

IP Forwarding Table MIB

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This document is a product of the IPv6 MIB Revision Design Team and it is a working item of the IPv6 Working Group. Comments should be addressed to the editor, or to the IPv6 Working Group mailing list at ipng@sunroof.eng.sun.com.

2 Abstract

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects related to the forwarding of Internet Protocol (IP) packets, in an IP version independent manner.

3 Copyright Notice

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4 Conventions Used In This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

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6 Revision History

Changes from [draft-ietf-ipv6-rfc-2096-update-01.txt](#):

02 Nov 2002 Fixed bugs that caused the MIB not to compile.

Changed the type of inetCidrRouteDscp to Dscp.

Improved the revision information.

Removed inetCidrRouteNumber and inetCidrRouteWeight.

Other editorial changes.

Changes from [draft-ietf-ipv6-rfc-2096-update-00.txt](#):

22 Aug 2002 Minor editorial changes and clean-up

Changes from [draft-ietf-ipngwg-rfc-2096-update-00.txt](#):

27 Jun 2002 Added inetCidrRouteDscp index and inetCidrRouteWeight
object to the inetCidrRouteTable.

Restored inetCidrRouteNextHopType variable (may be
different from inetCidrRouteDestType, due to global
vs. non-global distinction in new InetAddress TCs).

Removed inetCidrRouteInstance object. Use to identify

a conceptual routing table is obviated by new
InetAddress types and inclusion of DSCP index.

Changed editor, moved author information to end,
several editorial changes.

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13 Jul 2002 Changed name to [draft-ietf-ipv6-rfc-2096-update](#)-.txt
Removed inetCidrRouteNextHopType.

Changes from [draft-ops-rfc2096-update-00.txt](#):

12 Jul 2001 Renamed to IPNG working group draft
Added scopes to the uses of instance
Added inetCidrRouteDiscards to replace
ipRoutingDiscards
Fixed some remaining ipCidr*/inetCidr* confusion in
DESCRIPTIONs

Changes from first draft posted to v6mib mailing list:

23 Feb 2001 Updated MODULE-IDENTITY

Deleted inetCidrRouteTos, add inetCidrRouteInstance
in INDEX of inetCidrRouteTable.

Used InterfaceIndex, InetAddressPrefixLength and
InetAutonomousSystemNumber TC's, and limited the SIZE
of inetCidrRouteDest and inetCidrRouteNextHop

Updated conformance info. Added copyright and table
of contents.

7 The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- An overall architecture, described in [RFC 2571](#) [2].
- Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, [RFC 1155](#) [3], STD 16, [RFC 1212](#) [4] and [RFC 1215](#) [5]. The second version, called SMIV2, is described in STD 58, [RFC 2578](#) [6], STD 58, [RFC 2579](#) [7] and STD 58, [RFC 2580](#) [8].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, [RFC 1157](#) [9]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in [RFC 1901](#) [10] and [RFC 1906](#) [11]. The third version of the message protocol is called SNMPv3 and described in [RFC 1906](#) [11], [RFC 2572](#) [12] and [RFC 2574](#) [13].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, [RFC 1157](#) [9]. A second set of protocol operations and associated PDU formats is described in [RFC 1905](#) [14].
- A set of fundamental applications described in [RFC 2573](#) [15] and the view-based access control mechanism described in [RFC 2575](#) [16].

A more detailed introduction to the current SNMP Management framework can be found in [RFC 2570](#) [17].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

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8 Overview

The MIB consists of one current table and two current global objects.

1. The object `inetCidrRouteNumber` indicates the number of current routes. This is primarily to avoid having to read the table in order to determine this number.
2. The object `inetCidrRouteDiscards` counts the number of valid routes that were discarded for any reason.
3. The `inetCidrRouteTable` provides the ability to display IP version independent multipath CIDR routes.

In addition, there is one deprecated table and object, and one obsolete table and object, representing previous revisions of this MIB.

1. The obsolete object `ipForwardNumber` represents the number of entries in the obsolete `ipForwardTable`.
2. The obsolete `ipForwardTable` updates the [RFC 1213](#) `ipRouteTable` to display multipath IP Routes. This is in turn obsoleted by the `ipCidrRouteTable`.
3. The deprecated object `ipCidrRouteNumber` represents the number of entries in the deprecated `ipCidrRouteTable`.
4. The deprecated `ipCidrRouteTable` updates the [RFC 1213](#)

ipRouteTable to display multipath IP Routes having the same network number but differing network masks.

