Definitions of Managed Objects for
IP Storage User Identity Authorization

Status of This Memo

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

Copyright Notice

Copyright (C) The Internet Society (2006).

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing user identities and the names, addresses, and credentials required manage access control, for use with various protocols. This document was motivated by the need for the configuration of authorized user identities for the iSCSI protocol, but has been extended to be useful for other protocols that have similar requirements. It is important to note that this MIB module provides only the set of identities to be used within access lists; it is the responsibility of other MIB modules making use of this one to tie them to their own access lists or other authorization control methods.
1. Introduction

This MIB module will be used to configure and/or look at the configuration of user identities and their credential information. For the purposes of this MIB module, a "user" identity does not need to be an actual person; a user can also be a host, an application, a cluster of hosts, or any other identifiable entity that can be authorized to access a resource.

Most objects in this MIB module have a MAX-ACCESS of read-create; this module is intended to allow configuration of user identities and their names, addresses, and credentials. MIN-ACCESS for all objects is read-only for those implementations that configure through other means, but require the ability to monitor user identities.

2. Specification of Requirements

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

3. The Internet-Standard Management Framework

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

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, STD 58, RFC 2579 and STD 58, RFC 2580.

4. Relationship to Other MIB Modules

The IPS-AUTH-MIB module does not directly address objects within other modules. The identity address objects contain IPv4, IPv6, or other address types, and as such they may be indirectly related to objects within the IP MIB module.

This MIB module does not provide actual authorization or access control lists; it provides a means to identify entities that can be included in other authorization lists. This should generally be done in MIB modules that reference identities in this one. It also does not cover login or authentication failure statistics or
notifications, as these are all fairly application specific and are not generic enough to be included here.

The user identity objects within this module are typically referenced from other modules by a RowPointer within that module. A module containing resources for which it requires a list of authorized user identities may create such a list, with a single RowPointer within each list element pointing to a user identity within this module. This is neither required nor restricted by this MIB module.

5. Relationship to the USM MIB Module

The User-based Security Model (USM) [RFC3414] also defines the concept of a user, defining authentication and privacy protocols and their credentials. The definition of USM includes the SNMP-USER-BASED-SM-MIB module allows configuration of SNMPv3 user credentials to protect SNMPv3 messages. Although USM’s users are not related to the user identities managed by the IPS-AUTH-MIB module defined in this document, USM will often be implemented on the same system as the IPS-AUTH-MIB module, with the SNMP-USER-BASED-SM-MIB module used to manage the security protecting SNMPv3 messages, including those that access the IPS-AUTH-MIB module.

The term "user" in this document is distinct from an SNMPv3 user and is intended to include, but is not limited to, users of IP storage devices. A "user" in this document is a collection of user names (unique identifiers), user addresses, and credentials that can be used together to determine whether an entity should be allowed access to a resource. Each user can have multiple names, addresses, and credentials. As a result, this MIB module is particularly suited to managing users of storage resources, which are typically given access control lists consisting of potentially multiple identifiers, addresses, and credentials. This MIB module provides for authorization lists only and does not include setting of data privacy parameters.

In contrast, an SNMPv3 user as defined in [RFC3414] has exactly one user-name, one authentication protocol, and one privacy protocol, along with their associated information and SNMP-specific information, such as an engine ID. These objects are defined to support exactly the information needed for SNMPv3 security.

For the remainder of this document, the term "user" means an IPS-AUTH-MIB user identity.
6. Relationship to SNMP Contexts

Each non-scalar object in the IPS-AUTH-MIB module is indexed first by an instance. Each instance is a collection of identities that can be used to authorize access to a resource. The use of an instance works well with partitionable or hierarchical 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 collection of identities within a device to one or more SNMP contexts, without having to do so for each identity’s row.

7. Discussion

This MIB module structure is intended to allow the configuration of a list of user identities, each with a list of names, addresses, credentials, and certificates that, when combined, will distinguish that identity.

The IPS-AUTH-MIB module is structured around two primary "objects", the authorization instance and the identity, which serve as containers for the remainder of the objects. This section contains a brief description of the "object" hierarchy and a description of each object, followed by a discussion of the actual SNMP table structure within the objects.

7.1. Authorization MIB Object Model

The top-level object in this structure is the authorization instance, which "contains" all of the other objects. The indexing hierarchy of this module looks like:

ipsAuthInstance
   -- A distinct authorization entity within the managed system.
   -- Most implementations will have just one of these.
   ipsAuthIdentity
      -- A user identity, consisting of a set of identity names,
      -- addresses, and credentials reflected in the following
      -- objects:
      ipsAuthIdentityName
         -- A name for a user identity. A name should be globally
         -- unique, and unchanging over time. Some protocols may
         -- not require this one.
      ipsAuthIdentityAddress
         -- An address range, typically but not necessarily an
         -- IPv4, IPv6, or Fibre Channel address range, at which
         -- the identity is allowed to reside.
      ipsAuthCredential
         -- A single credential, such as a CHAP username,
ipsAuthCredChap
   -- CHAP-specific attributes for an ipsAuthCredential
ipsAuthCredSrp
   -- SRP-specific attributes
ipsAuthCredKerberos
   -- Kerberos-specific attributes

Each identity contains the information necessary to identify a particular end-point that wishes to access a service, such as iSCSI.

An identity can contain multiple names, addresses, and credentials. Each of these names, addresses, and credentials exists in its own row. If multiple rows of one of these three types are present, they are treated in an "OR" fashion; an entity to be authorized need only match one of the rows. If rows of different types are present (e.g., a name and an address), these are treated in an "AND" fashion; an entity to be authorized must match at least one row from each category. If there are no rows present of a category, this category is ignored.

For example, if an ipsAuthIdentity contains two rows of ipsAuthIdentityAddress, one row of ipsAuthCredential, and no rows of ipsAuthIdentityName, an entity must match the Credential row and at least one of the two Address rows to match the identity.

Index values such as ipsAuthInstIndex and ipsAuthIdentIndex are referenced in multiple tables, and rows can be added and deleted. An implementation should therefore attempt to keep all index values persistent across reboots; index values for rows that have been deleted must not be reused before a reboot.

7.2. ipsAuthInstance

The ipsAuthInstanceAttributesTable is the primary table of the IPS-AUTH-MIB module. Every other table entry in this module includes the index of an ipsAuthInstanceAttributesEntry as its primary index. An authorization instance is basically a managed set of identities.

