Definitions of Managed Objects for Extensible SNMP Agents

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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 describes objects managing SNMP agents that use the Agent Extensibility (AgentX) Protocol.

This memo specifies a MIB module in a manner that is both compliant to the SNMPv2 SMI, and semantically identical to the peer SNMPv1 definitions.

This memo does not specify a standard for the Internet community.
1. The SNMP Network Management Framework

The SNMP Network Management Framework presently consists of three major components. They are:

- the SMI, described in RFC 1902 [1] - the mechanisms used for describing and naming objects for the purpose of management.


- the protocol, RFC 1157 [3] and/or RFC 1905 [4], - the protocol for accessing managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

1.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) defined in the SMI. In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to also refer to the object type.

2. Introduction

The SNMP Agent Extensibility Protocol (AgentX) is a protocol used to distribute the implementation of an SNMP agent amongst a single "master agent" and multiple "subagents". See [5] for details about the AgentX protocol.

The goals of the AgentX MIB are:

- List the set of subagents that currently have logical sessions open with the master agent.

- Identify each subagent’s type, vendor, transport address, AgentX protocol version, and other characteristics.

- Identify the set of MIB objects each subagent implements, the context in which the objects are registered, and the priority of the registration.
- Provide statistics about the protocol operation such as the number of packets to and from each subagent.

- Determine protocol operational parameters such as the timeout interval for responses from a subagent and the priority at which a subagent registers a particular MIB region.

- Allow (but do not require) managers to be able to modify AgentX protocol operational parameters and to explicitly close subagent sessions with the master agent.

3. Overview

This MIB is organized into four groups. The agentxGeneral group provides information describing the master agent’s Agentx support, including the protocol version supported and the supported transport mechanisms. The agentxConnection group provides information describing the current set of connections capable of carrying Agentx sessions. The agentxSession group provides information describing the current set of AgentX sessions. The agentxRegistration group provides information describing the current set of registrations.

Three tables form the heart of this mib. These are the connection, session, and registration tables.

Entries in the registration table exist in a many-to-one relationship with entries in the session table. This relationship is represented through the agentxSessionIndex and agentxConnIndex. Registration entries are indexed by agentxConnIndex and agentxSessionIndex, to determine which registration(s), a subagent session is responsible for a given connection.

Entries in the session table exist in a many-to-one relationship with entries in the connection table. This relationship is represented through the agentxConnIndex in a session table. Session entries are indexed by agentxConnIndex to determine which sessions(s), are carried by a given connection.
4. Definitions

AGENTX-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, experimental, Counter32,
    Gauge32, Unsigned32, TDomain, TAddress
    FROM SNMPv2-SMI

    MODULE-COMPLIANCE, OBJECT-GROUP
    FROM SNMPv2-CONF

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

agentxMIB MODULE-IDENTITY
    LAST-UPDATED "9804141200Z" -- April 14, 1998
    ORGANIZATION "IETF AgentX Working Group"
    CONTACT-INFO
        "WG-email: agentx@peer.com
        Subscribe: agentx-request@peer.com
        http://www.ietf.org/html.charters/agentx-charter.html"

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    DESCRIPTION
        "This is the MIB module for the SNMP Agent Extensibility
        Protocol (AgentX). This MIB module will be implemented by
        the master agent."
    -- For testing purposes only. Need to get an experimental id
    ::= { experimental 2001 }

agentxObjects OBJECT IDENTIFIER ::= { agentxMIB 1 }

    --
    -- Define the four groups that serve to organize the
    -- objects in this MIB
    --
    agentxGeneral OBJECT IDENTIFIER ::= { agentxObjects 1 }
    agentxConnection OBJECT IDENTIFIER ::= { agentxObjects 2 }
agentxSession OBJECT IDENTIFIER ::= { agentxObjects 3 }
agentxRegistration OBJECT IDENTIFIER ::= { agentxObjects 4 }
agentxTCPDomain  OBJECT IDENTIFIER ::=  {agentxObjects 5}

