

Network Working Group
Request for Comments: 1213
Obsoletes: RFC 1158

K. McCloghrie
Hughes LAN Systems, Inc.
M. Rose
Performance Systems International
Editors
March 1991

Management Information Base for Network Management
of TCP/IP-based internets:
MIB-II

Status of this Memo

This memo defines the second version of the Management Information Base (MIB-II) for use with network management protocols in TCP/IP-based internets. This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Table of Contents

1. Abstract.....	2
2. Introduction	2
3. Changes from RFC 1156	3
3.1 Deprecated Objects	3
3.2 Display Strings	4
3.3 Physical Addresses	4
3.4 The System Group	5
3.5 The Interfaces Group	5
3.6 The Address Translation Group	6
3.7 The IP Group	6
3.8 The ICMP Group	7
3.9 The TCP Group	7
3.10 The UDP Group	7
3.11 The EGP Group	7
3.12 The Transmission Group	8
3.13 The SNMP Group	8
3.14 Changes from RFC 1158	9
4. Objects	10
4.1 Format of Definitions	10
5. Overview	10
6. Definitions	12
6.1 Textual Conventions	12
6.2 Groups in MIB-II	13
6.3 The System Group	13

6.4 The Interfaces Group	16
6.5 The Address Translation Group	23
6.6 The IP Group	26
6.7 The ICMP Group	41
6.8 The TCP Group	46
6.9 The UDP Group	52
6.10 The EGP Group	54
6.11 The Transmission Group	60
6.12 The SNMP Group	60
7. Acknowledgements	67
8. References	69
9. Security Considerations	70
10. Authors' Addresses	70

1. Abstract

This memo defines the second version of the Management Information Base (MIB-II) for use with network management protocols in TCP/IP-based internets. In particular, together with its companion memos which describe the structure of management information (RFC 1155) along with the network management protocol (RFC 1157) for TCP/IP-based internets, these documents provide a simple, workable architecture and system for managing TCP/IP-based internets and in particular the Internet community.

2. Introduction

As reported in RFC 1052, IAB Recommendations for the Development of Internet Network Management Standards [1], a two-prong strategy for network management of TCP/IP-based internets was undertaken. In the short-term, the Simple Network Management Protocol (SNMP) was to be used to manage nodes in the Internet community. In the long-term, the use of the OSI network management framework was to be examined. Two documents were produced to define the management information: RFC 1065, which defined the Structure of Management Information (SMI) [2], and RFC 1066, which defined the Management Information Base (MIB) [3]. Both of these documents were designed so as to be compatible with both the SNMP and the OSI network management framework.

This strategy was quite successful in the short-term: Internet-based network management technology was fielded, by both the research and commercial communities, within a few months. As a result of this, portions of the Internet community became network manageable in a timely fashion.

As reported in RFC 1109, Report of the Second Ad Hoc Network Management Review Group [4], the requirements of the SNMP and the OSI

network management frameworks were more different than anticipated. As such, the requirement for compatibility between the SMI/MIB and both frameworks was suspended. This action permitted the operational network management framework, the SNMP, to respond to new operational needs in the Internet community by producing this document.

As such, the current network management framework for TCP/IP- based internets consists of: Structure and Identification of Management Information for TCP/IP-based internets, RFC 1155 [12], which describes how managed objects contained in the MIB are defined; Management Information Base for Network Management of TCP/IP-based internets: MIB-II, this memo, which describes the managed objects contained in the MIB (and supercedes RFC 1156 [13]); and, the Simple Network Management Protocol, RFC 1098 [5], which defines the protocol used to manage these objects.

3. Changes from RFC 1156

Features of this MIB include:

- (1) incremental additions to reflect new operational requirements;
- (2) upwards compatibility with the SMI/MIB and the SNMP;
- (3) improved support for multi-protocol entities; and,
- (4) textual clean-up of the MIB to improve clarity and readability.

The objects defined in MIB-II have the OBJECT IDENTIFIER prefix:

```
mib-2      OBJECT IDENTIFIER ::= { mgmt 1 }
```

which is identical to the prefix used in MIB-I.

3.1. Deprecated Objects

In order to better prepare implementors for future changes in the MIB, a new term "deprecated" may be used when describing an object. A deprecated object in the MIB is one which must be supported, but one which will most likely be removed from the next version of the MIB (e.g., MIB-III).

MIB-II marks one object as being deprecated:

```
atTable
```

As a result of deprecating the atTable object, the entire Address Translation group is deprecated.

Note that no functionality is lost with the deprecation of these objects: new objects providing equivalent or superior functionality are defined in MIB-II.

3.2. Display Strings

In the past, there have been misinterpretations of the MIB as to when a string of octets should contain printable characters, meant to be displayed to a human. As a textual convention in the MIB, the datatype

```
DisplayString ::=
    OCTET STRING
```

is introduced. A DisplayString is restricted to the NVT ASCII character set, as defined in pages 10-11 of [6].

The following objects are now defined in terms of DisplayString:

```
sysDescr
ifDescr
```

It should be noted that this change has no effect on either the syntax nor semantics of these objects. The use of the DisplayString notation is merely an artifact of the explanatory method used in MIB-II and future MIBs.

Further it should be noted that any object defined in terms of OCTET STRING may contain arbitrary binary data, in which each octet may take any value from 0 to 255 (decimal).

3.3. Physical Addresses

As a further, textual convention in the MIB, the datatype

```
PhysAddress ::=
    OCTET STRING
```

is introduced to represent media- or physical-level addresses.

The following objects are now defined in terms of PhysAddress:

```
ifPhysAddress
atPhysAddress
ipNetToMediaPhysAddress
```

It should be noted that this change has no effect on either the syntax nor semantics of these objects. The use of the PhysAddress notation is merely an artifact of the explanatory method used in MIB-II and future MIBs.

3.4. The System Group

Four new objects are added to this group:

```
sysContact
sysName
sysLocation
sysServices
```

These provide contact, administrative, location, and service information regarding the managed node.

3.5. The Interfaces Group

The definition of the ifNumber object was incorrect, as it required all interfaces to support IP. (For example, devices without IP, such as MAC-layer bridges, could not be managed if this definition was strictly followed.) The description of the ifNumber object is changed accordingly.

The ifTable object was mistakenly marked as read-write, it has been (correctly) re-designated as not-accessible. In addition, several new values have been added to the ifType column in the ifTable object:

```
ppp(23)
softwareLoopback(24)
eon(25)
ethernet-3Mbit(26)
nsip(27)
slip(28)
ultra(29)
ds3(30)
sip(31)
frame-relay(32)
```

Finally, a new column has been added to the ifTable object:

```
ifSpecific
```

which provides information about information specific to the media being used to realize the interface.

3.6. The Address Translation Group

In MIB-I this group contained a table which permitted mappings from network addresses (e.g., IP addresses) to physical addresses (e.g., MAC addresses). Experience has shown that efficient implementations of this table make two assumptions: a single network protocol environment, and mappings occur only from network address to physical address.

The need to support multi-protocol nodes (e.g., those with both the IP and CLNP active), and the need to support the inverse mapping (e.g., for ES-IS), have invalidated both of these assumptions. As such, the atTable object is declared deprecated.

In order to meet both the multi-protocol and inverse mapping requirements, MIB-II and its successors will allocate up to two address translation tables inside each network protocol group. That is, the IP group will contain one address translation table, for going from IP addresses to physical addresses. Similarly, when a document defining MIB objects for the CLNP is produced (e.g., [7]), it will contain two tables, for mappings in both directions, as this is required for full functionality.

It should be noted that the choice of two tables (one for each direction of mapping) provides for ease of implementation in many cases, and does not introduce undue burden on implementations which realize the address translation abstraction through a single internal table.

3.7. The IP Group

The access attribute of the variable ipForwarding has been changed from read-only to read-write.

In addition, there is a new column to the ipAddrTable object,

ipAdEntReasmMaxSize

which keeps track of the largest IP datagram that can be re-assembled on a particular interface.

The descriptor of the ipRoutingTable object has been changed to ipRouteTable for consistency with the other IP routing objects. There are also three new columns in the ipRouteTable object,

ipRouteMask
ipRouteMetric5
ipRouteInfo

the first is used for IP routing subsystems that support arbitrary subnet masks, and the latter two are IP routing protocol-specific.

Two new objects are added to the IP group:

```
ipNetToMediaTable
ipRoutingDiscards
```

the first is the address translation table for the IP group (providing identical functionality to the now deprecated atTable in the address translation group), and the latter provides information when routes are lost due to a lack of buffer space.

3.8. The ICMP Group

There are no changes to this group.

3.9. The TCP Group

Two new variables are added:

```
tcpInErrs
tcpOutRsts
```

which keep track of the number of incoming TCP segments in error and the number of resets generated by a TCP.

3.10. The UDP Group

A new table:

```
udpTable
```

is added.

3.11. The EGP Group

Experience has indicated a need for additional objects that are useful in EGP monitoring. In addition to making several additions to the egpNeighborTable object, i.e.,

```
egpNeighAs
egpNeighInMsgs
egpNeighInErrs
egpNeighOutMsgs
egpNeighOutErrs
egpNeighInErrMsgs
egpNeighOutErrMsgs
```

```
egpNeighStateUps
egpNeighStateDowns
egpNeighIntervalHello
egpNeighIntervalPoll
egpNeighMode
egpNeighEventTrigger
```

a new variable is added:

```
egpAs
```

which gives the autonomous system associated with this EGP entity.