Many implementations will include just one authorization instance row in this table. However, there will be cases where multiple rows in this table may be used:

- A large system may be "partitioned" into multiple, distinct virtual systems, perhaps sharing the SNMP agent but not their lists of identities. Each virtual system would have its own authorization instance.
- A set of stackable systems, each with its own set of identities, may be represented by a common SNMP agent. Each individual system would have its own authorization instance.

- Multiple protocols, each with its own set of identities, may exist within a single system and be represented by a single SNMP agent. In this case, each protocol may have its own authorization instance.

An entry in this table is often referenced by its name (ipsAuthInstDescr), which should be displayed to the user by the management station. When an implementation supports only one entry in this table, the description may be returned as a zero-length string.

7.3. ipsAuthIdentity

The ipsAuthIdentAttributesTable contains one entry for each configured user identity. The identity contains only a description of what the identity is used for; its attributes are all contained in other tables, since they can each have multiple values.

Other MIB modules containing lists of users authorized to access a particular resource should generally contain a RowPointer to the ipsAuthIdentAttributesEntry that will, if authenticated, be allowed access to the resource.

All other table entries make use of the indices to this table as their primary indices.

7.4. ipsAuthIdentityName

The ipsAuthIdentNameAttributesTable contains a list of UTF-8 names, each of which belongs to, and may be used to identify, a particular identity in the authIdentity table.

Implementations making use of the IPS-AUTH-MIB module may identify their resources by names, addresses, or both. A name is typically a unique (within the required scope), unchanging identifier for a resource. It will normally meet some or all of the requirements for a Uniform Resource Name [RFC1737], although a name in the context of this MIB module does not need to be a URN. Identifiers that typically change over time should generally be placed into the ipsAuthIdentityAddress table; names that have no uniqueness properties should usually be placed into the description attribute for the identity.
An example of an identity name is the iSCSI Name, defined in [RFC3720]. Any other MIB module defining names to be used as ipsAuthIdentityName objects should specify how its names are unique, and the domain within which they are unique.

If this table contains no entries associated with a particular user identity, the implementation does not need to check any name parameters when verifying that identity. If the table contains multiple entries associated with a particular user identity, the implementation should consider a match with any one of these entries to be valid.

7.5. ipsAuthIdentityAddress

The ipsAuthIdentAddrAttributesTable contains a list of addresses at which the identity may reside. For example, an identity may be allowed access to a resource only from a certain IP address, or only if its address is in a certain range or set of ranges.

Each entry contains a starting and ending address. If a single address is desired in the list, both starting and ending addresses must be identical.

Each entry contains an AddrType attribute. This attribute contains an enumeration registered as an IANA Address Family type [IANA-AF]. Although many implementations will use IPv4 or IPv6 address types for these entries, any IANA-registered type may be used, as long as it makes sense to the application.

Matching any address within any range within the list associated with a particular identity is considered a valid match. If no entries are present in this list for a given identity, its address is automatically assumed to match the identity.

Netmasks are not supported, since an address range can express the same thing with more flexibility. An application specifying addresses using network masks may do so, and convert to and from address ranges when reading or writing this MIB module.

7.6. ipsAuthCredential

The ipsAuthCredentialAttributesTable contains a list of credentials, each of which may be used to verify a particular identity.
Each credential contains an authentication method to be used, such as CHAP [RFC1994], SRP [RFC2945], or Kerberos [RFC4120]. This attribute contains an object identifier instead of an enumerated type, allowing other MIB modules to add their own authentication methods, without modifying this MIB module.

For each entry in this table, there will exist an entry in another table containing its attributes. The table in which to place the entry depends on the AuthMethod attribute:

- **CHAP**
  - If the AuthMethod is set to the CHAP OID, an entry using the same indices as the ipsAuthCredential will exist in the ipsAuthCredChap table, which contains the CHAP username.

- **SRP**
  - If the AuthMethod is set to the SRP OID, an entry using the same indices as the ipsAuthCredential will exist in the ipsAuthCredSrp table, which contains the SRP username.

- **Kerberos**
  - If the AuthMethod is set to the Kerberos OID, an entry using the same indices as the ipsAuthCredential will exist in the ipsAuthCredKerberos table, which contains the Kerberos principal.

- **Other**
  - If the AuthMethod is set to any OID not defined in this module, an entry using the same indices as the ipsAuthCredential entry should be placed in the other module that define whatever attributes are needed for that type of credential.

An additional credential type can be added to this MIB module by defining a new OID in the ipsAuthMethodTypes subtree, and defining a new table specific to that credential type.

### 7.7. IP, Fibre Channel, and Other Addresses

The IP addresses in this MIB module are represented by two attributes, one of type AddressFamilyNumbers, and the other of type AuthAddress. Each address can take on any of the types within the list of address family numbers; the most likely being IPv4, IPv6, or one of the Fibre Channel address types.

The type AuthAddress is an octet string. If the address family is IPv4 or IPv6, the format is taken from the InetAddress specified in [RFC4001]. If the address family is one of the Fibre Channel types, the format is identical to the FcNameIdOrZero type defined in [RFC4044].
7.8. Descriptors: Using OIDs in Place of Enumerated Types

Some attributes, particularly the authentication method attribute, would normally require an enumerated type. However, implementations will likely need to add new authentication method types of their own, without extending this MIB module. To make this work, this module defines a set of object identities within ipsAuthDescriptors. Each of these object identities is basically an enumerated type.

Attributes that make use of these object identities have a value that is an OID instead of an enumerated type. These OIDs can either indicate 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 authentication 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.

