                    Network Services Monitoring MIB

Status of this Memo

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1. Introduction

   A networked application is a realization of some well defined service
   on one or more host computers that is accessible via some network,
   uses some network for its internal operations, or both.

   There are a wide range of networked applications for which it is
   appropriate to provide SNMP monitoring of their network usage. This
   includes applications using both TCP/IP and OSI networking. This
   document defines a MIB which contains the elements common to the
   monitoring of any network service application. This information
   includes a table of all monitorable network service applications, a
   count of the associations (connections) to each application, and
   basic information about the parameters and status of each
   application-related association.

   This MIB may be used on its own for any application, and for most
   simple applications this will suffice. This MIB is also designed to
   serve as a building block which can be used in conjunction with
   application-specific monitoring and management. Two examples of this
   are MIBs defining additional variables for monitoring a Message
   Transfer Agent (MTA) service or a Directory Service Agent (DSA)
   service. It is expected that further MIBs of this nature will be
   specified.

This MIB does not attempt to provide facilities for management of the
host or hosts the network service application runs on, nor does it
provide facilities for monitoring applications that provide something
other than a network service. Host resource and general application
monitoring is handled by the Host Resources MIB at present;
development of an additional application MIB is currently underway in
the IETF.

2. Table of Contents

3. The SNMPv2 Network Management Framework

    The SNMPv2 Network Management Framework consists of seven major
    components. They are:

    o   RFC 1902 [1] which defines the SMI, the mechanisms used for
         describing and naming objects for the purpose of management.

    o   RFC 1903 [2] defines textual conventions for SNMPv2.

    o   RFC 1904 [3] defines conformance statements for SNMPv2.

    o   RFC 1905 [4] defines transport mappings for SNMPv2.

    o   RFC 1906 [5] defines the protocol operations used for network
         access to managed objects.

    o   RFC 1907 [6] defines the Management Information Base for SNMPv2.

    o   RFC 1908 [7] specifies coexistance between SNMP and SNMPv2.

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

3.1. 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 refer to the
object type.

4. Rationale for having a Network Services Monitoring MIB

Much effort has been expended in developing tools to manage lower
layer network facilities. However, relatively little work has been
done on managing application layer entities. It is neither efficient
nor reasonable to manage all aspects of application layer entities
using only lower layer information. Moreover, the difficulty of
managing application entities in this way increases dramatically as
application entities become more complex.

This leads to a substantial need to monitor applications which
provide network services, particularly distributed components such as
MTAs and DSAs, by monitoring specific aspects of the application
itself. Reasons to monitor such components include but are not
limited to measuring load, detecting broken connectivity, isolating
system failures, and locating congestion.

In order to manage network service applications effectively two
requirements must be met:

   (1)   It must be possible to monitor a large number of components
         (typical for a large organization).

   (2)   Application monitoring must be integrated into general network
         management.

This specification defines simple read-only access; this is
sufficient to determine up/down status and provide an indication of a
broad class of operational problems.

4.1. General Relationship to Other MIBs

   This MIB is intended to only provide facilities common to the
   monitoring of any network service application. It does not provide
   all the facilities necessary to monitor any specific application.
   Each specific type of network service application is expected to have
   a MIB of its own that makes use of these common facilities.

4.2. Restriction of Scope

   The framework provided here is very minimal; there is a lot more that
   could be done. For example:

   (1)   General network service application configuration monitoring
          and control.

   (2)   Detailed examination and modification of individual entries in
          service-specific request queues.

   (3)   Probing to determine the status of a specific request (e.g.
          the location of a mail message with a specific message-id).

   (4)   Requesting that certain actions be performed (e.g. forcing an
          immediate connection and transfer of pending messages to some
          specific system).

   All these capabilities are both impressive and useful. However,
   these capabilities would require provisions for strict security
   checking. These capabilities would also mandate a much more complex
   design, with many characteristics likely to be fairly
   implementation-specific. As a result such facilities are likely to
   be both contentious and difficult to implement.

   This document religiously keeps things simple and focuses on the
   basic monitoring aspect of managing applications providing network
   services. The goal here is to provide a framework which is simple,
   useful, and widely implementable.

4.3. Configuration Information

   This MIB attempts to provide information about the operational
   aspects of an application. Further information about the actual
   configuration of a given application may be kept in other places; the
   applDirectoryName or applURL may be used to point to places where
   such information is kept.

