

## X.500 Directory Monitoring MIB

### 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.

### Abstract

This document defines a portion of the Management Information Base (MIB). It defines the MIB for monitoring Directory System Agents (DSA), a component of the OSI Directory. This MIB will be used in conjunction with the APPLICATION-MIB for monitoring DSAs.

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### 1. The SNMPv2 Network Management Framework

The major components of the SNMPv2 Network Management framework are described in the documents listed below.

- o RFC 1442 [1] defines the Structure of Management Information (SMI), the mechanisms used for describing and naming objects for the purpose of management.
- o STD 17, RFC 1213 [2] defines MIB-II, the core set of managed objects (MO) for the Internet suite of protocols.

- o RFC 1445 [3] defines the administrative and other architectural aspects of the management framework.
- o RFC 1448 [4] defines the protocol used for network access to managed objects.

The framework is adaptable/extensible by defining new MIBs to suit the requirements of specific applications/protocols/situations.

Managed objects are accessed via a virtual information store, the 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, which is 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, often a textual string, termed the descriptor, is used to refer to the object type.

## 2. MIB Model for DSA Management

A DSA-manager may wish to monitor several aspects of the operational DSA. He/she may want to know the process related aspects-the resource utilization of the operational DSA; the network service related aspects e.g., inbound-associations, outbound-associations, operational status, and finally the information specific to the DSA application - its operations and performance.

The MIB defined in this document covers the portion which is specific to the DSA-application. The network service related part of the MIB, and the host-resources related part of the MIB, as well other parts of interest to a Manager monitoring the DSA-application, are covered in separate documents [6] [7].

## 3. The DSA functions and operations

The Directory System Agent [DSA], a component of the OSI-Directory [5] [9], is an application process. It provides access to the Directory Information Base [DIB] to Directory User Agents [DUA] and/or other DSAs. Functionally, a User [DUA] and the Directory are bound together for a period of time at an access point to the Directory [DSA]. A DSA may use information stored in its local database or interact with (chain the request to) other DSAs to service requirements. Alternatively, a DSA may return a reference to another DSA.

The local database of a DSA consists of the part of the DIT that is mastered by the DSA, the part of the DIT for which it keeps slave copies and cached information that is gathered during the operation

of the DSA.

The specific operations carried out by the DSA are: Read, Compare, AddEntry, ModifyEntry, ModifyRDN, RemoveEntry, List, Search. There is also the special operation Abandon. In response to requests results and/or errors are returned by the DSA.

#### 4. MIB design

The basic principle has been to keep the MIB as simple as possible. The Managed objects included in the MIB are divided into three tables - dsaOpsTable, dsaEntryTable and dsaIntTable.

- The dsaOpsTable provides summary statistics on the accesses, operations and errors.
- The dsaEntriesTable provides summary statistics on the entries held by the DSA and on cache performance.
- The dsaIntTable provides some useful information on the interaction of the monitored DSA with peer DSAs.

There are references to the Directory itself for static information pertaining to the DSA. These references are in the form of "Directory Distinguished Name" [8] of the corresponding object. It is intended that DSA management applications will use these references to obtain further related information on the objects of interest.

#### 5. The Directory Monitoring MIB

DSA-MIB DEFINITIONS ::= BEGIN

```

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE,
    NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    DisplayString, TimeStamp,
    TEXTUAL-CONVENTION
        FROM SNMPv2-TC
    mib-2
        FROM RFC1213-MIB
    applIndex, DistinguishedName
        FROM APPLICATION-MIB;

dsaMIB MODULE-IDENTITY
    LAST-UPDATED "9311250000Z"
    ORGANIZATION "IETF Mail and Directory Management Working
        Group"

```

## CONTACT-INFO

```
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```

## DESCRIPTION

```
" The MIB module for monitoring Directory System Agents."
 ::= { mib-2 29 }
```

## dsaOpsTable OBJECT-TYPE

```
SYNTAX SEQUENCE OF DsaOpsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    " The table holding information related to the
      DSA operations."
 ::= { dsaMIB 1 }
```

## dsaOpsEntry OBJECT-TYPE

```
SYNTAX DsaOpsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    " Entry containing operations related statistics
      for a DSA."
INDEX { applIndex }
 ::= { dsaOpsTable 1 }
```

```
DsaOpsEntry ::= SEQUENCE {
```

## -- Bindings

```
dsaAnonymousBinds
    Counter32,
dsaUnauthBinds
    Counter32,
dsaSimpleAuthBinds
    Counter32,
dsaStrongAuthBinds
    Counter32,
dsaBindSecurityErrors
    Counter32,
```