7.9. Notifications

Monitoring of authentication failures and other notification events are outside the scope of this MIB module, as they are generally application specific. No notifications are provided or required.
8. MIB Definitions

IPS-AUTH-MIB DEFINITIONS ::= BEGIN

IMPORTS
MODULE-IDENTITY, OBJECT-TYPE, OBJECT-IDENTITY, Unsigned32, mib-2
FROM SNMPv2-SMI

TEXTUAL-CONVENTION, RowStatus, AutonomousType, StorageType
FROM SNMPv2-TC

MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF

SnmpAdminString
FROM SNMP-FRAMEWORK-MIB -- RFC 3411

AddressFamilyNumbers
FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB ;

ipsAuthMibModule MODULE-IDENTITY
LAST-UPDATED "200605220000Z" -- May 22, 2006
ORGANIZATION "IETF IPS Working Group"
CONTACT-INFO
"Mark Bakke
Postal: Cisco Systems, Inc
7900 International Drive, Suite 400
Bloomington, MN
USA 55425

E-mail: mbakke@cisco.com

James Muchow
Postal: Qlogic Corp.
6321 Bury Dr.
Eden Prairie, MN
USA 55346

E-Mail: james.muchow@qlogic.com"

DESCRIPTION
"The IP Storage Authorization MIB module.
Copyright (C) The Internet Society (2006). This version of
this MIB module is part of RFC 4545; see the RFC itself for
full legal notices."
DESCRIPTION
"Initial version of the IP Storage Authentication MIB module, published as RFC 4545"

::= { mib-2 141 }

ipsAuthNotifications OBJECT IDENTIFIER ::= { ipsAuthMibModule 0 }
ipsAuthObjects OBJECT IDENTIFIER ::= { ipsAuthMibModule 1 }
ipsAuthConformance OBJECT IDENTIFIER ::= { ipsAuthMibModule 2 }

-- Textual Conventions

IpsAuthAddress ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"IP Storage requires the use of address information that uses not only the InetAddress type defined in the INET-ADDRESS-MIB, but also Fibre Channel type defined in the Fibre Channel Management MIB. Although these address types are recognized in the IANA Address Family Numbers MIB, the addressing mechanisms have not been merged into a well-known, common type. This data type, the IpsAuthAddress, performs the merging for this MIB module.

The formats of objects of this type are determined by a corresponding object with syntax AddressFamilyNumbers, and thus every object defined using this TC must identify the object with syntax AddressFamilyNumbers that specifies its type.

The syntax and semantics of this object depend on the identified AddressFamilyNumbers object as follows:

AddressFamilyNumbers this object
==================== ===========
ipV4(1) restricted to the same syntax and semantics as the InetAddressIPv4 TC.
ipV6(2) restricted to the same syntax and semantics as the InetAddressIPv6 TC.
fibreChannelWWPN (22)
& fibreChannelWWNN(23) restricted to the same syntax and semantics as the FcNameIdOrZero TC.

Types other than the above should not be used unless
the corresponding format of the IpsAuthAddress object is
further specified (e.g., in a future revision of this TC)."
REFERENCE
"IANA-ADDRESS-FAMILY-NUMBERS-MIB;
INET-ADDRESS-MIB (RFC 4001);
FC-MGMT-MIB (RFC 4044)."
SYNTAX     OCTET STRING (SIZE(0..255))

ipsAuthDescriptors OBJECT IDENTIFIER ::= { ipsAuthObjects 1 }

ipsAuthMethodTypes OBJECT-IDENTITY
STATUS        current
DESCRIPTION   "Registration point for Authentication Method Types."
REFERENCE "RFC 3720, iSCSI Protocol Specification."
::= { ipsAuthMethodTypes 1 }

ipsAuthMethodNone OBJECT-IDENTITY
STATUS        current
DESCRIPTION   "The authoritative identifier when no authentication
               method is used."
REFERENCE "RFC 3720, iSCSI Protocol Specification."
::= { ipsAuthMethodTypes 1 }

ipsAuthMethodSrp OBJECT-IDENTITY
STATUS        current
DESCRIPTION   "The authoritative identifier when the authentication
               method is SRP."
REFERENCE "RFC 3720, iSCSI Protocol Specification."
::= { ipsAuthMethodTypes 2 }

ipsAuthMethodChap OBJECT-IDENTITY
STATUS        current
DESCRIPTION   "The authoritative identifier when the authentication
               method is CHAP."
REFERENCE "RFC 3720, iSCSI Protocol Specification."
::= { ipsAuthMethodTypes 3 }

ipsAuthMethodKerberos OBJECT-IDENTITY
STATUS        current
DESCRIPTION   "The authoritative identifier when the authentication
               method is Kerberos."
REFERENCE "RFC 3720, iSCSI Protocol Specification."
::= { ipsAuthMethodTypes 4 }

ipsAuthInstance OBJECT IDENTIFIER ::= { ipsAuthObjects 2 }

-- Instance Attributes Table

ipsAuthInstanceAttributesTable OBJECT-TYPE
SYNTAX SEQUENCE OF IpsAuthInstanceAttributesEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A list of Authorization instances present on the system."
::= { ipsAuthInstance 2 }

ipsAuthInstanceAttributesEntry OBJECT-TYPE
SYNTAX IpsAuthInstanceAttributesEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry (row) containing management information
applicable to a particular Authorization instance."
INDEX { ipsAuthInstIndex }
::= { ipsAuthInstanceAttributesTable 1 }

IpsAuthInstanceAttributesEntry ::= SEQUENCE {
  ipsAuthInstIndex               Unsigned32,
  ipsAuthInstDescr               SnmpAdminString,
  ipsAuthInstStorageType         StorageType
}

ipsAuthInstIndex OBJECT-TYPE
SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An arbitrary integer used to uniquely identify a
particular authorization 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."
::= { ipsAuthInstanceAttributesEntry 1 }

ipsAuthInstDescr OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-write
STATUS        current
DESCRIPTION
"A character string, determined by the implementation to
describe the authorization instance. When only a single
instance is present, this object may be set to the
zero-length string; with multiple authorization
instances, it must be set to a unique value in an
implementation-dependent manner to describe the purpose
of the respective instance. If this is deployed in a
master agent with more than one subagent implementing
this MIB module, the master agent is responsible for
ensuring that this object is unique across all
subagents."

::= { ipsAuthInstanceAttributesEntry 2 }

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

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

An implementation may choose to allow this object
to be set to either 'nonVolatile' or 'volatile',
allowing the management application to choose this
behavior."
DEFVAL        { volatile }
::= { ipsAuthInstanceAttributesEntry 3 }

ipsAuthIdentity OBJECT IDENTIFIER ::= { ipsAuthObjects 3 }

-- User Identity Attributes Table

ipsAuthIdentAttributesTable OBJECT-TYPE
SYNTAX        SEQUENCE OF IpsAuthIdentAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current
**DESCRIPTION**

"A list of user identities, each belonging to a particular ipsAuthInstance."

```plaintext
::= { ipsAuthIdentity 1 }
```

**ipsAuthIdentAttributesEntry** OBJECT-TYPE

- **SYNTAX**          IpsAuthIdentAttributesEntry
- **MAX-ACCESS**      not-accessible
- **STATUS**          current

**DESCRIPTION**

"An entry (row) containing management information describing a user identity within an authorization instance on this node."