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[9](#) Definitions

IP-FORWARD-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE,	
IpAddress, Integer32, Gauge32,	
Unsigned32, Counter32	FROM SNMPv2-SMI
RowStatus	FROM SNMPv2-TC
MODULE-COMPLIANCE, OBJECT-GROUP	FROM SNMPv2-CONF
InterfaceIndex	FROM IF-MIB
ip	FROM IP-MIB
IANAipRouteProtocol	FROM IANA-RTPROTO-MIB
InetAddress, InetAddressType,	
InetAddressPrefixLength,	
InetAddressAutonomousSystemNumber	FROM INET-ADDRESS-MIB
Dscp	FROM DIFFSERV-DSCP-TC;

ipForward MODULE-IDENTITY

LAST-UPDATED "200107130000Z"
ORGANIZATION "IETF IPv6 MIB Revision Team"
CONTACT-INFO
"Editor:
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Wind River
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Nashua, NH 03062

Phone: +1 603 897-2067
Email: <mrw@windriver.com>"

DESCRIPTION

"The MIB module for the management of CIDR multipath IP
Routes."

REVISION "200206270000Z"

DESCRIPTION

"IPv4/v6 version-independent revision. Minimal changes
were made to the original [RFC 2096](#) MIB, to allow easy
upgrade of existing IPv4 implementations to the
version-independent MIB. published as RFC XXXX."

REVISION "9609190000Z"

DESCRIPTION

"Revised to support CIDR routes."

::= { ip 24 }

inetCidrRouteDiscards OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

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

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buffer space for other routing entries."

::= { ipForward 8 }

-- Inet CIDR Route Table

-- The Inet CIDR Route Table deprecates and replaces the
-- ipCidrRoute Table currently in the IP Forwarding Table MIB.
-- It adds IP protocol independence.

inetCidrRouteTable OBJECT-TYPE

SYNTAX SEQUENCE OF InetCidrRouteEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This entity's IP Routing table."

REFERENCE

"[RFC 1213 Section 6.6](#), The IP Group"

::= { ipForward 7 }

```

inetCidrRouteEntry OBJECT-TYPE
    SYNTAX      InetCidrRouteEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A particular route to a particular destination, under a
        particular policy."
    INDEX {
        inetCidrRouteDestType,
        inetCidrRouteDest,
        inetCidrRoutePfxLen,
        inetCidrRouteDscp,
        inetCidrRouteNextHopType,
        inetCidrRouteNextHop
    }
    ::= { inetCidrRouteTable 1 }

```

```

InetCidrRouteEntry ::= SEQUENCE {
    inetCidrRouteDestType      InetAddressType,
    inetCidrRouteDest          InetAddress,
    inetCidrRoutePfxLen        InetAddressPrefixLength,
    inetCidrRouteDscp          Dscp,
    inetCidrRouteNextHopType    InetAddressType,
    inetCidrRouteNextHop       InetAddress,
    inetCidrRouteIfIndex        InterfaceIndex,
    inetCidrRouteType           INTEGER,
    inetCidrRouteProto          IANAipRouteProtocol,
    inetCidrRouteAge            Integer32,
    inetCidrRouteNextHopAS      InetAutonomousSystemNumber,
    inetCidrRouteMetric1        Integer32,
    inetCidrRouteMetric2        Integer32,
    inetCidrRouteMetric3        Integer32,
    inetCidrRouteMetric4        Integer32,
    inetCidrRouteMetric5        Integer32,
    inetCidrRouteStatus         RowStatus

```

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}

```

inetCidrRouteDestType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The type of the inetCidrRouteDest address, as defined
        in the InetAddress MIB [19]"
    ::= { inetCidrRouteEntry 1 }

```

inetCidrRouteDest OBJECT-TYPE

SYNTAX InetAddress (SIZE(0..36))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The destination IP address of this route.

Any assignment (implicit or otherwise) of an instance of this object to a value x MUST be rejected if the bitwise logical-AND of x with the value of the mask formed from the corresponding instance of the inetCidrRoutePfxLen object is not equal to x."

