Diffie-Helman USM Key
Management Information Base and Textual Convention

Status of this Memo

This memo defines an Experimental Protocol for the Internet community. It does not specify an Internet standard of any kind. Discussion and suggestions for improvement are requested. Distribution of this memo is unlimited.

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IESG Note

This document specifies an experimental MIB. Readers, implementers and users of this MIB should be aware that in the future the IETF may charter an IETF Working Group to develop a standards track MIB to address the same problem space that this MIB addresses. It is quite possible that an incompatible standards track MIB may result from that effort.

Abstract

This memo defines an experimental portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines a textual convention for doing Diffie-Helman key agreement key exchanges and a set of objects which extend the usmUserTable to permit the use of a DH key exchange in addition to the key change method described in [12]. In otherwords, this MIB adds the possibility of forward secrecy to the USM model. It also defines a set of objects that can be used to kick start security on an SNMPv3 agent when the out of band path is authenticated, but not necessarily private or confidential.

The KeyChange textual convention described in [12] permits secure key changes, but has the property that if a third-party has knowledge of the original key (e.g. if the agent was manufactured with a standard default key) and could capture all SNMP exchanges, the third-party would know the new key. The Diffie-Helman key change described here
limits knowledge of the new key to the agent and the manager making the change. In otherwords, this process adds forward secrecy to the key change process.

The recommendation in [12] is that the usmUserTable be populated out of band - e.g. not via SNMP. If the number of agents to be configured is small, this can be done via a console port and manually. If the number of agents is large, as is the case for a cable modem system, the manual approach doesn’t scale well. The combination of the two mechanisms specified here - the DH key change mechanism, and the DH key ignition mechanism - allows manageable use of SNMPv3 USM in a system of millions of devices.

This memo specifies a MIB module in a manner that is compliant to the SNMP SMIv2[5][6][7]. The set of objects is consistent with the SNMP framework and existing SNMP standards and is intended for use with the SNMPv3 User Security Model MIB and other security related MIBs.

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 [16].

This memo is a private submission by the author, but is applicable to the SNMPv3 working group within the Internet Engineering Task Force. Comments are solicited and should be addressed to the the author.

Table of Contents

1 The SNMP Management Framework ............................................. 2
1.1 Structure of the MIB ................................................... 3
2 Theory of Operation ..................................................... 4
2.1 Diffie-Helman Key Changes ........................................... 4
2.2 Diffie-Helman Key Ignition .......................................... 4
3 Definitions ............................................................................. 6
4 References ............................................................................ 17
5 Security Considerations ....................................................... 18
6 Intellectual Property ............................................................. 19
7 Author’s Address .................................................................. 19
8 Full Copyright Statement ...................................................... 20

1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in RFC 2271 [1].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD

16

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19

20
Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2272 [11] and RFC 2274 [12].

Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].

A set of fundamental applications described in RFC 2273 [14] and the view-based access control mechanism described in RFC 2275 [15].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIv2. A MIB conforming to the SMIv1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIv2 will be converted into textual descriptions in SMIv1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

1.1. Structure of the MIB

This MIB is structured into three groups and a single textual convention:

- The DHKeyChange textual convention defines the process for changing a secret key value via a Diffie-Helman key exchange.

- The usmDHPublicObjects group contains a single object which describes the public Diffie-Helman parameters required by any instance of a DHKeyChange typed object.
The `usmDHUserKeyTable` augments and extends the `usmUserTable` defined in the SNMPv3 User-based Security Model MIB [12] by providing objects which permit the updating of the Authentication and Privacy keys for a row in this table through the use of a Diffie-Helman key exchange.

The `usmDHKickstartTable` provides a mechanism for a management station to be able to agree upon a set of authentication and confidentiality keys and their associated row in the `usmUserTable`.

2. Theory of Operation

2.1. Diffie-Helman Key Changes

Upon row creation (in the `usmUserTable`), or object change (either of the object in the `usmDHUserKeyTable` or its associated value in the `usmUserTable`), the agent generates a random number. From this random number, the agent uses the DH parameters and transforms to derive a DH public value which is then published to the associated MIB object. The management station reads one or more of the objects in the `usmDHUserKeyTable` to get the agent’s DH public values.