**INDEX** { ipsAuthInstIndex, ipsAuthIdentIndex }

```plaintext
::= { ipsAuthIdentAttributesTable  1 }
```

**IpsAuthIdentAttributesEntry** ::= SEQUENCE {

- **ipsAuthIdentIndex**             Unsigned32,
- **ipsAuthIdentDescription**       SnmpAdminString,
- **ipsAuthIdentRowStatus**         RowStatus,
- **ipsAuthIdentStorageType**       StorageType

}

**ipsAuthIdentIndex** OBJECT-TYPE

- **SYNTAX**          Unsigned32 (1..4294967295)
- **MAX-ACCESS**      not-accessible
- **STATUS**          current

**DESCRIPTION**

"An arbitrary integer used to uniquely identify a particular identity instance within an authorization instance present on the node. 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."

```plaintext
::= { ipsAuthIdentAttributesEntry 1 }
```

**ipsAuthIdentDescription** OBJECT-TYPE

- **SYNTAX**          SnmpAdminString
- **MAX-ACCESS**      read-create
- **STATUS**          current

**DESCRIPTION**

"A character string describing this particular identity."

```plaintext
::= { ipsAuthIdentAttributesEntry 2 }
```

**ipsAuthIdentRowStatus** 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.
Rows may be discarded using RowStatus. The value of
ipsAuthIdentDescription may be set while
ipsAuthIdentRowStatus is 'active'."

::= { ipsAuthIdentAttributesEntry 3 }

ipsAuthIdentStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION

"The storage type for all read-create objects in this row.
Rows in this table that were created through an external
process may have a storage type of readOnly or permanent.
Conceptual rows having the value 'permanent' need not
allow write access to any columnar objects in the row."
DEFVAL        { nonVolatile }
::= { ipsAuthIdentAttributesEntry 4 }

ipsAuthIdentityName OBJECT IDENTIFIER ::= { ipsAuthObjects 4 }

-- User Initiator Name Attributes Table

ipsAuthIdentNameAttributesTable OBJECT-TYPE
SYNTAX        SEQUENCE OF IpsAuthIdentNameAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION

"A list of unique names that can be used to positively
identify a particular user identity."
::= { ipsAuthIdentityName 1 }

ipsAuthIdentNameAttributesEntry OBJECT-TYPE
SYNTAX        IpsAuthIdentNameAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION

"An entry (row) containing management information
applicable to a unique identity name, which can be used
to identify a user identity within a particular
authorization instance."
INDEX { ipsAuthInstIndex, ipsAuthIdentIndex,
ipsAuthIdentNameIndex }
::= { ipsAuthIdentNameAttributesTable 1 }
IpsAuthIdentNameAttributesEntry ::= SEQUENCE {
    ipsAuthIdentNameIndex          Unsigned32,
    ipsAuthIdentName               SnmpAdminString,
    ipsAuthIdentNameRowStatus      RowStatus,
    ipsAuthIdentNameStorageType    StorageType
}

ipsAuthIdentNameIndex OBJECT-TYPE
SYNTAX        Unsigned32 (1..4294967295)
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An arbitrary integer used to uniquely identify a
particular identity name instance within an
ipsAuthIdentity within an authorization 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."
::= { ipsAuthIdentNameAttributesEntry 1 }

ipsAuthIdentName OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"A character string that is the unique name of an
identity that may be used to identify this ipsAuthIdent
entry."
::= { ipsAuthIdentNameAttributesEntry 2 }

ipsAuthIdentNameRowStatus 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.
Rows may be discarded using RowStatus. The value of
ipsAuthIdentName may be set when this value is ‘active’."
::= { ipsAuthIdentNameAttributesEntry 3 }

ipsAuthIdentNameStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The storage type for all read-create objects in this row. Rows in this table that were created through an external process may have a storage type of readOnly or permanent. Conceptual rows having the value ‘permanent’ need not allow write access to any columnar objects in the row."

DEFVAL { nonVolatile } ::= { ipsAuthIdentNameAttributesEntry 4 }

ipsAuthIdentityAddress OBJECT IDENTIFIER ::= { ipsAuthObjects 5 }

-- User Initiator Address Attributes Table

ipsAuthIdentAddrAttributesTable OBJECT-TYPE
SYNTAX SEQUENCE OF IpsAuthIdentAddrAttributesEntry
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION
"A list of address ranges that are allowed to serve as the endpoint addresses of a particular identity. An address range includes a starting and ending address and an optional netmask, and an address type indicator, which can specify whether the address is IPv4, IPv6, FC-WPWN, or FC-WWNN."

::= { ipsAuthIdentityAddress 1 }

ipsAuthIdentAddrAttributesEntry OBJECT-TYPE
SYNTAX IpsAuthIdentAddrAttributesEntry
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION
"An entry (row) containing management information applicable to an address range that is used as part of the authorization of an identity within an authorization instance on this node."

INDEX { ipsAuthInstIndex, ipsAuthIdentIndex, 
ipsAuthIdentAddrIndex )

::= { ipsAuthIdentAddrAttributesTable 1 }

IpsAuthIdentAddrAttributesEntry ::= SEQUENCE {
ipsAuthIdentAddrIndex Unsigned32,
ipsAuthIdentAddrType AddressFamilyNumbers,
ipsAuthIdentAddrStart IpsAuthAddress,
ipsAuthIdentAddrEnd IpsAuthAddress,
ipsAuthIdentAddrRowStatus RowStatus,
ipsAuthIdentAddrStorageType StorageType
}

ipsAuthIdentAddrIndex OBJECT-TYPE
SYNTAX        Unsigned32 (1..4294967295)
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An arbitrary integer used to uniquely identify a particular ipsAuthIdentAddress instance within an ipsAuthIdentity within an authorization instance present on the node. 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."
::= { ipsAuthIdentAddrAttributesEntry 1 }

ipsAuthIdentAddrType OBJECT-TYPE
SYNTAX        AddressFamilyNumbers
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The address types used in the ipsAuthIdentAddrStart and ipsAuthAddrEnd objects. This type is taken from the IANA address family types."
::= { ipsAuthIdentAddrAttributesEntry 2 }

ipsAuthIdentAddrStart OBJECT-TYPE
SYNTAX        IpsAuthAddress
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The starting address of the allowed address range. The format of this object is determined by ipsAuthIdentAddrType."
::= { ipsAuthIdentAddrAttributesEntry 3 }

ipsAuthIdentAddrEnd OBJECT-TYPE
SYNTAX        IpsAuthAddress
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The ending address of the allowed address range. If the ipsAuthIdentAddrEntry specifies a single address, this shall match the ipsAuthIdentAddrStart. The format of this object is determined by ipsAuthIdentAddrType."
::= { ipsAuthIdentAddrAttributesEntry 4 }

ipsAuthIdentAddrRowStatus 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.
Rows may be discarded using RowStatus. The values of
ipsAuthIdentAddrStart and ipsAuthIdentAddrEnd may be set
when this value is ‘active’. The value of
ipsAuthIdentAddrType may not be set when this value is
‘active’.
"