3.12. The Transmission Group

MIB-I was lacking in that it did not distinguish between different types of transmission media. A new group, the Transmission group, is allocated for this purpose:

```
transmission OBJECT IDENTIFIER ::= { mib-2 10 }
```

When Internet-standard definitions for managing transmission media are defined, the transmission group is used to provide a prefix for the names of those objects.

Typically, such definitions reside in the experimental portion of the MIB until they are "proven", then as a part of the Internet standardization process, the definitions are accordingly elevated and a new object identifier, under the transmission group is defined. By convention, the name assigned is:

```
type OBJECT IDENTIFIER ::= { transmission number }
```

where "type" is the symbolic value used for the media in the ifType column of the ifTable object, and "number" is the actual integer value corresponding to the symbol.

3.13. The SNMP Group

The application-oriented working groups of the IETF have been tasked to be receptive towards defining MIB variables specific to their respective applications.

For the SNMP, it is useful to have statistical information. A new group, the SNMP group, is allocated for this purpose:

```
snmp OBJECT IDENTIFIER ::= { mib-2 11 }
```


3.14. Changes from RFC 1158

Features of this MIB include:

- (1) The managed objects in this document have been defined using the conventions defined in the Internet-standard SMI, as amended by the extensions specified in [14]. It must be emphasized that definitions made using these extensions are semantically identically to those in RFC 1158.
- (2) The PhysAddress textual convention has been introduced to represent media addresses.
- (3) The ACCESS clause of sysLocation is now read-write.
- (4) The definition of sysServices has been clarified.
- (5) New ifType values (29-32) have been defined. In addition, the textual-descriptor for the DS1 and E1 interface types has been corrected.
- (6) The definition of ipForwarding has been clarified.
- (7) The definition of ipRouteType has been clarified.
- (8) The ipRouteMetric5 and ipRouteInfo objects have been defined.
- (9) The ACCESS clause of tcpConnState is now read-write, to support deletion of the TCB associated with a TCP connection. The definition of this object has been clarified to explain this usage.
- (10) The definition of egpNeighEventTrigger has been clarified.
- (11) The definition of several of the variables in the new snmp group have been clarified. In addition, the snmpInBadTypes and snmpOutReadOnlys objects are no longer present. (However, the object identifiers associated with those objects are reserved to prevent future use.)
- (12) The definition of snmpInReadOnlys has been clarified.
- (13) The textual descriptor of the snmpEnableAuthTraps has been changed to snmpEnableAuthenTraps, and the definition has been clarified.

(14) The ipRoutingDiscards object was added.

(15) The optional use of an implementation-dependent, small positive integer was disallowed when identifying instances of the IP address and routing tables.

4. Objects

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) [8] defined in the SMI. In particular, each object has a name, a syntax, and an encoding. The name is an object identifier, an administratively assigned name, which specifies an object type. 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 OBJECT DESCRIPTOR, to also refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for this purpose. However, the SMI [12] purposely restricts the ASN.1 constructs which may be used. These restrictions are explicitly made for simplicity.

The encoding of an object type is simply how that object type is represented using the object type's syntax. Implicitly tied to the notion of an object type's syntax and encoding is how the object type is represented when being transmitted on the network.

The SMI specifies the use of the basic encoding rules of ASN.1 [9], subject to the additional requirements imposed by the SNMP.

4.1. Format of Definitions

Section 6 contains contains the specification of all object types contained in this MIB module. The object types are defined using the conventions defined in the SMI, as amended by the extensions specified in [14].

5. Overview

Consistent with the IAB directive to produce simple, workable systems in the short-term, the list of managed objects defined here, has been derived by taking only those elements which are considered essential.

This approach of taking only the essential objects is NOT restrictive, since the SMI defined in the companion memo provides

three extensibility mechanisms: one, the addition of new standard objects through the definitions of new versions of the MIB; two, the addition of widely-available but non-standard objects through the experimental subtree; and three, the addition of private objects through the enterprises subtree. Such additional objects can not only be used for vendor-specific elements, but also for experimentation as required to further the knowledge of which other objects are essential.

The design of MIB-II is heavily influenced by the first extensibility mechanism. Several new variables have been added based on operational experience and need. Based on this, the criteria for including an object in MIB-II are remarkably similar to the MIB-I criteria:

- (1) An object needed to be essential for either fault or configuration management.
- (2) Only weak control objects were permitted (by weak, it is meant that tampering with them can do only limited damage). This criterion reflects the fact that the current management protocols are not sufficiently secure to do more powerful control operations.
- (3) Evidence of current use and utility was required.
- (4) In MIB-I, an attempt was made to limit the number of objects to about 100 to make it easier for vendors to fully instrument their software. In MIB-II, this limit was raised given the wide technological base now implementing MIB-I.
- (5) To avoid redundant variables, it was required that no object be included that can be derived from others in the MIB.
- (6) Implementation specific objects (e.g., for BSD UNIX) were excluded.
- (7) It was agreed to avoid heavily instrumenting critical sections of code. The general guideline was one counter per critical section per layer.

MIB-II, like its predecessor, the Internet-standard MIB, contains only essential elements. There is no need to allow individual objects to be optional. Rather, the objects are arranged into the following groups:

- System
- Interfaces
- Address Translation (deprecated)
- IP
- ICMP
- TCP
- UDP
- EGP
- Transmission
- SNMP

These groups are the basic unit of conformance: This method is as follows: if the semantics of a group is applicable to an implementation, then it must implement all objects in that group. For example, an implementation must implement the EGP group if and only if it implements the EGP.

There are two reasons for defining these groups: to provide a means of assigning object identifiers; and, to provide a method for implementations of managed agents to know which objects they must implement.

6. Definitions

```
RFC1213-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    mgmt, NetworkAddress, IpAddress, Counter, Gauge,  
        TimeTicks
```

```
    FROM RFC1155-SMI
```

```
    OBJECT-TYPE
```

```
        FROM RFC-1212;
```

```
-- This MIB module uses the extended OBJECT-TYPE macro as  
-- defined in [14];
```

```
-- MIB-II (same prefix as MIB-I)
```

```
mib-2      OBJECT IDENTIFIER ::= { mgmt 1 }
```

```
-- textual conventions
```

```
DisplayString ::=
```

```
    OCTET STRING
```

```
-- This data type is used to model textual information taken  
-- from the NVT ASCII character set.  By convention, objects  
-- with this syntax are declared as having
```

```
--
--      SIZE (0..255)

PhysAddress ::=
    OCTET STRING
-- This data type is used to model media addresses.  For many
-- types of media, this will be in a binary representation.
-- For example, an ethernet address would be represented as
-- a string of 6 octets.

-- groups in MIB-II

system      OBJECT IDENTIFIER ::= { mib-2 1 }
interfaces  OBJECT IDENTIFIER ::= { mib-2 2 }
at          OBJECT IDENTIFIER ::= { mib-2 3 }
ip          OBJECT IDENTIFIER ::= { mib-2 4 }
icmp        OBJECT IDENTIFIER ::= { mib-2 5 }
tcp         OBJECT IDENTIFIER ::= { mib-2 6 }
udp         OBJECT IDENTIFIER ::= { mib-2 7 }
egp         OBJECT IDENTIFIER ::= { mib-2 8 }

-- historical (some say hysterical)
-- cmot      OBJECT IDENTIFIER ::= { mib-2 9 }

transmission OBJECT IDENTIFIER ::= { mib-2 10 }

snmp        OBJECT IDENTIFIER ::= { mib-2 11 }

-- the System group

-- Implementation of the System group is mandatory for all
-- systems.  If an agent is not configured to have a value
-- for any of these variables, a string of length 0 is
-- returned.

sysDescr OBJECT-TYPE
    SYNTAX  DisplayString (SIZE (0..255))
    ACCESS  read-only
    STATUS  mandatory
```

DESCRIPTION

"A textual description of the entity. This value should include the full name and version identification of the system's hardware type, software operating-system, and networking software. It is mandatory that this only contain printable ASCII characters."

::= { system 1 }

sysObjectID OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The vendor's authoritative identification of the network management subsystem contained in the entity. This value is allocated within the SMI enterprises subtree (1.3.6.1.4.1) and provides an easy and unambiguous means for determining 'what kind of box' is being managed. For example, if vendor 'Flintstones, Inc.' was assigned the subtree 1.3.6.1.4.1.4242, it could assign the identifier 1.3.6.1.4.1.4242.1.1 to its 'Fred Router'."

::= { system 2 }

sysUpTime OBJECT-TYPE

SYNTAX TimeTicks

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The time (in hundredths of a second) since the network management portion of the system was last re-initialized."

::= { system 3 }

sysContact OBJECT-TYPE

SYNTAX DisplayString (SIZE (0..255))

ACCESS read-write

STATUS mandatory

DESCRIPTION

"The textual identification of the contact person for this managed node, together with information on how to contact this person."

::= { system 4 }

sysName OBJECT-TYPE

SYNTAX DisplayString (SIZE (0..255))

```

ACCESS    read-write
STATUS    mandatory
DESCRIPTION
    "An administratively-assigned name for this
    managed node.  By convention, this is the node's
    fully-qualified domain name."
 ::= { system 5 }

```

```

sysLocation OBJECT-TYPE
    SYNTAX  DisplayString (SIZE (0..255))
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The physical location of this node (e.g.,
        'telephone closet, 3rd floor')."
 ::= { system 6 }

```

```

sysServices OBJECT-TYPE
    SYNTAX  INTEGER (0..127)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "A value which indicates the set of services that
        this entity primarily offers.