5. Application Objects

   This MIB defines a set of general purpose attributes which would be
   appropriate for a range of applications that provide network
   services. Both OSI and non-OSI services can be accomodated.
   Additional tables defined in extensions to this MIB provide
   attributes specific to specific network services.

   A table is defined which will have one row for each operational
   network service application on the system. The only static
   information held on the application is its name. All other static
   information should be obtained from various directory services. The
   applDirectoryName is an external key, which allows an SNMP MIB entry
   to be cleanly related to the X.500 Directory. In SNMP terms, the
   applications are grouped in a table called applTable, which is
   indexed by an integer key applIndex.

   The type of the application will be determined by one or both of:

      (1)   Additional MIB variables specific to the applications.

      (2)   An association to the application of a specific protocol.

6. Definitions

      NETWORK-SERVICES-MIB DEFINITIONS ::= BEGIN

IMPORTS
      OBJECT-TYPE, Counter32, Gauge32, MODULE-IDENTITY, mib-2
        FROM SNMPv2-SMI
      DisplayString, TimeStamp, TEXTUAL-CONVENTION
        FROM SNMPv2-TC
      MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF;

application MODULE-IDENTITY
      LAST-UPDATED "9708170000Z"
      ORGANIZATION "IETF Mail and Directory Management Working Group"
      CONTACT-INFO
        "   Ned Freed

         Postal: Innosoft International, Inc.
                 1050 Lakes Drive
                 West Covina, CA 91790
                 US

            Tel: +1 626 919 3600
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```
         E-Mail: ned.freed@innosoft.com"
     DESCRIPTION
       "The MIB module describing network service applications"
     REVISION "9311280000Z"
     DESCRIPTION
       "The original version of this MIB was published in RFC 1565"
     ::= {mib-2 27}

-- Textual conventions

-- DistinguishedName is used to refer to objects in the
-- directory.

DistinguishedName ::= TEXTUAL-CONVENTION
     STATUS current
     DESCRIPTION
         "A Distinguished Name represented in accordance with
          RFC 1779 [8]."
     SYNTAX DisplayString

-- Uniform Resource Locators are stored in URLStrings.

URLString ::= TEXTUAL-CONVENTION
     STATUS current
     DESCRIPTION
         "A Uniform Resource Locator represented in accordance
          with RFC 1738 [10]."
     SYNTAX DisplayString

-- The basic applTable contains a list of the application
-- entities.

applTable OBJECT-TYPE
     SYNTAX SEQUENCE OF ApplEntry
     MAX-ACCESS not-accessible
     STATUS current
     DESCRIPTION
         "The table holding objects which apply to all different
          kinds of applications providing network services.
          Each network service application capable of being
          monitored should have a single entry in this table."
     ::= {application 1}

applEntry OBJECT-TYPE
     SYNTAX ApplEntry
     MAX-ACCESS not-accessible
     STATUS current
     DESCRIPTION
```

          "An entry associated with a single network service
           application."
     INDEX {applIndex}
     ::= {applTable 1}

ApplEntry ::= SEQUENCE {
     applIndex
          INTEGER,
     applName
          DisplayString,
     applDirectoryName
          DistinguishedName,
     applVersion
          DisplayString,
     applUptime
          TimeStamp,
     applOperStatus
          INTEGER,
     applLastChange
          TimeStamp,
     applInboundAssociations
          Gauge32,
     applOutboundAssociations
          Gauge32,
     applAccumulatedInboundAssociations
          Counter32,
     applAccumulatedOutboundAssociations
          Counter32,
     applLastInboundActivity
          TimeStamp,
     applLastOutboundActivity
          TimeStamp,
     applRejectedInboundAssociations
          Counter32,
     applFailedOutboundAssociations
          Counter32,
     applDescription
          DisplayString,
     applURL
          URLString
}

applIndex OBJECT-TYPE
     SYNTAX INTEGER (1..2147483647)
     MAX-ACCESS not-accessible
     STATUS current
     DESCRIPTION
        "An index to uniquely identify the network service

        application. This attribute is the index used for
        lexicographic ordering of the table."

     ::= {applEntry 1}

applName OBJECT-TYPE
     SYNTAX DisplayString
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The name the network service application chooses to be
        known by."
     ::= {applEntry 2}

applDirectoryName OBJECT-TYPE
     SYNTAX DistinguishedName
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The Distinguished Name of the directory entry where
        static information about this application is stored.
        An empty string indicates that no information about
        the application is available in the directory."
     ::= {applEntry 3}

applVersion OBJECT-TYPE
     SYNTAX DisplayString
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The version of network service application software.
        This field is usually defined by the vendor of the
        network service application software."
     ::= {applEntry 4}

applUptime OBJECT-TYPE
     SYNTAX TimeStamp
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The value of sysUpTime at the time the network service
        application was last initialized. If the application was
        last initialized prior to the last initialization of the
        network management subsystem, then this object contains
        a zero value."
     ::= {applEntry 5}