--
-- Textual Conventions
--
Utf8String ::= TEXTUAL-CONVENTION
   DISPLAY-HINT "255a"
   STATUS  current
   DESCRIPTION
"To facilitate internationalization, this TC represents
information taken from the ISO/IEC IS 10646-1 character set,
encoded as an octet string using the UTF-8 character encoding
scheme described in RFC 2044 [8]. For strings in 7-bit US-ASCII,
there is no impact since the UTF-8 representation is identical
to the US-ASCII encoding."
   SYNTAX  OCTET STRING (SIZE (0..255))

AgentxTCPAddress ::= TEXTUAL-CONVENTION
   DISPLAY-HINT "1d.1d.1d.1d/2d"
   STATUS  current
   DESCRIPTION "Represents a TCP Address."
   SYNTAX  OCTET STRING (SIZE (6))

agentxDefaultTimeout OBJECT-TYPE
   SYNTAX      INTEGER (0..255)
   UNITS       "seconds"
   MAX-ACCESS  read-write
   STATUS      current
   DESCRIPTION
"The default length of time, in seconds, that the master agent
should allow to elapse after dispatching a message to a subagent
before it regards the subagent as not responding. This is a
system-wide value that may be overridden by the values
associated with a particular subagent (agentxSessionTimeout) or a
particular registered MIB region (agentxRegTimeout)."
   DEFVAL { 5 }
::= { agentxGeneral 1 }

agentxMasterAgentXVer OBJECT-TYPE
   SYNTAX      INTEGER (1..255)
   MAX-ACCESS read-only
   STATUS      current
   DESCRIPTION
"The AgentX protocol version supported by this master
agent. Current version is 1. Note that the master agent must
allow registration of earlier version subagents."
DEFVAL { 1 }
 ::= { agentxGeneral 2 }

--
-- The Agentx Subagent Connection Group
--
agentxConnTableLastChange OBJECT-TYPE
 SYNTAX TimeStamp
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The value of sysUpTime when the last row creation or deletion 
 occurred in the agentxConnectionTable."
 ::= { agentxConnection 1 }

agentxConnNumber OBJECT-TYPE
 SYNTAX Gauge32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The current number of entries in the agentxConnectionTable. Note 
 that this may be smaller than the largest value of agentxConnIndex 
 since index values are not reused when entries come and go from 
 the agentxConnectionTable."
 ::= { agentxConnection 2 }

agentxConnectionTable OBJECT-TYPE
 SYNTAX SEQUENCE OF AgentxConnectionEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "The agentxConnectionTable tracks all current Agentx transport 
 connections. There may be zero, one, or more agentx sessions 
 on a given Agentx connection."
 ::= { agentxConnection 3 }

AgentxConnectionEntry ::= SEQUENCE {
   agentxConnIndex            Unsigned32,
   agentxConnOpenTime         TimeStamp,
   agentxConnTransportDomain  TDomain,
   agentxConnTransportAddress TAddress,
   agentxConnSessions         Gauge32 }

agentxConnectionEntry OBJECT-TYPE
 SYNTAX AgentxConnectionEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
"An agentxConnectionEntry contains information describing a single Agentx transport connection. A connection may be used to support zero or more Agentx sessions. Entries come into being when the transport connection is established, and are not deleted unless the transport connection has been terminated."

INDEX { agentxConnIndex }
::= { agentxConnectionTable 1 }

agentxConnIndex OBJECT-TYPE
SYNTAX       Unsigned32
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"The value of agentxConnIndex uniquely identifies each open transport connection used by this master agent to provide AgentX service. Values of this index should not be re-used. The value assigned to a given transport connection is constant for the lifetime of that connection."
::= { agentxConnectionEntry 1 }

agentxConnOpenTime OBJECT-TYPE
SYNTAX       TimeStamp
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"The value of sysUpTime when this connection was established and, therefore, its value when this entry was added to the table."
::= { agentxConnectionEntry 2 }

agentxConnTransportDomain OBJECT-TYPE
SYNTAX       TDomain
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"The transport protocol in use for this connection to the master agent."
::= { agentxConnectionEntry 3 }