```

The value is a sum. This sum initially takes the value zero, Then, for each layer, L, in the range 1 through 7, that this node performs transactions for, 2 raised to (L - 1) is added to the sum. For example, a node which performs primarily routing functions would have a value of 4 ($2^{(3-1)}$). In contrast, a node which is a host offering application services would have a value of 72 ($2^{(4-1)} + 2^{(7-1)}$). Note that in the context of the Internet suite of protocols, values should be calculated accordingly:

layer	functionality
1	physical (e.g., repeaters)
2	datalink/subnetwork (e.g., bridges)
3	internet (e.g., IP gateways)
4	end-to-end (e.g., IP hosts)
7	applications (e.g., mail relays)

```

        For systems including OSI protocols, layers 5 and
        6 may also be counted."
 ::= { system 7 }

```

```
-- the Interfaces group

-- Implementation of the Interfaces group is mandatory for
-- all systems.

ifNumber OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of network interfaces (regardless of
        their current state) present on this system."
    ::= { interfaces 1 }

-- the Interfaces table

-- The Interfaces table contains information on the entity's
-- interfaces. Each interface is thought of as being
-- attached to a 'subnetwork'. Note that this term should
-- not be confused with 'subnet' which refers to an
-- addressing partitioning scheme used in the Internet suite
-- of protocols.

ifTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF IfEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "A list of interface entries. The number of
        entries is given by the value of ifNumber."
    ::= { interfaces 2 }

ifEntry OBJECT-TYPE
    SYNTAX  IfEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "An interface entry containing objects at the
        subnetwork layer and below for a particular
        interface."
    INDEX   { ifIndex }
    ::= { ifTable 1 }

IfEntry ::=
    SEQUENCE {
        ifIndex
            INTEGER,
```



```
    ifDescr
        DisplayString,
    ifType
        INTEGER,
    ifMtu
        INTEGER,
    ifSpeed
        Gauge,
    ifPhysAddress
        PhysAddress,
    ifAdminStatus
        INTEGER,
    ifOperStatus
        INTEGER,
    ifLastChange
        TimeTicks,
    ifInOctets
        Counter,
    ifInUcastPkts
        Counter,
    ifInNUcastPkts
        Counter,
    ifInDiscards
        Counter,
    ifInErrors
        Counter,
    ifInUnknownProtos
        Counter,
    ifOutOctets
        Counter,
    ifOutUcastPkts
        Counter,
    ifOutNUcastPkts
        Counter,
    ifOutDiscards
        Counter,
    ifOutErrors
        Counter,
    ifOutQLen
        Gauge,
    ifSpecific
        OBJECT IDENTIFIER
}

ifIndex OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-only
    STATUS  mandatory
```

DESCRIPTION

"A unique value for each interface. Its value ranges between 1 and the value of ifNumber. The value for each interface must remain constant at least from one re-initialization of the entity's network management system to the next re-initialization."

::= { ifEntry 1 }

ifDescr OBJECT-TYPE

SYNTAX DisplayString (SIZE (0..255))

ACCESS read-only

STATUS mandatory

DESCRIPTION

"A textual string containing information about the interface. This string should include the name of the manufacturer, the product name and the version of the hardware interface."

::= { ifEntry 2 }

ifType OBJECT-TYPE

SYNTAX INTEGER {

other(1), -- none of the following
 regular1822(2),
 hdh1822(3),
 ddn-x25(4),
 rfc877-x25(5),
 ethernet-csmacd(6),
 iso88023-csmacd(7),
 iso88024-tokenBus(8),
 iso88025-tokenRing(9),
 iso88026-man(10),
 starLan(11),
 proteon-10Mbit(12),
 proteon-80Mbit(13),
 hyperchannel(14),
 fddi(15),
 lapb(16),
 sdlc(17),
 ds1(18), -- T-1
 e1(19), -- european equiv. of T-1
 basicISDN(20),
 primaryISDN(21), -- proprietary serial
 propPointToPointSerial(22),
 ppp(23),
 softwareLoopback(24),
 eon(25), -- CLNP over IP [11]
 ethernet-3Mbit(26),

```

        nsip(27),          -- XNS over IP
        slip(28),         -- generic SLIP
        ultra(29),        -- ULTRA technologies
        ds3(30),          -- T-3
        sip(31),           -- SMDS
        frame-relay(32)
    }
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The type of interface, distinguished according to
    the physical/link protocol(s) immediately 'below'
    the network layer in the protocol stack."
::= { ifEntry 3 }

ifMtu OBJECT-TYPE
SYNTAX    INTEGER
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The size of the largest datagram which can be
    sent/received on the interface, specified in
    octets.  For interfaces that are used for
    transmitting network datagrams, this is the size
    of the largest network datagram that can be sent
    on the interface."
::= { ifEntry 4 }

ifSpeed OBJECT-TYPE
SYNTAX    Gauge
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "An estimate of the interface's current bandwidth
    in bits per second.  For interfaces which do not
    vary in bandwidth or for those where no accurate
    estimation can be made, this object should contain
    the nominal bandwidth."
::= { ifEntry 5 }

ifPhysAddress OBJECT-TYPE
SYNTAX    PhysAddress
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The interface's address at the protocol layer
    immediately 'below' the network layer in the
    protocol stack.  For interfaces which do not have

```

such an address (e.g., a serial line), this object should contain an octet string of zero length."
 ::= { ifEntry 6 }

ifAdminStatus OBJECT-TYPE

SYNTAX INTEGER {
 up(1), -- ready to pass packets
 down(2),
 testing(3) -- in some test mode
}

ACCESS read-write

STATUS mandatory

DESCRIPTION

"The desired state of the interface. The testing(3) state indicates that no operational packets can be passed."

::= { ifEntry 7 }

ifOperStatus OBJECT-TYPE

SYNTAX INTEGER {
 up(1), -- ready to pass packets
 down(2),
 testing(3) -- in some test mode
}

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The current operational state of the interface. The testing(3) state indicates that no operational packets can be passed."

::= { ifEntry 8 }

ifLastChange OBJECT-TYPE

SYNTAX TimeTicks

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The value of sysUpTime at the time the interface entered its current operational state. If the current state was entered prior to the last re-initialization of the local network management subsystem, then this object contains a zero value."

::= { ifEntry 9 }

ifInOctets OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

```
STATUS    mandatory
DESCRIPTION
    "The total number of octets received on the
    interface, including framing characters."
 ::= { ifEntry 10 }

ifInUcastPkts OBJECT-TYPE
    SYNTAX    Counter
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
        "The number of subnetwork-unicast packets
        delivered to a higher-layer protocol."
    ::= { ifEntry 11 }

ifInNUcastPkts OBJECT-TYPE
    SYNTAX    Counter
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
        "The number of non-unicast (i.e., subnetwork-
        broadcast or subnetwork-multicast) packets
        delivered to a higher-layer protocol."
    ::= { ifEntry 12 }

ifInDiscards OBJECT-TYPE
    SYNTAX    Counter
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
        "The number of inbound packets which were chosen
        to be discarded even though no errors had been
        detected to prevent their being deliverable to a
        higher-layer protocol.  One possible reason for
        discarding such a packet could be to free up
        buffer space."
    ::= { ifEntry 13 }

ifInErrors OBJECT-TYPE
    SYNTAX    Counter
    ACCESS    read-only
    STATUS    mandatory
    DESCRIPTION
        "The number of inbound packets that contained
        errors preventing them from being deliverable to a
        higher-layer protocol."
    ::= { ifEntry 14 }
```

```
ifInUnknownPkts OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of packets received via the interface
        which were discarded because of an unknown or
        unsupported protocol."
    ::= { ifEntry 15 }

ifOutOctets OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of octets transmitted out of the
        interface, including framing characters."
    ::= { ifEntry 16 }

ifOutUcastPkts OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of packets that higher-level
        protocols requested be transmitted to a
        subnetwork-unicast address, including those that
        were discarded or not sent."
    ::= { ifEntry 17 }

ifOutNUcastPkts OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of packets that higher-level
        protocols requested be transmitted to a non-
        unicast (i.e., a subnetwork-broadcast or
        subnetwork-multicast) address, including those
        that were discarded or not sent."
    ::= { ifEntry 18 }

ifOutDiscards OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of outbound packets which were chosen
```

```

        to be discarded even though no errors had been
        detected to prevent their being transmitted.  One
        possible reason for discarding such a packet could
        be to free up buffer space."
 ::= { ifEntry 19 }

ifOutErrors OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of outbound packets that could not be
        transmitted because of errors."
 ::= { ifEntry 20 }

ifOutQLen OBJECT-TYPE
    SYNTAX Gauge
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The length of the output packet queue (in
        packets)."
 ::= { ifEntry 21 }

ifSpecific OBJECT-TYPE
    SYNTAX OBJECT IDENTIFIER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "A reference to MIB definitions specific to the
        particular media being used to realize the
        interface.  For example, if the interface is
        realized by an ethernet, then the value of this
        object refers to a document defining objects
        specific to ethernet.  If this information is not
        present, its value should be set to the OBJECT
        IDENTIFIER { 0 0 }, which is a syntatically valid
        object identifier, and any conformant
        implementation of ASN.1 and BER must be able to
        generate and recognize this value."
 ::= { ifEntry 22 }

-- the Address Translation group

-- Implementation of the Address Translation group is
-- mandatory for all systems.  Note however that this group
-- is deprecated by MIB-II.  That is, it is being included
```

```
-- solely for compatibility with MIB-I nodes, and will most
-- likely be excluded from MIB-III nodes.  From MIB-II and
-- onwards, each network protocol group contains its own
-- address translation tables.

-- The Address Translation group contains one table which is
-- the union across all interfaces of the translation tables
-- for converting a NetworkAddress (e.g., an IP address) into
-- a subnetwork-specific address.  For lack of a better term,
-- this document refers to such a subnetwork-specific address
-- as a 'physical' address.

-- Examples of such translation tables are: for broadcast
-- media where ARP is in use, the translation table is
-- equivalent to the ARP cache; or, on an X.25 network where
-- non-algorithmic translation to X.121 addresses is
-- required, the translation table contains the
-- NetworkAddress to X.121 address equivalences.
```

atTable OBJECT-TYPE

SYNTAX SEQUENCE OF AtEntry

ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"The Address Translation tables contain the NetworkAddress to 'physical' address equivalences. Some interfaces do not use translation tables for determining address equivalences (e.g., DDN-X.25 has an algorithmic method); if all interfaces are of this type, then the Address Translation table is empty, i.e., has zero entries."