```
applOperStatus OBJECT-TYPE
    SYNTAX INTEGER {
      up(1),
      down(2),
      halted(3),
      congested(4),
      restarting(5),
      quiescing(6)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "Indicates the operational status of the network service
       application. 'down' indicates that the network service is
       not available. 'up' indicates that the network service
       is operational and available.  'halted' indicates that the
       service is operational but not available.  'congested'
       indicates that the service is operational but no additional
       inbound associations can be accomodated.  'restarting'
       indicates that the service is currently unavailable but is
       in the process of restarting and will be available soon.
       'quiescing' indicates that service is currently operational
       but is in the process of shutting down. Additional inbound
       associations may be rejected by applications in the
       'quiescing' state."
    ::= {applEntry 6}

applLastChange OBJECT-TYPE
    SYNTAX TimeStamp
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The value of sysUpTime at the time the network service
       application entered its current operational state.  If
       the current state was entered prior to the last
       initialization of the local network management subsystem,
       then this object contains a zero value."
    ::= {applEntry 7}

applInboundAssociations OBJECT-TYPE
    SYNTAX Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The number of current associations to the network service
       application, where it is the responder.  An inbound
       assocation occurs when a another application successfully
       connects to this one."
```

```
     ::= {applEntry 8}

applOutboundAssociations OBJECT-TYPE
    SYNTAX Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The number of current associations to the network service
       application, where it is the initiator.  An outbound
       association occurs when this application successfully
       connects to another one."
    ::= {applEntry 9}

applAccumulatedInboundAssociations OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The total number of associations to the application entity
       since application initialization, where it was the responder."
    ::= {applEntry 10}

applAccumulatedOutboundAssociations OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The total number of associations to the application entity
       since application initialization, where it was the initiator."
    ::= {applEntry 11}

applLastInboundActivity OBJECT-TYPE
    SYNTAX TimeStamp
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The value of sysUpTime at the time this application last
       had an inbound association.  If the last association
       occurred prior to the last initialization of the network
       subsystem, then this object contains a zero value."
    ::= {applEntry 12}

