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

Abstract

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

This document obsoletes RFC 4544.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7147.
1. The Internet-Standard Management Framework

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

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

2. Introduction

This document defines a MIB module for iSCSI [RFC7143], used to manage devices that implement the iSCSI protocol. It obsoletes RFC 4544 [RFC4544].

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

3. 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 it 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 IPS-AUTH MIB module to which the initiator should attempt to establish sessions. The IPS-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].

4. 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.

5. Differences from RFC 4544

[RFC7143] updates several RFCs, including [RFC3720]. This document updates the iSCSI MIB correspondingly. The document uses iscsiProtocolLevel as defined in [RFC7144]. It obsoletes [RFC4544]. Below is a brief description of the changes.

- Added iscsiInstXNodeArchitecture to InstanceAttributes.
- Added iscsiSsnTaskReporting of type BITS to SessionAttributes.
- Added iscsiSsnProtocolLevel to SessionAttributes.
- Deprecated the marker objects.
- Fixed the errata to [RFC4544].
- Added NOP counters at iSCSI session scope for heartbeat tracking.
- Added port number to the iscsiTgtLoginFailure and iscsiIntrLoginFailure notifications, and to the last failure info in iscsiInitiatorAttributesEntry.
- Added description string to the iSCSI portal.
- Added iscsiInstSsnTgtUnmappedErrors to support "Target Unmapped" session failure reporting in the iscsiInstSessionFailure notification.
- Added iscsiTgtLogoutCxnClosed and iscsiTgtLogoutCxnRemoved, which maintain the count of Logout Command PDUs received by the target with reason codes 1 and 2, respectively.
- Changed the conformance statements to match the above.

6. Discussion

This MIB module structure supplies configuration, fault, and statistics information for iSCSI devices [RFC7143]. 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 [RFC4455] 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
-- (an outside initiator to the target represented by
-- this node) or Outbound (the initiator represented by
-- this node 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 when a row is created or destroyed in the iscsiPortalAttributesTable or when 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 [RFC7143]. 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 if 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 that 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 that are within this instance and share 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 Group 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 exist 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 Definition

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 "201402180000Z" -- February 18, 2014
   ORGANIZATION "IETF STORage Maintenance (STORM) Working Group"

   CONTACT-INFO "
      Working Group Email: storm@ietf.org
      Attn: Mark Bakke
      Dell
      Email: mark_bakke@dell.com

      Prakash Venkatesen
      HCL Technologies
      Email: prakashvn@hcl.com"

   DESCRIPTION
      "This module defines management information specific
to the iSCSI protocol.

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REVISION "201402180000Z"

DESCRIPTION
"Second version of the iSCSI Protocol MIB Module. RFC 7143 makes several updates to [RFC3720]. This version makes corresponding updates to the MIB module. This MIB module published as RFC 7147."

REVISION "200605220000Z"

DESCRIPTION
"Initial version of the iSCSI Protocol MIB module. This MIB module published as RFC 4544."

::= { 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. Protocol numbers are assigned by IANA. A current list of all assignments is available from <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 RFC 7143).
   CRC32c - require a CRC32C digest."
REFERENCE

"RFC 7143, Section 13.1, 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 7143, Section 4.2.7.1, and encoded as specified in RFC 7143, Section 4.2.7.2. A zero-length string indicates the absence of an iSCSI name."

REFERENCE

"RFC 7143, Section 4.2.7, 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 the header is being used."

REFERENCE

"RFC 7143, Section 13.1, HeaderDigest and DataDigest"

::= { iscsiHeaderIntegrityTypes 1 }

iscsiHdrIntegrityCrc32c OBJECT-IDENTITY

STATUS current

DESCRIPTION

"The authoritative identifier when the integrity scheme for the header is CRC32c."

REFERENCE

"RFC 7143, Section 13.1, HeaderDigest and DataDigest"

::= { iscsiHeaderIntegrityTypes 2 }

iscsiDataIntegrityTypes OBJECT IDENTIFIER ::= { iscsiDescriptors 2 }

---**********************************************************************
iscsiDataIntegrityNone OBJECT-IDENTITY
STATUS     current
DESCRIPTION
"The authoritative identifier when no integrity
scheme for the data is being used."
REFERENCE
"RFC 7143, Section 13.1, HeaderDigest and DataDigest"
::= { iscsiDataIntegrityTypes 1 }

iscsiDataIntegrityCrc32c OBJECT-IDENTITY
STATUS     current
DESCRIPTION
"The authoritative identifier when the integrity
scheme for the data is CRC32c."
REFERENCE
"RFC 7143, Section 13.1, 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."
::= { iscsiInstanceAttributesTable 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,
iscsiInstXNodeArchitecture SnmpAdminString

