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G. Mansfield  
Cyber Solutions Inc.  
S. Kille  
MessagingDirect Ltd.  
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## Directory Server 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.

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### Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. This memo obsoletes RFC 1567, "X.500 Directory Monitoring MIB". This memo extends that specification to a more generic MIB for monitoring one or more directory servers each of which may support multiple access protocols. The MIB defined in this memo will be used in conjunction with the NETWORK-SERVICES-MIB [19] for monitoring Directory Servers.

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## 1. The SNMP Network Management Framework

The SNMP Network Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [1].
- o 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, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIV2, is described in STD 58, RFC 2578 [5], RFC 2579 [6] and RFC 2580 [7].
- o 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 2572 [11] and RFC 2574 [12].
- o 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].
- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [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.

2. The Directory Services Model.

The Directory comprises of a set of servers (Directory Servers). Clients or Directory User Agents (DUA) are provided access to the Directory which maybe local or distributed, by the Directory Servers. The server maybe a X.500 Directory System Agent (DSA) [16] running over the OSI suite of protocols or, a (C)LDAP[17,18] frontend to the X.500 Directory System Agent or, a native LDAP Directory Server running directly over TCP or other protocols, or a database acting as a backend to another server, or any other application protocol, or any combination of the above. A Directory Server has one or more application protocol interfaces. Through these interfaces the Directory Server interacts with the DUA and with the peer Directory Servers.

Fig. 1 shows the case of a Directory Server that receives requests and sends back responses in some protocol. Fig. 2 shows one possible scenario where the Directory Server speaks multiple protocols.

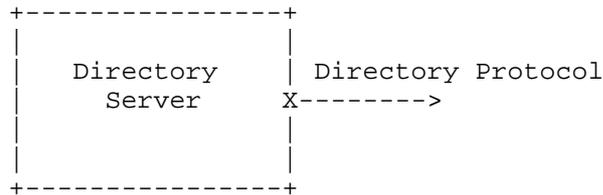


FIG. 1.

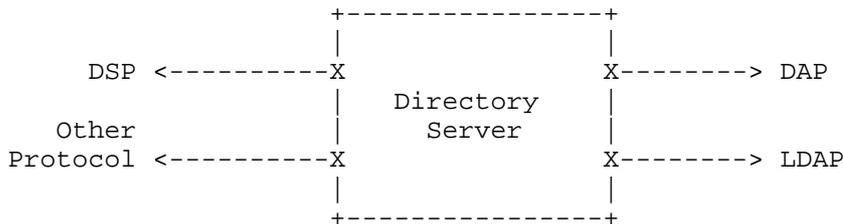


FIG. 2.

The Directory contains information in the form of entries. An entry is a collection of attributes and is uniquely identified by a name, the Distinguished Name (DN). The entries are arranged in a hierarchical tree-like structure called the Directory Information Tree (DIT).

A DUA requests a Directory Server to perform some operation on the Directory. The Directory Server is responsible for performing the operation and after completing its effort to carry out the request, returns a response to the DUA.

A Directory Server may use information stored in its local database or interact with (chain the request to) other Directory Servers to service the DUA request. Alternatively, a Directory Server may return a reference to another Directory Server (referral).

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

In the connection oriented mode a DUA "binds" to a Directory Server with a particular identification. The Directory Server may authenticate the identity of the DUA. In the connectionless mode as is employed in CLDAP no binding and/or authentication is carried out between the DUA and the Directory Server. The following type of operations are carried out by the Directory Server : Read, Compare, Addition of an Entry (AddEntry), Modification of an Entry (ModifyEntry), Modification of a DN (ModifyRDN), Deletion of an Entry (RemoveEntry), List, Search, Abandon. Some Directory Servers do not support some type of operations. For example CLDAP does not support AddEntry, ModifyEntry, ModifyRDN, RemoveEntry etc. In response to requests results and/or errors are returned by the Directory Server.