```
-- In-coming operations
```

```
    dsaInOps
      Counter32,
    dsaReadOps
      Counter32,
    dsaCompareOps
      Counter32,
    dsaAddEntryOps
      Counter32,
    dsaRemoveEntryOps
      Counter32,
    dsaModifyEntryOps
      Counter32,
    dsaModifyRDNops
      Counter32,
    dsaListOps
      Counter32,
    dsaSearchOps
      Counter32,
    dsaOneLevelSearchOps
      Counter32,
    dsaWholeTreeSearchOps
      Counter32,
```

```
-- Out going operations
```

```
    dsaReferrals
      Counter32,
    dsaChainings
      Counter32,
```

```
-- Errors
```

```
    dsaSecurityErrors
      Counter32,
    dsaErrors
      Counter32
  }
```

```
dsaAnonymousBinds OBJECT-TYPE
```

```
  SYNTAX Counter32
```

```
  MAX-ACCESS read-only
```

```
  STATUS current
```

```
  DESCRIPTION
```

```
    " Number of anonymous binds to this DSA from DUAs
      since application start."
```

```
 ::= { dsaOpsEntry 1 }
```

```
dsaUnauthBinds OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of un-authenticated binds to this
          DSA since application start."
    ::= {dsaOpsEntry 2}

dsaSimpleAuthBinds OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of binds to this DSA that were authenticated
          using simple authentication procedures since
          application start."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 8.1.2.1.1."
    ::= {dsaOpsEntry 3}

dsaStrongAuthBinds OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of binds to this DSA that were authenticated
          using the strong authentication procedures since
          application start. This includes the binds that were
          authenticated using external authentication procedures."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Sections 8.1.2.1.2 & 8.1.2.1.3."
    ::= {dsaOpsEntry 4}

dsaBindSecurityErrors OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of bind operations that have been rejected
          by this DSA due to inappropriateAuthentication or
          invalidCredentials."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 12.7.2"
```

```
 ::= {dsaOpsEntry 5}

dsaInOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of operations forwarded to this DSA
          from DUAs or other DSAs since application
          start up."
    ::= {dsaOpsEntry 6}

dsaReadOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of read operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 9.1."
    ::= {dsaOpsEntry 7}

dsaCompareOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of compare operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 9.2."
    ::= {dsaOpsEntry 8}

dsaAddEntryOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of addEntry operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 11.1."
    ::= {dsaOpsEntry 9}
```

```
dsaRemoveEntryOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of removeEntry operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 11.2."
    ::= {dsaOpsEntry 10}

dsaModifyEntryOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of modifyEntry operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 11.3."
    ::= {dsaOpsEntry 11}

dsaModifyRDNops OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of modifyRDN operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 11.4."
    ::= {dsaOpsEntry 12}

dsaListOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of list operations serviced by
          this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 10.1."
    ::= {dsaOpsEntry 13}
```



```
dsaSearchOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of search operations- baseObjectSearches,
          oneLevelSearches and subTreeSearches, serviced
          by this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 10.2."
    ::= {dsaOpsEntry 14}

dsaOneLevelSearchOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of oneLevelSearch operations serviced
          by this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 10.2.2.2."
    ::= {dsaOpsEntry 15}

dsaWholeTreeSearchOps OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of wholeTreeSearch operations serviced
          by this DSA since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 10.2.2.2."
    ::= {dsaOpsEntry 16}

dsaReferrals OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of referrals returned by this DSA in response
          to requests for operations since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 12.6."
    ::= {dsaOpsEntry 17}
```

```

dsaChainings OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of operations forwarded by this DSA
          to other DSAs since application startup."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.518, 1988:
          Section 14."
    ::= {dsaOpsEntry 18}

dsaSecurityErrors OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of operations forwarded to this DSA
          which did not meet the security requirements. "
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Section 12.7."
    ::= {dsaOpsEntry 19}

dsaErrors          OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of operations that could not be serviced
          due to errors other than security errors, and
          referrals.
          A partially serviced operation will not be counted
          as an error.
          The errors include NameErrors, UpdateErrors, Attribute
          errors and ServiceErrors."
    REFERENCE
        " CCITT Blue Book Fascicle VIII.8 - Rec. X.511, 1988:
          Sections 12.4, 12.5, 12.8 & 12.9."
    ::= {dsaOpsEntry 20}

-- Entry statistics/Cache performance
dsaEntriesTable OBJECT-TYPE
    SYNTAX SEQUENCE OF DsaEntriesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        " The table holding information related to the

```