agentxConnTransportAddress OBJECT-TYPE
SYNTAX       TAddress
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"The transport address of the remote (subagent) end of this connection to the master agent."
::= { agentxConnectionEntry 4 }
agentxConnSessions OBJECT-TYPE
  SYNTAX       Gauge32
  MAX-ACCESS   read-only
  STATUS       current
  DESCRIPTION  
    "The current number of AgentX sessions being carried by
    this transport connection. For purposes of this MIB,
    an AgentX session begins when a valid agentx-Open-PDU is
    received, and ends when a corresponding agentx-Close-PDU
    has been sent or received by the master agent."
  ::= { agentxConnectionEntry 5 }

--
-- The AgentX Subagent Session Group
--

agentxSessionTableLastChange OBJECT-TYPE
  SYNTAX      TimeStamp
  MAX-ACCESS  read-only
  STATUS      current
  DESCRIPTION  
    "The value of sysUpTime when the last row creation or deletion
    occurred in the agentxSessionTable."
  ::= { agentxSession 1 }

agentxSessionNumber OBJECT-TYPE
  SYNTAX      Gauge32
  MAX-ACCESS  read-only
  STATUS      current
  DESCRIPTION  
    "The current number of entries in the
    agentxSessionTable. Note that this may be smaller than
    the largest value of agentxSessionIndex since index
    values are not reused when entries come and go from the
    agentxSessionTable."
  ::= { agentxSession 2 }

--
-- The AgentX Subagent Session Table
--

agentxSessionTable OBJECT-TYPE
  SYNTAX      SEQUENCE OF AgentxSessionEntry
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION  
    "A table of AgentX subagents that have open sessions with the
    AgentX master agent."
  ::= { agentxSession 3 }
agentxSessionEntry OBJECT-TYPE
SYNTAX       AgentxSessionEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  
"Information about a single open session between the AgentX
master agent and a subagent."
INDEX        { agentxConnIndex, agentxSessionIndex }
 ::= { agentxSessionTable 1 }

AgentxSessionEntry ::= SEQUENCE {
    agentxSessionIndex         Unsigned32,
    agentxSessionObjectID      OBJECT IDENTIFIER,
    agentxSessionDescr         Utf8String,
    agentxSessionAdminStatus   INTEGER,
    agentxSessionOpenTime      TimeStamp,
    agentxSessionAgentXVer     INTEGER,
    agentxSessionTimeout       INTEGER
}

agentxSessionIndex OBJECT-TYPE
SYNTAX       Unsigned32
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  
"A unique index for the subagent session. Note that if a
subagent's session with the master agent is closed for
any reason its index should not be re-used, therefore,
the values of agentxSessionIndex may not be contiguous and
will generally not be the same for the same subagent
across multiple sessions. Index values assigned for
a given registration are constant for the lifetime of
this table."
 ::= { agentxSessionEntry 1 }

agentxSessionObjectID OBJECT-TYPE
SYNTAX       OBJECT IDENTIFIER
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This is analogous to sysObjectID defined in MIB-2 [2] and is taken
from the o.id field of the agentx-Open-PDU."
 ::= { agentxSessionEntry 2 }

--
-- Issue: should we describe this more in terms of AGENT-CAPABILITIES
-- or sysORTable?
--
agentxSessionDescr OBJECT-TYPE
SYNTAX      Utf8String
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A textual description of the subagent. This is analogous to
  sysDescr defined in MIB-2 [2] and is taken from the o.descr
  field of the agentx-Open-PDU."
 ::= { agentxSessionEntry 3 }  

agentxSessionAdminStatus OBJECT-TYPE
SYNTAX      INTEGER { up(1),
                  down(2) }
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
  "The administrative (desired) status of the subagent. Setting
  the value to ‘down(2)’ closes the subagent session (with c.reason
  set to ‘reasonByManager’). When read, the value returned is always
  ‘up(1)’.”
DEFVAL      { up  }
 ::= { agentxSessionEntry 4 }  

