7 }

    iscsiPortalPrimaryHdrDigest OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-create
        STATUS   current
        DESCRIPTION
            "The preferred header digest for this portal."
        DEFVAL   { crc32c }
    ::= { iscsiPortalAttributesEntry 8 }

    iscsiPortalPrimaryDataDigest OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-create
        STATUS   current
        DESCRIPTION
            "The preferred data digest method for this portal."
        DEFVAL   { crc32c }
    ::= { iscsiPortalAttributesEntry 9 }

    iscsiPortalSecondaryHdrDigest OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-create
        STATUS   current
        DESCRIPTION
            "An alternate header digest preference for this portal."
        DEFVAL   { noDigest }
    ::= { iscsiPortalAttributesEntry 10 }

    iscsiPortalSecondaryDataDigest OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-create
        STATUS   current
        DESCRIPTION
            "An alternate data digest preference for this portal."
        DEFVAL   { noDigest }
    ::= { iscsiPortalAttributesEntry 11 }

    iscsiPortalRecvMarker OBJECT-TYPE
        SYNTAX   TruthValue

```
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
        "This object indicates whether or not this portal will
        request markers in its incoming data stream."
    REFERENCE
        "RFC 3720, Appendix A."
    DEFVAL         { false }
::= { iscsiPortalAttributesEntry 12 }

iscsiPortalStorageType OBJECT-TYPE
    SYNTAX         StorageType
    MAX-ACCESS     read-create
    STATUS         current
    DESCRIPTION
        "The storage type for this row.  Rows in this table that were
         created through an external process may have a storage type of
         readOnly or permanent.

         Conceptual rows having the value 'permanent' need not
         allow write access to any columnar objects in the row."
    DEFVAL         { nonVolatile }
::= { iscsiPortalAttributesEntry 13 }

--**********************************************************************
iscsiTargetPortal OBJECT IDENTIFIER ::= { iscsiObjects 3 }

-- Target Portal Attributes Table

iscsiTgtPortalAttributesTable OBJECT-TYPE
    SYNTAX         SEQUENCE OF IscsiTgtPortalAttributesEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
        "A list of transport endpoints (using TCP or another transport
        protocol) on which this iSCSI instance listens for incoming
        connections to its targets."
::= { iscsiTargetPortal 1 }

iscsiTgtPortalAttributesEntry OBJECT-TYPE
    SYNTAX         IscsiTgtPortalAttributesEntry
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular portal instance that is used to listen for
        incoming connections to local targets.  One or more rows in
        this table is populated by the agent for each
```

```
        iscsiPortalAttributesEntry row that has the bit
        targetTypePortal set in its iscsiPortalRoles column."
    INDEX { iscsiInstIndex, iscsiPortalIndex,
          iscsiTgtPortalNodeIndexOrZero   }
::= { iscsiTgtPortalAttributesTable 1 }


IscsiTgtPortalAttributesEntry ::= SEQUENCE {
    iscsiTgtPortalNodeIndexOrZero  Unsigned32,
    iscsiTgtPortalPort             InetPortNumber,
    iscsiTgtPortalTag              Unsigned32
}

iscsiTgtPortalNodeIndexOrZero OBJECT-TYPE
    SYNTAX         Unsigned32 (0..4294967295)
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a
        particular node within an iSCSI instance present
        on the local system.

        For implementations where each {portal, node} tuple
        can have a different portal tag, this value will
        map to the iscsiNodeIndex.

        For implementations where the portal tag is the
        same for a given portal regardless of which node
        is using the portal, the value 0 (zero) is used."
::= { iscsiTgtPortalAttributesEntry 1 }


iscsiTgtPortalPort OBJECT-TYPE
    SYNTAX         InetPortNumber (1..65535)
    MAX-ACCESS     read-write
    STATUS         current
    DESCRIPTION
        "The portal's transport protocol port number on which the
        portal listens for incoming iSCSI connections when the
        portal is used as a target portal.  This object's storage
        type is specified in iscsiPortalStorageType."
::= { iscsiTgtPortalAttributesEntry 2 }


iscsiTgtPortalTag OBJECT-TYPE
    SYNTAX         Unsigned32 (1..65535)
    MAX-ACCESS     read-write
    STATUS         current
    DESCRIPTION
        "The portal's aggregation tag when the portal is used as
        a target portal.  Multiple-connection sessions may
```

         be aggregated over portals sharing an identical
         aggregation tag. This object's storage type is
         specified in iscsiPortalStorageType."
    REFERENCE
         "RFC 3720, Section 3.4.1, iSCSI Architectural Model"
::= { iscsiTgtPortalAttributesEntry 3 }

--**

iscsiInitiatorPortal OBJECT IDENTIFIER ::= { iscsiObjects 4 }

-- Initiator Portal Attributes Table

iscsiIntrPortalAttributesTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IscsiIntrPortalAttributesEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
         "A list of Internet Network Addresses (using TCP or another
         transport protocol) from which this iSCSI instance may
         initiate connections to other targets."
::= { iscsiInitiatorPortal 1 }

iscsiIntrPortalAttributesEntry OBJECT-TYPE
    SYNTAX   IscsiIntrPortalAttributesEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
         "An entry (row) containing management information applicable
         to a particular portal instance that is used to initiate
         connections to iSCSI targets. One or more rows in
         this table is populated by the agent for each
         iscsiPortalAttributesEntry row that has the bit
         initiatorTypePortal set in its iscsiPortalRoles column."
    INDEX { iscsiInstIndex, iscsiPortalIndex,
            iscsiIntrPortalNodeIndexOrZero }
::= { iscsiIntrPortalAttributesTable 1 }

IscsiIntrPortalAttributesEntry ::= SEQUENCE {
    iscsiIntrPortalNodeIndexOrZero Unsigned32,
    iscsiIntrPortalTag   Unsigned32
}

iscsiIntrPortalNodeIndexOrZero OBJECT-TYPE
    SYNTAX   Unsigned32 (0..4294967295)
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION

```
        "An arbitrary integer used to uniquely identify a
        particular node within an iSCSI instance present
        on the local system.

        For implementations where each {portal, node} tuple
        can have a different portal tag, this value will
        map to the iscsiNodeIndex.

        For implementations where the portal tag is the
        same for a given portal regardless of which node
        is using the portal, the value 0 (zero) is used."
::= { iscsiIntrPortalAttributesEntry 1 }

iscsiIntrPortalTag OBJECT-TYPE
    SYNTAX        Unsigned32 (1..65535)
    MAX-ACCESS    read-write
    STATUS        current
    DESCRIPTION
        "The portal's aggregation tag when the portal is used as
        an initiator portal.  Multiple-connection sessions may
        be aggregated over portals sharing an identical
        aggregation tag.  This object's storage type is
        specified in iscsiPortalStorageType."
    REFERENCE
        "RFC 3720, Section 3.4.1, iSCSI Architectural Model"
::= { iscsiIntrPortalAttributesEntry 2 }

--********************************************************************

iscsiNode OBJECT IDENTIFIER ::= { iscsiObjects 5 }

-- Node Attributes Table

iscsiNodeAttributesTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF IscsiNodeAttributesEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "A list of iSCSI nodes belonging to each iSCSI instance
        present on the local system.  An iSCSI node can act as
        an initiator, a target, or both."
::= { iscsiNode 1 }

iscsiNodeAttributesEntry OBJECT-TYPE
    SYNTAX        IscsiNodeAttributesEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
```

```
        "An entry (row) containing management information applicable
        to a particular iSCSI node."
    INDEX { iscsiInstIndex, iscsiNodeIndex }
::= { iscsiNodeAttributesTable 1 }


IscsiNodeAttributesEntry ::= SEQUENCE {
    iscsiNodeIndex                 Unsigned32,
    iscsiNodeName                  IscsiName,
    iscsiNodeAlias                 SnmpAdminString,
    iscsiNodeRoles                 BITS,
    iscsiNodeTransportType         RowPointer,
    iscsiNodeInitialR2T            TruthValue,
    iscsiNodeImmediateData         TruthValue,
    iscsiNodeMaxOutstandingR2T     Unsigned32,
    iscsiNodeFirstBurstLength      Unsigned32,
    iscsiNodeMaxBurstLength        Unsigned32,
    iscsiNodeMaxConnections        Unsigned32,
    iscsiNodeDataSequenceInOrder   TruthValue,
    iscsiNodeDataPDUInOrder        TruthValue,
    iscsiNodeDefaultTime2Wait      Unsigned32,
    iscsiNodeDefaultTime2Retain    Unsigned32,
    iscsiNodeErrorRecoveryLevel    Unsigned32,
    iscsiNodeDiscontinuityTime     TimeStamp,
    iscsiNodeStorageType           StorageType
}


iscsiNodeIndex OBJECT-TYPE
    SYNTAX        Unsigned32 (1..4294967295)
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a particular
        node within an iSCSI instance.  This index value must not be
        modified or reused by an agent unless a reboot has occurred.
        An agent should attempt to keep this value persistent across
        reboots."
::= { iscsiNodeAttributesEntry 1 }


iscsiNodeName OBJECT-TYPE
    SYNTAX        IscsiName
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This node's iSCSI name, which is independent of the location
        of the node, and can be resolved into a set of addresses
        through various discovery services."
::= { iscsiNodeAttributesEntry 2 }
```

iscsiNodeAlias OBJECT-TYPE
    SYNTAX   SnmpAdminString
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "A character string that is a human-readable name or
        description of the iSCSI node. If configured, this alias
        may be communicated to the initiator or target node at
        the remote end of the connection during a Login Request
        or Response message. This string is not used as an
        identifier, but can be displayed by the system's user
        interface in a list of initiators and/or targets to
        which it is connected.