In the distributed Directory data is often replicated to enhance performance and for other advantages. The data to be replicated is transferred from the "Supplier" Directory Server to the "Consumer" Directory Server according to the replication agreement between the supplier and the receiver.

### 3. MIB Model for Directory Management.

A Directory manager should be able to monitor all the Directory Servers in his/her domain of management. The Directory Servers may be running on one or more hosts and, multiple Directory Servers may be running on the same host.

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

The MIB defined in this document covers the portion which is specific to Directory services. The network service related part of the MIB, and the host-resources related part of the MIB, as well as other parts of interest to a Manager monitoring the Directory services, are covered in separate documents [19] [20].

The MIB will cover a group of Directory Servers. The grouping will be done on some logical basis by the administrator/manager. In all cases, the grouping will be reflected in the pertinent NETWORK-SERVICES-MIB which will have an entry corresponding to each Directory Server in the group.

#### 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 - dsTable, dsApplIfOpsTable, and dsIntTable.

- The dsTable contains a list of Directory Servers. The list contains a description of the Directory Servers as well as summary statistics on the entries held by and the cache performance of each Directory Server. The group of servers on this list is likely to contain a part of, if not all, the Directory Servers in the management domain.
- The dsApplIfOpsTable provides summary statistics on the accesses, operations and errors for each application protocol interface of a Directory Server.
- The dsIntTable provides some useful information on the interaction of the monitored Directory Servers with peer Directory Servers.

There are references to the Directory itself for static information pertaining to the Directory Server. These references are in the form of "Directory Distinguished Name" [21] of the corresponding object. It is intended that Directory management applications will use these references to obtain further information on the objects of interest.

#### 5. The Directory Server Monitoring MIB.

```
DIRECTORY-SERVER-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
MODULE-IDENTITY, Counter32, Gauge32, OBJECT-TYPE
    FROM SNMPv2-SMI
mib-2          FROM RFC1213-MIB
DisplayString, TimeStamp
```

```

FROM SNMPv2-TC
MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF
ZeroBasedCounter32
FROM RMON2-MIB
applIndex, DistinguishedName, URLString

FROM NETWORK-SERVICES-MIB;

```

## dsMIB MODULE-IDENTITY

```

LAST-UPDATED "9906070000Z"
ORGANIZATION "IETF Mail and Directory Management Working
              Group"
CONTACT-INFO
"
    Glenn Mansfield
    Postal: Cyber Solutions Inc.
           6-6-3, Minami Yoshinari
           Aoba-ku, Sendai, Japan 989-3204.

    Tel: +81-22-303-4012
    Fax: +81-22-303-4015
    E-mail: glenn@cysols.com
Working Group E-mail: ietf-madman@innosoft.com
To subscribe: ietf-madman-request@innosoft.com"

```

## DESCRIPTION

" The MIB module for monitoring Directory Services."

-- revision information

REVISION "9906070000Z"

## DESCRIPTION

"This revision of this MIB is published in RFC 2605.

This revision obsoletes RFC 1567. It is incompatible with the original MIB and so it has been renamed from dsaMIB to dsMIB."

REVISION "9311250000Z" -- 25th November 1993

## DESCRIPTION

"The original version of this MIB was published in RFC 1567."  
 ::= { mib-2 66 }

## dsTable OBJECT-TYPE

```

SYNTAX SEQUENCE OF DsTableEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

```

```

    " The table holding information related to the Directory
      Servers."
 ::= {dsMIB 1}

```

```
dsTableEntry OBJECT-TYPE
```

```

  SYNTAX DsTableEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION
    " Entry containing summary description for a Directory
      Server."
  INDEX { applIndex }
  ::= {dsTable 1}

```

```

-- General description of the Directory Server application will be
-- available in the applTable of the NETWORK-SERVICES-MIB indexed by
-- applIndex.