::= { at 1 }

atEntry OBJECT-TYPE

SYNTAX AtEntry

ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"Each entry contains one NetworkAddress to 'physical' address equivalence."

INDEX { atIfIndex,
atNetAddress }

::= { atTable 1 }

AtEntry ::=

```
SEQUENCE {
    atIfIndex
        INTEGER,
```



```
        atPhysAddress
            PhysAddress,
        atNetAddress
            NetworkAddress
    }

atIfIndex OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  deprecated
    DESCRIPTION
        "The interface on which this entry's equivalence
        is effective. The interface identified by a
        particular value of this index is the same
        interface as identified by the same value of
        ifIndex."
    ::= { atEntry 1 }

atPhysAddress OBJECT-TYPE
    SYNTAX  PhysAddress
    ACCESS  read-write
    STATUS  deprecated
    DESCRIPTION
        "The media-dependent 'physical' address.

        Setting this object to a null string (one of zero
        length) has the effect of invaliding the
        corresponding entry in the atTable object. That
        is, it effectively dissasociates the interface
        identified with said entry from the mapping
        identified with said entry. It is an
        implementation-specific matter as to whether the
        agent removes an invalidated entry from the table.
        Accordingly, management stations must be prepared
        to receive tabular information from agents that
        corresponds to entries not currently in use.
        Proper interpretation of such entries requires
        examination of the relevant atPhysAddress object."
    ::= { atEntry 2 }

atNetAddress OBJECT-TYPE
    SYNTAX  NetworkAddress
    ACCESS  read-write
    STATUS  deprecated
    DESCRIPTION
        "The NetworkAddress (e.g., the IP address)
        corresponding to the media-dependent 'physical'
        address."
```

```
 ::= { atEntry 3 }

-- the IP group

-- Implementation of the IP group is mandatory for all
-- systems.

ipForwarding OBJECT-TYPE
    SYNTAX  INTEGER {
                forwarding(1),      -- acting as a gateway
                not-forwarding(2) -- NOT acting as a gateway
            }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The indication of whether this entity is acting
        as an IP gateway in respect to the forwarding of
        datagrams received by, but not addressed to, this
        entity.  IP gateways forward datagrams.  IP hosts
        do not (except those source-routed via the host).

        Note that for some managed nodes, this object may
        take on only a subset of the values possible.
        Accordingly, it is appropriate for an agent to
        return a 'badValue' response if a management
        station attempts to change this object to an
        inappropriate value."
    ::= { ip 1 }

ipDefaultTTL OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The default value inserted into the Time-To-Live
        field of the IP header of datagrams originated at
        this entity, whenever a TTL value is not supplied
        by the transport layer protocol."
    ::= { ip 2 }

ipInReceives OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of input datagrams received from
        interfaces, including those received in error."
```

```
::= { ip 3 }
```

```
ipInHdrErrors OBJECT-TYPE
```

```
SYNTAX Counter
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

"The number of input datagrams discarded due to errors in their IP headers, including bad checksums, version number mismatch, other format errors, time-to-live exceeded, errors discovered in processing their IP options, etc."

```
::= { ip 4 }
```

```
ipInAddrErrors OBJECT-TYPE
```

```
SYNTAX Counter
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

"The number of input datagrams discarded because the IP address in their IP header's destination field was not a valid address to be received at this entity. This count includes invalid addresses (e.g., 0.0.0.0) and addresses of unsupported Classes (e.g., Class E). For entities which are not IP Gateways and therefore do not forward datagrams, this counter includes datagrams discarded because the destination address was not a local address."

```
::= { ip 5 }
```

```
ipForwDatagrams OBJECT-TYPE
```

```
SYNTAX Counter
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

"The number of input datagrams for which this entity was not their final IP destination, as a result of which an attempt was made to find a route to forward them to that final destination. In entities which do not act as IP Gateways, this counter will include only those packets which were Source-Routed via this entity, and the Source-Route option processing was successful."

```
::= { ip 6 }
```

```
ipInUnknownProtos OBJECT-TYPE
```

```
SYNTAX Counter
```

```
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The number of locally-addressed datagrams
    received successfully but discarded because of an
    unknown or unsupported protocol."
 ::= { ip 7 }

ipInDiscards OBJECT-TYPE
    SYNTAX Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of input IP datagrams for which no
        problems were encountered to prevent their
        continued processing, but which were discarded
        (e.g., for lack of buffer space). Note that this
        counter does not include any datagrams discarded
        while awaiting re-assembly."
    ::= { ip 8 }

ipInDelivers OBJECT-TYPE
    SYNTAX Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of input datagrams successfully
        delivered to IP user-protocols (including ICMP)."
    ::= { ip 9 }

ipOutRequests OBJECT-TYPE
    SYNTAX Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of IP datagrams which local IP
        user-protocols (including ICMP) supplied to IP in
        requests for transmission. Note that this counter
        does not include any datagrams counted in
        ipForwDatagrams."
    ::= { ip 10 }

ipOutDiscards OBJECT-TYPE
    SYNTAX Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of output IP datagrams for which no
```

problem was encountered to prevent their transmission to their destination, but which were discarded (e.g., for lack of buffer space). Note that this counter would include datagrams counted in ipForwDatagrams if any such packets met this (discretionary) discard criterion."

::= { ip 11 }

ipOutNoRoutes OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP datagrams discarded because no route could be found to transmit them to their destination. Note that this counter includes any packets counted in ipForwDatagrams which meet this 'no-route' criterion. Note that this includes any datagrams which a host cannot route because all of its default gateways are down."

::= { ip 12 }

ipReasmTimeout OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The maximum number of seconds which received fragments are held while they are awaiting reassembly at this entity."

::= { ip 13 }

ipReasmReqds OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP fragments received which needed to be reassembled at this entity."

::= { ip 14 }

ipReasmOKs OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP datagrams successfully re-assembled."

```
::= { ip 15 }
```

ipReasmFails OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of failures detected by the IP re-assembly algorithm (for whatever reason: timed out, errors, etc). Note that this is not necessarily a count of discarded IP fragments since some algorithms (notably the algorithm in RFC 815) can lose track of the number of fragments by combining them as they are received."

```
::= { ip 16 }
```

ipFragOKs OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP datagrams that have been successfully fragmented at this entity."

```
::= { ip 17 }
```

ipFragFails OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP datagrams that have been discarded because they needed to be fragmented at this entity but could not be, e.g., because their Don't Fragment flag was set."

```
::= { ip 18 }
```

ipFragCreates OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of IP datagram fragments that have been generated as a result of fragmentation at this entity."

```
::= { ip 19 }
```

```
-- the IP address table

-- The IP address table contains this entity's IP addressing
-- information.

ipAddrTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpAddrEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "The table of addressing information relevant to
         this entity's IP addresses."
    ::= { ip 20 }

ipAddrEntry OBJECT-TYPE
    SYNTAX      IpAddrEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "The addressing information for one of this
         entity's IP addresses."
    INDEX       { ipAdEntAddr }
    ::= { ipAddrTable 1 }

IpAddrEntry ::=
    SEQUENCE {
        ipAdEntAddr
            IpAddress,
        ipAdEntIfIndex
            INTEGER,
        ipAdEntNetMask
            IpAddress,
        ipAdEntBcastAddr
            INTEGER,
        ipAdEntReasmMaxSize
            INTEGER (0..65535)
    }

ipAdEntAddr OBJECT-TYPE
    SYNTAX      IpAddress
    ACCESS      read-only
    STATUS      mandatory
    DESCRIPTION
        "The IP address to which this entry's addressing
         information pertains."
    ::= { ipAddrEntry 1 }
```

ipAdEntIfIndex OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The index value which uniquely identifies the interface to which this entry is applicable. The interface identified by a particular value of this index is the same interface as identified by the same value of ifIndex."

::= { ipAddrEntry 2 }

ipAdEntNetMask OBJECT-TYPE

SYNTAX IpAddress

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The subnet mask associated with the IP address of this entry. The value of the mask is an IP address with all the network bits set to 1 and all the hosts bits set to 0."

::= { ipAddrEntry 3 }

ipAdEntBcastAddr OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The value of the least-significant bit in the IP broadcast address used for sending datagrams on the (logical) interface associated with the IP address of this entry. For example, when the Internet standard all-ones broadcast address is used, the value will be 1. This value applies to both the subnet and network broadcasts addresses used by the entity on this (logical) interface."

::= { ipAddrEntry 4 }

ipAdEntReasmMaxSize OBJECT-TYPE

SYNTAX INTEGER (0..65535)

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The size of the largest IP datagram which this entity can re-assemble from incoming IP fragmented datagrams received on this interface."

::= { ipAddrEntry 5 }


```
-- the IP routing table

-- The IP routing table contains an entry for each route
-- presently known to this entity.
```