        If no alias exists, the value is a zero-length string."
    REFERENCE
        "RFC 3720, Section 12.6, TargetAlias, 12.7, InitiatorAlias"
::= { iscsiNodeAttributesEntry 3 }

iscsiNodeRoles OBJECT-TYPE
    SYNTAX   BITS {
                        targetTypeNode(0),
                        initiatorTypeNode(1)
                    }
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "A node can operate in one or both of two roles:
        a target role and/or an initiator role. If the node
        will operate in both roles, both bits must be set.

        This object will also define the corresponding rows that
        will exist in the iscsiTargetAttributesTable, the
        iscsiInitiatorAttributesTable or both. If the
        targetTypeNode bit is set, there will be a corresponding
        iscsiTargetAttributesEntry. If the initiatorTypeNode bit
        is set, there will be a corresponding
        iscsiInitiatorAttributesEntry. If both bits are set,
        there will be a corresponding iscsiTgtPortalAttributesEntry
        and iscsiPortalAttributesEntry."
::= { iscsiNodeAttributesEntry 4 }

iscsiNodeTransportType OBJECT-TYPE
    SYNTAX   RowPointer
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "A pointer to the corresponding row in the appropriate

         table for this SCSI transport, thereby allowing management
         stations to locate the SCSI-level device that is represented
         by this iscsiNode. For example, it will usually point to the
         corresponding scsiTrnspt object in the SCSI MIB module.

         If no corresponding row exists, the value 0.0 must be
         used to indicate this."
     REFERENCE
         "SCSI-MIB"
::= { iscsiNodeAttributesEntry 5 }

iscsiNodeInitialR2T OBJECT-TYPE
     SYNTAX   TruthValue
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
         "This object indicates the InitialR2T preference for this
         node:
         true = YES,
         false = will try to negotiate NO, will accept YES "
     REFERENCE
         "RFC 3720, Section 12.10, InitialR2T"
::= { iscsiNodeAttributesEntry 6 }

iscsiNodeImmediateData OBJECT-TYPE
     SYNTAX   TruthValue
     MAX-ACCESS   read-write
     STATUS   current
     DESCRIPTION
         "This object indicates ImmediateData preference for this
         node:
         true = YES (but will accept NO),
         false = NO "
     REFERENCE
         "RFC 3720, Section 12.11, ImmediateData"
     DEFVAL   { true }
::= { iscsiNodeAttributesEntry 7 }

iscsiNodeMaxOutstandingR2T OBJECT-TYPE
     SYNTAX   Unsigned32 (1..65535)
     UNITS   "R2Ts"
     MAX-ACCESS   read-write
     STATUS   current
     DESCRIPTION
         "Maximum number of outstanding requests-to-transmit (R2Ts)
         allowed per iSCSI task."
     REFERENCE
         "RFC 3720, Section 12.17, MaxOutstandingR2T"

```
    DEFVAL          { 1 }
::= { iscsiNodeAttributesEntry 8 }


iscsiNodeFirstBurstLength OBJECT-TYPE
    SYNTAX          Unsigned32 (512..16777215)
    UNITS           "bytes"
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The maximum length (bytes) supported for unsolicited data
        to/from this node."
    REFERENCE
        "RFC 3720, Section 12.14, FirstBurstLength"
    DEFVAL          { 65536 }
::= { iscsiNodeAttributesEntry 9 }


iscsiNodeMaxBurstLength OBJECT-TYPE
    SYNTAX          Unsigned32 (512..16777215)
    UNITS           "bytes"
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
         "The maximum number of bytes that can be sent within
         a single sequence of Data-In or Data-Out PDUs."
    REFERENCE
        "RFC 3720, Section 12.13, MaxBurstLength"
    DEFVAL          { 262144 }
::= { iscsiNodeAttributesEntry 10 }


iscsiNodeMaxConnections OBJECT-TYPE
    SYNTAX          Unsigned32 (1..65535)
    UNITS           "connections"
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The maximum number of connections allowed in each
        session to and/or from this node."
    REFERENCE
        "RFC 3720, Section 12.2, MaxConnections"
    DEFVAL          { 1 }
::= { iscsiNodeAttributesEntry 11 }


iscsiNodeDataSequenceInOrder OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The DataSequenceInOrder preference of this node.
```

```
        False (=No) indicates that iSCSI data PDU sequences may
        be transferred in any order.  True (=Yes) indicates that
        data PDU sequences must be transferred using
        continuously increasing offsets, except during
        error recovery."
    REFERENCE
        "RFC 3720, Section 12.19, DataSequenceInOrder"
    DEFVAL          { true }
::= { iscsiNodeAttributesEntry 12 }


iscsiNodeDataPDUInOrder OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The DataPDUInOrder preference of this node.
        False (=No) indicates that iSCSI data PDUs within sequences
        may be in any order.  True (=Yes) indicates that data PDUs
        within sequences must be at continuously increasing
        addresses, with no gaps or overlay between PDUs."
    REFERENCE
        "RFC 3720, Section 12.18, DataPDUInOrder"
    DEFVAL          { true }
::= { iscsiNodeAttributesEntry 13 }


iscsiNodeDefaultTime2Wait OBJECT-TYPE
    SYNTAX          Unsigned32 (0..3600)
    UNITS           "seconds"
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The DefaultTime2Wait preference of this node.  This is the
        minimum time, in seconds, to wait before attempting an
        explicit/implicit logout or active iSCSI task reassignment
        after an unexpected connection termination or a connection
        reset."
    REFERENCE
        "RFC 3720, Section 12.15, DefaultTime2Wait"
    DEFVAL          { 2 }
::= { iscsiNodeAttributesEntry 14 }


iscsiNodeDefaultTime2Retain OBJECT-TYPE
    SYNTAX          Unsigned32 (0..3600)
    UNITS           "seconds"
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "The DefaultTime2Retain preference of this node.  This is
```

        the maximum time, in seconds after an initial wait
        (Time2Wait), before which an active iSCSI task reassignment
        is still possible after an unexpected connection termination
        or a connection reset."
    REFERENCE
        "RFC 3720, Section 12.16, DefaultTime2Retain"
    DEFVAL   { 20 }
::= { iscsiNodeAttributesEntry 15 }

iscsiNodeErrorRecoveryLevel OBJECT-TYPE
    SYNTAX   Unsigned32 (0..255)
    MAX-ACCESS   read-write
    STATUS   current
    DESCRIPTION
        "The ErrorRecoveryLevel preference of this node.
        Currently, only 0-2 are valid.

        This object is designed to accommodate future error recovery
        levels.

        Higher error recovery levels imply support in addition to
        support for the lower error level functions. In other words,
        error level 2 implies support for levels 0-1, since those
        functions are subsets of error level 2."
    REFERENCE
        "RFC 3720, Section 12.20, ErrorRecoveryLevel"
    DEFVAL   { 0 }
::= { iscsiNodeAttributesEntry 16 }

iscsiNodeDiscontinuityTime 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 this node's counters
        suffered a discontinuity.

        If no such discontinuities have occurred since the last
        re-initialization of the local management subsystem,
        then this object contains a zero value."
::= { iscsiNodeAttributesEntry 17 }

iscsiNodeStorageType OBJECT-TYPE
    SYNTAX   StorageType
    MAX-ACCESS   read-write
    STATUS   current
    DESCRIPTION

                "The storage type for all read-write objects within this
                row. Rows in this table are always created via an
                external process, and may have a storage type of readOnly
                or permanent. Conceptual rows having the value 'permanent'
                need not allow write access to any columnar objects in
                the row.

                If this object has the value 'volatile', modifications
                to read-write objects in this row are not persistent
                across reboots. If this object has the value
                'nonVolatile', modifications to objects in this row
                are persistent.