```

```

DsTableEntry ::= SEQUENCE {
  dsServerType
    BITS,
  dsServerDescription
    DisplayString,

```

```
-- Entry statistics/Cache performance
```

```

  dsMasterEntries
    Gauge32,
  dsCopyEntries
    Gauge32,
  dsCacheEntries
    Gauge32,
  dsCacheHits
    Counter32,
  dsSlaveHits
    Counter32
}

```

```
dsServerType OBJECT-TYPE
```

```

  SYNTAX BITS {
    frontEndDirectoryServer(0),
    backEndDirectoryServer(1)
  }
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION
    "This object indicates whether the server is
      a frontend or, a backend or, both. If the server
      is a frontend, then the frontEndDirectoryServer

```

```

    bit will be set. Similarly for the backend."
 ::= {dsTableEntry 1}

```

dsServerDescription 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."

```
 ::= {dsTableEntry 2}
```

```

-- A (C)LDAP frontend to the X.500 Directory will not have
-- MasterEntries, CopyEntries; the following counters will
-- be inaccessible for LDAP/CLDAP frontends to the X.500
-- directory: dsMasterEntries, dsCopyEntries, dsSlaveHits.

```

dsMasterEntries OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of entries mastered in the Directory Server."

```
 ::= {dsTableEntry 3}
```

dsCopyEntries OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of entries for which systematic (slave) copies are maintained in the Directory Server."

```
 ::= {dsTableEntry 4}
```

dsCacheEntries OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of entries cached (non-systematic copies) in the Directory Server. This will include the entries that are cached partially. The negative cache is not counted."

```
 ::= {dsTableEntry 5}
```

dsCacheHits OBJECT-TYPE

SYNTAX Counter32

```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " Number of operations that were serviced from
      the locally held cache."
 ::= {dsTableEntry 6}

```

```

dsSlaveHits OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " Number of operations that were serviced from
      the locally held object replications ( copy-
      entries). "
 ::= {dsTableEntry 7}

```

```

dsApplIfOpsTable OBJECT-TYPE
SYNTAX SEQUENCE OF DsApplIfOpsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    " The table holding information related to the
      Directory Server operations."
 ::= {dsMIB 2}

```

```

dsApplIfOpsEntry OBJECT-TYPE
SYNTAX DsApplIfOpsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    " Entry containing operations related statistics
      for a Directory Server."
INDEX { applIndex, dsApplIfProtocolIndex }
 ::= {dsApplIfOpsTable 1}

```

```

DsApplIfOpsEntry ::= SEQUENCE {

```

```

    dsApplIfProtocolIndex
        INTEGER,
    dsApplIfProtocol
        OBJECT IDENTIFIER,

```

```

-- Bindings

```

```

    dsApplIfUnauthBinds
        Counter32,
    dsApplIfSimpleAuthBinds
        Counter32,