```

        entry statistics and cache performance of the DSAs."
 ::= {dsaMIB 2}

dsaEntriesEntry OBJECT-TYPE
    SYNTAX DsaEntriesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        " Entry containing statistics pertaining to entries
          held by a DSA."
    INDEX { applIndex }
    ::= {dsaEntriesTable 1}

DsaEntriesEntry ::= SEQUENCE {
    dsaMasterEntries
        Gauge32,
    dsaCopyEntries
        Gauge32,
    dsaCacheEntries
        Gauge32,
    dsaCacheHits
        Counter32,
    dsaSlaveHits
        Counter32
}

dsaMasterEntries OBJECT-TYPE
    SYNTAX Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of entries mastered in the DSA."
    ::= {dsaEntriesEntry 1}

dsaCopyEntries OBJECT-TYPE
    SYNTAX Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of entries for which systematic (slave)
          copies are maintained in the DSA."
    ::= {dsaEntriesEntry 2}

dsaCacheEntries OBJECT-TYPE
    SYNTAX Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION

```

```

    " Number of entries cached (non-systematic copies) in
      the DSA. This will include the entries that are
      cached partially. The negative cache is not counted."
 ::= { dsaEntriesEntry 3 }

```

```

dsaCacheHits OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION
    " Number of operations that were serviced from
      the locally held cache since application
      startup."
 ::= { dsaEntriesEntry 4 }

```

```

dsaSlaveHits OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION
    " Number of operations that were serviced from
      the locally held object replications [ shadow
      entries] since application startup."
 ::= { dsaEntriesEntry 5 }

```

```

-- The dsaIntTable contains statistical data on the peer DSAs
-- with which the monitored DSAs [attempt to] interact. This
-- table will provide a useful insight into the effect of
-- neighbours on the DSA performance.
-- The table keeps track of the last "N" DSAs with which the
-- monitored DSAs has interacted [attempted to interact],
-- where "N" is a locally-defined constant.

```

```

dsaIntTable OBJECT-TYPE
  SYNTAX SEQUENCE OF DsaIntEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION
    " Each row of this table contains some details
      related to the history of the interaction
      of the monitored DSAs with their respective
      peer DSAs."
 ::= { dsaMIB 3 }

```

```

dsaIntEntry OBJECT-TYPE
  SYNTAX DsaIntEntry
  MAX-ACCESS not-accessible

```

```

        STATUS current
        DESCRIPTION
            " Entry containing interaction details of a DSA
              with a peer DSA."
        INDEX { applIndex,dsaIntIndex }
        ::= { dsaIntTable 1 }

DsaIntEntry ::= SEQUENCE {
    dsaIntIndex
        INTEGER,
    dsaName
        DistinguishedName,
    dsaTimeOfCreation
        TimeStamp,
    dsaTimeOfLastAttempt
        TimeStamp,
    dsaTimeOfLastSuccess
        TimeStamp,
    dsaFailuresSinceLastSuccess
        Counter32,
    dsaFailures
        Counter32,
    dsaSuccesses
        Counter32
}

dsaIntIndex OBJECT-TYPE
    SYNTAX INTEGER (1..2147483647)
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        " Together with applIndex it forms the unique key to
          identify the conceptual row which contains useful info
          on the (attempted) interaction between the DSA (referred
          to by applIndex) and a peer DSA."
    ::= { dsaIntEntry 1}

dsaName OBJECT-TYPE
    SYNTAX DistinguishedName
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Distinguished Name of the peer DSA to which this
          entry pertains."
    ::= { dsaIntEntry 2}

dsaTimeOfCreation OBJECT-TYPE
    SYNTAX TimeStamp

```

```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " The value of sysUpTime when this row was created.
      If the entry was created before the network management
      subsystem was initialized, this object will contain
      a value of zero."
 ::= {dsaIntEntry 3}

dsaTimeOfLastAttempt OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " The value of sysUpTime when the last attempt was made
      to contact this DSA. If the last attempt was made before
      the network management subsystem was initialized, this
      object will contain a value of zero."
 ::= {dsaIntEntry 4}

dsaTimeOfLastSuccess OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " The value of sysUpTime when the last attempt made to
      contact this DSA was successful. If there have
      been no successful attempts this entry will have a value
      of zero. If the last successful attempt was made before
      the network management subsystem was initialized, this
      object will contain a value of zero."
 ::= {dsaIntEntry 5}

dsaFailuresSinceLastSuccess OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " The number of failures since the last time an
      attempt to contact this DSA was successful. If
      there has been no successful attempts, this counter
      will contain the number of failures since this entry
      was created."
 ::= {dsaIntEntry 6}

dsaFailures OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only

```

```

STATUS current
DESCRIPTION
  " Cumulative failures since the creation of
  this entry."
 ::= { dsaIntEntry 7 }

```