::= { ipsAuthIdentAddrAttributesEntry 5 }

ipsAuthIdentAddrStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current

DESCRIPTION
"The storage type for all read-create objects in this row.
Rows in this table that were created through an external
process may have a storage type of readOnly or permanent.
Conceptual rows having the value ‘permanent’ need not
allow write access to any columnar objects in the row."

DEFVAL        { nonVolatile }

::= { ipsAuthIdentAddrAttributesEntry 6 }

ipsAuthCredential OBJECT IDENTIFIER ::= { ipsAuthObjects 6 }

-- Credential Attributes Table

ipsAuthCredentialAttributesTable OBJECT-TYPE
SYNTAX        SEQUENCE OF IpsAuthCredentialAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"A list of credentials related to user identities
that are allowed as valid authenticators of the
particular identity."

::= { ipsAuthCredential 1 }

ipsAuthCredentialAttributesEntry OBJECT-TYPE
SYNTAX        IpsAuthCredentialAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current

DESCRIPTION
"An entry (row) containing management information
applicable to a credential that verifies a user
identity within an authorization instance."
To provide complete information in this MIB for a credential, the management station must not only create the row in this table but must also create a row in another table, where the other table is determined by the value of `ipsAuthCredAuthMethod`, e.g., if `ipsAuthCredAuthMethod` has the value `ipsAuthMethodChap`, a row must be created in the `ipsAuthCredChapAttributesTable`.

```
INDEX { ipsAuthInstIndex, ipsAuthIdentIndex, ipsAuthCredIndex }
 ::= { ipsAuthCredentialAttributesTable  1 }
```

```
IpsAuthCredentialAttributesEntry ::= SEQUENCE {
  ipsAuthCredIndex               Unsigned32,
  ipsAuthCredAuthMethod          AutonomousType,
  ipsAuthCredRowStatus           RowStatus,
  ipsAuthCredStorageType         StorageType
}
```

```
ipsAuthCredIndex OBJECT-TYPE
SYNTAX          Unsigned32 (1..4294967295)
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION  
"An arbitrary integer used to uniquely identify a particular Credential instance within an instance present on the node. 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."
 ::= { ipsAuthCredentialAttributesEntry 1 }
```

```
ipsAuthCredAuthMethod OBJECT-TYPE
SYNTAX          AutonomousType
MAX-ACCESS      read-create
STATUS          current
DESCRIPTION  
"This object contains an OBJECT IDENTIFIER that identifies the authentication method used with this credential.

When a row is created in this table, a corresponding row must be created by the management station in a corresponding table specified by this value.

When a row is deleted from this table, the corresponding row must be automatically deleted by the agent in the corresponding table specified by this value.

```
If the value of this object is ipsAuthMethodNone, no corresponding rows are created or deleted from other tables.

Some standardized values for this object are defined within the ipsAuthMethodTypes subtree.

::= { ipsAuthCredentialAttributesEntry 2 }

ipsAuthCredRowStatus 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. Rows may be discarded using RowStatus. The value of ipsAuthCredAuthMethod must not be changed while this row is 'active'."
::= { ipsAuthCredentialAttributesEntry 3 }

ipsAuthCredStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The storage type for all read-create objects in this row. Rows in this table that were created through an external process may have a storage type of readOnly or permanent. Conceptual rows having the value ‘permanent’ need not allow write access to any columnar objects in the row."
DEFVAL { nonVolatile }
::= { ipsAuthCredentialAttributesEntry 4 }

ipsAuthCredChap OBJECT IDENTIFIER ::= { ipsAuthObjects 7 }

-- Credential Chap-Specific Attributes Table

ipsAuthCredChapAttributesTable OBJECT-TYPE
SYNTAX SEQUENCE OF IpsAuthCredChapAttributesEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A list of CHAP attributes for credentials that use ipsAuthMethodChap as their ipsAuthCredAuthMethod.

A row in this table can only exist when an instance of the ipsAuthCredAuthMethod object exists (or is created
simultaneously) having the same instance identifiers
and a value of ‘ipsAuthMethodChap’.
::= { ipsAuthCred Chap 1 }

ipsAuthCred ChapAttributesEntry OBJECT-TYPE
SYNTAX IpsAuthCred ChapAttributesEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An entry (row) containing management information
applicable to a credential that uses
ipsAuthMethodChap as their ipsAuthCredAuthMethod.

When a row is created in ipsAuthCredentialAttributesTable
with ipsAuthCredAuthMethod = ipsAuthCred Chap, the
management station must create a corresponding row
in this table.

When a row is deleted from ipsAuthCredentialAttributesTable
with ipsAuthCredAuthMethod = ipsAuthCred Chap, the
agent must delete the corresponding row (if any) in
this table."
INDEX { ipsAuthInstIndex, ipsAuthIdentIndex, ipsAuthCredIndex }
::= { ipsAuthCred ChapAttributesTable 1 }

IpsAuthCred ChapAttributesEntry ::= SEQUENCE {
  ipsAuthCred ChapUserName        SnmpAdminString,
  ipsAuthCred ChapRowStatus       RowStatus,
  ipsAuthCred ChapStorageType     StorageType
}

ipsAuthCred ChapUserName OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"A character string containing the CHAP user name for this
credential."
REFERENCE
"W. Simpson, RFC 1994: PPP Challenge Handshake
Authentication Protocol (CHAP), August 1996"
::= { ipsAuthCred ChapAttributesEntry 1 }

ipsAuthCred ChapRowStatus 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. Rows may be discarded using RowStatus. The value of ipsAuthCredChapUserName may be changed while this row is 'active'."