```

```
    dsApplIfStrongAuthBinds
      Counter32,
    dsApplIfBindSecurityErrors
      Counter32,
-- In-coming operations

    dsApplIfInOps
      Counter32,
    dsApplIfReadOps
      Counter32,
    dsApplIfCompareOps
      Counter32,
    dsApplIfAddEntryOps
      Counter32,
    dsApplIfRemoveEntryOps
      Counter32,
    dsApplIfModifyEntryOps
      Counter32,
    dsApplIfModifyRDNOps
      Counter32,
    dsApplIfListOps
      Counter32,
    dsApplIfSearchOps
      Counter32,
    dsApplIfOneLevelSearchOps
      Counter32,
    dsApplIfWholeSubtreeSearchOps
      Counter32,
-- Out going operations

    dsApplIfReferrals
      Counter32,
    dsApplIfChainings
      Counter32,
-- Errors

    dsApplIfSecurityErrors
      Counter32,
    dsApplIfErrors
      Counter32,
-- replications

    dsApplIfReplicationUpdatesIn
      Counter32,
```

```

    dsApplIfReplicationUpdatesOut
        Counter32,
-- Traffic Volume

    dsApplIfInBytes
        Counter32,
    dsApplIfOutBytes
        Counter32
}

-- CLDAP does not use binds; for the CLDAP interface of a Directory
-- Server the bind related counters will be inaccessible.
--
-- CLDAP and LDAP implement "Read" and "List" operations
-- indirectly via the "search" operation; the following
-- counters will be inaccessible for the CLDAP and LDAP interfaces of
-- Directory Servers: dsApplIfReadOps, dsApplIfListOps
--
-- CLDAP does not implement "Compare", "Add", "Remove",
-- "Modify", "ModifyRDN"; the following counters will be
-- inaccessible for the CLDAP interfaces of Directory Servers:
-- dsApplIfCompareOps, dsApplIfAddEntryOps, dsApplIfRemoveEntryOps,
-- dsApplIfModifyEntryOps, dsApplIfModifyRDNOps.
--
-- CLDAP Directory Servers do not return Referrals
-- the following fields will remain inaccessible for
-- CLDAP interfaces of Directory Servers: dsApplIfReferrals.

dsApplIfProtocolIndex OBJECT-TYPE
    SYNTAX INTEGER (1..2147483647)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "An index to uniquely identify an entry corresponding to a
        application-layer protocol interface. This index is used
        for lexicographic ordering of the table."
    ::= {dsApplIfOpsEntry 1}

dsApplIfProtocol OBJECT-TYPE
    SYNTAX OBJECT IDENTIFIER
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "An identification of the protocol being used by the application
        on this interface. For an OSI Application, this will be the
        Application Context. For Internet applications, the IANA
        maintains a registry[22] 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. The OIDs applTCPProtoID and applUDPProtoID are defined in NETWORK-SERVICES-MIB"

```
::= {dsApplIfOpsEntry 2}
```

dsApplIfUnauthBinds OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of unauthenticated/anonymous bind requests received."

```
::= {dsApplIfOpsEntry 3}
```

dsApplIfSimpleAuthBinds OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of bind requests that were authenticated using simple authentication procedures like password checks. This includes the password authentication using SASL mechanisms like CRAM-MD5."

```
::= {dsApplIfOpsEntry 4}
```

dsApplIfStrongAuthBinds OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of bind requests that were authenticated using TLS and X.500 strong authentication procedures. This includes the binds that were authenticated using external authentication procedures."

```
::= {dsApplIfOpsEntry 5}
```

dsApplIfBindSecurityErrors OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Number of bind requests that have been rejected due to inappropriate authentication or

```
        invalid credentials."  
 ::= {dsApplIfOpsEntry 6}
```

```
dsApplIfInOps OBJECT-TYPE  
    SYNTAX Counter32  
    MAX-ACCESS read-only  
    STATUS current  
    DESCRIPTION  
        " Number of requests received from DUAs or other  
        Directory Servers."  
 ::= {dsApplIfOpsEntry 7}
```

```
dsApplIfReadOps OBJECT-TYPE  
    SYNTAX Counter32  
    MAX-ACCESS read-only  
    STATUS current  
    DESCRIPTION  
        " Number of read requests received."  
 ::= {dsApplIfOpsEntry 8}
```

```
dsApplIfCompareOps OBJECT-TYPE  
    SYNTAX Counter32  
    MAX-ACCESS read-only  
    STATUS current  
    DESCRIPTION  
        " Number of compare requests received."  
 ::= {dsApplIfOpsEntry 9}
```

```
dsApplIfAddEntryOps OBJECT-TYPE  
    SYNTAX Counter32  
    MAX-ACCESS read-only  
    STATUS current  
    DESCRIPTION  
        " Number of addEntry requests received."  
 ::= {dsApplIfOpsEntry 10}
```

```
dsApplIfRemoveEntryOps OBJECT-TYPE  
    SYNTAX Counter32  
    MAX-ACCESS read-only  
    STATUS current  
    DESCRIPTION  
        " Number of removeEntry requests received."  
 ::= {dsApplIfOpsEntry 11}
```