The management station generates a random number, derives a DH public value from that random number (as described in the DHKeyChange Textual Convention), and does an SNMP SET against the object in the `usmDHUserKeyTable`. The set consists of the concatenation of the agent’s derived DH public value and the manager’s derived DH public value (to ensure the DHKeyChange object hasn’t otherwise changed in the meantime).

Upon successful completion of the set, the underlying key (authentication or confidentiality) for the associated object in the `usmUserTable` is changed to a key derived from the DH shared secret. Both the agent and the management station are able to calculate this value based on their knowledge of their own random number and the other’s DH public number.

2.2. Diffie-Helman Key Ignition

[12] recommends that the `usmUserTable` be populated out of band, for example - manually. This works reasonably well if there are a small number of agents, or if all the agents are using the same key material, and if the device is physically accessible for that action. It does not scale very well to the case of possibly millions of devices located in thousands of locations in hundreds of markets in
multiple countries. In other words, it doesn’t work well with a
cable modem system, and may not work all that well with other large-
scale consumer broadband IP offerings.

The methods described in the objects under the usmDHKickstartGroup
can be used to populate the usmUserTable in the circumstances where
you may be able to provide at least limited integrity for the
provisioning process, but you can’t guarantee confidentiality. In
addition, as a side effect of using the DH exchange, the operational
USM keys for each agent will differ from the operational USM keys for
every other device in the system, ensuring that compromise of one
device does not compromise the system as a whole.

The vendor who implements these objects is expected to provide one or
more usmSecurityNames which map to a set of accesses defined in the
VACM [15] tables. For example, the vendor may provide a ‘root’ user
who has access to the entire device for read-write, and ‘operator’
user who has access to the network specific monitoring objects and
can also reset the device, and a ‘customer’ user who has access to a
subset of the monitoring objects which can be used to help the
customer debug the device in conjunction with customer service
questions.

To use, the system manager (the organization or individual who own
the group of devices) generates one or more random numbers - R. The
manager derives the DH Public Numbers R’ from these random numbers,
associates the public numbers with a security name, and configures
the agent with this association. The configuration would be done
either manually (in the case of a small number of devices), or via
some sort of distributed configuration file. The actual mechanism is
outside the scope of this document. The agent in turn generates a
random number for each name/number pair, and publishes the DH Public
Number derived from its random number in the usmDHKickstartTable
along with the manager’s public number and provided security name.

Once the agent is initialized, an SNMP Manager can read the contents
of the usmDHKickstartTable using the security name of ‘dhKickstart’
with no authentication. The manager looks for one or more entries in
this table where it knows the random number used to derive the
usmDHKickstartMgrPublicKey number. Given the manager’s knowledge of the
private random number, and the usmDHKickstartMyPublicKey number, the
manager can calculate the DH shared secret. From that shared secret,
it can derive the operational authentication and confidentiality keys
for the usmUserTable row which has the matching security name. Given
the keys and the security name, the manager can then use normal USM
mechanisms to access the remainder of the agent’s MIB space.
3. Definitions

SNMP-USM-DH-OBJECTS-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE,
   -- OBJECT-IDENTITY,
   experimental, Integer32
   FROM SNMPv2-SMI
   TEXTUAL-CONVENTION
   FROM SNMPv2-TC
   MODULE-COMPLIANCE, OBJECT-GROUP
   FROM SNMPv2-CONF
   usmUserEntry
   FROM SNMP-USER-BASED-SM-MIB
   SnmpAdminString
   FROM SNMP-FRAMEWORK-MIB;

snmpUsmDObjectsMIB MODULE-IDENTITY
   LAST-UPDATED "200003060000Z"  -- 6 March 2000, Midnight
   ORGANIZATION "Excite@Home"
   CONTACT-INFO "Author: Mike StJohns
                  Postal: Excite@Home
                          450 Broadway
                          Redwood City, CA 94063
                  Email: stjohns@corp.home.net
                  Phone: +1-650-556-5368"

   DESCRIPTION
      "The management information definitions for providing forward
       secrecy for key changes for the usmUserTable, and for providing a
       method for 'kickstarting' access to the agent via a Diffie-Helman
       key agreement."

   REVISION   "200003060000Z"
   DESCRIPTION
      "Initial version published as RFC 2786."