```
ipRouteTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF IpRouteEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "This entity's IP Routing table."
    ::= { ip 21 }

ipRouteEntry OBJECT-TYPE
    SYNTAX  IpRouteEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "A route to a particular destination."
    INDEX   { ipRouteDest }
    ::= { ipRouteTable 1 }
```

```
IpRouteEntry ::=
    SEQUENCE {
        ipRouteDest
            IpAddress,
        ipRouteIfIndex
            INTEGER,
        ipRouteMetric1
            INTEGER,
        ipRouteMetric2
            INTEGER,
        ipRouteMetric3
            INTEGER,
        ipRouteMetric4
            INTEGER,
        ipRouteNextHop
            IpAddress,
        ipRouteType
            INTEGER,
        ipRouteProto
            INTEGER,
        ipRouteAge
            INTEGER,
        ipRouteMask
            IpAddress,
        ipRouteMetric5
            INTEGER,
```

```
        ipRouteInfo
            OBJECT IDENTIFIER
    }

ipRouteDest OBJECT-TYPE
    SYNTAX  IPAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The destination IP address of this route.  An
        entry with a value of 0.0.0.0 is considered a
        default route.  Multiple routes to a single
        destination can appear in the table, but access to
        such multiple entries is dependent on the table-
        access mechanisms defined by the network
        management protocol in use."
    ::= { ipRouteEntry 1 }

ipRouteIfIndex OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the
        local interface through which the next hop of this
        route should be reached.  The interface identified
        by a particular value of this index is the same
        interface as identified by the same value of
        ifIndex."
    ::= { ipRouteEntry 2 }

ipRouteMetric1 OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The primary routing metric for this route.  The
        semantics of this metric are determined by the
        routing-protocol specified in the route's
        ipRouteProto value.  If this metric is not used,
        its value should be set to -1."
    ::= { ipRouteEntry 3 }

ipRouteMetric2 OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
```

```
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the
        routing-protocol specified in the route's
        ipRouteProto value.  If this metric is not used,
        its value should be set to -1."
 ::= { ipRouteEntry 4 }

ipRouteMetric3 OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the
        routing-protocol specified in the route's
        ipRouteProto value.  If this metric is not used,
        its value should be set to -1."
 ::= { ipRouteEntry 5 }

ipRouteMetric4 OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the
        routing-protocol specified in the route's
        ipRouteProto value.  If this metric is not used,
        its value should be set to -1."
 ::= { ipRouteEntry 6 }

ipRouteNextHop OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The IP address of the next hop of this route.
        (In the case of a route bound to an interface
        which is realized via a broadcast media, the value
        of this field is the agent's IP address on that
        interface.)"
 ::= { ipRouteEntry 7 }

ipRouteType OBJECT-TYPE
    SYNTAX  INTEGER {
                other(1),          -- none of the following
                invalid(2),        -- an invalidated route
            }
```

```

        direct(3),          -- route to directly
                             -- connected (sub-)network

        indirect(4)        -- route to a non-local
                             -- host/network/sub-network
    }
ACCESS read-write
STATUS mandatory
DESCRIPTION
    "The type of route.  Note that the values
    direct(3) and indirect(4) refer to the notion of
    direct and indirect routing in the IP
    architecture.

    Setting this object to the value invalid(2) has
    the effect of invalidating the corresponding entry
    in the ipRouteTable object.  That is, it
    effectively dissasociates the destination
    identified with said entry from the route
    identified with said entry.  It is an
    implementation-specific matter as to whether the
    agent removes an invalidated entry from the table.
    Accordingly, management stations must be prepared
    to receive tabular information from agents that
    corresponds to entries not currently in use.
    Proper interpretation of such entries requires
    examination of the relevant ipRouteType object."
::= { ipRouteEntry 8 }

ipRouteProto OBJECT-TYPE
    SYNTAX INTEGER {
        other(1),          -- none of the following

                             -- non-protocol information,
                             -- e.g., manually configured
        local(2),          -- entries

                             -- set via a network
        netmgmt(3),        -- management protocol

                             -- obtained via ICMP,
                             -- e.g., Redirect
        icmp(4),

                             -- the remaining values are
                             -- all gateway routing
                             -- protocols
        egp(5),
        ggp(6),
    }

```

```

        hello(7),
        rip(8),
        is-is(9),
        es-is(10),
        ciscoIgrp(11),
        bbnSpfIgp(12),
        ospf(13),
        bgp(14)
    }
ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The routing mechanism via which this route was
    learned. Inclusion of values for gateway routing
    protocols is not intended to imply that hosts
    should support those protocols."
::= { ipRouteEntry 9 }

ipRouteAge OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The number of seconds since this route was last
        updated or otherwise determined to be correct.
        Note that no semantics of 'too old' can be implied
        except through knowledge of the routing protocol
        by which the route was learned."
    ::= { ipRouteEntry 10 }

ipRouteMask OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "Indicate the mask to be logical-ANDed with the
        destination address before being compared to the
        value in the ipRouteDest field. For those systems
        that do not support arbitrary subnet masks, an
        agent constructs the value of the ipRouteMask by
        determining whether the value of the correspondent
        ipRouteDest field belong to a class-A, B, or C
        network, and then using one of:

            mask            network
            255.0.0.0       class-A
            255.255.0.0     class-B
            255.255.255.0   class-C

```

```
        If the value of the ipRouteDest is 0.0.0.0 (a
        default route), then the mask value is also
        0.0.0.0. It should be noted that all IP routing
        subsystems implicitly use this mechanism."
 ::= { ipRouteEntry 11 }

ipRouteMetric5 OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "An alternate routing metric for this route. The
        semantics of this metric are determined by the
        routing-protocol specified in the route's
        ipRouteProto value. If this metric is not used,
        its value should be set to -1."
 ::= { ipRouteEntry 12 }

ipRouteInfo OBJECT-TYPE
    SYNTAX  OBJECT IDENTIFIER
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "A reference to MIB definitions specific to the
        particular routing protocol which is responsible
        for this route, as determined by the value
        specified in the route's ipRouteProto value. If
        this information is not present, its value should
        be set to the OBJECT IDENTIFIER { 0 0 }, which is
        a syntatically valid object identifier, and any
        conformant implementation of ASN.1 and BER must be
        able to generate and recognize this value."
 ::= { ipRouteEntry 13 }

-- the IP Address Translation table

-- The IP address translation table contain the IpAddress to
-- 'physical' address equivalences. Some interfaces do not
-- use translation tables for determining address
-- equivalences (e.g., DDN-X.25 has an algorithmic method);
-- if all interfaces are of this type, then the Address
-- Translation table is empty, i.e., has zero entries.

ipNetToMediaTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF IpNetToMediaEntry
    ACCESS  not-accessible
    STATUS  mandatory
```

```
DESCRIPTION
    "The IP Address Translation table used for mapping
    from IP addresses to physical addresses."
 ::= { ip 22 }

ipNetToMediaEntry OBJECT-TYPE
    SYNTAX  IpNetToMediaEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "Each entry contains one IpAddress to 'physical'
        address equivalence."
    INDEX   { ipNetToMediaIfIndex,
              ipNetToMediaNetAddress }
    ::= { ipNetToMediaTable 1 }

IpNetToMediaEntry ::=
    SEQUENCE {
        ipNetToMediaIfIndex
            INTEGER,
        ipNetToMediaPhysAddress
            PhysAddress,
        ipNetToMediaNetAddress
            IpAddress,
        ipNetToMediaType
            INTEGER
    }

ipNetToMediaIfIndex OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The interface on which this entry's equivalence
        is effective. The interface identified by a
        particular value of this index is the same
        interface as identified by the same value of
        ifIndex."
    ::= { ipNetToMediaEntry 1 }

ipNetToMediaPhysAddress OBJECT-TYPE
    SYNTAX  PhysAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "The media-dependent 'physical' address."
    ::= { ipNetToMediaEntry 2 }
```

ipNetToMediaNetAddress OBJECT-TYPE

SYNTAX IpAddress
 ACCESS read-write
 STATUS mandatory
 DESCRIPTION

"The IpAddress corresponding to the media-dependent 'physical' address."

::= { ipNetToMediaEntry 3 }

ipNetToMediaType OBJECT-TYPE

SYNTAX INTEGER {
 other(1), -- none of the following
 invalid(2), -- an invalidated mapping
 dynamic(3),
 static(4)
 }

ACCESS read-write
 STATUS mandatory
 DESCRIPTION

"The type of mapping.

Setting this object to the value invalid(2) has the effect of invalidating the corresponding entry in the ipNetToMediaTable. That is, it effectively dissasociates the interface identified with said entry from the mapping identified with said entry. It is an implementation-specific matter as to whether the agent removes an invalidated entry from the table. Accordingly, management stations must be prepared to receive tabular information from agents that corresponds to entries not currently in use. Proper interpretation of such entries requires examination of the relevant ipNetToMediaType object."

::= { ipNetToMediaEntry 4 }

-- additional IP objects

ipRoutingDiscards OBJECT-TYPE

SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION

"The number of routing entries which were chosen to be discarded even though they are valid. One possible reason for discarding such an entry could be to free-up buffer space for other routing


```
        entries."
 ::= { ip 23 }

-- the ICMP group

-- Implementation of the ICMP group is mandatory for all
-- systems.

icmpInMsgs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of ICMP messages which the
         entity received. Note that this counter includes
         all those counted by icmpInErrors."
    ::= { icmp 1 }

icmpInErrors OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP messages which the entity
         received but determined as having ICMP-specific
         errors (bad ICMP checksums, bad length, etc.)."
    ::= { icmp 2 }

icmpInDestUnreachs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Destination Unreachable
         messages received."
    ::= { icmp 3 }

icmpInTimeExcds OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Time Exceeded messages
         received."
    ::= { icmp 4 }
```