```
dsApplIfModifyEntryOps OBJECT-TYPE
```

```
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Number of modifyEntry requests received."
 ::= {dsApplIfOpsEntry 12}
```

```
dsApplIfModifyRDNops OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Number of modifyRDN requests received."
 ::= {dsApplIfOpsEntry 13}
```

```
dsApplIfListOps OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Number of list requests received."
 ::= {dsApplIfOpsEntry 14}
```

```
dsApplIfSearchOps OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Number of search requests- baseObject searches,
  oneLevel searches and whole subtree searches,
  received."
 ::= {dsApplIfOpsEntry 15}
```

```
dsApplIfOneLevelSearchOps OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  " Number of oneLevel search requests received."
 ::= {dsApplIfOpsEntry 16}
```

```
dsApplIfWholeSubtreeSearchOps OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
```

" Number of whole subtree search requests received."  
 ::= {dsApplIfOpsEntry 17}

dsApplIfReferrals OBJECT-TYPE

SYNTAX Counter32  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
 " Number of referrals returned in response  
 to requests for operations."  
 ::= {dsApplIfOpsEntry 18}

dsApplIfChainings OBJECT-TYPE

SYNTAX Counter32  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
 " Number of operations forwarded by this Directory Server  
 to other Directory Servers."  
 ::= {dsApplIfOpsEntry 19}

dsApplIfSecurityErrors OBJECT-TYPE

SYNTAX Counter32  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
 " Number of requests received  
 which did not meet the security requirements. "  
 ::= {dsApplIfOpsEntry 20}

dsApplIfErrors OBJECT-TYPE

SYNTAX Counter32  
 MAX-ACCESS read-only  
 STATUS current  
 DESCRIPTION  
 " Number of requests 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 naming-related, update-related,  
 attribute-related and service-related errors."  
 ::= {dsApplIfOpsEntry 21}

-- Replication operations

dsApplIfReplicationUpdatesIn OBJECT-TYPE

```

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    " Number of replication updates fetched or received from
      supplier Directory Servers."
 ::= {dsApplIfOpsEntry 22}

```

```

dsApplIfReplicationUpdatesOut OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Number of replication updates sent to or taken by
          consumer Directory Servers."
    ::= {dsApplIfOpsEntry 23}

```

```

dsApplIfInBytes OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Incoming traffic, in bytes, on the interface.
          This will include requests from DUAs as well
          as responses from other Directory Servers."
    ::= {dsApplIfOpsEntry 24}

```

```

dsApplIfOutBytes OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        " Outgoing traffic in bytes on the interface.
          This will include responses to DUAs and Directory
          Servers as well as requests to other Directory Servers."
    ::= {dsApplIfOpsEntry 25}

```

```

-- The dsIntTable contains statistical data on the peer
-- Directory Servers with which the monitored Directory
-- Server interacts or, attempts to interact. This table is
-- expected to provide a useful insight into the effect of
-- neighbours on the Directory Server's performance.
-- The table keeps track of the last "N" Directory Servers
-- with which the monitored Directory has interacted
-- (attempted to interact), where "N" is a locally-defined
-- constant.
-- For a multiprotocol server, statistics for each protocol

```

-- are kept separately.

```

dsIntTable OBJECT-TYPE
    SYNTAX SEQUENCE OF DsIntEntry
    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 Directory Server with its
          peer Directory Servers."
    ::= { dsMIB 3 }

dsIntEntry OBJECT-TYPE
    SYNTAX DsIntEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        " Entry containing interaction details of a Directory
          Server with a peer Directory Server."
    INDEX { applIndex, dsIntEntIndex, dsApplIfProtocolIndex }
    ::= { dsIntTable 1 }