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 7143, Section 11.12, 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 7143, Section 11.12, 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; the string 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 failed. If this counter has
suffered a discontinuity, the time of the last discontinuity
is indicated in iscsiInstDiscontinuityTime."
REFERENCE      "RFC 7143, Section 13.1, HeaderDigest and DataDigest"
::= { iscsiInstanceAttributesEntry 10 }

iscsiInstLastSsnFailureType  OBJECT-TYPE
SYNTAX        AutonomousType
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION    "The counter object in the iscsiInstanceSsnErrorStatsTable
                that was incremented when the last session failure occurred.
                If the reason for failure is not found in the
                iscsiInstanceSsnErrorStatsTable, the value { 0.0 } is
                used instead."
::= { iscsiInstanceAttributesEntry 11 }

iscsiInstLastSsnRmtNodeName  OBJECT-TYPE
SYNTAX        IscsiName

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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 }

iscsiInstXNodeArchitecture OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"A UTF-8 string set by the manufacturer declaring the
details of its iSCSI node architecture to the remote
endpoint. These details may include, but are not limited
to, iSCSI vendor software, firmware, or hardware versions,
the OS version, or hardware architecture.
The format of this string is determined solely by the
manufacturer; the string is for informational purposes only.
It is unrelated to the iSCSI specification version numbers."
REFERENCE
"RFC 7143, Section 13.26, X#NodeArchitecture"
::= { iscsiInstanceAttributesEntry 14 }

-- 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 }
An entry (row) containing management information applicable to a particular iSCSI instance.

::= { iscsiInstanceAttributesEntry 1 }

iscsiInstSsnDigestErrors OBJECT-TYPE
SYNTAX Counter32
UNITS "sessions"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The count of sessions that 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 7143, Section 7.8, Digest Errors"

::= { iscsiInstanceSsnErrorStatsEntry 1 }

iscsiInstSsnCxnTimeoutErrors OBJECT-TYPE
SYNTAX Counter32
UNITS "sessions"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The count of sessions that 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 7143, Section 7.5, Connection Timeout Management"

::= { iscsiInstanceSsnErrorStatsEntry 2 }

iscsiInstSsnFormatErrors OBJECT-TYPE
SYNTAX Counter32
UNITS "sessions"
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"The count of sessions that 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 7143 Section 7.7, Format Errors"
::= { iscsiInstanceSsnErrorStatsEntry 3 }

iscsiInstSsnTgtUnmappedErrors OBJECT-TYPE
SYNTAX        Counter32
UNITS         "sessions"
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"The count of sessions that failed due to the target
becoming unmapped. If this counter has
suffered a discontinuity, the time of the last discontinuity
is indicated in iscsiInstDiscontinuityTime."
::= { iscsiInstanceSsnErrorStatsEntry 4 }

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 Iscsiprotocol,  
    iscsiPortalMaxRecvDataSegLength Unsigned32,  
    iscsiPortalPrimaryHdrDigest IscsidigestMethod,  
    iscsiPortalPrimaryDataDigest IscsidigestMethod,  
    iscsiPortalSecondaryHdrDigest IscsidigestMethod,  
    iscsiPortalSecondaryDataDigest IscsidigestMethod,  
    iscsiPortalRecvMarker TruthValue,  
    iscsiPortalStorageType StorageType,  
    iscsiPortalDescr SnmpAdminString
}

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 the
iscsiTgtPortalAttributesTable and/or the
iscsiIntrPortalAttributesTable."
 ::= { iscsiPortalAttributesEntry 2 }

iscsiPortalRoles OBJECT-TYPE

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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
The portal’s transport protocol.

TCP

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.

RFC 7143, Section 13.12, MaxRecvDataSegmentLength

The preferred header digest for this portal.

The preferred data digest method for this portal.