```
icmpInParmProbs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Parameter Problem messages
        received."
    ::= { icmp 5 }

icmpInSrcQuenchs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Source Quench messages
        received."
    ::= { icmp 6 }

icmpInRedirects OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Redirect messages received."
    ::= { icmp 7 }

icmpInEchos OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Echo (request) messages
        received."
    ::= { icmp 8 }

icmpInEchoReps OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Echo Reply messages received."
    ::= { icmp 9 }

icmpInTimestamps OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
```

```
        "The number of ICMP Timestamp (request) messages
        received."
 ::= { icmp 10 }

icmpInTimestampReps OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Timestamp Reply messages
        received."
 ::= { icmp 11 }

icmpInAddrMasks OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Address Mask Request messages
        received."
 ::= { icmp 12 }

icmpInAddrMaskReps OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Address Mask Reply messages
        received."
 ::= { icmp 13 }

icmpOutMsgs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of ICMP messages which this
        entity attempted to send. Note that this counter
        includes all those counted by icmpOutErrors."
 ::= { icmp 14 }

icmpOutErrors OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP messages which this entity did
        not send due to problems discovered within ICMP"
```

```
such as a lack of buffers. This value should not
include errors discovered outside the ICMP layer
such as the inability of IP to route the resultant
datagram. In some implementations there may be no
types of error which contribute to this counter's
value."
 ::= { icmp 15 }

icmpOutDestUnreachs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Destination Unreachable
        messages sent."
    ::= { icmp 16 }

icmpOutTimeExcds OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Time Exceeded messages sent."
    ::= { icmp 17 }

icmpOutParmProbs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Parameter Problem messages
        sent."
    ::= { icmp 18 }

icmpOutSrcQuenchs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Source Quench messages sent."
    ::= { icmp 19 }

icmpOutRedirects OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of ICMP Redirect messages sent. For a
```

host, this object will always be zero, since hosts
do not send redirects."
 ::= { icmp 20 }

icmpOutEchos OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Echo (request) messages sent."

::= { icmp 21 }

icmpOutEchoReps OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Echo Reply messages sent."

::= { icmp 22 }

icmpOutTimestamps OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Timestamp (request) messages
sent."

::= { icmp 23 }

icmpOutTimestampReps OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Timestamp Reply messages
sent."

::= { icmp 24 }

icmpOutAddrMasks OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Address Mask Request messages
sent."

::= { icmp 25 }

icmpOutAddrMaskReps OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of ICMP Address Mask Reply messages sent."

::= { icmp 26 }

-- the TCP group

-- Implementation of the TCP group is mandatory for all
 -- systems that implement the TCP.

-- Note that instances of object types that represent
 -- information about a particular TCP connection are
 -- transient; they persist only as long as the connection
 -- in question.

tcpRtoAlgorithm OBJECT-TYPE

SYNTAX INTEGER {

other(1), -- none of the following

constant(2), -- a constant rto

rsre(3), -- MIL-STD-1778, Appendix B

vanj(4) -- Van Jacobson's algorithm [10]

}

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The algorithm used to determine the timeout value
 used for retransmitting unacknowledged octets."

::= { tcp 1 }

tcpRtoMin OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The minimum value permitted by a TCP
 implementation for the retransmission timeout,
 measured in milliseconds. More refined semantics
 for objects of this type depend upon the algorithm
 used to determine the retransmission timeout. In
 particular, when the timeout algorithm is rsre(3),
 an object of this type has the semantics of the
 LBOUND quantity described in RFC 793."

::= { tcp 2 }

tcpRtoMax OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The maximum value permitted by a TCP implementation for the retransmission timeout, measured in milliseconds. More refined semantics for objects of this type depend upon the algorithm used to determine the retransmission timeout. In particular, when the timeout algorithm is rsre(3), an object of this type has the semantics of the UBOUND quantity described in RFC 793."

::= { tcp 3 }

tcpMaxConn OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The limit on the total number of TCP connections the entity can support. In entities where the maximum number of connections is dynamic, this object should contain the value -1."

::= { tcp 4 }

tcpActiveOpens OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of times TCP connections have made a direct transition to the SYN-SENT state from the CLOSED state."

::= { tcp 5 }

tcpPassiveOpens OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of times TCP connections have made a direct transition to the SYN-RCVD state from the LISTEN state."

::= { tcp 6 }

tcpAttemptFails OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The number of times TCP connections have made a direct transition to the CLOSED state from either the SYN-SENT state or the SYN-RCVD state, plus the number of times TCP connections have made a direct transition to the LISTEN state from the SYN-RCVD state."

::= { tcp 7 }

tcpEstabResets OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The number of times TCP connections have made a direct transition to the CLOSED state from either the ESTABLISHED state or the CLOSE-WAIT state."

::= { tcp 8 }

tcpCurrEstab OBJECT-TYPE

SYNTAX Gauge
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The number of TCP connections for which the current state is either ESTABLISHED or CLOSE-WAIT."

::= { tcp 9 }

tcpInSegs OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The total number of segments received, including those received in error. This count includes segments received on currently established connections."

::= { tcp 10 }

tcpOutSegs OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory


```
DESCRIPTION
    "The total number of segments sent, including
    those on current connections but excluding those
    containing only retransmitted octets."
 ::= { tcp 11 }

tcpRetransSegs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of segments retransmitted - that
        is, the number of TCP segments transmitted
        containing one or more previously transmitted
        octets."
    ::= { tcp 12 }

-- the TCP Connection table

-- The TCP connection table contains information about this
-- entity's existing TCP connections.

tcpConnTable OBJECT-TYPE
    SYNTAX SEQUENCE OF TcpConnEntry
    ACCESS not-accessible
    STATUS mandatory
    DESCRIPTION
        "A table containing TCP connection-specific
        information."
    ::= { tcp 13 }

tcpConnEntry OBJECT-TYPE
    SYNTAX TcpConnEntry
    ACCESS not-accessible
    STATUS mandatory
    DESCRIPTION
        "Information about a particular current TCP
        connection. An object of this type is transient,
        in that it ceases to exist when (or soon after)
        the connection makes the transition to the CLOSED
        state."
    INDEX { tcpConnLocalAddress,
            tcpConnLocalPort,
            tcpConnRemAddress,
            tcpConnRemPort }
    ::= { tcpConnTable 1 }
```

```

TcpConnEntry ::=
    SEQUENCE {
        tcpConnState
            INTEGER,
        tcpConnLocalAddress
            IpAddress,
        tcpConnLocalPort
            INTEGER (0..65535),
        tcpConnRemAddress
            IpAddress,
        tcpConnRemPort
            INTEGER (0..65535)
    }

```

```

tcpConnState OBJECT-TYPE
    SYNTAX  INTEGER {
        closed(1),
        listen(2),
        synSent(3),
        synReceived(4),
        established(5),
        finWait1(6),
        finWait2(7),
        closeWait(8),
        lastAck(9),
        closing(10),
        timeWait(11),
        deleteTCB(12)
    }

```

ACCESS read-write

STATUS mandatory

DESCRIPTION

"The state of this TCP connection.

The only value which may be set by a management station is deleteTCB(12). Accordingly, it is appropriate for an agent to return a 'badValue' response if a management station attempts to set this object to any other value.

If a management station sets this object to the value deleteTCB(12), then this has the effect of deleting the TCB (as defined in RFC 793) of the corresponding connection on the managed node, resulting in immediate termination of the connection.

As an implementation-specific option, a RST

```
        segment may be sent from the managed node to the
        other TCP endpoint (note however that RST segments
        are not sent reliably)."
```

```
 ::= { tcpConnEntry 1 }
```

```
tcpConnLocalAddress OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The local IP address for this TCP connection.  In
        the case of a connection in the listen state which
        is willing to accept connections for any IP
        interface associated with the node, the value
        0.0.0.0 is used."
    ::= { tcpConnEntry 2 }
```

```
tcpConnLocalPort OBJECT-TYPE
    SYNTAX  INTEGER (0..65535)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The local port number for this TCP connection."
    ::= { tcpConnEntry 3 }
```

```
tcpConnRemAddress OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The remote IP address for this TCP connection."
    ::= { tcpConnEntry 4 }
```

```
tcpConnRemPort OBJECT-TYPE
    SYNTAX  INTEGER (0..65535)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The remote port number for this TCP connection."
    ::= { tcpConnEntry 5 }
```

```
-- additional TCP objects
```

```
tcpInErrs OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
```

```
DESCRIPTION
    "The total number of segments received in error
    (e.g., bad TCP checksums)."
```

```
::= { tcp 14 }
```

```
tcpOutRsts OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of TCP segments sent containing the
        RST flag."
```

```
::= { tcp 15 }
```

```
-- the UDP group

-- Implementation of the UDP group is mandatory for all
-- systems which implement the UDP.
```

```
udpInDatagrams OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of UDP datagrams delivered to
        UDP users."
```

```
::= { udp 1 }
```

```
udpNoPorts OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of received UDP datagrams for
        which there was no application at the destination
        port."
```

```
::= { udp 2 }
```

```
udpInErrors OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of received UDP datagrams that could
        not be delivered for reasons other than the lack
        of an application at the destination port."
```

```
::= { udp 3 }
```

```
udpOutDatagrams OBJECT-TYPE
    SYNTAX      Counter
    ACCESS      read-only
    STATUS      mandatory
    DESCRIPTION
        "The total number of UDP datagrams sent from this
         entity."
    ::= { udp 4 }