                An implementation may choose to allow this object
                to be set to either 'nonVolatile' or 'volatile',
                allowing the management application to choose this
                behavior."
        DEFVAL   { volatile }
    ::= { iscsiNodeAttributesEntry 18 }

    --**

    iscsiTarget OBJECT IDENTIFIER ::= { iscsiObjects 6 }

    -- Target Attributes Table

    iscsiTargetAttributesTable OBJECT-TYPE
        SYNTAX   SEQUENCE OF IscsiTargetAttributesEntry
        MAX-ACCESS   not-accessible
        STATUS   current
        DESCRIPTION
            "A list of iSCSI nodes that can take on a target role,
            belonging to each iSCSI instance present on the local
            system."
    ::= { iscsiTarget 1 }

    iscsiTargetAttributesEntry OBJECT-TYPE
        SYNTAX   IscsiTargetAttributesEntry
        MAX-ACCESS   not-accessible
        STATUS   current
        DESCRIPTION
            "An entry (row) containing management information applicable
            to a particular node that can take on a target role."
        INDEX { iscsiInstIndex, iscsiNodeIndex }
    ::= { iscsiTargetAttributesTable 1 }

    IscsiTargetAttributesEntry ::= SEQUENCE {
        iscsiTgtLoginFailures   Counter32,

```
    iscsiTgtLastFailureTime         TimeStamp,
    iscsiTgtLastFailureType         AutonomousType,
    iscsiTgtLastIntrFailureName     IscsiName,
    iscsiTgtLastIntrFailureAddrType InetAddressType,
    iscsiTgtLastIntrFailureAddr     InetAddress
}

iscsiTgtLoginFailures OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "failed login attempts"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "This object counts the number of times a login attempt to this
        local target has failed.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetAttributesEntry 1 }

iscsiTgtLastFailureTime OBJECT-TYPE
    SYNTAX        TimeStamp
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The timestamp of the most recent failure of a login attempt
        to this target.  A value of zero indicates that no such
        failures have occurred since the last system boot."
::= { iscsiTargetAttributesEntry 2 }

iscsiTgtLastFailureType  OBJECT-TYPE
    SYNTAX        AutonomousType
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The type of the most recent failure of a login attempt
        to this target, represented as the OID of the counter
        object in iscsiTargetLoginStatsTable for which the
        relevant instance was incremented.  A value of 0.0
        indicates a type that is not represented by any of
        the counters in iscsiTargetLoginStatsTable."
::= { iscsiTargetAttributesEntry 3 }

iscsiTgtLastIntrFailureName  OBJECT-TYPE
    SYNTAX        IscsiName
    MAX-ACCESS    read-only
    STATUS        current
```

        DESCRIPTION
            "The iSCSI name of the initiator that failed the last
            login attempt."
    ::= { iscsiTargetAttributesEntry 4 }

    iscsiTgtLastIntrFailureAddrType OBJECT-TYPE
        SYNTAX   InetAddressType
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The type of Internet Network Address contained in the
            corresponding instance of the iscsiTgtLastIntrFailureAddr.
            The value 'dns' is not allowed."
    ::= { iscsiTargetAttributesEntry 5 }

    iscsiTgtLastIntrFailureAddr OBJECT-TYPE
        SYNTAX   InetAddress
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "An Internet Network Address, of the type specified by
            the object iscsiTgtLastIntrFailureAddrType, giving the
            host address of the initiator that failed the last login
            attempt."
    ::= { iscsiTargetAttributesEntry 6 }

    -- Target Login Stats Table

    iscsiTargetLoginStatsTable OBJECT-TYPE
        SYNTAX   SEQUENCE OF IscsiTargetLoginStatsEntry
        MAX-ACCESS   not-accessible
        STATUS   current
        DESCRIPTION
            "A table of counters that keep a record of the results
            of initiators' login attempts to this target."
    ::= { iscsiTarget 2 }

    iscsiTargetLoginStatsEntry OBJECT-TYPE
        SYNTAX   IscsiTargetLoginStatsEntry
        MAX-ACCESS   not-accessible
        STATUS   current
        DESCRIPTION
            "An entry (row) containing counters for each result of
            a login attempt to this target."
        AUGMENTS { iscsiTargetAttributesEntry }
    ::= { iscsiTargetLoginStatsTable 1 }

    IscsiTargetLoginStatsEntry ::= SEQUENCE {

```
    iscsiTgtLoginAccepts          Counter32,
    iscsiTgtLoginOtherFails       Counter32,
    iscsiTgtLoginRedirects        Counter32,
    iscsiTgtLoginAuthorizeFails   Counter32,
    iscsiTgtLoginAuthenticateFails Counter32,
    iscsiTgtLoginNegotiateFails   Counter32
}

iscsiTgtLoginAccepts OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "successful logins"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The count of Login Response PDUs with status
        0x0000, Accept Login, transmitted by this
        target.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetLoginStatsEntry 1 }

iscsiTgtLoginOtherFails OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "failed logins"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The number of Login Response PDUs that were transmitted
        by this target and that were not counted by any other
        object in the row.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetLoginStatsEntry 2 }

iscsiTgtLoginRedirects OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "redirected logins"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The count of Login Response PDUs with status class 0x01,
        Redirection, transmitted by this target.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
```

```
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetLoginStatsEntry 3 }


iscsiTgtLoginAuthorizeFails OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "failed logins"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Login Response PDUs with status 0x0202,
        Forbidden Target, transmitted by this target.

        If this counter is incremented, an iscsiTgtLoginFailure
        notification should be generated.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetLoginStatsEntry 4 }


iscsiTgtLoginAuthenticateFails OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "failed logins"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Login Response PDUs with status 0x0201,
        Authentication Failed, transmitted by this target.

        If this counter is incremented, an iscsiTgtLoginFailure
        notification should be generated.

        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiTargetLoginStatsEntry 5 }


iscsiTgtLoginNegotiateFails OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "failed logins"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The number of times a target has effectively refused a
        login because the parameter negotiation failed.
```

```
        If this counter is incremented, an iscsiTgtLoginFailure
        notification should be generated.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
::= { iscsiTargetLoginStatsEntry 6 }


-- Target Logout Stats Table

iscsiTargetLogoutStatsTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF IscsiTargetLogoutStatsEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "When a target receives a Logout command, it responds
        with a Logout Response that carries a status code.
        This table contains counters for both normal and
        abnormal logout requests received by this target."
::= { iscsiTarget 3 }

iscsiTargetLogoutStatsEntry OBJECT-TYPE
    SYNTAX        IscsiTargetLogoutStatsEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "An entry (row) containing counters of Logout Response
        PDUs that were received by this target."
    AUGMENTS { iscsiTargetAttributesEntry }
::= { iscsiTargetLogoutStatsTable 1 }

IscsiTargetLogoutStatsEntry ::= SEQUENCE {
    iscsiTgtLogoutNormals        Counter32,
    iscsiTgtLogoutOthers         Counter32
}

iscsiTgtLogoutNormals OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "normal logouts"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The count of Logout Command PDUs received by this target,
        with reason code 0 (closes the session).
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.14.1, Reason Code"
::= { iscsiTargetLogoutStatsEntry 1 }
```

```
iscsiTgtLogoutOthers OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "abnormal logouts"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Logout Command PDUs received by this target,
        with any reason code other than 0.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.14.1, Reason Code"
::= { iscsiTargetLogoutStatsEntry 2 }

--********************************************************************

iscsiTgtAuthorization OBJECT IDENTIFIER ::= { iscsiObjects 7 }

-- Target Authorization Attributes Table

iscsiTgtAuthAttributesTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF IscsiTgtAuthAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A list of initiator identities that are authorized to
        access each target node within each iSCSI instance
        present on the local system."
::= { iscsiTgtAuthorization 1 }

iscsiTgtAuthAttributesEntry OBJECT-TYPE
    SYNTAX          IscsiTgtAuthAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing management information
        applicable to a particular target node's authorized
        initiator identity."
    INDEX { iscsiInstIndex, iscsiNodeIndex, iscsiTgtAuthIndex }
::= { iscsiTgtAuthAttributesTable 1 }

IscsiTgtAuthAttributesEntry ::= SEQUENCE {
    iscsiTgtAuthIndex               Unsigned32,
    iscsiTgtAuthRowStatus           RowStatus,
    iscsiTgtAuthIdentity            RowPointer,
    iscsiTgtAuthStorageType         StorageType
}
```

```
iscsiTgtAuthIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (1..4294967295)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a particular
        target's authorized initiator identity within an iSCSI
        instance present on the local system.  This index value must
        not be modified or reused by an agent unless a reboot has
        occurred.  An agent should attempt to keep this value
        persistent across reboots."
::= { iscsiTgtAuthAttributesEntry 1 }

iscsiTgtAuthRowStatus OBJECT-TYPE
    SYNTAX          RowStatus
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This field allows entries to be dynamically added and
        removed from this table via SNMP.  When adding a row to
        this table, all non-Index/RowStatus objects must be set.
        When the value of this object is 'active', the values of
        the other objects in this table cannot be changed.
        Rows may be discarded using RowStatus."
::= { iscsiTgtAuthAttributesEntry 2 }

iscsiTgtAuthIdentity OBJECT-TYPE
    SYNTAX          RowPointer
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "A pointer to the corresponding user entry in the IPS-AUTH
        MIB module that will be allowed to access this iSCSI target."
    REFERENCE
        "IPS-AUTH MIB, RFC 4545"
::= { iscsiTgtAuthAttributesEntry 3 }

iscsiTgtAuthStorageType OBJECT-TYPE
    SYNTAX          StorageType
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "The storage type for this row.  Rows in this table that were
         created through an external process may have a storage type of
         readOnly or permanent.

         Conceptual rows having the value 'permanent' need not
         allow write access to any columnar objects in the row."
```

```
    DEFVAL          { nonVolatile }
::= { iscsiTgtAuthAttributesEntry 4 }


--**********************************************************************


iscsiInitiator OBJECT IDENTIFIER ::= { iscsiObjects 8 }

-- Initiator Attributes Table

iscsiInitiatorAttributesTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF IscsiInitiatorAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A list of iSCSI nodes that can take on an initiator
        role, belonging to each iSCSI instance present on
        the local system."
::= { iscsiInitiator 1 }

iscsiInitiatorAttributesEntry OBJECT-TYPE
    SYNTAX          IscsiInitiatorAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing management information
        applicable to a particular iSCSI node that has
        initiator capabilities."
    INDEX  { iscsiInstIndex, iscsiNodeIndex }
::= { iscsiInitiatorAttributesTable 1 }

IscsiInitiatorAttributesEntry ::= SEQUENCE {
    iscsiIntrLoginFailures        Counter32,
    iscsiIntrLastFailureTime      TimeStamp,
    iscsiIntrLastFailureType      AutonomousType,
    iscsiIntrLastTgtFailureName   IscsiName,
    iscsiIntrLastTgtFailureAddrType InetAddressType,
    iscsiIntrLastTgtFailureAddr   InetAddress
}

iscsiIntrLoginFailures OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "failed logins"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object counts the number of times a login attempt from
        this local initiator has failed.
        If this counter has suffered a discontinuity, the time of the
```