   ::= { experimental 101 }  -- IANA DHKEY-CHANGE 101

   -- Administrative assignments

   usmDHKeyObjects OBJECT IDENTIFIER ::= { snmpUsmDObjectsMIB 1 }
   usmDHKeyConformance OBJECT IDENTIFIER ::= { snmpUsmDObjectsMIB 2 }

   -- Textual conventions
DHKeyChange ::= TEXTUAL-CONVENTION

DESCRIPTION
"Upon initialization, or upon creation of a row containing an object of this type, and after any successful SET of this value, a GET of this value returns 'y' where y = g^xa MOD p, and where g is the base from usmDHParameters, p is the prime from usmDHParameters, and xa is a new random integer selected by the agent in the interval 2^(l-1) <= xa < 2^l < p-1. 'l' is the optional privateValueLength from usmDHParameters in bits. If 'l' is omitted, then xa (and xr below) is selected in the interval 0 <= xa < p-1. y is expressed as an OCTET STRING 'PV' of length 'k' which satisfies

\[ y = \sum_{i=1}^{k} 2^{(8(k-i))} PV_i \]

where PV1,...,PVk are the octets of PV from first to last, and where PV1 <> 0.

A successful SET consists of the value 'y' expressed as an OCTET STRING as above concatenated with the value 'z' (expressed as an OCTET STRING in the same manner as y) where z = g^xr MOD p, where g, p and l are as above, and where xr is a new random integer selected by the manager in the interval 2^(l-1) <= xr < 2^l < p-1. A SET to an object of this type will fail with the error wrongValue if the current 'y' does not match the 'y' portion of the value of the varbind for the object. (E.g. GET yout, SET concat(yin, z), yout <> yin).

Note that the private values xa and xr are never transmitted from manager to device or vice versa, only the values y and z. Obviously, these values must be retained until a successful SET on the associated object.

The shared secret 'sk' is calculated at the agent as sk = z^xa MOD p, and at the manager as sk = y^xr MOD p.

Each object definition of this type MUST describe how to map from the shared secret 'sk' to the operational key value used by the protocols and operations related to the object. In general, if n bits of key are required, the author suggests using the n right-most bits of the shared secret as the operational key value."

REFERENCE
"-- Diffie-Hellman Key-Agreement Standard, PKCS #3; RSA Laboratories, November 1993"

SYNTAX
OCTET STRING
-- Diffie-Hellman public values

usmDHPublicObjects OBJECT IDENTIFIER ::= { usmDHKeyObjects 1 }

usmDHParameters OBJECT-TYPE
SYNTAX OCTET STRING
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The public Diffie-Hellman parameters for doing a Diffie-Hellman key agreement for this device. This is encoded as an ASN.1 DHParameter per PKCS #3, section 9. E.g.

    DHParameter ::= SEQUENCE {
      prime    INTEGER,    -- p
      base     INTEGER,    -- g
      privateValueLength INTEGER OPTIONAL }

Implementors are encouraged to use either the values from Oakley Group 1 or the values of from Oakley Group 2 as specified in RFC-2409, The Internet Key Exchange, Section 6.1, 6.2 as the default for this object. Other values may be used, but the security properties of those values MUST be well understood and MUST meet the requirements of PKCS #3 for the selection of Diffie-Hellman primes.

In addition, any time usmDHParameters changes, all values of type DHKeyChange will change and new random numbers MUST be generated by the agent for each DHKeyChange object."

REFERENCE "-- Diffie-Hellman Key-Agreement Standard, PKCS #3, RSA Laboratories, November 1993
-- The Internet Key Exchange, RFC 2409, November 1998, Sec 6.1, 6.2"
 ::= { usmDHPublicObjects 1 }

usmDHUserKeyTable OBJECT-TYPE
SYNTAX SEQUENCE OF UsmDHUserKeyEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "This table augments and extends the usmUserTable and provides 4 objects which exactly mirror the objects in that table with the textual convention of 'KeyChange'. This extension allows key changes to be done in a manner where the knowledge of the current secret plus knowledge of the key change data exchanges (e.g. via wiretapping) will not reveal the new key."
::= { usmDHPublicObjects 2 }

usmDHUserKeyEntry OBJECT-TYPE
SYNTAX  UsmDHUserKeyEntry
MAX-ACCESS not-accessible
STATUS  current
DESCRIPTION
"A row of DHKeyChange objects which augment or replace the
functionality of the KeyChange objects in the base table row."
AUGMENTS { usmUserEntry }
::= {usmDHUserKeyTable 1 }

UsmDHUserKeyEntry ::= SEQUENCE {
    usmDHUserAuthKeyChange          DHKeyChange,
    usmDHUserOwnAuthKeyChange   DHKeyChange,
    usmDHUserPrivKeyChange          DHKeyChange,
    usmDHUserOwnPrivKeyChange       DHKeyChange
}

usmDHUserAuthKeyChange OBJECT-TYPE
SYNTAX  DHKeyChange
MAX-ACCESS read-create
STATUS  current
DESCRIPTION
"The object used to change any given user’s Authentication Key
using a Diffie-Hellman key exchange.