```

dsaSuccesses OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Cumulative successes since the creation of
  this entry."
 ::= { dsaIntEntry 8 }

```

-- Conformance information

```

dsaConformance OBJECT IDENTIFIER ::= { dsaMIB 4 }

dsaGroups      OBJECT IDENTIFIER ::= { dsaConformance 1 }
dsaCompliances OBJECT IDENTIFIER ::= { dsaConformance 2 }

```

-- Compliance statements

```

dsaOpsCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
  "The compliance statement for SNMPv2 entities
  which implement the DSA-MIB for monitoring
  DSA operations."

MODULE -- this module
MANDATORY-GROUPS { dsaOpsGroup }

 ::= { dsaCompliances 1 }

```

```

dsaEntryCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
  "The compliance statement for SNMPv2 entities
  which implement the DSA-MIB for monitoring
  DSA operations, entry statistics and cache
  performance."

MODULE -- this module
MANDATORY-GROUPS { dsaOpsGroup, dsaEntryGroup }

```

```
::= { dsaCompliances 2 }
```

```
dsaIntCompliance MODULE-COMPLIANCE
```

```
STATUS current
```

```
DESCRIPTION
```

```
" The compliance statement for SNMPv2 entities
  which implement the DSA-MIB for monitoring DSA
  operations and the interaction of the DSA with
  peer DSAs."
```

```
MODULE -- this module
```

```
MANDATORY-GROUPS { dsaOpsGroup, dsaIntGroup }
```

```
::= { dsaCompliances 3 }
```

```
-- Units of conformance
```

```
dsaOpsGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
  dsaAnonymousBinds, dsaUnauthBinds, dsaSimpleAuthBinds,
  dsaStrongAuthBinds, dsaBindSecurityErrors, dsaInOps,
  dsaReadOps, dsaCompareOps, dsaAddEntryOps,
  dsaRemoveEntryOps, dsaModifyEntryOps, dsaModifyRDNops,
  dsaListOps, dsaSearchOps, dsaOneLevelSearchOps,
  dsaWholeTreeSearchOps, dsaReferrals, dsaChainings,
  dsaSecurityErrors, dsaErrors}
```

```
STATUS current
```

```
DESCRIPTION
```

```
" A collection of objects for monitoring the DSA
  operations."
```

```
::= { dsaGroups 1 }
```

```
dsaEntryGroup OBJECT-GROUP
```

```
OBJECTS { dsaMasterEntries, dsaCopyEntries, dsaCacheEntries,
          dsaCacheHits, dsaSlaveHits }
```

```
STATUS current
```

```
DESCRIPTION
```

```
" A collection of objects for monitoring the DSA
  entry statistics and cache performance."
```

```
::= { dsaGroups 2 }
```

```
dsaIntGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
  dsaName, dsaTimeOfCreation, dsaTimeOfLastAttempt,
  dsaTimeOfLastSuccess, dsaFailuresSinceLastSuccess, dsaFailures,
  dsaSuccesses}
```

```
STATUS current
```



## DESCRIPTION

```
" A collection of objects for monitoring the DSA's
  interaction with peer DSAs."
 ::= { dsaGroups 3 }
```

END

## 6. Acknowledgements

This draft is the product of discussions and deliberations carried out in the following working groups:

```
ietf-madman-wg  ietf-madman@innosoft.com
wide-isode-wg   isode-wg@wide.ad.jp
wide-netman-wg  netman-wg@wide.ad.jp
```

## 7. References

- [1] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Structure of Management Information for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1442, SNMP Research, Inc., Hughes LAN Systems, Dover Beach Consulting, Inc., Carnegie Mellon University, April 1993.
- [2] McCloghrie, K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, RFC 1213, Hughes LAN Systems, Performance Systems International, March 1991.
- [3] Galvin, J., and K. McCloghrie, "Administrative Model for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1445, Trusted Information Systems, Hughes LAN Systems, April 1993.
- [4] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Protocol Operations for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1448, SNMP Research, Inc., Hughes LAN Systems, Dover Beach Consulting, Inc., Carnegie Mellon University, April 1993.
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- [9] Kille, S., Huizer, E., Cerf, V., Hobby, R., and S. Kent, "A Strategic Plan for Deploying an Internet X.500 Directory Service", RFC 1430, ISODE Consortium, SURFnet bv, Corporation for National Research Initiatives, University of California, Davis, Bolt, Beranek and Newman, February 1993.

#### Security Considerations

Security issues are not discussed in this memo.

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