applLastOutboundActivity OBJECT-TYPE
    SYNTAX TimeStamp
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The value of sysUpTime at the time this application last
```

          had an outbound association. If the last association
          occurred prior to the last initialization of the network
          subsystem, then this object contains a zero value."
     ::= {applEntry 13}

applRejectedInboundAssociations OBJECT-TYPE
     SYNTAX Counter32
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The total number of inbound associations the application
        entity has rejected, since application initialization.
        Rejected associations are not counted in the accumulated
        association totals. Note that this only counts
        associations the application entity has rejected itself;
        it does not count rejections that occur at lower layers
        of the network. Thus, this counter may not reflect the
        true number of failed inbound associations."
     ::= {applEntry 14}

applFailedOutboundAssociations OBJECT-TYPE
     SYNTAX Counter32
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "The total number associations where the application entity
        is initiator and association establishment has failed,
        since application initialization. Failed associations are
        not counted in the accumulated association totals."
     ::= {applEntry 15}

applDescription OBJECT-TYPE
     SYNTAX DisplayString
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "A text description of the application. This information
        is intended to identify and briefly describe the
        application in a status display."
     ::= {applEntry 16}

applURL OBJECT-TYPE
     SYNTAX URLString
     MAX-ACCESS read-only
     STATUS current
     DESCRIPTION
       "A URL pointing to a description of the application.
        This information is intended to identify and describe

         the application in a status display."
     ::= {applEntry 17}

-- The assocTable augments the information in the applTable
-- with information about associations. Note that two levels
-- of compliance are specified below, depending on whether
-- association monitoring is mandated.

assocTable OBJECT-TYPE
    SYNTAX SEQUENCE OF AssocEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The table holding a set of all active application
         associations."
    ::= {application 2}

assocEntry OBJECT-TYPE
    SYNTAX AssocEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
      "An entry associated with an association for a network
       service application."
    INDEX {applIndex, assocIndex}
    ::= {assocTable 1}

AssocEntry ::= SEQUENCE {
    assocIndex
        INTEGER,
    assocRemoteApplication
        DisplayString,
    assocApplicationProtocol
        OBJECT IDENTIFIER,
    assocApplicationType
        INTEGER,
    assocDuration
        TimeStamp
}

assocIndex OBJECT-TYPE
    SYNTAX INTEGER (1..2147483647)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
      "An index to uniquely identify each association for a network
       service application. This attribute is the index that is

          used for lexicographic ordering of the table. Note that the
          table is also indexed by the applIndex."
       ::= {assocEntry 1}

assocRemoteApplication OBJECT-TYPE
       SYNTAX DisplayString
       MAX-ACCESS read-only
       STATUS current
       DESCRIPTION
         "The name of the system running remote network service
          application. For an IP-based application this should be
          either a domain name or IP address. For an OSI application
          it should be the string encoded distinguished name of the
          managed object. For X.400(1984) MTAs which do not have a
          Distinguished Name, the RFC 1327 [9] syntax
          'mta in globalid' should be used. Note, however, that not
          all connections an MTA are necessarily to another MTA."
       ::= {assocEntry 2}

assocApplicationProtocol OBJECT-TYPE
       SYNTAX OBJECT IDENTIFIER
       MAX-ACCESS read-only
       STATUS current
       DESCRIPTION
         "An identification of the protocol being used for the
          application. For an OSI Application, this will be the
          Application Context. For Internet applications, the IANA
          maintains a registry of the OIDs which correspond to
          well-known applications. If the application protocol is
          not listed in the registry, an OID value of the form
          {applTCPProtoID port} or {applUDPProtoID port} are used for
          TCP-based and UDP-based protocols, respectively. In either
          case 'port' corresponds to the primary port number being
          used by the protocol."
       ::= {assocEntry 3}

assocApplicationType OBJECT-TYPE
       SYNTAX INTEGER {
           ua-initiator(1),
           ua-responder(2),
           peer-initiator(3),
           peer-responder(4)}
       MAX-ACCESS read-only
       STATUS current
       DESCRIPTION
         "This indicates whether the remote application is some type of
          client making use of this network service (e.g. a Mail User
          Agent) or a server acting as a peer. Also indicated is whether

        the remote end initiated an incoming connection to the network
        service or responded to an outgoing connection made by the
        local application. MTAs and messaging gateways are
        considered to be peers for the purposes of this variable."
    ::= {assocEntry 4}

assocDuration OBJECT-TYPE
    SYNTAX TimeStamp
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "The value of sysUpTime at the time this association was
       started. If this association started prior to the last
       initialization of the network subsystem, then this
       object contains a zero value."
    ::= {assocEntry 5}

-- Conformance information

applConformance OBJECT IDENTIFIER ::= {application 3}

applGroups   OBJECT IDENTIFIER ::= {applConformance 1}
applCompliances OBJECT IDENTIFIER ::= {applConformance 2}

-- Compliance statements

applCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
      "The compliance statement for SNMPv2 entities
       which implement the Network Services Monitoring MIB
       for basic monitoring of network service applications."
    MODULE -- this module
      MANDATORY-GROUPS {applGroup}
    ::= {applCompliances 1}

assocCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
      "The compliance statement for SNMPv2 entities which
       implement the Network Services Monitoring MIB for basic
       monitoring of network service applications and their
       associations."
    MODULE -- this module
      MANDATORY-GROUPS {applGroup, assocGroup}
    ::= {applCompliances 2}