An alternate header digest preference for this portal.
::= { 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         deprecated  
DESCRIPTION     "This object indicates whether or not this portal will request markers in its incoming data stream."  
REFERENCE       "RFC 7143, Section 13.25, Obsoleted Keys."  
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 (e.g., not created via this MIB) 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 }

iscsiPortalDescr OBJECT-TYPE  
SYNTAX         SnmpAdminString  
MAX-ACCESS     read-only  
STATUS         current  
DESCRIPTION     "A UTF-8 string, determined by the implementation to describe the iSCSI portal. When only a single instance is present, this object may be set to the zero-length string; with multiple iSCSI portals, it may be used in an implementation-dependent manner to describe the respective portal, and could include information such as
Host Bus Adapter (HBA) model, description, and version, or software driver and version.

 ::= { iscsiPortalAttributesEntry 14 }

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

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.

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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 7143, Section 4.4.1, iSCSI Architecture 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 7143, Section 4.4.1, iSCSI Architecture 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
"A conceptual 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,
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 it 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 7143, Sections 13.6 (TargetAlias) and 13.7
 (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, RFC 4455, Section 9, Object Definitions,
scsiTransportTypes"
 ::= { 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 "

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**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 7143, Section 13.11, ImmediateData"

**DEFVAL**        { true }

::= { iscsiNodeAttributesEntry 6 }

**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 7143, Section 13.17, MaxOutstandingR2T"

**DEFVAL**        { 1 }

::= { iscsiNodeAttributesEntry 7 }

**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 7143, Section 13.14, FirstBurstLength"

**DEFVAL**        { 65536 }

::= { iscsiNodeAttributesEntry 8 }

**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 7143, Section 13.13, MaxBurstLength"
DEFVAL: { 262144 }

```plaintext
::= { 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 7143, Section 13.2, MaxConnections"
DEFVAL: { 1 }