agentxSessionOpenTime OBJECT-TYPE
SYNTAX      TimeStamp
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "The value of sysUpTime when this session was opened and,
  therefore, its value when this entry was added to the table."
 ::= { agentxSessionEntry 5 }  

agentxSessionAgentXVer OBJECT-TYPE
SYNTAX      INTEGER (1..255)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "The version of the AgentX protocol supported by the
  subagent. This will be less than or equal to the value of
  agentxMasterAgentXVer."
DEFVAL      { 1  }
 ::= { agentxSessionEntry 6 }  

agentxSessionTimeout OBJECT-TYPE
SYNTAX      INTEGER (0..255)
UNITS      "seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The length of time, in seconds, that a master agent should
allow to elapse after dispatching a message to this subagent
before it regards the subagent as not responding. This value is
taken from the o.timeout field of the agentx-Open-PDU.

This is a subagent-specific value that may be overridden by
values associated with specific registered MIB regions (see
agentxRegTimeout). The default value of '0' indicates that the
master agent's default timeout value should be used (see
agentxDefaultTimeout)."

DEFVAL  { 0 }
::= { agentxSessionEntry 7 }

--
-- The AgentX Registration Information group
--
-- The statistics in this group are maintained by the Master Agent.
--
-- Other stats have been removed. Support trap generation based
-- on certain situations for duplicate registration.
--
agentxRegisterDuplicate OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The number of agentx-Response-PDU messages sent by this master
agent where the res.error field was set to 'duplicateRegistration'."
::= { agentxRegistration 1 }

--
-- The AgentX Registration Table
--

agentxRegistrationTable OBJECT-TYPE
SYNTAX      SEQUENCE OF AgentxRegistrationEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A table of registered OBJECT IDENTIFIER regions. This is the
table used to identify a registered region of a subagent.
Note that a subagent registration may be broken up into multiple
entries in this table, as described in the AgentX Protocol
specification [5]."
::= { agentxRegistration 2 }
agentxRegistrationEntry OBJECT-TYPE
SYNTAX AgentxRegistrationEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A single registered region. Regions are added by the master
agent when subagents register and are removed from the table
when the subagents unregister the region or their sessions are
closed. Note that the combination of agentxRegContext,
agentxRegStart and agentxRegDispatchOrder will be unique and
could have been used for indexing purposes, but would have
potentially resulted in excessively long OBJECT IDENTIFIERS."
INDEX { agentxConnIndex, agentxSessionIndex, agentxRegIndex } ::= { agentxRegistrationTable 1 }

AgentxRegistrationEntry ::= SEQUENCE {
agentxRegIndex Unsigned32,
agentxRegContext OCTET STRING,
agentxRegStart OBJECT IDENTIFIER,
agentxRegEnd OBJECT IDENTIFIER,
agentxRegPriority Unsigned32,
agentxRegTimeout INTEGER,
agentxRegInstance TruthValue
}

agentxRegIndex OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"AgentxRegIndex is an integer that uniquely identifies a
registration entry. Its value is constant for the lifetime
of an entry."
 ::= { agentxRegistrationEntry 1 }

agentxRegContext OBJECT-TYPE
SYNTAX OCTET STRING
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The context in which the subagent supports the objects in this
region. A zero-length context indicates the default context."
 ::= { agentxRegistrationEntry 2 }

agentxRegStart OBJECT-TYPE
SYNTAX OBJECT IDENTIFIER
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The starting OBJECT IDENTIFIER of this registration entry. The
subagent identified by agentxSessionIndex implements objects
starting at this value (inclusive). Note that this value could
identify an object type, an object instance, or a partial object
instance."
::= { agentxRegistrationEntry 3 }

agentxRegEnd OBJECT-TYPE
SYNTAX OBJECT IDENTIFIER
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The ending OBJECT IDENTIFIER of this registration entry. The
subagent identified by agentxSessionIndex implements
objects up to but not including this value. Note that this
value could identify an object type, an object instance,
or a partial object instance."
::= { agentxRegistrationEntry 4 }