          last discontinuity is indicated in iscsiNodeDiscontinuityTime."
     REFERENCE
          "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorAttributesEntry 1 }

iscsiIntrLastFailureTime OBJECT-TYPE
     SYNTAX   TimeStamp
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
          "The timestamp of the most recent failure of a login attempt
          from this initiator. A value of zero indicates that no such
          failures have occurred since the last system boot."
::= { iscsiInitiatorAttributesEntry 2 }

iscsiIntrLastFailureType OBJECT-TYPE
     SYNTAX   AutonomousType
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
          "The type of the most recent failure of a login attempt
          from this initiator, represented as the OID of the counter
          object in iscsiInitiatorLoginStatsTable for which the
          relevant instance was incremented. A value of 0.0
          indicates a type that is not represented by any of
          the counters in iscsiInitiatorLoginStatsTable."
::= { iscsiInitiatorAttributesEntry 3 }

iscsiIntrLastTgtFailureName OBJECT-TYPE
     SYNTAX   IscsiName
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
          "A UTF-8 string giving the name of the target that failed
          the last login attempt."
::= { iscsiInitiatorAttributesEntry 4 }

iscsiIntrLastTgtFailureAddrType OBJECT-TYPE
     SYNTAX   InetAddressType
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
          "The type of Internet Network Address contained in the
          corresponding instance of the iscsiIntrLastTgtFailureAddr.
          The value 'dns' is not allowed."
::= { iscsiInitiatorAttributesEntry 5 }

iscsiIntrLastTgtFailureAddr OBJECT-TYPE

```
    SYNTAX          InetAddress
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "An Internet Network Address, of the type specified by the
        object iscsiIntrLastTgtFailureAddrType, giving the host
        address of the target that failed the last login attempt."
::= { iscsiInitiatorAttributesEntry 6 }

-- Initiator Login Stats Table

iscsiInitiatorLoginStatsTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF IscsiInitiatorLoginStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A table of counters which keep track of the results of
        this initiator's login attempts."
::= { iscsiInitiator 2 }

iscsiInitiatorLoginStatsEntry OBJECT-TYPE
    SYNTAX          IscsiInitiatorLoginStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing counters of each result
        of this initiator's login attempts."
    AUGMENTS { iscsiInitiatorAttributesEntry }
::= { iscsiInitiatorLoginStatsTable 1 }

IscsiInitiatorLoginStatsEntry ::= SEQUENCE {
    iscsiIntrLoginAcceptRsps       Counter32,
    iscsiIntrLoginOtherFailRsps    Counter32,
    iscsiIntrLoginRedirectRsps     Counter32,
    iscsiIntrLoginAuthFailRsps     Counter32,
    iscsiIntrLoginAuthenticateFails Counter32,
    iscsiIntrLoginNegotiateFails   Counter32
}

iscsiIntrLoginAcceptRsps OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "successful logins"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Login Response PDUs with status
        0x0000, Accept Login, received by this initiator.
        If this counter has suffered a discontinuity, the time of the
```

        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 1 }

iscsiIntrLoginOtherFailRsps OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "failed logins"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The count of Login Response PDUs received by this
        initiator with any status code not counted in the
        objects below.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 2 }

iscsiIntrLoginRedirectRsps OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "failed logins"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The count of Login Response PDUs with status class 0x01,
        Redirection, received by this initiator.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 3 }

iscsiIntrLoginAuthFailRsps OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "failed logins"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The count of Login Response PDUs with status class 0x201,
        Authentication Failed, received by this initiator.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 4 }

iscsiIntrLoginAuthenticateFails OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "failed logins"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The number of times the initiator has aborted a
        login because the target could not be authenticated.

        No response is generated.

        If this counter is incremented, an iscsiIntrLoginFailure
        notification should be generated.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 5 }

iscsiIntrLoginNegotiateFails OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "failed logins"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The number of times the initiator has aborted a
        login because parameter negotiation with the target
        failed.

        No response is generated.

        If this counter is incremented, an iscsiIntrLoginFailure
        notification should be generated.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 6.10, Negotiation Failures"
::= { iscsiInitiatorLoginStatsEntry 6 }

-- Initiator Logout Stats Table

iscsiInitiatorLogoutStatsTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IscsiInitiatorLogoutStatsEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
        "When an initiator attempts to send a Logout command, the target
        responds with a Logout Response that carries a status code.

          This table contains a list of counters of Logout Response
          PDUs of each status code that was received by each
          initiator belonging to this iSCSI instance present on this
          system."
::= { iscsiInitiator 3 }

iscsiInitiatorLogoutStatsEntry OBJECT-TYPE
    SYNTAX   IscsiInitiatorLogoutStatsEntry
    MAX-ACCESS   not-accessible
    STATUS   current
    DESCRIPTION
        "An entry (row) containing counters of Logout Response
        PDUs of each status code that was generated by this
        initiator."
    AUGMENTS { iscsiInitiatorAttributesEntry }
::= { iscsiInitiatorLogoutStatsTable 1 }

IscsiInitiatorLogoutStatsEntry ::= SEQUENCE {
    iscsiIntrLogoutNormals   Counter32,
    iscsiIntrLogoutOthers   Counter32
}

iscsiIntrLogoutNormals OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "normal logouts"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The count of Logout Command PDUs generated by this initiator
        with reason code 0 (closes the session).
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.14.1, Reason Code"
::= { iscsiInitiatorLogoutStatsEntry 1 }