The right-most n bits of the shared secret ‘sk’, where ‘n’ is the
number of bits required for the protocol defined by
usmUserAuthProtocol, are installed as the operational
authentication key for this row after a successful SET."
::= { usmDHUserKeyEntry 1 }

usmDHUserOwnAuthKeyChange OBJECT-TYPE
SYNTAX  DHKeyChange
MAX-ACCESS read-create
STATUS  current
DESCRIPTION
"The object used to change the agent’s own Authentication Key
using a Diffie-Hellman key exchange.

The right-most n bits of the shared secret ‘sk’, where ‘n’ is the
number of bits required for the protocol defined by
usmUserAuthProtocol, are installed as the operational
authentication key for this row after a successful SET."
::= { usmDHUserKeyEntry 2 }

usmDHUserPrivKeyChange OBJECT-TYPE
The right-most n bits of the shared secret ‘sk’, where ‘n’ is the number of bits required for the protocol defined by usmUserPrivProtocol, are installed as the operational privacy key for this row after a successful SET.

::= { usmDHUserKeyEntry 3 }

usmDHUserOwnPrivKeyChange OBJECT-TYPE
SYNTAX  DHKeyChange
MAX-ACCESS read-create
STATUS  current
DESCRIPTION
"The object used to change the agent’s own Privacy Key using a Diffie-Hellman key exchange.

The right-most n bits of the shared secret ‘sk’, where ‘n’ is the number of bits required for the protocol defined by usmUserPrivProtocol, are installed as the operational privacy key for this row after a successful SET."

::= { usmDHUserKeyEntry 4 }

usmDHKickstartGroup OBJECT IDENTIFIER ::= { usmDHKeyObjects 2 }

usmDHKickstartTable OBJECT-TYPE
SYNTAX  SEQUENCE OF UsmDHKickstartEntry
MAX-ACCESS not-accessible
STATUS  current
DESCRIPTION
"A table of mappings between zero or more Diffie-Hellman key agreement values and entries in the usmUserTable. Entries in this table are created by providing the associated device with a Diffie-Hellman public value and a usmUserName/usmUserSecurityName pair during initialization. How these values are provided is outside the scope of this MIB, but could be provided manually, or through a configuration file. Valid public value/name pairs result in the creation of a row in this table as well as the creation of an associated row (with keys derived as indicated) in the usmUserTable. The actual access the related usmSecurityName has is dependent on the entries in the VACM tables. In general, an implementor will specify one or more standard security names and will provide entries in the VACM tables granting various levels of access to those names. The actual content of the VACM
Note: This table is expected to be readable without authentication using the usmUserSecurityName 'dhKickstart'. See the conformance statements for details.

::= { usmDHKickstartGroup 1 }

usmDHKickstartEntry OBJECT-TYPE
SYNTAX     UsmDHKickstartEntry
MAX-ACCESS not-accessible
STATUS      current
DESCRIPTION

"An entry in the usmDHKickstartTable. The agent SHOULD either delete this entry or mark it as inactive upon a successful SET of any of the KeyChange-typed objects in the usmUserEntry or upon a successful SET of any of the DHKeyChange-typed objects in the usmDhKeyChangeEntry where the related usmSecurityName (e.g. row of usmUserTable or row of usmDhKeyChangeTable) equals this entry's usmDHKickstartSecurityName. In otherwords, once you’ve changed one or more of the keys for a row in usmUserTable with a particular security name, the row in this table with that same security name is no longer useful or meaningful."