::= { ipsAuthCredChapAttributesEntry 2 }

ipsAuthCredChapStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The storage type for all read-create objects in this row. Rows in this table that were created through an external process may have a storage type of readOnly or permanent. Conceptual rows having the value 'permanent' need not allow write access to any columnar objects in the row."
DEFVAL        { nonVolatile }
::= { ipsAuthCredChapAttributesEntry 3 }

ipsAuthCredSrp OBJECT IDENTIFIER ::= { ipsAuthObjects 8 }

-- Credential Srp-Specific Attributes Table

ipsAuthCredSrpAttributesTable OBJECT-TYPE
SYNTAX        SEQUENCE OF IpsAuthCredSrpAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"A list of SRF attributes for credentials that use ipsAuthMethodSrp as their ipsAuthCredAuthMethod. A row in this table can only exist when an instance of the ipsAuthCredAuthMethod object exists (or is created simultaneously) having the same instance identifiers and a value of 'ipsAuthMethodSrp'."
::= { ipsAuthCredSrp 1 }

ipsAuthCredSrpAttributesEntry OBJECT-TYPE
SYNTAX        IpsAuthCredSrpAttributesEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry (row) containing management information applicable to a credential that uses ipsAuthMethodSrp as their ipsAuthCredAuthMethod."
When a row is created in ipsAuthCredentialAttributesTable with ipsAuthCredAuthMethod = ipsAuthCredSrp, the management station must create a corresponding row in this table.

When a row is deleted from ipsAuthCredentialAttributesTable with ipsAuthCredAuthMethod = ipsAuthCredSrp, the agent must delete the corresponding row (if any) in this table.

INDEX { ipsAuthInstIndex, ipsAuthIdentIndex, ipsAuthCredIndex }
::= { ipsAuthCredSrpAttributesTable  1 }

IpsAuthCredSrpAttributesEntry ::= SEQUENCE {
  ipsAuthCredSrpUserName         SnmpAdminString,
  ipsAuthCredSrpRowStatus        RowStatus,
  ipsAuthCredSrpStorageType      StorageType
}

ipsAuthCredSrpUserName OBJECT-TYPE
SYNTAX        SnmpAdminString
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
  "A character string containing the SRP user name for this credential."
REFERENCE
::= { ipsAuthCredSrpAttributesEntry 1 }

ipsAuthCredSrpRowStatus 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. Rows may be discarded using RowStatus. The value of ipsAuthCredSrpUserName may be changed while the status of this row is ‘active’." 
::= { ipsAuthCredSrpAttributesEntry 2 }

ipsAuthCredSrpStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The storage type for all read-create objects in this row. Rows in this table that were created through an external process may have a storage type of readOnly or permanent. Conceptual rows having the value 'permanent' need not allow write access to any columnar objects in the row."

DEFVAL               { nonVolatile }
 ::= { ipsAuthCredSrpAttributesEntry 3 }

ipsAuthCredKerberos OBJECT IDENTIFIER ::= { ipsAuthObjects 9 }

-- Credential Kerberos-Specific Attributes Table

ipsAuthCredKerbAttributesTable OBJECT-TYPE
 SYNTAX        SEQUENCE OF IpsAuthCredKerbAttributesEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
   "A list of Kerberos attributes for credentials that use ipsAuthMethodKerberos as their ipsAuthCredAuthMethod.

   A row in this table can only exist when an instance of the
   ipsAuthCredAuthMethod object exists (or is created simultaneously) having the same instance identifiers
   and a value of 'ipsAuthMethodKerb'."
 ::= { ipsAuthCredKerberos 1 }

ipsAuthCredKerbAttributesEntry OBJECT-TYPE
 SYNTAX        IpsAuthCredKerbAttributesEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
   "An entry (row) containing management information applicable to a credential that uses
   ipsAuthMethodKerberos as its ipsAuthCredAuthMethod.

   When a row is created in ipsAuthCredAttributesTable with
   ipsAuthCredAuthMethod = ipsAuthCredKerberos, the
   management station must create a corresponding row in this table.

   When a row is deleted from ipsAuthCredAttributesTable with
   ipsAuthCredAuthMethod = ipsAuthCredKerberos, the
   agent must delete the corresponding row (if any) in this table."
 INDEX { ipsAuthInstIndex, ipsAuthIdentIndex, ipsAuthCredIndex }  ::= { ipsAuthCredKerbAttributesTable 1 }

IpsAuthCredKerbAttributesEntry ::= SEQUENCE {
ipsAuthCredKerbPrincipal SnmpAdminString,  
ipsAuthCredKerbRowStatus RowStatus,  
ipsAuthCredKerbStorageType StorageType  
}

ipsAuthCredKerbPrincipal OBJECT-TYPE  
SYNTAX SnmpAdminString  
MAX-ACCESS read-create  
STATUS current  
DESCRIPTION "A character string containing a Kerberos principal for this credential."  
 ::= { ipsAuthCredKerbAttributesEntry 1 }

ipsAuthCredKerbRowStatus OCTET-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. Rows may be discarded using RowStatus. The value of ipsAuthCredKerbPrincipal may be changed while this row is 'active'."  
 ::= { ipsAuthCredKerbAttributesEntry 2 }

ipsAuthCredKerbStorageType OBJECT-TYPE  
SYNTAX StorageType  
MAX-ACCESS read-create  
STATUS current  
DESCRIPTION "The storage type for all read-create objects in this row. Rows in this table that were created through an external process may have a storage type of readOnly or permanent. Conceptual rows having the value 'permanent' need not allow write access to any columnar objects in the row."  
DEFVAL { nonVolatile }  
 ::= { ipsAuthCredKerbAttributesEntry 3 }

--******************************************************************  
-- Notifications  
-- There are no notifications necessary in this MIB module.  