```plaintext
::= { 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 7143, Section 13.19, DataSequenceInOrder"
DEFVAL: { true }

```plaintext
::= { 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 7143, Section 13.18, 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 7143, Section 13.15, 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 7143, Section 13.16, 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 7143, Section 13.20, 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 (e.g., not created via this MIB module). 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 Liquid List 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 }

IscciTargetAttributesEntry ::= SEQUENCE {
  iscsiTgtLoginFailures Counter32,
  iscsiTgtLastFailureTime TimeStamp,
  iscsiTgtLastFailureType AutonomousType,
  iscsiTgtLastIntrFailureName IscsiName,
  iscsiTgtLastIntrfailureAddrType InetAddressType,
  iscsiTgtLastIntrFailureAddr InetAddress,
  iscsiTgtLastIntrFailurePort InetPortNumber
}

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 7143, Section 11.13.5, Status-Class and Status-Detail"
 ::= { iscsiTargetAttributesEntry 1 }

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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. If no such failures
              have occurred since the last system boot, this attribute
              will have the value 0.0. A value of 0.0 may also be used
              to indicate 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. If no such failures have occurred since
              the last system boot, this value is a zero-length string."
 ::= { 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. If no such failures have
              occurred since the last system boot, this value is zero."
 ::= { iscsiTargetAttributesEntry 5 }

iscsiTgtLastIntrFailureAddr OBJECT-TYPE
SYNTAX       InetAddress

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. If no such failures have occurred since the last
system boot, this value is a zero-length string.

::= { iscsiTargetAttributesEntry 6 }

iscsiTgtLastIntrFailurePort OBJECT-TYPE
SYNTAX       InetPortNumber
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "The transport protocol port number used by the initiator
that failed the last login attempt. If no such failures
have occurred since the last system boot, this value is a
zero-length string."

::= { iscsiTargetAttributesEntry 7 }

-- 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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,
    iscsiTgtLogoutCxnClosed        Counter32,
    iscsiTgtLogoutCxnRemoved       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 7143, Section 11.14.1, Reason Code"
 ::= { iscsiTargetLogoutStatsEntry 1 }

iscsiTgtLogoutOthers OBJECT-TYPE
SYNTAX       Counter32
UNITS         "abnormal logouts"
MAX-ACCESS   read-only
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 7143, Section 11.14.1, Reason Code"

::= { iscsiTargetLogoutStatsEntry 2 }

iscsiTgtLogoutCxnClosed 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 reason code 1 (closes the connection). If this counter has suffered a discontinuity, the time of the last discontinuity is indicated in iscsiNodeDiscontinuityTime."

REFERENCE
"RFC 7143, Section 11.14.1, Reason Code"

::= { iscsiTargetLogoutStatsEntry 3 }

iscsiTgtLogoutCxnRemoved 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 reason code 2 (removes the connection). If this counter has suffered a discontinuity, the time of the last discontinuity is indicated in iscsiNodeDiscontinuityTime."

REFERENCE
"RFC 7143, Section 11.14.1, Reason Code"

::= { iscsiTargetLogoutStatsEntry 4 }

--**********************************************************************
iscsiTgtAuthorization OBJECT IDENTIFIER ::= { iscsiObjects 7 }
-- Target Authorization Attributes Table

ger
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, Section 7.3, ipsAuthIdentity"
::= {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 (e.g., not created via this MIB) 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,
    iscsiIntrLastTgtFailurePort      InetPortNumber
}

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 7143, Section 11.13.5, 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. If no such failures have
occurred since the last system boot, this attribute will
have the value 0.0. A value of 0.0 may also be used to
indicate 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. If no such failures have occurred
since the last system boot, this value is a zero-length string."
::= { 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. If no such failures have
occurred since the last system boot, this value is zero."
::= { 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.
If no such failures have occurred since the last system boot,
this value is a zero-length string."
::= { iscsiInitiatorAttributesEntry 6 }

iscsiIntrLastTgtFailurePort OBJECT-TYPE
SYNTAX     InetPortNumber
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The transport protocol port number used by the target
that failed the last login attempt.
If no such failures have occurred since the last system boot,
this value is a zero-length string.

::= { iscsiInitiatorAttributesEntry 7 }

-- Initiator Login Stats Table

iscsiInitiatorLoginStatsTable OBJECT-TYPE
SYNTAX    SEQUENCE OF IscsiInitiatorLoginStatsEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION "A table of counters that 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,
  iscsiIntrLoginAuthorizeFails     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 7143, Section 11.13.5, Status-Class and Status-Detail"
 ::= { iscsiInitiatorLoginStatsEntry 1 }

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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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 11.13.5, 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 7143, Section 7.12, Negotiation Failures"