INDEX   { usmDHKickstartIndex }
 ::= {usmDHKickstartTable 1 }

UsmDHKickstartEntry ::= SEQUENCE  {
   usmDHKickstartIndex     Integer32,
   usmDHKickstartMyPublic   OCTET STRING,
   usmDHKickstartMgrPublic  OCTET STRING,
   usmDHKickstartSecurityName SnmpAdminString
}

usmDHKickstartIndex OBJECT-TYPE
SYNTAX     Integer32  (1..2147483647)
MAX-ACCESS not-accessible
STATUS      current
DESCRIPTION

"Index value for this row."
 ::= { usmDHKickstartEntry 1 }

usmDHKickstartMyPublic OBJECT-TYPE
SYNTAX     OCTET STRING
MAX-ACCESS read-only
STATUS      current
DESCRIPTION

"The agent’s Diffie-Hellman public value for this row. At
initialization, the agent generates a random number and derives its public value from that number. This public value is published here. This public value ‘y’ equals g^r MOD p where g is the from the set of Diffie-Hellman parameters, p is the prime from those parameters, and r is a random integer selected by the agent in the interval 2^(l-1) <= r < p-1 < 2^l. If l is unspecified, then r is a random integer selected in the interval 0 <= r < p-1.

The public value is expressed as an OCTET STRING ‘PV’ of length ‘k’ which satisfies

\[ y = \sum_{i=1}^{k} 2^{(8(k-i))} PV'i \]

where PV1,...,PVk are the octets of PV from first to last, and where PV1 != 0.

The following DH parameters (Oakley group #2, RFC 2409, sec 6.1, 6.2) are used for this object:

\[ g = 2 \]
\[ p = C90FDAA2 2168C234 C4C6628B 80DC1CD1 29024E08 8A67CC74 020BBEA6 3B139B22 51A0879 8E3404DD EF9519B3 CD3A431B 302B0A6D F25F1437 4FE1356D 6D51C245 E485B576 62E7EC6 F4C42E9 A637ED6B 0BFF5CB6 F406B7ED EE386BF8 5A899FA5 AE9F2411 7C4B1FE6 52686839 02 F1C564EE 3B2B90F2 1067C1EF 6BC41DDC BC93077E FF25BAAE 6ECBDA9D 18417881
\]

l=1024

REFERENCE
"-- Diffie-Hellman Key-Agreement Standard, PKCS#3v1.4;
RSA Laboratories, November 1993
-- The Internet Key Exchange, RFC2409;
Harkins, D., Carrel, D.; November 1998"
::= { usmDHKickstartEntry 2 }

usmDHKickstartMgrPublic OBJECT-TYPE
SYNTAX OCTET STRING
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The manager’s Diffie-Hellman public value for this row. Note that this value is not set via the SNMP agent, but may be set via some out of band method, such as the device’s configuration file."
The manager calculates this value in the same manner and using the same parameter set as the agent does. E.g. it selects a random number \( r \), calculates \( y = g^r \mod p \) and provides \( 'y' \) as the public number expressed as an OCTET STRING. See usmDHKickstartMyPublic for details.

When this object is set with a valid value during initialization, a row is created in the usmUserTable with the following values:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>usmUserEngineID</td>
<td>localEngineID</td>
</tr>
<tr>
<td>usmUserName</td>
<td>[value of usmDHKickstartSecurityName]</td>
</tr>
<tr>
<td>usmUserSecurityName</td>
<td>[value of usmDHKickstartSecurityName]</td>
</tr>
<tr>
<td>usmUserCloneFrom</td>
<td>ZeroDotZero</td>
</tr>
<tr>
<td>usmUserAuthProtocol</td>
<td>usmHMACMD5AuthProtocol</td>
</tr>
<tr>
<td>usmUserAuthKeyChange</td>
<td>-- derived from set value</td>
</tr>
<tr>
<td>usmUserOwnAuthKeyChange</td>
<td>-- derived from set value</td>
</tr>
<tr>
<td>usmUserPrivProtocol</td>
<td>usmDESPrivProtocol</td>
</tr>
<tr>
<td>usmUserPrivKeyChange</td>
<td>-- derived from set value</td>
</tr>
<tr>
<td>usmUserOwnPrivKeyChange</td>
<td>-- derived from set value</td>
</tr>
<tr>
<td>usmUserPublic</td>
<td>''</td>
</tr>
<tr>
<td>usmUserStorageType</td>
<td>permanent</td>
</tr>
<tr>
<td>usmUserStatus</td>
<td>active</td>
</tr>
</tbody>
</table>