Bakke & Muchow Standards Track [Page 28]
-- Conformance Statements

ipsAuthCompliances OBJECT IDENTIFIER ::= { ipsAuthConformance 1 }
ipsAuthGroups OBJECT IDENTIFIER ::= { ipsAuthConformance 2 }

ipsAuthInstanceAttributesGroup OBJECT-GROUP
    OBJECTS {
        ipsAuthInstDescr,
        ipsAuthInstStorageType
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about
           authorization instances."
    ::= { ipsAuthGroups 1 }

ipsAuthIdentAttributesGroup OBJECT-GROUP
    OBJECTS {
        ipsAuthIdentDescription,
        ipsAuthIdentRowStatus,
        ipsAuthIdentStorageType
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about
           user identities within an authorization instance."
    ::= { ipsAuthGroups 2 }

ipsAuthIdentNameAttributesGroup OBJECT-GROUP
    OBJECTS {
        ipsAuthIdentName,
        ipsAuthIdentNameRowStatus,
        ipsAuthIdentNameStorageType
    }
    STATUS current
    DESCRIPTION
        "A collection of objects providing information about
           user names within user identities within an authorization
           instance."
    ::= { ipsAuthGroups 3 }

ipsAuthIdentAddrAttributesGroup OBJECT-GROUP
    OBJECTS {
        ipsAuthIdentAddrType,
        ipsAuthIdentAddrStart,
        ipsAuthIdentAddrEnd,
ipsAuthIdentAddrRowStatus,
ipsAuthIdentAddrStorageType
}
STATUS current
DESCRIPTION
"A collection of objects providing information about
address ranges within user identities within an
authorization instance."
::= { ipsAuthGroups 4 }

ipsAuthIdentCredAttributesGroup OBJECT-GROUP
OBJECTS {
  ipsAuthCredAuthMethod,
  ipsAuthCredRowStatus,
  ipsAuthCredStorageType
}
STATUS current
DESCRIPTION
"A collection of objects providing information about
credentials within user identities within an authorization
instance."
::= { ipsAuthGroups 5 }

ipsAuthIdentChapAttrGroup OBJECT-GROUP
OBJECTS {
  ipsAuthCredChapUserName,
  ipsAuthCredChapRowStatus,
  ipsAuthCredChapStorageType
}
STATUS current
DESCRIPTION
"A collection of objects providing information about
CHAP credentials within user identities within an
authorization instance."
::= { ipsAuthGroups 6 }

ipsAuthIdentSrpAttrGroup OBJECT-GROUP
OBJECTS {
  ipsAuthCredSrpUserName,
  ipsAuthCredSrpRowStatus,
  ipsAuthCredSrpStorageType
}
STATUS current
DESCRIPTION
"A collection of objects providing information about
SRP credentials within user identities within an
authorization instance."
::= { ipsAuthGroups 7 }
ipsAuthIdentKerberosAttrGroup OBJECT-GROUP
OBJECTS {
    ipsAuthCredKerbPrincipal, 
    ipsAuthCredKerbRowStatus, 
    ipsAuthCredKerbStorageType 
}
STATUS current
DESCRIPTION
"A collection of objects providing information about
Kerberos credentials within user identities within an
authorization instance."
::= { ipsAuthGroups 8 }

--******************************************************************
ipsAuthComplianceV1 MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Initial version of compliance statement based on
initial version of this MIB module.

The Instance and Identity groups are mandatory; at least one of the other groups (Name, Address, Credential, Certificate) is also mandatory for any given implementation."

MODULE -- this module
MANDATORY-GROUPS {
    ipsAuthInstanceAttributesGroup, 
    ipsAuthIdentAttributesGroup 
}

-- Conditionally mandatory groups to be included with
-- the mandatory groups when necessary.

GROUP ipsAuthIdentNameAttributesGroup
DESCRIPTION
"This group is mandatory for all implementations that make use of unique identity names."

GROUP ipsAuthIdentAddrAttributesGroup
DESCRIPTION
"This group is mandatory for all implementations that use addresses to help verify identities."

GROUP ipsAuthIdentCredAttributesGroup
DESCRIPTION
"This group is mandatory for all implementations that use credentials to help verify identities."
GROUP ipsAuthIdentChapAttrGroup
DESCRIPTION
"This group is mandatory for all implementations
that use CHAP to help verify identities.

The ipsAuthIdentCredAttributesGroup must be
implemented if this group is implemented."

GROUP ipsAuthIdentSrpAttrGroup
DESCRIPTION
"This group is mandatory for all implementations
that use SRP to help verify identities.

The ipsAuthIdentCredAttributesGroup must be
implemented if this group is implemented."

GROUP ipsAuthIdentKerberosAttrGroup
DESCRIPTION
"This group is mandatory for all implementations
that use Kerberos to help verify identities.

The ipsAuthIdentCredAttributesGroup must be
implemented if this group is implemented."

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

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

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

OBJECT ipsAuthIdentRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the
six enumerated values for the RowStatus textual
convention need be supported, specifically:
active(1)."
OBJECT ipsAuthIdentName
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required."

OBJECT ipsAuthIdentNameRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

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

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

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

OBJECT ipsAuthIdentAddrRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

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

OBJECT ipsAuthCredRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the
six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

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

OBJECT ipsAuthCredChapRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

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

OBJECT ipsAuthCredSrpRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

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

OBJECT ipsAuthCredKerbRowStatus
SYNTAX INTEGER { active(1) } -- subset of RowStatus
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and only one of the six enumerated values for the RowStatus textual convention need be supported, specifically: active(1)."

::= { ipsAuthCompliances 1 }

END
9. Security Considerations

9.1. MIB 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:

- in the ipsAuthInstanceAttributesTable:
  - ipsAuthInstDescr could be modified to camouflage the existence
    of a rogue authorization instance;

- in the ipsAuthIdentAttributesTable:
  - ipsAuthIdentDescription could be modified to camouflage the
    existence of a rogue identity;
  - ipsAuthIdentRowStatus could be modified to add or delete a rogue
    identity;
  - ipsAuthIdentStorageType could be modified to make temporary rows
    permanent, or permanent rows temporary;

- in the ipsAuthIdentNameAttributesTable:
  - ipsAuthIdentName could be modified to change the name of an
    existing identity;
  - ipsAuthIdentNameRowStatus could be modified to add or delete a
    name of an existing identity;
  - ipsAuthIdentNameStorageType could be modified to make temporary
    rows permanent, or permanent rows temporary;

- in the ipsAuthIdentAddrAttributesTable:
  - ipsAuthIdentAddrType could be modified to change the type of
    address checking performed;
  - ipsAuthIdentAddrStart could be modified to change the start of
    the allowed range;
- ipsAuthIdentAddrEnd could be modified to change the end of the allowed range;

- ipsAuthIdentAddrRowStatus could be modified to add or delete the checking of an address range;

- ipsAuthIdentAddrStorageType could be modified to make temporary rows permanent, or permanent rows temporary;

\[ in the ipsAuthCredentialAttributesTable:\]

- ipsAuthCredAuthMethod could be modified to change the type of authentication to be used;

- ipsAuthCredRowStatus could be modified to add or delete checking of credentials;

- ipsAuthCredStorageType could be modified to make temporary rows permanent, or permanent rows temporary;

\[ in the ipsAuthCredChapAttributesTable:\]