DsIntEntry ::= SEQUENCE {
    dsIntEntIndex
        INTEGER,
    dsIntEntDirectoryName
        DistinguishedName,
    dsIntEntTimeOfCreation
        TimeStamp,
    dsIntEntTimeOfLastAttempt
        TimeStamp,
    dsIntEntTimeOfLastSuccess
        TimeStamp,
    dsIntEntFailuresSinceLastSuccess
        Gauge32,
    dsIntEntFailures
        ZeroBasedCounter32,
    dsIntEntSuccesses
        ZeroBasedCounter32,
    dsIntEntURL
        URLString
}

dsIntEntIndex OBJECT-TYPE
    SYNTAX INTEGER (1..2147483647)
    MAX-ACCESS not-accessible
    STATUS current

```

## DESCRIPTION

" Together with applIndex and dsApplIfProtocolIndex, this object forms the unique key to identify the conceptual row which contains useful info on the (attempted) interaction between the Directory Server (referred to by applIndex) and a peer Directory Server using a particular protocol."

::= {dsIntEntry 1}

dsIntEntDirectoryName OBJECT-TYPE

SYNTAX DistinguishedName

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" Distinguished Name of the peer Directory Server to which this entry pertains."

::= {dsIntEntry 2}

dsIntEntTimeOfCreation 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."

::= {dsIntEntry 3}

dsIntEntTimeOfLastAttempt OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" The value of sysUpTime when the last attempt was made to contact the peer Directory Server. If the last attempt was made before the network management subsystem was initialized, this object will contain a value of zero."

::= {dsIntEntry 4}

dsIntEntTimeOfLastSuccess OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

" The value of sysUpTime when the last attempt made to contact the peer Directory Server 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."

```
::= {dsIntEntry 5}
```

```
dsIntEntFailuresSinceLastSuccess OBJECT-TYPE
```

```
SYNTAX Gauge32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
" The number of failures since the last time an
attempt to contact the peer Directory Server was successful.
If there have been no successful attempts, this counter
will contain the number of failures since this entry
was created."
```

```
::= {dsIntEntry 6}
```

```
-- note this gauge has a maximum value of 4294967295 and,
-- it does not wrap.[5]
```

```
dsIntEntFailures OBJECT-TYPE
```

```
SYNTAX ZeroBasedCounter32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
" Cumulative failures in contacting the peer Directory Server
since the creation of this entry."
```

```
::= {dsIntEntry 7}
```

```
dsIntEntSuccesses OBJECT-TYPE
```

```
SYNTAX ZeroBasedCounter32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
" Cumulative successes in contacting the peer Directory Server
since the creation of this entry."
```

```
::= {dsIntEntry 8}
```

```
dsIntEntURL OBJECT-TYPE
```

```
SYNTAX URLString
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
" URL of the peer Directory Server."
```

```
::= {dsIntEntry 9}
```

```
-- Conformance information
```

```
dsConformance OBJECT IDENTIFIER ::= { dsMIB 4 }

dsGroups      OBJECT IDENTIFIER ::= { dsConformance 1 }
dsCompliances OBJECT IDENTIFIER ::= { dsConformance 2 }

-- Compliance statements

dsEntryCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "The compliance statement for SNMP entities
    which implement the DIRECTORY-SERVER-MIB for
    a summary overview of the Directory Servers ."

  MODULE -- this module
    MANDATORY-GROUPS { dsEntryGroup }

  ::= { dsCompliances 1 }

dsOpsCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "The compliance statement for SNMP entities
    which implement the DIRECTORY-SERVER-MIB for monitoring
    Directory Server operations, entry statistics and cache
    performance."

  MODULE -- this module
    MANDATORY-GROUPS { dsEntryGroup, dsOpsGroup }

  ::= { dsCompliances 2 }

dsIntCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    " The compliance statement for SNMP entities
    which implement the DIRECTORY-SERVER-MIB for
    monitoring Directory Server operations and the
    interaction of the Directory Server with peer
    Directory Servers."