--
To support other subagent types that can be visible
to the manager.
--

agentxRegPriority OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The subagent’s priority when exporting this OID range. Lower
values have higher priority."
DEFVAL { 255 }
::= { agentxRegistrationEntry 5 }

agentxRegTimeout OBJECT-TYPE
SYNTAX INTEGER (0..255)
UNITS "seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The timeout value, in seconds, for subagent responses to
requests associated with this OID range. The value ‘0’ indicates
that the default value (indicated by agentxSessionTimeout or
agentxDefaultTimeout) is to be used. This value is taken from
the r.timeout field of the agentx-Register-PDU."
DEFVAL { 0 }
::= { agentxRegistrationEntry 7 }
agentxRegInstance OBJECT-TYPE
SYNTAX      TruthValue
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "The value of agentxRegInstance is 'true' for registrations for which the INSTANCE_REGISTRATION was set, and is 'false' for all other registrations."
DEFVAL      { false }
 ::= { agentxRegistrationEntry 8 }

--
-- Conformance Statements for the AgentX MIB
--
agentxConformance OBJECT IDENTIFIER ::= { agentxMIB 2 }
agentxMIBGroups OBJECT IDENTIFIER ::= { agentxConformance 1 }
agentxMIBCompliances OBJECT IDENTIFIER ::= { agentxConformance 2 }

agentxMIBCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
 "The compliance statement for SNMP entities that implement the AgentX protocol. Note that a compliant agent can implement all objects in this MIB module as read-only."

MODULE -- this module
MANDATORY-GROUPS  { agentxMIBGroup }

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

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

 ::= { agentxMIBCompliances 1 }

agentxMIBGroup OBJECT-GROUP
OBJECTS {
  agentxDefaultTimeout,
  agentxMasterAgentXVer,
  agentxConnTableLastChange,
  agentxConnNumber,
  agentxConnOpenTime,
agentxConnTransportDomain,
agentxConnTransportAddress,
agentxConnSessions,
agentxSessionTableLastChange,
agentxSessionNumber,
agentxSessionTimeout,
agentxSessionObjectID,
agentxSessionDescr,
agentxSessionAdminStatus,
agentxSessionOpenTime,
agentxSessionAgentXVer,
agentxRegisterDuplicate,
agentxRegContext,
agentxRegStart,
agentxRegEnd,
agentxRegPriority,
agentxRegTimeout,
agentxRegInstance
}

STATUS      current
DESCRIPTION
"All accessible objects in the AgentX MIB."
::= { agentxMIBGroups 1 }

END

5. Acknowledgments

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Special acknowledgement is made to:

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This MIB is an evolution of the Subagent MIB by Bert Wijnen
(wijnen@vnet.ibm.com) which in turn was derived from the SMUX-MIB by
Marshall Rose [6].

6. References

[1] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
   S. Waldbusser, "Structure of Management Information for Version 2


7. Security Considerations

In most cases, MIBs are not themselves security risks; if SNMP security is operating as intended, the use of a MIB to view information about a system, or to change some parameter at the system, is a tool, not a threat.

None of the read-only objects in this MIB reports a password, user data, or anything else that is particularly sensitive. If access to these objects is not limited by an appropriate access control policy, these objects can provide an attacker with information about a system’s configuration and the services that that system is providing. Some enterprises view their network and system configurations themselves, as
well as information about usage and performance, as corporate assets; such enterprises may wish to restrict SNMP access to most of the objects in the MIB.

This MIB contains two read-write objects: agentxDefaultTimeout and agentxSessionAdminStatus. Setting agentxDefaultTimeout to an inappropriately small value can prevent new subagent sessions from being usable. Setting agentxSessionAdminStatus to an inappropriate value can effectively prevent access to management information, or provide access to inappropriate information. Since changes to either of these objects can adversely impact the manageability of a system, write access to these objects should be subject to an appropriate access control policy. Such a policy may be realized in an implementation by limiting support for these objects to read-only access.

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