iscsiIntrLogoutOthers OBJECT-TYPE
    SYNTAX   Counter32
    UNITS   "abnormal logouts"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
        "The count of Logout Command PDUs generated by this initiator
        with any status code other than 0.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiNodeDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 10.14.1, Reason Code"

```
::= { iscsiInitiatorLogoutStatsEntry 2 }

--*********************************************************************

iscsiIntrAuthorization OBJECT IDENTIFIER ::= { iscsiObjects 9 }

-- Initiator Authorization Attributes Table

iscsiIntrAuthAttributesTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF IscsiIntrAuthAttributesEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "A list of target identities that each initiator
        on the local system may access."
::= { iscsiIntrAuthorization 1 }

iscsiIntrAuthAttributesEntry OBJECT-TYPE
    SYNTAX        IscsiIntrAuthAttributesEntry
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular initiator node's authorized target identity."
    INDEX { iscsiInstIndex, iscsiNodeIndex, iscsiIntrAuthIndex }
::= { iscsiIntrAuthAttributesTable 1 }

IscsiIntrAuthAttributesEntry ::= SEQUENCE {
    iscsiIntrAuthIndex            Unsigned32,
    iscsiIntrAuthRowStatus        RowStatus,
    iscsiIntrAuthIdentity         RowPointer,
    iscsiIntrAuthStorageType      StorageType
}

iscsiIntrAuthIndex OBJECT-TYPE
    SYNTAX        Unsigned32 (1..4294967295)
    MAX-ACCESS    not-accessible
    STATUS        current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a
        particular initiator node's authorized target
        identity within an iSCSI instance present on the
        local system.  This index value must not be modified
        or reused by an agent unless a reboot has occurred.
        An agent should attempt to keep this value persistent
        across reboots."
::= { iscsiIntrAuthAttributesEntry 1 }
```

```
iscsiIntrAuthRowStatus OBJECT-TYPE
    SYNTAX        RowStatus
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "This field allows entries to be dynamically added and
        removed from this table via SNMP.  When adding a row to
        this table, all non-Index/RowStatus objects must be set.
        When the value of this object is 'active', the values of
        the other objects in this table cannot be changed.
        Rows may be discarded using RowStatus."
::= { iscsiIntrAuthAttributesEntry 2 }

iscsiIntrAuthIdentity OBJECT-TYPE
    SYNTAX        RowPointer
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "A pointer to the corresponding user entry in the IPS-AUTH
        MIB module to which this initiator node should attempt to
        establish an iSCSI session."
    REFERENCE
        "IPS-AUTH MIB, RFC 4545"
::= { iscsiIntrAuthAttributesEntry 3 }

iscsiIntrAuthStorageType OBJECT-TYPE
    SYNTAX        StorageType
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION
        "The storage type for this row.  Rows in this table that were
        created through an external process may have a storage type of
        readOnly or permanent.

        Conceptual rows having the value 'permanent' need not
        allow write access to any columnar objects in the row."
    DEFVAL        { nonVolatile }
::= { iscsiIntrAuthAttributesEntry 4 }

--********************************************************************

iscsiSession OBJECT IDENTIFIER ::= { iscsiObjects 10 }

-- Session Attributes Table

iscsiSessionAttributesTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF IscsiSessionAttributesEntry
    MAX-ACCESS    not-accessible
```

```
    STATUS          current
    DESCRIPTION
        "A list of sessions belonging to each iSCSI instance
        present on the system."
::= { iscsiSession 1 }

iscsiSessionAttributesEntry OBJECT-TYPE
    SYNTAX          IscsiSessionAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular session.

        If this session is a discovery session that is not attached
        to any particular node, the iscsiSsnNodeIndex will be zero.
        Otherwise, the iscsiSsnNodeIndex will have the same value as
        iscsiNodeIndex."
    INDEX  { iscsiInstIndex, iscsiSsnNodeIndex, iscsiSsnIndex }
::= { iscsiSessionAttributesTable 1 }

IscsiSessionAttributesEntry ::= SEQUENCE {
    iscsiSsnNodeIndex               Unsigned32,
    iscsiSsnIndex                   Unsigned32,
    iscsiSsnDirection               INTEGER,
    iscsiSsnInitiatorName           IscsiName,
    iscsiSsnTargetName              IscsiName,
    iscsiSsnTSIH                    Unsigned32,
    iscsiSsnISID                    OCTET STRING,
    iscsiSsnInitiatorAlias          SnmpAdminString,
    iscsiSsnTargetAlias             SnmpAdminString,
    iscsiSsnInitialR2T              TruthValue,
    iscsiSsnImmediateData           TruthValue,
    iscsiSsnType                    INTEGER,
    iscsiSsnMaxOutstandingR2T       Unsigned32,
    iscsiSsnFirstBurstLength        Unsigned32,
    iscsiSsnMaxBurstLength          Unsigned32,
    iscsiSsnConnectionNumber        Gauge32,
    iscsiSsnAuthIdentity            RowPointer,
    iscsiSsnDataSequenceInOrder     TruthValue,
    iscsiSsnDataPDUInOrder          TruthValue,
    iscsiSsnErrorRecoveryLevel      Unsigned32,
    iscsiSsnDiscontinuityTime       TimeStamp
}

iscsiSsnNodeIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (0..4294967295)
    MAX-ACCESS      not-accessible
```

```
    STATUS         current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a
        particular node within an iSCSI instance present
        on the local system.  For normal, non-discovery
        sessions, this value will map to the iscsiNodeIndex.
        For discovery sessions that do not have a node
        associated, the value 0 (zero) is used."
::= { iscsiSessionAttributesEntry 1 }

iscsiSsnIndex OBJECT-TYPE
    SYNTAX         Unsigned32 (1..4294967295)
    MAX-ACCESS     not-accessible
    STATUS         current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a
        particular session within an iSCSI instance present
        on the local system.  An agent should attempt to
        not reuse index values unless a reboot has occurred.
        iSCSI sessions are destroyed during a reboot; rows
        in this table are not persistent across reboots."
::= { iscsiSessionAttributesEntry 2 }

iscsiSsnDirection OBJECT-TYPE
    SYNTAX         INTEGER {
                       inboundSession(1),
                       outboundSession(2)
                   }
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "Direction of iSCSI session:
        inboundSession  - session is established from an external
                          initiator to a target within this iSCSI
                          instance.
        outboundSession - session is established from an initiator
                          within this iSCSI instance to an external
                          target."
::= { iscsiSessionAttributesEntry 3 }

iscsiSsnInitiatorName OBJECT-TYPE
    SYNTAX         IscsiName
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "If iscsiSsnDirection is Inbound, this object is a
        UTF-8 string that will contain the name of the remote
        initiator.  If this session is a discovery session that
```

          does not specify a particular initiator, this object
          will contain a zero-length string.

          If iscsiSsnDirection is Outbound, this object will
          contain a zero-length string."
    ::= { iscsiSessionAttributesEntry 4 }

    iscsiSsnTargetName OBJECT-TYPE
        SYNTAX   IscsiName
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "If iscsiSsnDirection is Outbound, this object is a
            UTF-8 string that will contain the name of the remote
            target. If this session is a discovery session that
            does not specify a particular target, this object will
            contain a zero-length string.

            If iscsiSsnDirection is Inbound, this object will
            contain a zero-length string."
    ::= { iscsiSessionAttributesEntry 5 }

    iscsiSsnTSIH OBJECT-TYPE
        SYNTAX   Unsigned32 (1..65535)
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The target-defined identification handle for this session."
        REFERENCE
            "RFC 3720, Section 10.12.6, TSIH"
    ::= { iscsiSessionAttributesEntry 6 }

    iscsiSsnISID OBJECT-TYPE
        SYNTAX   OCTET STRING (SIZE(6))
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "The initiator-defined portion of the iSCSI Session ID."
        REFERENCE
            "RFC 3720, Section 10.12.5, ISID"
    ::= { iscsiSessionAttributesEntry 7 }