-- the UDP Listener table

-- The UDP listener table contains information about this
-- entity's UDP end-points on which a local application is
-- currently accepting datagrams.

udpTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF UdpEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "A table containing UDP listener information."
    ::= { udp 5 }

udpEntry OBJECT-TYPE
    SYNTAX      UdpEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "Information about a particular current UDP
         listener."
    INDEX      { udpLocalAddress, udpLocalPort }
    ::= { udpTable 1 }

UdpEntry ::=
    SEQUENCE {
        udpLocalAddress
            IpAddress,
        udpLocalPort
            INTEGER (0..65535)
    }

udpLocalAddress OBJECT-TYPE
    SYNTAX      IpAddress
    ACCESS      read-only
    STATUS      mandatory
    DESCRIPTION
        "The local IP address for this UDP listener.  In
```

```
        the case of a UDP listener which is willing to
        accept datagrams for any IP interface associated
        with the node, the value 0.0.0.0 is used."
 ::= { udpEntry 1 }

udpLocalPort OBJECT-TYPE
    SYNTAX  INTEGER (0..65535)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The local port number for this UDP listener."
 ::= { udpEntry 2 }

-- the EGP group

-- Implementation of the EGP group is mandatory for all
-- systems which implement the EGP.

egpInMsgs OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of EGP messages received without
        error."
 ::= { egp 1 }

egpInErrors OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of EGP messages received that proved
        to be in error."
 ::= { egp 2 }

egpOutMsgs OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of locally generated EGP
        messages."
 ::= { egp 3 }

egpOutErrors OBJECT-TYPE
    SYNTAX  Counter
```

```

ACCESS    read-only
STATUS    mandatory
DESCRIPTION
    "The number of locally generated EGP messages not
    sent due to resource limitations within an EGP
    entity."
 ::= { egp 4 }

-- the EGP Neighbor table

-- The EGP neighbor table contains information about this
-- entity's EGP neighbors.

egpNeighTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF EgpNeighEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "The EGP neighbor table."
    ::= { egp 5 }

egpNeighEntry OBJECT-TYPE
    SYNTAX      EgpNeighEntry
    ACCESS      not-accessible
    STATUS      mandatory
    DESCRIPTION
        "Information about this entity's relationship with
        a particular EGP neighbor."
    INDEX       { egpNeighAddr }
    ::= { egpNeighTable 1 }

EgpNeighEntry ::=
    SEQUENCE {
        egpNeighState
            INTEGER,
        egpNeighAddr
            IpAddress,
        egpNeighAs
            INTEGER,
        egpNeighInMsgs
            Counter,
        egpNeighInErrs
            Counter,
        egpNeighOutMsgs
            Counter,
        egpNeighOutErrs
            Counter,
    }

```

```

        egpNeighInErrMsgs
            Counter,
        egpNeighOutErrMsgs
            Counter,
        egpNeighStateUps
            Counter,
        egpNeighStateDowns
            Counter,
        egpNeighIntervalHello
            INTEGER,
        egpNeighIntervalPoll
            INTEGER,
        egpNeighMode
            INTEGER,
        egpNeighEventTrigger
            INTEGER
    }

egpNeighState OBJECT-TYPE
    SYNTAX  INTEGER {
                idle(1),
                acquisition(2),
                down(3),
                up(4),
                cease(5)
            }
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The EGP state of the local system with respect to
        this entry's EGP neighbor.  Each EGP state is
        represented by a value that is one greater than
        the numerical value associated with said state in
        RFC 904."
    ::= { egpNeighEntry 1 }

egpNeighAddr OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The IP address of this entry's EGP neighbor."
    ::= { egpNeighEntry 2 }

egpNeighAs OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-only
    STATUS  mandatory

```


DESCRIPTION
 "The autonomous system of this EGP peer. Zero
 should be specified if the autonomous system
 number of the neighbor is not yet known."
 ::= { egpNeighEntry 3 }

egpNeighInMsgs OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of EGP messages received without error
 from this EGP peer."
 ::= { egpNeighEntry 4 }

egpNeighInErrs OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of EGP messages received from this EGP
 peer that proved to be in error (e.g., bad EGP
 checksum)."
 ::= { egpNeighEntry 5 }

egpNeighOutMsgs OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of locally generated EGP messages to
 this EGP peer."
 ::= { egpNeighEntry 6 }

egpNeighOutErrs OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory
 DESCRIPTION
 "The number of locally generated EGP messages not
 sent to this EGP peer due to resource limitations
 within an EGP entity."
 ::= { egpNeighEntry 7 }

egpNeighInErrMsgs OBJECT-TYPE
 SYNTAX Counter
 ACCESS read-only
 STATUS mandatory

DESCRIPTION
 "The number of EGP-defined error messages received
 from this EGP peer."
 ::= { egpNeighEntry 8 }

egpNeighOutErrMsgs OBJECT-TYPE
SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION
 "The number of EGP-defined error messages sent to
 this EGP peer."
 ::= { egpNeighEntry 9 }

egpNeighStateUps OBJECT-TYPE
SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION
 "The number of EGP state transitions to the UP
 state with this EGP peer."
 ::= { egpNeighEntry 10 }

egpNeighStateDowns OBJECT-TYPE
SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION
 "The number of EGP state transitions from the UP
 state to any other state with this EGP peer."
 ::= { egpNeighEntry 11 }

egpNeighIntervalHello OBJECT-TYPE
SYNTAX INTEGER
ACCESS read-only
STATUS mandatory
DESCRIPTION
 "The interval between EGP Hello command
 retransmissions (in hundredths of a second). This
 represents the t1 timer as defined in RFC 904."
 ::= { egpNeighEntry 12 }

egpNeighIntervalPoll OBJECT-TYPE
SYNTAX INTEGER
ACCESS read-only
STATUS mandatory
DESCRIPTION
 "The interval between EGP poll command

retransmissions (in hundredths of a second). This represents the t3 timer as defined in RFC 904."
 ::= { egpNeighEntry 13 }

egpNeighMode OBJECT-TYPE

SYNTAX INTEGER { active(1), passive(2) }

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The polling mode of this EGP entity, either passive or active."

::= { egpNeighEntry 14 }

egpNeighEventTrigger OBJECT-TYPE

SYNTAX INTEGER { start(1), stop(2) }

ACCESS read-write

STATUS mandatory

DESCRIPTION

"A control variable used to trigger operator-initiated Start and Stop events. When read, this variable always returns the most recent value that egpNeighEventTrigger was set to. If it has not been set since the last initialization of the network management subsystem on the node, it returns a value of 'stop'.

When set, this variable causes a Start or Stop event on the specified neighbor, as specified on pages 8-10 of RFC 904. Briefly, a Start event causes an Idle peer to begin neighbor acquisition and a non-Idle peer to reinitiate neighbor acquisition. A stop event causes a non-Idle peer to return to the Idle state until a Start event occurs, either via egpNeighEventTrigger or otherwise."

::= { egpNeighEntry 15 }

-- additional EGP objects

egpAs OBJECT-TYPE

SYNTAX INTEGER

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The autonomous system number of this EGP entity."

::= { egp 6 }

```
-- the Transmission group

-- Based on the transmission media underlying each interface
-- on a system, the corresponding portion of the Transmission
-- group is mandatory for that system.

-- When Internet-standard definitions for managing
-- transmission media are defined, the transmission group is
-- used to provide a prefix for the names of those objects.

-- Typically, such definitions reside in the experimental
-- portion of the MIB until they are "proven", then as a
-- part of the Internet standardization process, the
-- definitions are accordingly elevated and a new object
-- identifier, under the transmission group is defined. By
-- convention, the name assigned is:
--
--      type OBJECT IDENTIFIER      ::= { transmission number }
--
-- where "type" is the symbolic value used for the media in
-- the ifType column of the ifTable object, and "number" is
-- the actual integer value corresponding to the symbol.

-- the SNMP group

-- Implementation of the SNMP group is mandatory for all
-- systems which support an SNMP protocol entity. Some of
-- the objects defined below will be zero-valued in those
-- SNMP implementations that are optimized to support only
-- those functions specific to either a management agent or
-- a management station. In particular, it should be
-- observed that the objects below refer to an SNMP entity,
-- and there may be several SNMP entities residing on a
-- managed node (e.g., if the node is hosting acting as
-- a management station).

snmpInPkts OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of Messages delivered to the
        SNMP entity from the transport service."
    ::= { snmp 1 }

snmpOutPkts OBJECT-TYPE
    SYNTAX  Counter
```

```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
    "The total number of SNMP Messages which were
    passed from the SNMP protocol entity to the
    transport service."
 ::= { snmp 2 }

snmpInBadVersions OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Messages which were
        delivered to the SNMP protocol entity and were for
        an unsupported SNMP version."
    ::= { snmp 3 }

snmpInBadCommunityNames OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Messages delivered to
        the SNMP protocol entity which used a SNMP
        community name not known to said entity."
    ::= { snmp 4 }

snmpInBadCommunityUses OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Messages delivered to
        the SNMP protocol entity which represented an SNMP
        operation which was not allowed by the SNMP
        community named in the Message."
    ::= { snmp 5 }

snmpInASNParseErrs OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of ASN.1 or BER errors
        encountered by the SNMP protocol entity when
        decoding received SNMP Messages."
    ::= { snmp 6 }
```

-- { snmp 7 } is not used

snmpInTooBigs OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were delivered to the SNMP protocol entity and for which the value of the error-status field is 'tooBig'."

::= { snmp 8 }

snmpInNoSuchNames OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were delivered to the SNMP protocol entity and for which the value of the error-status field is 'noSuchName'."

::= { snmp 9 }

snmpInBadValues OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were delivered to the SNMP protocol entity and for which the value of the error-status field is 'badValue'."

::= { snmp 10 }

snmpInReadOnlys OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number valid SNMP PDUs which were delivered to the SNMP protocol entity and for which the value of the error-status field is 'readOnly'. It should be noted that it is a protocol error to generate an SNMP PDU which contains the value 'readOnly' in the error-status field, as such this object is provided as a means of detecting incorrect implementations of the