::= { iscsiInitiatorLoginStatsEntry 6 }

iscsiIntrLoginAuthorizeFails 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, received by this initiator.

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 7143, Section 11.13.5, Status-Class and Status-Detail"
::= { iscsiInitiatorLoginStatsEntry 7 }

-- 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 7143, Section 11.14.1, Reason Code"
::= { iscsiInitiatorLogoutStatsEntry 1 }

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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 7143, Section 11.14.1, Reason Code"
 ::= { iscsiInitiatorLogoutStatsEntry 2 }

-- Initiator Authorization Attributes Table

iscsiIntrAuthorization OBJECT IDENTIFIER ::= { iscsiObjects 9 }
--
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, Section 7.3, ipsAuthIdentity"
 ::= { 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 (e.g., not created via this MIB) 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,
iscsiSsnProtocolLevel Unsigned32,
iscsiSsnTaskReporting BITS

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 7143, Section 11.12.6, 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 7143, Section 11.12.5, 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 7143, Section 13.7, 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 7143, Section 13.6, 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 7143, Section 13.10, 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 7143, Section 13.11, 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 7143, Section 13.21, 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 7143, Section 13.17, 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 7143, Section 13.14, 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 7143, Section 13.13, 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
    identity being used on this session, as communicated
    during the login phase."
REFERENCE
   "IPS-AUTH MIB, RFC 4545, Section 7.3, ipsAuthIdentity"
::= { 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 7143, Section 13.19, 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 7143, Section 13.18, 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 7143, Section 13.20, 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 }

iscsiSsnProtocolLevel OBJECT-TYPE
SYNTAX Unsigned32 (0..31)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The iSCSI protocol level negotiated for this session."
REFERENCE
"RFC 7144, Section 7.1.1, iSCSIProtocolLevel"
DEFVAL
{ 1 }
::= { iscsiSessionAttributesEntry 22 }

iscsiSsnTaskReporting OBJECT-TYPE
SYNTAX        BITS {
          taskReportingRfc3720(0),
          taskReportingResponseFence(1),
          taskReportingFastAbort(2)
        }
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"This key is used to negotiate the task completion reporting
semantics from the SCSI target.
Default value is taskReportingRfc3720."
REFERENCE
"RFC 7143, Section 13.23, TaskReporting"
::= { iscsiSessionAttributesEntry 23 }

-- 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 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 are accessible via SNMPv1 only.
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 which are accessible via SNMPv1 only.
If this counter has suffered a discontinuity, the time of the last discontinuity is indicated in iscsiSsnDiscontinuityTime."

::= { iscsiSessionStatsEntry 6 }

iscsiSsnNopReceivedPDUs OBJECT-TYPE
SYNTAX Counter32
UNITS "PDUs"
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"The count of NOP-In or NOP-Out PDUs received on this session.
If this counter has suffered a discontinuity, the time of the last discontinuity is indicated in iscsiSsnDiscontinuityTime."

::= { iscsiSessionStatsEntry 7 }

iscsiSsnNopSentPDUs OBJECT-TYPE
SYNTAX Counter32
UNITS "PDUs"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The count of NOP-In or NOP-Out PDUs sent on this session. If this counter has suffered a discontinuity, the time of the last discontinuity is indicated in iscsiSsnDiscontinuityTime."

::= { iscsiSessionStatsEntry 8 }

-- 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. This counter is most likely provided when the error-recovery level is 1 or 2"
REFERENCE
   "RFC 7143, Section 7.8, 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. This counter is most likely provided when the error-recovery level is 2"
REFERENCE
"RFC 7143, Section 7.5, 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."
::= { iscsiConnectionAttributesTable 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 }
::= { iscsiConnectionAttributesEntry 1 }

IscsiConnectionAttributesEntry ::= SEQUENCE {
  iscsiCxnIndex                  Unsigned32,  
  iscsiCxnCid                    Unsigned32,  
  iscsiCxnState                  INTEGER,  
  iscsiCxnAddrType               InetAddressType,  
  iscsiCxnLocalAddr              InetAddress,  
  iscsiCxnProtocol               IscsiTransportProtocol,

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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 7143, Section 13.12, 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 7143, Section 13.12, 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        deprecated
DESCRIPTION
 "This object indicates whether or not this connection
 is receiving markers in its incoming data stream."
REFERENCE
 "RFC 7143, Section 13.25, Obsoleted Keys."
::= { iscsiConnectionAttributesEntry 14 }

iscsiCxnSendMarker OBJECT-TYPE
SYNTAX        TruthValue
MAX-ACCESS    read-only
STATUS        deprecated
DESCRIPTION
 "This object indicates whether or not this connection
 is inserting markers in its outgoing data stream."
REFERENCE
 "RFC 7143, Section 13.25, Obsoleted Keys."
::= { 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 7143, Section 11.12, Login Request"
::= { iscsiConnectionAttributesEntry 16 }

--**********************************************************************
-- Notifications
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iscsiTgtLoginFailure NOTIFICATION-TYPE