    iscsiSsnInitiatorAlias OBJECT-TYPE
        SYNTAX   SnmpAdminString
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
            "A UTF-8 string that gives the alias communicated by the

```
        initiator end of the session during the login phase.

        If no alias exists, the value is a zero-length string."
    REFERENCE
        "RFC 3720, Section 12.7, InitiatorAlias"
::= { iscsiSessionAttributesEntry 8 }


iscsiSsnTargetAlias OBJECT-TYPE
    SYNTAX          SnmpAdminString
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A UTF-8 string that gives the alias communicated by the
        target end of the session during the login phase.

        If no alias exists, the value is a zero-length string."
    REFERENCE
        "RFC 3720, Section 12.6, TargetAlias"
::= { iscsiSessionAttributesEntry 9 }


iscsiSsnInitialR2T OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "If set to true, indicates that the initiator must wait
        for an R2T before sending to the target.  If set to false,
        the initiator may send data immediately, within limits set
        by iscsiSsnFirstBurstLength and the expected data transfer
        length of the request."
    REFERENCE
        "RFC 3720, Section 12.10, InitialR2T"
::= { iscsiSessionAttributesEntry 10 }


iscsiSsnImmediateData OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "Indicates whether the initiator and target have agreed to
        support immediate data on this session."
    REFERENCE
        "RFC 3720, Section 12.11, ImmediateData"
::= { iscsiSessionAttributesEntry 11 }


iscsiSsnType OBJECT-TYPE
    SYNTAX          INTEGER {
                        normalSession(1),
```

```
                     discoverySession(2)
                 }
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "Type of iSCSI session:
        normalSession    - session is a normal iSCSI session
        discoverySession - session is being used only for discovery."
    REFERENCE
        "RFC 3720, Section 12.21, SessionType"
::= { iscsiSessionAttributesEntry 12 }

iscsiSsnMaxOutstandingR2T OBJECT-TYPE
    SYNTAX        Unsigned32 (1..65535)
    UNITS         "R2Ts"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The maximum number of outstanding requests-to-transmit
        (R2Ts) per iSCSI task within this session."
    REFERENCE
        "RFC 3720, Section 12.17, MaxOutstandingR2T"
::= { iscsiSessionAttributesEntry 13 }

iscsiSsnFirstBurstLength OBJECT-TYPE
    SYNTAX        Unsigned32 (512..16777215)
    UNITS         "bytes"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The maximum length supported for unsolicited data sent
        within this session."
    REFERENCE
        "RFC 3720, Section 12.14, FirstBurstLength"
::= { iscsiSessionAttributesEntry 14 }

iscsiSsnMaxBurstLength OBJECT-TYPE
    SYNTAX        Unsigned32 (512..16777215)
    UNITS         "bytes"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The maximum number of bytes that can be sent within
        a single sequence of Data-In or Data-Out PDUs."
    REFERENCE
        "RFC 3720, Section 12.13, MaxBurstLength"
::= { iscsiSessionAttributesEntry 15 }
```

```
iscsiSsnConnectionNumber OBJECT-TYPE
    SYNTAX          Gauge32 (1..65535)
    UNITS           "connections"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The number of transport protocol connections that currently
        belong to this session."
::= { iscsiSessionAttributesEntry 16 }

iscsiSsnAuthIdentity OBJECT-TYPE
    SYNTAX          RowPointer
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object contains a pointer to a row in the
        IPS-AUTH MIB module that identifies the authentication
        method being used on this session, as communicated
        during the login phase."
    REFERENCE
        "IPS-AUTH MIB, RFC 4545"
::= { iscsiSessionAttributesEntry 17 }

 iscsiSsnDataSequenceInOrder OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "False indicates that iSCSI data PDU sequences may
        be transferred in any order.  True indicates that
        data PDU sequences must be transferred using
        continuously increasing offsets, except during
        error recovery."
    REFERENCE
        "RFC 3720, Section 12.19, DataSequenceInOrder"
::= { iscsiSessionAttributesEntry 18 }

iscsiSsnDataPDUInOrder OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "False indicates that iSCSI data PDUs within sequences
        may be in any order.  True indicates that data PDUs
        within sequences must be at continuously increasing
        addresses, with no gaps or overlay between PDUs.

        Default is true."
```

```
    REFERENCE
        "RFC 3720, Section 12.18, DataPDUInOrder"
::= { iscsiSessionAttributesEntry 19 }


iscsiSsnErrorRecoveryLevel OBJECT-TYPE
    SYNTAX          Unsigned32 (0..255)
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The level of error recovery negotiated between
        the initiator and the target.  Higher numbers
        represent more detailed recovery schemes."
    REFERENCE
        "RFC 3720, Section 12.20, ErrorRecoveryLevel"
::= { iscsiSessionAttributesEntry 20 }


iscsiSsnDiscontinuityTime  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 this session's counters
        suffered a discontinuity.
        When a session is established, and this object is
        created, it is initialized to the current value
        of SysUpTime."
::= { iscsiSessionAttributesEntry 21 }

-- Session Stats Table

iscsiSessionStatsTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF IscsiSessionStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A list of general iSCSI traffic counters for each of the
        sessions present on the system."
::= { iscsiSession 2 }


iscsiSessionStatsEntry OBJECT-TYPE
    SYNTAX          IscsiSessionStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing general iSCSI traffic counters
        for a particular session."
    AUGMENTS { iscsiSessionAttributesEntry }
```

```
::= { iscsiSessionStatsTable 1 }

IscsiSessionStatsEntry ::= SEQUENCE {
    iscsiSsnCmdPDUs                 Counter32,
    iscsiSsnRspPDUs                 Counter32,
    iscsiSsnTxDataOctets            Counter64,
    iscsiSsnRxDataOctets            Counter64,
    iscsiSsnLCTxDataOctets          Counter32,
    iscsiSsnLCRxDataOctets          Counter32
}

iscsiSsnCmdPDUs OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "PDUs"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Command PDUs transferred on this session.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 1 }

iscsiSsnRspPDUs OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "PDUs"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of Response PDUs transferred on this session.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 2 }

iscsiSsnTxDataOctets OBJECT-TYPE
    SYNTAX          Counter64
    UNITS           "octets"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of data octets that were transmitted by
        the local iSCSI node on this session.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 3 }

iscsiSsnRxDataOctets OBJECT-TYPE
    SYNTAX          Counter64
    UNITS           "octets"
```

```
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The count of data octets that were received by
        the local iSCSI node on this session.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 4 }

iscsiSsnLCTxDataOctets OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "octets"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A Low Capacity shadow object of iscsiSsnTxDataOctets
        for those systems that don't support Counter64.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 5 }

iscsiSsnLCRxDataOctets OBJECT-TYPE
    SYNTAX          Counter32
    UNITS           "octets"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A Low Capacity shadow object of iscsiSsnRxDataOctets
        for those systems that don't support Counter64.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
::= { iscsiSessionStatsEntry 6 }

-- Session Connection Error Stats Table

iscsiSessionCxnErrorStatsTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF IscsiSessionCxnErrorStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A list of error counters for each of the sessions
        present on this system."
::= { iscsiSession 3 }

iscsiSessionCxnErrorStatsEntry OBJECT-TYPE
    SYNTAX          IscsiSessionCxnErrorStatsEntry
    MAX-ACCESS      not-accessible
    STATUS          current
```

```
    DESCRIPTION
        "An entry (row) containing error counters for
        a particular session."
    AUGMENTS { iscsiSessionAttributesEntry }
::= { iscsiSessionCxnErrorStatsTable 1 }

IscsiSessionCxnErrorStatsEntry ::= SEQUENCE {
    iscsiSsnCxnDigestErrors       Counter32,
    iscsiSsnCxnTimeoutErrors      Counter32
}

iscsiSsnCxnDigestErrors OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "PDUs"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The count of PDUs that were received on the session and
        contained header or data digest errors.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 6.7, Digest Errors"
::= { iscsiSessionCxnErrorStatsEntry 1 }

iscsiSsnCxnTimeoutErrors OBJECT-TYPE
    SYNTAX        Counter32
    UNITS         "connections"
    MAX-ACCESS    read-only
    STATUS        current
    DESCRIPTION
        "The count of connections within this session
        that have been terminated due to timeout.
        If this counter has suffered a discontinuity, the time of the
        last discontinuity is indicated in iscsiSsnDiscontinuityTime."
    REFERENCE
        "RFC 3720, Section 6.4, Connection Timeout Management"
::= { iscsiSessionCxnErrorStatsEntry 2 }

--********************************************************************

iscsiConnection OBJECT IDENTIFIER ::= { iscsiObjects 11 }

-- Connection Attributes Table

iscsiConnectionAttributesTable OBJECT-TYPE
    SYNTAX        SEQUENCE OF IscsiConnectionAttributesEntry
    MAX-ACCESS    not-accessible
```

```
    STATUS          current
    DESCRIPTION
        "A list of connections belonging to each iSCSI instance
        present on the system."
::= { iscsiConnection 1 }


iscsiConnectionAttributesEntry OBJECT-TYPE
    SYNTAX          IscsiConnectionAttributesEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry (row) containing management information applicable
        to a particular connection."
    INDEX  { iscsiInstIndex, iscsiSsnNodeIndex, iscsiSsnIndex,
            iscsiCxnIndex }
::= { iscsiConnectionAttributesTable 1 }


IscsiConnectionAttributesEntry ::= SEQUENCE {
    iscsiCxnIndex                 Unsigned32,
    iscsiCxnCid                   Unsigned32,
    iscsiCxnState                 INTEGER,
    iscsiCxnAddrType              InetAddressType,
    iscsiCxnLocalAddr             InetAddress,
    iscsiCxnProtocol              IscsiTransportProtocol,
    iscsiCxnLocalPort             InetPortNumber,
    iscsiCxnRemoteAddr            InetAddress,
    iscsiCxnRemotePort            InetPortNumber,
    iscsiCxnMaxRecvDataSegLength  Unsigned32,
    iscsiCxnMaxXmitDataSegLength  Unsigned32,
    iscsiCxnHeaderIntegrity       IscsiDigestMethod,
    iscsiCxnDataIntegrity         IscsiDigestMethod,
    iscsiCxnRecvMarker            TruthValue,
    iscsiCxnSendMarker            TruthValue,
    iscsiCxnVersionActive         Unsigned32
}


iscsiCxnIndex OBJECT-TYPE
    SYNTAX          Unsigned32 (1..4294967295)
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An arbitrary integer used to uniquely identify a
        particular connection of a particular session within
        an iSCSI instance present on the local system.  An
        agent should attempt to not reuse index values unless
        a reboot has occurred.  iSCSI connections are destroyed
        during a reboot; rows in this table are not persistent
        across reboots."
```

```
    ::= { iscsiConnectionAttributesEntry 1 }

    iscsiCxnCid OBJECT-TYPE
        SYNTAX        Unsigned32 (1..65535)
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The iSCSI Connection ID for this connection."
    ::= { iscsiConnectionAttributesEntry 2 }

    iscsiCxnState OBJECT-TYPE
        SYNTAX          INTEGER {
                           login(1),
                           full(2),
                           logout(3)
                        }
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The current state of this connection, from an iSCSI negotiation
            point of view.  Here are the states:

            login  - The transport protocol connection has been established,
                     but a valid iSCSI login response with the final bit set
                     has not been sent or received.
            full   - A valid iSCSI login response with the final bit set
                     has been sent or received.
            logout - A valid iSCSI logout command has been sent or
                     received, but the transport protocol connection has
                     not yet been closed."
    ::= { iscsiConnectionAttributesEntry 3 }

    iscsiCxnAddrType OBJECT-TYPE
        SYNTAX        InetAddressType
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The type of Internet Network Addresses contained in the
            corresponding instances of iscsiCxnLocalAddr and
            iscsiCxnRemoteAddr.
            The value 'dns' is not allowed."
    ::= { iscsiConnectionAttributesEntry 4 }

    iscsiCxnLocalAddr OBJECT-TYPE
        SYNTAX        InetAddress
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
```

```
        "The local Internet Network Address, of the type specified
        by iscsiCxnAddrType, used by this connection."
::= { iscsiConnectionAttributesEntry 5 }


iscsiCxnProtocol OBJECT-TYPE
    SYNTAX          IscsiTransportProtocol
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The transport protocol over which this connection is
        running."
::= { iscsiConnectionAttributesEntry 6 }


iscsiCxnLocalPort OBJECT-TYPE
    SYNTAX          InetPortNumber
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The local transport protocol port used by this connection.
        This object cannot have the value zero, since it represents
        an established connection."
::= { iscsiConnectionAttributesEntry 7 }


iscsiCxnRemoteAddr OBJECT-TYPE
    SYNTAX          InetAddress
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The remote Internet Network Address, of the type specified
        by iscsiCxnAddrType, used by this connection."
::= { iscsiConnectionAttributesEntry 8 }


iscsiCxnRemotePort OBJECT-TYPE
    SYNTAX          InetPortNumber
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The remote transport protocol port used by this connection.
        This object cannot have the value zero, since it represents
        an established connection."
::= { iscsiConnectionAttributesEntry 9 }


iscsiCxnMaxRecvDataSegLength OBJECT-TYPE
    SYNTAX          Unsigned32 (512..16777215)
    UNITS           "bytes"
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
```