```
-- Units of conformance

applGroup OBJECT-GROUP
     OBJECTS {
        applName, applVersion, applUptime, applOperStatus,
        applLastChange, applInboundAssociations,
        applOutboundAssociations, applAccumulatedInboundAssociations,
        applAccumulatedOutboundAssociations, applLastInboundActivity,
        applLastOutboundActivity, applRejectedInboundAssociations,
        applFailedOutboundAssociations, applDescription, applURL}
     STATUS current
     DESCRIPTION
       "A collection of objects providing basic monitoring of
        network service applications."
     ::= {applGroups 1}


assocGroup OBJECT-GROUP
     OBJECTS {
        assocRemoteApplication, assocApplicationProtocol,
        assocApplicationType, assocDuration}
     STATUS current
     DESCRIPTION
       "A collection of objects providing basic monitoring of
        network service applications' associations."
     ::= {applGroups 2}


-- OIDs of the form {applTCPProtoID port} are intended to be used
-- for TCP-based protocols that don't have OIDs assigned by other
-- means. {applUDPProtoID port} serves the same purpose for
-- UDP-based protocols. In either case 'port' corresponds to
-- the primary port number being used by the protocol. For example,
-- assuming no other OID is assigned for SMTP, an OID of
-- {applTCPProtoID 25} could be used, since SMTP is a TCP-based
-- protocol that uses port 25 as its primary port.

applTCPProtoID OBJECT IDENTIFIER ::= {application 4}
applUDPProtoID OBJECT IDENTIFIER ::= {application 5}

END
```

7. Changes made since RFC 1565

   The only changes made to this document since it was issued as RFC
   1565 [11] are the following:

   (1)   applDescription and applURL fields have been added. These
          fields are intended to identify and describe the application.

   (2)   A number of DESCRIPTION fields have been reworded, hopefully
          making them clearer.

   (3)   The new "quiescing" state has been added to applOperStatus.

   (4)   The prose about "dynamic single threaded processes" has been
          removed -- it was simply too confusing.

   (5)   Various RFC references have been updated to refer to more
          recent versions.

   (6)   The MIB has been renamed from APPLICATION-MIB to NETWORK-
          SERVICES-MIB. This was done because an application MIB is now
          under development within the IETF that provides very different
          functionality from this MIB.

8. Acknowledgements

   This document is a product of the Mail and Directory Management
   (MADMAN) Working Group. It is based on an earlier MIB designed by S.
   Kille, T. Lenggenhager, D. Partain, and W. Yeong. The Electronic
   Mail Association's TSC committee was instrumental in providing
   feedback on and suggesting enhancements to RFC 1565 [11] that have
   led to the present document.

9. References

   [1]   SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
          S. Waldbusser, "Structure of Management Information for Version
          2 of the Simple Network Management Protocol (SNMPv2)", RFC 1902,
          January 1996.

   [2]   SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
          S. Waldbusser, "Textual Conventions for Version 2 of the Simple
          Network Management Protocol (SNMPv2)", RFC 1903, January 1996.

   [3]   SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
          S. Waldbusser, "Conformance Statements for Version 2 of the
          Simple Network Management Protocol (SNMPv2)", RFC 1904, January
          1996.

   [4] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
        S. Waldbusser, "Protocol Operations for Version 2 of the Simple
        Network Management Protocol (SNMPv2)", RFC 1905, January 1996.

   [5] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
        S. Waldbusser, "Transport Mappings for Version 2 of the Simple
        Network Management Protocol (SNMPv2)", RFC 1906, January 1996.

   [6] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
        S. Waldbusser, "Management Information Base for Version 2 of the
        Simple Network Management Protocol (SNMPv2)", RFC 1907, January
        1996.

   [7] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and
        S. Waldbusser, "Coexistence between Version 1 and Version 2 of
        the Internet-standard Network Management Framework", RFC 1908,
        January 1996.

   [8] Kille, S., "A String Representation of Distinguished Names", RFC
        1779, March 1995.

   [9] Kille, S., "Mapping between X.400(1988) / ISO 10021 and RFC
        822", RFC 1327, May 1992.

   [10] Berners-Lee, T., Masinter, L. and M. McCahill, Uniform Resource
        Locators (URL)", RFC 1738, December 1994.

   [11] Freed, N., and S. Kille, "Network Services Monitoring MIB", RFC
        1565, January 1994.

10. Security Considerations

   This MIB does not offer write access, and as such cannot be used to
   actively attack a system. However, this MIB does provide passive
   information about the existance, type, and configuration of
   applications on a given host that could potentially indicate some
   sort of vulnerability. Finally, the information MIB provides about
   network usage could be used to analyze network traffic patterns.

11. Author and Chair Addresses

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12. Full Copyright Statement