A shared secret \( 'sk' \) is calculated at the agent as \( sk = mgrPublic^r \mod p \) where \( r \) is the agents random number and \( p \) is the DH prime from the common parameters. The underlying privacy key for this row is derived from \( sk \) by applying the key derivation function PBKDF2 defined in PKCS#5v2.0 with a salt of 0xd1310ba6, and iterationCount of 500, a keyLength of 16 (for usmDESPrivProtocol), and a prf (pseudo random function) of ‘id-hmacWithSHA1’. The underlying authentication key for this row is derived from sk by applying the key derivation function PBKDF2 with a salt of 0x98dfb5ac, an iteration count of 500, a keyLength of 16 (for usmHMAC5AuthProtocol), and a prf of ‘id-hmacWithSHA1’. Note: The salts are the first two words in the ks0 [key schedule 0] of the BLOWFISH cipher from ‘Applied Cryptography’ by Bruce Schnier - they could be any relatively random string of bits.

The manager can use its knowledge of its own random number and the agent’s public value to kickstart its access to the agent in a secure manner. Note that the security of this approach is directly related to the strength of the authorization security of the out of band provisioning of the managers public value (e.g. the configuration file), but is not dependent at all on the strength of the confidentiality of the out of band provisioning data.”

REFERENCE
::= { usmDHKickstartEntry 3 }

usmDHKickstartSecurityName OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The usmUserName and usmUserSecurityName in the usmUserTable associated with this row. This is provided in the same manner and at the same time as the usmDHKickstartMgrPublic value - e.g. possibly manually, or via the device’s configuration file."
::= { usmDHKickstartEntry 4 }

-- Conformance Information

usmDHKeyMIBCompliances OBJECT IDENTIFIER ::= { usmDHKeyConformance 1 }
usmDHKeyMIBGroups OBJECT IDENTIFIER ::= { usmDHKeyConformance 2 }

-- Compliance statements

usmDHKeyMIBCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION "The compliance statement for this module."
MODULE
GROUP usmDHKeyMIBBasicGroup
DESCRIPTION "This group MAY be implemented by any agent which implements the usmUserTable and which wishes to provide the ability to change user and agent authentication and privacy keys via Diffie-Hellman key exchanges."

GROUP usmDHKeyParamGroup
DESCRIPTION "This group MUST be implemented by any agent which implements a MIB containing the DHKeyChange Textual Convention defined in this module."

GROUP usmDHKeyKickstartGroup
DESCRIPTION "This group MAY be implemented by any agent which implements the usmUserTable and which wishes the ability to populate the USM table based on out-of-band provided DH ignition values."
Any agent implementing this group is expected to provide preinstalled entries in the vacm tables as follows:

In the usmUserTable: This entry allows access to the system and dhKickstart groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>usmUserEngineID</td>
<td>localEngineID</td>
</tr>
<tr>
<td>usmUserName</td>
<td>‘dhKickstart’</td>
</tr>
<tr>
<td>usmUserSecurityName</td>
<td>‘dhKickstart’</td>
</tr>
<tr>
<td>usmUserCloneFrom</td>
<td>ZeroDotZero</td>
</tr>
<tr>
<td>usmUserAuthProtocol</td>
<td>none</td>
</tr>
<tr>
<td>usmUserAuthKeyChange</td>
<td>‘’</td>
</tr>
<tr>
<td>usmUserOwnAuthKeyChange</td>
<td>‘’</td>
</tr>
<tr>
<td>usmUserPrivProtocol</td>
<td>none</td>
</tr>
<tr>
<td>usmUserPrivKeyChange</td>
<td>‘’</td>
</tr>
<tr>
<td>usmUserOwnPrivKeyChange</td>
<td>‘’</td>
</tr>
<tr>
<td>usmUserPublic</td>
<td>‘’</td>
</tr>
<tr>
<td>usmUserStorageType</td>
<td>permanent</td>
</tr>
<tr>
<td>usmUserStatus</td>
<td>active</td>
</tr>
</tbody>
</table>

In the vacmSecurityToGroupTable: This maps the initial user into the accessible objects.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vacmSecurityModel</td>
<td>3 (USM)</td>
</tr>
<tr>
<td>vacmSecurityName</td>
<td>‘dhKickstart’</td>
</tr>
<tr>
<td>vacmGroupName</td>
<td>‘dhKickstart’</td>
</tr>
<tr>
<td>vacmSecurityToGroupStorageType</td>
<td>permanent</td>
</tr>
<tr>
<td>vacmSecurityToGroupStatus</td>
<td>active</td>
</tr>
</tbody>
</table>