             "The maximum data payload size supported for command
             or data PDUs able to be received on this connection."
        REFERENCE
             "RFC 3720, Section 12.12, MaxRecvDataSegmentLength"
    ::= { iscsiConnectionAttributesEntry 10 }

    iscsiCxnMaxXmitDataSegLength OBJECT-TYPE
        SYNTAX   Unsigned32 (512..16777215)
        UNITS   "bytes"
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
             "The maximum data payload size supported for command
             or data PDUs to be sent on this connection."
        REFERENCE
             "RFC 3720, Section 12.12, MaxRecvDataSegmentLength"
    ::= { iscsiConnectionAttributesEntry 11 }

    iscsiCxnHeaderIntegrity OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
             "This object identifies the iSCSI header
             digest scheme in use within this connection."
    ::= { iscsiConnectionAttributesEntry 12 }

    iscsiCxnDataIntegrity OBJECT-TYPE
        SYNTAX   IscsiDigestMethod
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
             "This object identifies the iSCSI data
             digest scheme in use within this connection."
    ::= { iscsiConnectionAttributesEntry 13 }

    iscsiCxnRecvMarker OBJECT-TYPE
        SYNTAX   TruthValue
        MAX-ACCESS   read-only
        STATUS   current
        DESCRIPTION
             "This object indicates whether or not this connection
             is receiving markers in its incoming data stream."
        REFERENCE
             "RFC 3720, Appendix A."
    ::= { iscsiConnectionAttributesEntry 14 }

    iscsiCxnSendMarker OBJECT-TYPE

```
    SYNTAX         TruthValue
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "This object indicates whether or not this connection
        is inserting markers in its outgoing data stream."
    REFERENCE
        "RFC 3720, Appendix A."
::= { iscsiConnectionAttributesEntry 15 }

iscsiCxnVersionActive OBJECT-TYPE
    SYNTAX         Unsigned32 (0..255)
    MAX-ACCESS     read-only
    STATUS         current
    DESCRIPTION
        "Active version number of the iSCSI specification negotiated
        on this connection."
    REFERENCE
        "RFC 3720, Section 10.12, Login Request"
::= { iscsiConnectionAttributesEntry 16 }

--**********************************************************************
-- Notifications

iscsiTgtLoginFailure NOTIFICATION-TYPE
    OBJECTS {
        iscsiTgtLoginFailures,
        iscsiTgtLastFailureType,
        iscsiTgtLastIntrFailureName,
        iscsiTgtLastIntrFailureAddrType,
        iscsiTgtLastIntrFailureAddr
    }
    STATUS current
    DESCRIPTION
        "Sent when a login is failed by a target.

        To avoid sending an excessive number of notifications due
        to multiple errors counted, an SNMP agent implementing this
        notification SHOULD NOT send more than 3 notifications of
        this type in any 10-second time period."
::= { iscsiNotifications 1 }

iscsiIntrLoginFailure NOTIFICATION-TYPE
    OBJECTS {
        iscsiIntrLoginFailures,
        iscsiIntrLastFailureType,
        iscsiIntrLastTgtFailureName,
        iscsiIntrLastTgtFailureAddrType,
```

```
            iscsiIntrLastTgtFailureAddr
        }
        STATUS current
        DESCRIPTION
            "Sent when a login is failed by an initiator.

            To avoid sending an excessive number of notifications due
            to multiple errors counted, an SNMP agent implementing this
            notification SHOULD NOT send more than 3 notifications of
            this type in any 10-second time period."
    ::= { iscsiNotifications 2 }

    iscsiInstSessionFailure NOTIFICATION-TYPE
        OBJECTS {
            iscsiInstSsnFailures,
            iscsiInstLastSsnFailureType,
            iscsiInstLastSsnRmtNodeName
        }
        STATUS current
        DESCRIPTION
            "Sent when an active session is failed by either the initiator
            or the target.

            To avoid sending an excessive number of notifications due
            to multiple errors counted, an SNMP agent implementing this
            notification SHOULD NOT send more than 3 notifications of
            this type in any 10-second time period."
    ::= { iscsiNotifications 3 }

--********************************************************************

-- Conformance Statements

iscsiCompliances OBJECT IDENTIFIER ::= { iscsiConformance 1 }
iscsiGroups       OBJECT IDENTIFIER ::= { iscsiConformance 2 }

iscsiInstanceAttributesGroup OBJECT-GROUP
    OBJECTS {
        iscsiInstDescr,
        iscsiInstVersionMin,
        iscsiInstVersionMax,
        iscsiInstVendorID,
        iscsiInstVendorVersion,
        iscsiInstPortalNumber,
        iscsiInstNodeNumber,
        iscsiInstSessionNumber,
        iscsiInstSsnFailures,
        iscsiInstLastSsnFailureType,
```

```
            iscsiInstLastSsnRmtNodeName,
            iscsiInstDiscontinuityTime
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about iSCSI
            instances."
    ::= { iscsiGroups 1 }

    iscsiInstanceSsnErrorStatsGroup OBJECT-GROUP
        OBJECTS {
            iscsiInstSsnDigestErrors,
            iscsiInstSsnCxnTimeoutErrors,
            iscsiInstSsnFormatErrors
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about
            errors that have caused a session failure for an
            iSCSI instance."
    ::= { iscsiGroups 2 }

    iscsiPortalAttributesGroup OBJECT-GROUP
        OBJECTS {
            iscsiPortalRowStatus,
            iscsiPortalStorageType,
            iscsiPortalRoles,
            iscsiPortalAddrType,
            iscsiPortalAddr,
            iscsiPortalProtocol,
            iscsiPortalMaxRecvDataSegLength,
            iscsiPortalPrimaryHdrDigest,
            iscsiPortalPrimaryDataDigest,
            iscsiPortalSecondaryHdrDigest,
            iscsiPortalSecondaryDataDigest,
            iscsiPortalRecvMarker
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about
            the transport protocol endpoints of the local targets."
    ::= { iscsiGroups 3 }

    iscsiTgtPortalAttributesGroup OBJECT-GROUP
        OBJECTS {
            iscsiTgtPortalPort,
            iscsiTgtPortalTag
        }
```

```
     STATUS current
     DESCRIPTION
         "A collection of objects providing information about
         the transport protocol endpoints of the local targets."
::= { iscsiGroups 4 }

iscsiIntrPortalAttributesGroup OBJECT-GROUP
     OBJECTS {
         iscsiIntrPortalTag
     }
     STATUS current
     DESCRIPTION
         "An object providing information about
         the portal tags used by the local initiators."
::= { iscsiGroups 5 }

iscsiNodeAttributesGroup OBJECT-GROUP
     OBJECTS {
         iscsiNodeName,
         iscsiNodeAlias,
         iscsiNodeRoles,
         iscsiNodeTransportType,
         iscsiNodeInitialR2T,
         iscsiNodeImmediateData,
         iscsiNodeMaxOutstandingR2T,
         iscsiNodeFirstBurstLength,
         iscsiNodeMaxBurstLength,
         iscsiNodeMaxConnections,
         iscsiNodeDataSequenceInOrder,
         iscsiNodeDataPDUInOrder,
         iscsiNodeDefaultTime2Wait,
         iscsiNodeDefaultTime2Retain,
         iscsiNodeErrorRecoveryLevel,
         iscsiNodeDiscontinuityTime,
         iscsiNodeStorageType
     }
     STATUS current
     DESCRIPTION
         "A collection of objects providing information about all
         local targets."
::= { iscsiGroups 6 }

iscsiTargetAttributesGroup OBJECT-GROUP
     OBJECTS {
         iscsiTgtLoginFailures,
         iscsiTgtLastFailureTime,
         iscsiTgtLastFailureType,
         iscsiTgtLastIntrFailureName,
```

```
        iscsiTgtLastIntrFailureAddrType,
        iscsiTgtLastIntrFailureAddr
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        local targets."
::= { iscsiGroups 7 }

iscsiTargetLoginStatsGroup OBJECT-GROUP
    OBJECTS {
        iscsiTgtLoginAccepts,
        iscsiTgtLoginOtherFails,
        iscsiTgtLoginRedirects,
        iscsiTgtLoginAuthorizeFails,
        iscsiTgtLoginAuthenticateFails,
        iscsiTgtLoginNegotiateFails
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        login attempts by remote initiators to local targets."
::= { iscsiGroups 8 }

iscsiTargetLogoutStatsGroup OBJECT-GROUP
    OBJECTS {
        iscsiTgtLogoutNormals,
        iscsiTgtLogoutOthers
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        logout events between remote initiators and local targets."
::= { iscsiGroups 9 }

iscsiTargetAuthGroup OBJECT-GROUP
    OBJECTS {
        iscsiTgtAuthRowStatus,
        iscsiTgtAuthStorageType,
        iscsiTgtAuthIdentity
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        remote initiators that are authorized to connect to local
        targets."
::= { iscsiGroups 10 }
```

iscsiInitiatorAttributesGroup OBJECT-GROUP
    OBJECTS {
        iscsiIntrLoginFailures,
        iscsiIntrLastFailureTime,
        iscsiIntrLastFailureType,
        iscsiIntrLastTgtFailureName,
        iscsiIntrLastTgtFailureAddrType,
        iscsiIntrLastTgtFailureAddr
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about
        all local initiators."
::= { iscsiGroups 11 }

iscsiInitiatorLoginStatsGroup OBJECT-GROUP
    OBJECTS {
        iscsiIntrLoginAcceptRsps,
        iscsiIntrLoginOtherFailRsps,
        iscsiIntrLoginRedirectRsps,
        iscsiIntrLoginAuthFailRsps,
        iscsiIntrLoginAuthenticateFails,
        iscsiIntrLoginNegotiateFails
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        login attempts by local initiators to remote targets."
::= { iscsiGroups 12 }

iscsiInitiatorLogoutStatsGroup OBJECT-GROUP
    OBJECTS {
        iscsiIntrLogoutNormals,
        iscsiIntrLogoutOthers
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        logout events between local initiators and remote targets."
::= { iscsiGroups 13 }

iscsiInitiatorAuthGroup OBJECT-GROUP
    OBJECTS {
        iscsiIntrAuthRowStatus,
        iscsiIntrAuthStorageType,
        iscsiIntrAuthIdentity
    }
    STATUS current