- ipsAuthCredChapUserName could be modified to change the CHAP user name for a credential;

- ipsAuthCredChapRowStatus could be modified to add or delete CHAP attributes for credentials;

- ipsAuthCredChapStorageType could be modified to make temporary rows permanent, or permanent rows temporary;

\[ in the ipsAuthCredSrpAttributesTable:\]

- ipsAuthCredSrpUserName could be modified to change the SRP user name for a credential;

- ipsAuthCredSrpRowStatus could be modified to add or delete SRP attributes for credentials;

- ipsAuthCredSrpStorageType could be modified to make temporary rows permanent, or permanent rows temporary;

\[ in the ipsAuthCredKerbAttributesTable:\]

- ipsAuthCredKerbPrincipal could be modified to change the Kerberos principal for a credential;
ipsAuthCredKerbRowStatus could be modified to add or delete Kerberos attributes for credentials;

- ipsAuthCredKerbStorageType could be modified to make temporary rows permanent, or permanent rows temporary;

Note that removal of legitimate credentials can result in either denial of service or weakening the requirements for access of a particular service. Note also that some types of credentials, such as CHAP or SRP, also require passwords or verifiers to be associated with the credential. These are managed outside this MIB module.

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:

- All tables (specifically: ipsAuthInstanceAttributesTable, ipsAuthIdentAttributesTable, ipsAuthIdentNameAttributesTable, ipsAuthIdentAddrAttributesTable, ipsAuthCredentialAttributesTable, ipsAuthCredChapAttributesTable, ipsAuthCredSrpAttributesTable, and ipsAuthCredKerbAttributesTable) provide the ability to find out which names, addresses, and credentials would be required to access services on the managed system. If these credentials are easily spoofed (particularly the name or address), read access to this MIB module must be tightly controlled. When used with pointers from another MIB module to rows in the ipsAuthIdentAttributesTable, this MIB module provides information about which entities are authorized to connect to which entities.

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

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

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

In many implementations, the objects in this MIB module can be read and modified via other mechanisms or protocols in addition to this MIB module. For the system to be secure, other mechanisms that can read and modify the contents of this MIB module must also address the above issues, and handle the threats outlined in [RFC3411], section 1.4.

Given the sensitivity of information contained in this MIB module, it is strongly recommended that encryption (SNMPv3 with a securityLevel of authPriv [RFC3411]) be used for all access to objects in this MIB module.

9.2. Other Security Considerations

An identity consists of a set of names (e.g., an iSCSI Initiator Name), addresses (e.g., an IP address or Fibre Channel World Wide Name (WWN)), and credentials (e.g., a CHAP user name).

To match an identity, one must match:

- One of the IdentNames belonging to the IdentIndex, unless there are no IdentNames for the IdentIndex, and
- One of the IdentAddrs belonging to the IdentIndex, unless there are no IdentAddrs for the IdentIndex, and
- One of the IdentCreds belonging to the IdentIndex, unless there are no Creds for the IdentIndex.

Note that if any of the above lists are empty for a given IdentIndex, any identifier of that type is considered to match the identity. The non-empty lists will still be checked. For example, if the IdentAddrs list is empty for the IdentIndex, but there are entries in IdentNames and IdentCreds, any address will be considered a match, as long as the offered name and credential match one of the IdentNames and IdentCreds, respectively.

This leaves a possible security window while adding and removing entries from one of these lists. For example, an identity could consist of no IdentNames, no IdentAddrs, and exactly one IdentCred. If that IdentCred was to be updated, several methods could be used:
o The UserName or Principal could be simply written in the appropriate table, if the credential’s type remained the same (recommended).

o The new credential could be added, then the old deleted (recommended).

o The new credential could be added, and the old deleted in the same SNMP request (recommended, but do the add first).

o The old credential could be deleted, then the new added (Don’t use!).

Of the above methods, the last leaves a window in which the list is empty, possibly allowing unconstrained access to the resource making use of this MIB. This method should never be used for Names, Addr, or Creds.

The use of the third method, adding and deleting within the same request, should be used with care. It is recommended that within the request, the add be done first. Otherwise, an implementation may attempt to perform these operations in order, potentially leaving a window.

The first two methods are recommended.

Care must also be taken when updating the IdentAddrs for an identity. Each IdentAddr specifies a range of addresses that match the identity, and has an address type, starting address, and ending address. Modifying these one at a time can open a temporary window where a larger range of addresses are allowed. For example, a single address is specified using IdentAddrType = ipv4, IdentAddrStart = IdentAddrEnd = 192.0.2.5. We want to update this to specify the single address 192.0.2.34. If the end address is updated first, we temporarily allow the range 192.0.2.5 .. 192.0.2.34, which is not what we want. Similarly, if we change from 192.0.2.34 back to 192.0.2.5, and we update IdentAddrStart first, we end up with the range again. To handle this, an application must either:

o update both IdentAddrStart and IdentAddrEnd in the same SNMP set request, or

o add the new IdentAddrStart and IdentAddrEnd with a new IdentAddrIndex, then delete the old one, using the methods shown before.
Since the value of IdentAddrType specifies the formats of IdentAddrStart and IdentAddrEnd, modification of IdentAddrType is not allowed for an existing row.

10.  IANA Considerations

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

11.  Normative References


12. Informative References


13. Acknowledgements

In addition to the authors, several people contributed to the development of this MIB module through discussions of authentication, authorization, and access within the iSCSI MIB module and security teams, including John Hufferd, Marjorie Krueger, Keith McCloghrie, Tom McSweeney, Steve Senum, and Josh Tseng. Thanks also to Bill Studenmund (Wasabi Systems) for adding the Kerberos method, and to Ayman Ghanem for finding and suggesting changes to several problems found in the MIB module.

Thanks especially to Keith McCloghrie for serving as advisor for this MIB module.
Authors’ Addresses

Mark Bakke
Postal: Cisco Systems, Inc
7900 International Drive, Suite 400
Bloomington, MN
USA 55425

EMail: mbakke@cisco.com

James Muchow
Postal: Qlogic Corp.
6321 Bury Drive
Eden Prairie, MN
USA 55346

EMail: james.muchow@qlogic.com
Full Copyright Statement

Copyright (C) The Internet Society (2006).

This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at http://www.ietf.org/ipr.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Acknowledgement

Funding for the RFC Editor function is provided by the IETF Administrative Support Activity (IASA).