OBJECTS {
    iscsiTgtLoginFailures,
    iscsiTgtLastFailureType,
    iscsiTgtLastIntrFailureName,
    iscsiTgtLastIntrFailureAddrType,
    iscsiTgtLastIntrFailureAddr,
    iscsiTgtLastIntrFailurePort
}
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,
    iscsiIntrLastTgtFailurePort
}
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,
iscsiInstXNodeArchitecture
}
```

```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 deprecated
DESCRIPTION
  "A collection of objects providing information about the transport protocol endpoints of the local targets. This object group is deprecated because the marker key is obsolete."
REFERENCE
  "RFC 7143, Section 13.25, Obsoleted Keys."
 ::= { 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 {

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iscsiNodeName,
iscsiNodeAlias,
iscsiNodeRoles,
iscsiNodeTransportType,
iscsiNodeInitialR2T,
iscsiNodeImmediateData,
iscsiNodeMaxOutstandingR2T,
iscsiNodeFirstBurstLength,
iscsiNodeMaxBurstLength,
iscsiNodeMaxConnections,
iscsiNodeDataSequenceInOrder,
iscsiNodeDataPDUInOrder,
iscsiNodeDefaultTime2Wait,
iscsiNodeDefaultTime2Retain,
iscsiNodeErrorRecoveryLevel,
iscsiNodeDiscontinuityTime,
iscsiNodeStorageType

{ iscsiGroups 6 }

iscsiTargetAttributesGroup OBJECT-GROUP
OBJECTS {
  iscsiTgtLoginFailures,
  iscsiTgtLastFailureTime,
  iscsiTgtLastFailureType,
  iscsiTgtLastIntrFailureName,
  iscsiTgtLastIntrFailureAddrType,
  iscsiTgtLastIntrFailureAddr
}

{ 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,
iscsiIntrLoginAuthorizeFails
}
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,
iscsiSsnProtocolLevel,
iscsiSsnTaskReporting

} 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 deprecated

DESCRIPTION

"A collection of objects providing information about all connections used by all sessions. This object group is deprecated because the marker key is obsolete."

REFERENCE

"RFC 7143, Section 13.25, Obsoleted Keys."

::= { 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 }

iscsiPortalAttributesGroupV2 OBJECT-GROUP
OBJECTS {
  iscsiPortalRowStatus,
  iscsiPortalStorageType,
  iscsiPortalRoles,
  iscsiPortalAddrType,
  iscsiPortalAddr,
  iscsiPortalProtocol,
  iscsiPortalMaxRecvDataSegLength,
  iscsiPortalPrimaryHdrDigest,
  iscsiPortalPrimaryDataDigest,
  iscsiPortalSecondaryHdrDigest,
  iscsiPortalSecondaryDataDigest
}
STATUS current
DESCRIPTION
"A collection of objects providing information about the transport protocol endpoints of the local targets."
 ::= { iscsiGroups 24 }

iscsiConnectionAttributesGroupV2 OBJECT-GROUP
OBJECTS {
  iscsiCxnCid,
iscsiCxnState,  
iscsiCxnProtocol,  
iscsiCxnAddrType,  
iscsiCxnLocalAddr,  
iscsiCxnLocalPort,  
iscsiCxnRemoteAddr,  
iscsiCxnRemotePort,  
iscsiCxnMaxRecvDataSegLength,  
iscsiCxnMaxXmitDataSegLength,  
iscsiCxnHeaderIntegrity,  
iscsiCxnDataIntegrity,  
iscsiCxnVersionActive

{  
STATUS current  
DESCRIPTION  
"A collection of objects providing information about all 
connections used by all sessions."  
::= { iscsiGroups 25 }  

iscsiNewObjectsV2 OBJECT-GROUP  
OBJECTS {  
iscsiInstXNodeArchitecture,  
iscsiSsnTaskReporting,  
iscsiSsnProtocolLevel,  
iscsiSsnNopReceivedPDUs,  
iscsiSsnNopSentPDUs,  
iscsiIntrLastTgtFailurePort,  
iscsiTgtLastIntrFailurePort,  
iscsiPortalDescr,  
iscsiInstSsnTgtUnmappedErrors,  
iscsiTgtLogoutCxnClosed,  
iscsiTgtLogoutCxnRemoved

}  

STATUS current  
DESCRIPTION  
"A collection of objects added in the second version of the 
iSCSI MIB."  
::= { iscsiGroups 26 }  

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

iscsiComplianceV1 MODULE-COMPLIANCE  
STATUS deprecated  
DESCRIPTION  
"Initial version of compliance statement."
If an implementation can be both a target and an initiator, all groups are mandatory. This module compliance is deprecated because the marker keys are obsolete.

REFERENCE
"RFC 7143, Section 13.25, Obsoleted Keys."

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 }

iscsiComplianceV2 MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Version 2 of compliance statement based on
this revised version of the MIB module.

If an implementation can be both a target and an
initiator, all groups are mandatory."

MODULE   -- this module
MANDATORY-GROUPS {
    iscsiInstanceAttributesGroup,
    iscsiInstanceSsnErrorStatsGroup,
    iscsiPortalAttributesGroupV2,
    iscsiNodeAttributesGroup,
    iscsiSessionAttributesGroup,
    iscsiSessionPDUStatsGroup,
    iscsiSessionCxnErrorStatsGroup,
    iscsiConnectionAttributesGroupV2,
    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."
GROUP iscsiNewObjectsV2
DESCRIPTION
"This group is mandatory for all iSCSI implementations that support a value of the iSCSIProtocolLevel key of 2 or greater."
::= { iscsiCompliances 2 }
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 [RFC7143].
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.

Implementations SHOULD provide the security features described by the SNMPv3 framework (see [RFC3410]), and implementations claiming compliance to the SNMPv3 standard MUST include full support for authentication and privacy via the User-based Security Model (USM) [RFC3414] with the AES cipher algorithm [RFC3826]. Implementations MAY also provide support for the Transport Security Model (TSM) [RFC5591] in combination with a secure transport such as SSH [RFC5592] or TLS/DTLS [RFC6353].

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 MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER value recorded in the "SMI Network Management MGMT Codes Internet-standard MIB" registry:

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>iscsiMibModule</td>
<td>{ mib-2 142 }</td>
</tr>
</tbody>
</table>

IANA has updated the reference for the mib-2 142 identifier to refer to this document.

10. References

10.1. Normative References


10.2. Informative References


11. Acknowledgments

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