          DESCRIPTION
              "A collection of objects providing information about all
              remote targets that are initiators of the local system
              that they are authorized to access."
    ::= { iscsiGroups 14 }

    iscsiSessionAttributesGroup OBJECT-GROUP
        OBJECTS {
            iscsiSsnDirection,
            iscsiSsnInitiatorName,
            iscsiSsnTargetName,
            iscsiSsnTSIH,
            iscsiSsnISID,
            iscsiSsnInitiatorAlias,
            iscsiSsnTargetAlias,
            iscsiSsnInitialR2T,
            iscsiSsnImmediateData,
            iscsiSsnType,
            iscsiSsnMaxOutstandingR2T,
            iscsiSsnFirstBurstLength,
            iscsiSsnMaxBurstLength,
            iscsiSsnConnectionNumber,
            iscsiSsnAuthIdentity,
            iscsiSsnDataSequenceInOrder,
            iscsiSsnDataPDUInOrder,
            iscsiSsnErrorRecoveryLevel,
            iscsiSsnDiscontinuityTime
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information applicable to
            all sessions."
    ::= { iscsiGroups 15 }

    iscsiSessionPDUStatsGroup OBJECT-GROUP
        OBJECTS {
            iscsiSsnCmdPDUs,
            iscsiSsnRspPDUs
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about PDU
            traffic for each session."
    ::= { iscsiGroups 16 }

    iscsiSessionOctetStatsGroup OBJECT-GROUP
        OBJECTS {
            iscsiSsnTxDataOctets,

            iscsiSsnRxDataOctets
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about octet
            traffic for each session using a Counter64 data type."
    ::= { iscsiGroups 17 }

    iscsiSessionLCOctetStatsGroup OBJECT-GROUP
        OBJECTS {
            iscsiSsnLCTxDataOctets,
            iscsiSsnLCRxDataOctets
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about octet
            traffic for each session using a Counter32 data type."
    ::= { iscsiGroups 18 }

    iscsiSessionCxnErrorStatsGroup OBJECT-GROUP
        OBJECTS {
            iscsiSsnCxnDigestErrors,
            iscsiSsnCxnTimeoutErrors
        }
        STATUS current
        DESCRIPTION
            "A collection of objects providing information about connection
            errors for all sessions."
    ::= { iscsiGroups 19 }

    iscsiConnectionAttributesGroup OBJECT-GROUP
        OBJECTS {
            iscsiCxnCid,
            iscsiCxnState,
            iscsiCxnProtocol,
            iscsiCxnAddrType,
            iscsiCxnLocalAddr,
            iscsiCxnLocalPort,
            iscsiCxnRemoteAddr,
            iscsiCxnRemotePort,
            iscsiCxnMaxRecvDataSegLength,
            iscsiCxnMaxXmitDataSegLength,
            iscsiCxnHeaderIntegrity,
            iscsiCxnDataIntegrity,
            iscsiCxnRecvMarker,
            iscsiCxnSendMarker,
            iscsiCxnVersionActive
        }

```
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about all
        connections used by all sessions."
::= { iscsiGroups 20 }

iscsiTgtLgnNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        iscsiTgtLoginFailure
    }
    STATUS current
    DESCRIPTION
        "A collection of notifications that indicate a login
        failure from a remote initiator to a local target."
::= { iscsiGroups 21 }

iscsiIntrLgnNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        iscsiIntrLoginFailure
    }
    STATUS current
    DESCRIPTION
        "A collection of notifications that indicate a login
        failure from a local initiator to a remote target."
::= { iscsiGroups 22 }

iscsiSsnFlrNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
        iscsiInstSessionFailure
    }
    STATUS current
    DESCRIPTION
        "A collection of notifications that indicate session
        failures occurring after login."
::= { iscsiGroups 23 }

--*********************************************************************

iscsiComplianceV1 MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "Initial version of compliance statement based on
        initial version of this MIB module.

        If an implementation can be both a target and an
        initiator, all groups are mandatory."
    MODULE       -- this module
    MANDATORY-GROUPS {
```

```
        iscsiInstanceAttributesGroup,
        iscsiInstanceSsnErrorStatsGroup,
        iscsiPortalAttributesGroup,
        iscsiNodeAttributesGroup,
        iscsiSessionAttributesGroup,
        iscsiSessionPDUStatsGroup,
        iscsiSessionCxnErrorStatsGroup,
        iscsiConnectionAttributesGroup,
        iscsiSsnFlrNotificationsGroup
    }

    -- Conditionally mandatory groups depending on the ability
    -- to support Counter64 data types and/or to provide counter
    -- information to SNMPv1 applications.

    GROUP iscsiSessionOctetStatsGroup
    DESCRIPTION
        "This group is mandatory for all iSCSI implementations
        that can support Counter64 data types."

    GROUP iscsiSessionLCOctetStatsGroup
    DESCRIPTION
        "This group is mandatory for all iSCSI implementations
        that provide information to SNMPv1-only applications;
        this includes agents that cannot support Counter64
        data types."

    -- Conditionally mandatory groups to be included with
    -- the mandatory groups when the implementation has
    -- iSCSI target facilities.

    GROUP iscsiTgtPortalAttributesGroup
    DESCRIPTION
        "This group is mandatory for all iSCSI implementations
        that have iSCSI target facilities."

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

    OBJECT iscsiNodeStorageType
    MIN-ACCESS read-only
    DESCRIPTION
        "Write access is not required; an implementation may
         choose to allow this object to be set to 'volatile'
         or 'nonVolatile'."
```

        GROUP iscsiTargetAttributesGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI target facilities."

        GROUP iscsiTargetLoginStatsGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI target facilities."

        GROUP iscsiTargetLogoutStatsGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI target facilities."

        GROUP iscsiTgtLgnNotificationsGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI target facilities."

        GROUP iscsiTargetAuthGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI target facilities."

        -- Conditionally mandatory groups to be included with
        -- the mandatory groups when the implementation has
        -- iSCSI initiator facilities.

        GROUP iscsiIntrPortalAttributesGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI initiator facilities."

        GROUP iscsiInitiatorAttributesGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI initiator facilities."

        GROUP iscsiInitiatorLoginStatsGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI initiator facilities."

        GROUP iscsiInitiatorLogoutStatsGroup
        DESCRIPTION
            "This group is mandatory for all iSCSI implementations
            that have iSCSI initiator facilities."

```
     GROUP iscsiIntrLgnNotificationsGroup
     DESCRIPTION
         "This group is mandatory for all iSCSI implementations
         that have iSCSI initiator facilities."

     GROUP iscsiInitiatorAuthGroup
     DESCRIPTION
         "This group is mandatory for all iSCSI implementations
         that have iSCSI initiator facilities."

     OBJECT          iscsiNodeErrorRecoveryLevel
     SYNTAX          Unsigned32 (0..2)
     DESCRIPTION
         "Only values 0-2 are defined at present."

 ::= { iscsiCompliances 1 }

 END
```

8. 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. These are the tables and objects and their
   sensitivity/vulnerability:

      iscsiPortalAttributesTable, iscsiTgtPortalAttributesTable, and
      iscsiIntrPortalAttributesTable can be used to add or remove IP
      addresses to be used by iSCSI.

      iscsiTgtAuthAttributesTable entries can be added or removed, to
      allow or disallow access to a target by an initiator.

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

      iscsiNodeAttributesTable, iscsiTargetAttributesTable, and
      iscsiTgtAuthorization can be used to glean information needed to
      make connections to the iSCSI targets this module represents.
      However, it is the responsibility of the initiators and targets
      involved to authenticate each other to ensure that an
      inappropriately advertised or discovered initiator or target does
      not compromise their security. These issues are discussed in
      [RFC3720].

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

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

   Further, deployment of SNMP versions prior to SNMPv3 is NOT
   RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
   enable cryptographic security. It is then a customer/operator

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

9. IANA Considerations

   The IANA has assigned a MIB OID number under the mib-2 branch for the ISCSI-MIB.

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