In the vacmAccessTable: Group name to view name translation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vacmGroupName</td>
<td>‘dhKickstart’</td>
</tr>
<tr>
<td>vacmAccessContextPrefix</td>
<td>‘’</td>
</tr>
<tr>
<td>vacmAccessSecurityModel</td>
<td>3 (USM)</td>
</tr>
<tr>
<td>vacmAccessSecurityLevel</td>
<td>noAuthNoPriv</td>
</tr>
<tr>
<td>vacmAccessContextMatch</td>
<td>exact</td>
</tr>
<tr>
<td>vacmAccessReadViewName</td>
<td>‘dhKickRestricted’</td>
</tr>
<tr>
<td>vacmAccessWriteViewName</td>
<td>‘’</td>
</tr>
<tr>
<td>vacmAccessNotifyViewName</td>
<td>‘dhKickRestricted’</td>
</tr>
<tr>
<td>vacmAccessStorageType</td>
<td>permanent</td>
</tr>
<tr>
<td>vacmAccessStatus</td>
<td>active</td>
</tr>
</tbody>
</table>

In the vacmViewTreeFamilyTable: Two entries to allow the initial entry to access the system and kickstart groups.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vacmViewTreeFamilyViewName</td>
<td>‘dhKickRestricted’</td>
</tr>
<tr>
<td>vacmViewTreeFamilySubtree</td>
<td>1.3.6.1.2.1.1 (system)</td>
</tr>
<tr>
<td>vacmViewTreeFamilyMask</td>
<td>‘’</td>
</tr>
</tbody>
</table>
vacmViewTreeFamilyType 1
vacmViewTreeFamilyStorageType permanent
vacmViewTreeFamilyStatus active

vacmViewTreeFamilyViewName 'dhKickRestricted'
vacmViewTreeFamilySubtree (usmDHKickstartTable OID)
vacmViewTreeFamilyMask '',
vacmViewTreeFamilyType 1
vacmViewTreeFamilyStorageType permanent
vacmViewTreeFamilyStatus active

OBJECT usmDHParameters
MIN-ACCESS read-only
DESCRIPTION
"It is compliant to implement this object as read-only for any device."

::= { usmDHKeyMIBCompliances 1 }

-- Units of Compliance

usmDHKeyMIBBasicGroup OBJECT-GROUP
OBJECTS

  usmDHUserAuthKeyChange,
  usmDHUserOwnAuthKeyChange,
  usmDHUserPrivKeyChange,
  usmDHUserOwnPrivKeyChange

STATUS current
DESCRIPTION ""
::= { usmDHKeyMIBGroups 1 }

usmDHKeyParamGroup OBJECT-GROUP
OBJECTS

  usmDHParameters

STATUS current
DESCRIPTION "The mandatory object for all MIBs which use the DHKeyChange textual convention."
::= { usmDHKeyMIBGroups 2 }

usmDHKeyKickstartGroup OBJECT-GROUP
OBJECTS

  usmDHKickstartMyPublic,
  usmDHKickstartMgrPublic,
usmDHKickstartSecurityName
)

DESCRIPTION
"The objects used for kickstarting one or more SNMPv3 USM
associations via a configuration file or other out of band,
non-confidential access."

::= { usmDHKeyMIBGroups 3 }
5. Security Considerations

Objects in the usmDHUserKeyTable should be considered to have the same security sensitivity as the objects of the KeyChange type in usmUserTable and should be afforded the same level of protection. Specifically, the VACM should not grant more or less access to these objects than it grants to the usmUserTable KeyChange object.

The improper selection of parameters for use with Diffie-Hellman key changes may adversely affect the security of the agent. Please see the body of the MIB for specific recommendations or requirements on the selection of the DH parameters.
An unauthenticated DH exchange is subject to "man-in-the-middle" attacks. The use of the DH exchange in any specific environment should balance risk versus threat.

Good security from a DH exchange requires a good source of random numbers. If your application cannot provide a reasonable source of randomness, do not use a DH exchange. For more information, see "Randomness Recommendations for Security" [19].

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