  MODULE -- this module
    MANDATORY-GROUPS { dsEntryGroup, dsIntGroup }

  ::= { dsCompliances 3 }

dsOpsIntCompliance MODULE-COMPLIANCE
  STATUS current
```

## DESCRIPTION

" The compliance statement for SNMP entities which implement the DIRECTORY-SERVER-MIB for monitoring Directory Server operations and the interaction of the Directory Server with peer Directory Servers."

MODULE -- this module

MANDATORY-GROUPS { dsEntryGroup, dsOpsGroup, dsIntGroup }

::= { dsCompliances 4 }

-- Units of conformance

dsEntryGroup OBJECT-GROUP

OBJECTS { dsServerType, dsServerDescription,  
dsMasterEntries, dsCopyEntries,  
dsCacheEntries, dsCacheHits,  
dsSlaveHits }

STATUS current

DESCRIPTION

" A collection of objects for a summary overview of the Directory Servers."

::= { dsGroups 1 }

dsOpsGroup OBJECT-GROUP

OBJECTS {  
dsApplIfProtocolIndex, dsApplIfProtocol,  
dsApplIfUnauthBinds, dsApplIfSimpleAuthBinds,  
dsApplIfStrongAuthBinds, dsApplIfBindSecurityErrors,  
dsApplIfInOps, dsApplIfReadOps,  
dsApplIfCompareOps, dsApplIfAddEntryOps,  
dsApplIfRemoveEntryOps, dsApplIfModifyEntryOps,  
dsApplIfModifyRDNops, dsApplIfListOps,  
dsApplIfSearchOps, dsApplIfOneLevelSearchOps,  
dsApplIfWholeSubtreeSearchOps, dsApplIfReferrals,  
dsApplIfChainings, dsApplIfSecurityErrors,  
dsApplIfErrors, dsApplIfReplicationUpdatesIn,  
dsApplIfReplicationUpdatesOut, dsApplIfInBytes,  
dsApplIfOutBytes }

STATUS current

DESCRIPTION

" A collection of objects for monitoring the Directory Server operations."

::= { dsGroups 2 }

dsIntGroup OBJECT-GROUP

OBJECTS {

```

    dsIntEntDirectoryName,          dsIntEntTimeOfCreation,
    dsIntEntTimeOfLastAttempt,     dsIntEntTimeOfLastSuccess,
    dsIntEntFailuresSinceLastSuccess, dsIntEntFailures,
    dsIntEntSuccesses,             dsIntEntURL}
STATUS current
DESCRIPTION
    " A collection of objects for monitoring the Directory
      Server's interaction with peer Directory Servers."
 ::= { dsGroups 3 }

```

END

## 6. Intellectual Property

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## 7. Changes from RFC1567.

A more general Directory model in which, several Directory protocols coexist, has been adopted for the purpose of the MIB design. The result is a generic Directory Server Monitoring MIB.

## 8. Acknowledgements

This memo is the product of discussions and deliberations carried out in the Mail and Directory Management Working Group (ietf-madman-wg).

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#### Security Considerations

There are no management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. So, if this MIB is implemented correctly, then there is no risk that an intruder can alter or create any management objects of this MIB via direct SNMP SET operations.

However, the information itself may partly reveal the configuration of the directory system and passively increase its vulnerability. The information could also be used to analyze network usage and traffic patterns.

Therefore, it may be important in some environments to control read access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is such an insecure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET (read) the objects in this MIB.

It is recommended that the implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to those objects only to those principals (users) that have legitimate rights to access them.

#### Authors' Addresses

Glenn Mansfield  
Cyber Solutions Inc.  
6-6-3 Minami Yoshinari  
Aoba-ku, Sendai 989-3204  
Japan

Phone: +81-22-303-4012  
EMail: glenn@cysols.com

Steve E. Kille  
MessagingDirect Ltd.  
The Dome, The Square  
Richmond TW9 1DT  
UK

Phone: +44-181-332-9091  
EMail: Steve.Kille@MessagingDirect.com

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