```
        SNMP."
 ::= { snmp 11 }

snmpInGenErrs OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of SNMP PDUs which were
        delivered to the SNMP protocol entity and for
        which the value of the error-status field is
        'genErr'."
 ::= { snmp 12 }

snmpInTotalReqVars OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of MIB objects which have been
        retrieved successfully by the SNMP protocol entity
        as the result of receiving valid SNMP Get-Request
        and Get-Next PDUs."
 ::= { snmp 13 }

snmpInTotalSetVars OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of MIB objects which have been
        altered successfully by the SNMP protocol entity
        as the result of receiving valid SNMP Set-Request
        PDUs."
 ::= { snmp 14 }

snmpInGetRequests OBJECT-TYPE
    SYNTAX Counter
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The total number of SNMP Get-Request PDUs which
        have been accepted and processed by the SNMP
        protocol entity."
 ::= { snmp 15 }

snmpInGetNexts OBJECT-TYPE
    SYNTAX Counter
```

```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
    "The total number of SNMP Get-Next PDUs which have
    been accepted and processed by the SNMP protocol
    entity."
 ::= { snmp 16 }

snmpInSetRequests OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Set-Request PDUs which
        have been accepted and processed by the SNMP
        protocol entity."
    ::= { snmp 17 }

snmpInGetResponses OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Get-Response PDUs which
        have been accepted and processed by the SNMP
        protocol entity."
    ::= { snmp 18 }

snmpInTraps OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP Trap PDUs which have
        been accepted and processed by the SNMP protocol
        entity."
    ::= { snmp 19 }

snmpOutTooBigs OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The total number of SNMP PDUs which were
        generated by the SNMP protocol entity and for
        which the value of the error-status field is
        'tooBig.'"
    ::= { snmp 20 }
```


snmpOutNoSuchNames OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were generated by the SNMP protocol entity and for which the value of the error-status is 'noSuchName'."

::= { snmp 21 }

snmpOutBadValues OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were generated by the SNMP protocol entity and for which the value of the error-status field is 'badValue'."

::= { snmp 22 }

-- { snmp 23 } is not used

snmpOutGenErrs OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP PDUs which were generated by the SNMP protocol entity and for which the value of the error-status field is 'genErr'."

::= { snmp 24 }

snmpOutGetRequests OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP Get-Request PDUs which have been generated by the SNMP protocol entity."

::= { snmp 25 }

snmpOutGetNexts OBJECT-TYPE

SYNTAX Counter

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The total number of SNMP Get-Next PDUs which have been generated by the SNMP protocol entity."
 ::= { snmp 26 }

snmpOutSetRequests OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The total number of SNMP Set-Request PDUs which have been generated by the SNMP protocol entity."
 ::= { snmp 27 }

snmpOutGetResponses OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The total number of SNMP Get-Response PDUs which have been generated by the SNMP protocol entity."
 ::= { snmp 28 }

snmpOutTraps OBJECT-TYPE

SYNTAX Counter
ACCESS read-only
STATUS mandatory
DESCRIPTION

"The total number of SNMP Trap PDUs which have been generated by the SNMP protocol entity."
 ::= { snmp 29 }

snmpEnableAuthenTraps OBJECT-TYPE

SYNTAX INTEGER { enabled(1), disabled(2) }
ACCESS read-write
STATUS mandatory
DESCRIPTION

"Indicates whether the SNMP agent process is permitted to generate authentication-failure traps. The value of this object overrides any configuration information; as such, it provides a means whereby all authentication-failure traps may be disabled.

Note that it is strongly recommended that this object be stored in non-volatile memory so that it remains constant between re-initializations of the network management system."

```
::= { snmp 30 }
```

END

7. Acknowledgements

This document was produced by the SNMP Working Group:

Anne Ambler, Spider
Karl Auerbach, Sun
Fred Baker, ACC
David Bridgham, Epilogue Technology
Ken Brinkerhoff
Ron Broersma, NOSC
Brian Brown, Synoptics
Jack Brown, US Army
Theodore Brunner, Bellcore
Jeff Buffum, HP
Jeffrey Buffum, HP
John Burrell, Wellfleet
Jeffrey D. Case, University of Tennessee at Knoxville
Chris Chiptasso, Spartacus
Paul Ciarfella, DEC
Bob Collet
John Cook, Chipcom
Tracy Cox, Bellcore
James R. Davin, MIT-LCS
Eric Decker, cisco
Kurt Dobbins, Cabletron
Nadya El-Afandi, Network Systems
Gary Ellis, HP
Fred Engle
Mike Erlinger
Mark S. Fedor, PSI
Richard Fox, Synoptics
Karen Frisa, CMU
Stan Froyd, ACC
Chris Gunner, DEC
Fred Harris, University of Tennessee at Knoxville
Ken Hibbard, Xylogics
Ole Jacobsen, Interop
Ken Jones
Satish Joshi, Synoptics
Frank Kastenholz, Racal-Interlan
Shimshon Kaufman, Spartacus
Ken Key, University of Tennessee at Knoxville
Jim Kinder, Fibercom
Alex Koifman, BBN

Christopher Kolb, PSI
Cheryl Krupczak, NCR
Paul Langille, DEC
Martin Lee Schoffstall, PSI
Peter Lin, Vitalink
John Lunny, TWG
Carl Malamud
Gary Malkin, FTP Software, Inc.
Randy Mayhew, University of Tennessee at Knoxville
Keith McCloghrie, Hughes LAN Systems
Donna McMaster, David Systems
Lynn Monsanto, Sun
Dave Perkins, 3COM
Jim Reinstedler, Ungerman Bass
Anil Rijasinghani, DEC
Kathy Rinehart, Arnold AFB
Kary Robertson
Marshall T. Rose, PSI (chair)
L. Michael Sabo, NCSC
Jon Saperia, DEC
Greg Satz, cisco
Martin Schoffstall, PSI
John Seligson
Steve Sherry, Xyplex
Fei Shu, NEC
Sam Sjogren, TGV
Mark Sleeper, Sparta
Lance Sprung
Mike St.Johns
Bob Stewart, Xyplex
Emil Sturniold
Kaj Tesink, Bellcore
Geoff Thompson, Synoptics
Dean Throop, Data General
Bill Townsend, Xylogics
Maurice Turcotte, Racal-Milgo
Kannan Varadhou
Sudhanshu Verma, HP
Bill Versteeg, Network Research Corporation
Warren Vik, Interactive Systems
David Waitzman, BBN
Steve Waldbusser, CMU
Dan Wintringham
David Wood
Wengyik Yeong, PSI
Jeff Young, Cray Research

In addition, the comments of the following individuals are also acknowledged:

Craig A. Finseth, Minnesota Supercomputer Center, Inc.
Jeffrey C. Honig, Cornell University Theory Center
Philip R. Karn, Bellcore

8. References

- [1] Cerf, V., "IAB Recommendations for the Development of Internet Network Management Standards", RFC 1052, NRI, April 1988.
- [2] Rose M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based internets," RFC 1065, TWG, August 1988.
- [3] McCloghrie, K., and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets, RFC 1066, TWG, August 1988.
- [4] Cerf, V., "Report of the Second Ad Hoc Network Management Review Group", RFC 1109, NRI, August 1989.
- [5] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol (SNMP)", RFC 1098, University of Tennessee at Knoxville, NYSERNet, Inc., Rensselaer Polytechnic Institute, MIT Laboratory for Computer Science, April 1989.
- [6] Postel, J., and J. Reynolds, "TELNET Protocol Specification", RFC 854, USC/Information Sciences Institute, May 1983.
- [7] Satz, G., "Connectionless Network Protocol (ISO 8473) and End System to Intermediate System (ISO 9542) Management Information Base", RFC 1162, cisco Systems, Inc., June 1990.
- [8] Information processing systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), International Organization for Standardization, International Standard 8824, December 1987.
- [9] Information processing systems - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Notation One (ASN.1), International Organization for Standardization, International Standard 8825, December 1987.
- [10] Jacobson, V., "Congestion Avoidance and Control", SIGCOMM 1988, Stanford, California.

- [11] Hagens, R., Hall, N., and M. Rose, "Use of the Internet as a Subnetwork for Experimentation with the OSI Network Layer", RFC 1070, U of Wisconsin - Madison, U of Wisconsin - Madison, The Wollongong Group, February 1989.
- [12] Rose M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based internets", RFC 1155, Performance Systems International, Hughes LAN Systems, May 1990.
- [13] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", RFC 1157, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.
- [14] Rose, M., and K. McCloghrie, Editors, "Concise MIB Definitions", RFC 1212, Performance Systems International, Hughes LAN Systems, March 1991.

9. Security Considerations

Security issues are not discussed in this memo.

10. Authors' Addresses

Keith McCloghrie
Hughes LAN Systems
1225 Charleston Road
Mountain View, CA 94043
1225 Charleston Road
Mountain View, CA 94043

Phone: (415) 966-7934

EMail: kzm@hls.com

Marshall T. Rose
Performance Systems International
5201 Great America Parkway
Suite 3106
Santa Clara, CA 95054

Phone: +1 408 562 6222

EMail: mrose@psi.com
X.500: rose, psi, us