::= { inetCidrRouteEntry 2 }

inetCidrRoutePfxLen OBJECT-TYPE

SYNTAX InetAddressPrefixLength
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"Indicates the number of leading one bits which form the mask to be logical-ANDed with the destination address before being compared to the value in the inetCidrRouteDest field.

Any assignment (implicit or otherwise) of an instance of this object to a value x MUST be rejected if the bitwise logical-AND of the mask formed from x with the value of the corresponding instance of the inetCidrRouteDest object is not equal to inetCidrRouteDest."

::= { inetCidrRouteEntry 3 }

inetCidrRouteDscp OBJECT-TYPE

SYNTAX Dscp
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"Indicates the Differentiated Services Code Point (DSCP) [[18](#)] to which the routing information in this entry applies."

::= { inetCidrRouteEntry 4 }

inetCidrRouteNextHopType OBJECT-TYPE

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SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"The type of the inetCidrRouteNextHop address, as

defined in the InetAddress MIB [[19](#)].

Value should be set to unknown(0) for non-remote routes."

::= { inetCidrRouteEntry 5 }

inetCidrRouteNextHop OBJECT-TYPE

SYNTAX InetAddress (SIZE(0..36))

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"On remote routes, the address of the next system en route. For non-remote routes, a zero length string."

::= { inetCidrRouteEntry 6 }

inetCidrRouteIfIndex OBJECT-TYPE

SYNTAX InterfaceIndex

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The ifIndex value which identifies the local interface through which the next hop of this route should be reached."

::= { inetCidrRouteEntry 7 }

inetCidrRouteType OBJECT-TYPE

SYNTAX INTEGER {

other (1), -- not specified by this MIB
reject (2), -- route which discards traffic and
-- returns ICMP notification
local (3), -- local interface
remote (4), -- remote destination
blackhole(5) -- route which discards traffic
-- silently

}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of route. Note that local(3) refers to a route for which the next hop is the final destination; remote(4) refers to a route for which the next hop is not the final destination.

Routes which do not result in traffic forwarding or rejection should not be displayed even if the implementation keeps them stored internally.

reject(2) refers to a route which, if matched, discards the message as unreachable and returns a notification

(e.g. ICMP error) to the message sender. This is used in some protocols as a means of correctly aggregating routes.

blackhole(5) refers to a route which, if matched, discards the message silently."

::= { inetCidrRouteEntry 8 }

inetCidrRouteProto OBJECT-TYPE

SYNTAX IANAipRouteProtocol

MAX-ACCESS read-only

STATUS current

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."

::= { inetCidrRouteEntry 9 }

inetCidrRouteAge OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

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."

::= { inetCidrRouteEntry 10 }

inetCidrRouteNextHopAS OBJECT-TYPE

SYNTAX InetAutonomousSystemNumber

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Autonomous System Number of the Next Hop. The semantics of this object are determined by the routing-protocol specified in the route's inetCidrRouteProto value. When this object is unknown or not relevant its value should be set to zero."

DEFVAL { 0 }

::= { inetCidrRouteEntry 11 }

inetCidrRouteMetric1 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The primary routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's inetCidrRouteProto value. If this metric is not used, its value should be set to -1."

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DEFVAL { -1 }
::= { inetCidrRouteEntry 12 }

inetCidrRouteMetric2 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's inetCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { inetCidrRouteEntry 13 }

inetCidrRouteMetric3 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's inetCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { inetCidrRouteEntry 14 }

inetCidrRouteMetric4 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's inetCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { inetCidrRouteEntry 15 }

inetCidrRouteMetric5 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's inetCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }

::= { inetCidrRouteEntry 16 }

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inetCidrRouteStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The row status variable, used according to row installation and removal conventions."

::= { inetCidrRouteEntry 17 }

-- Conformance information

ipForwardConformance

OBJECT IDENTIFIER ::= { ipForward 5 }

ipForwardGroups

OBJECT IDENTIFIER ::= { ipForwardConformance 1 }

ipForwardCompliances

OBJECT IDENTIFIER ::= { ipForwardConformance 2 }

-- Compliance statements

ipForwardCompliance2 MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"The compliance statement for systems which have routing tables."

MODULE -- this module

MANDATORY-GROUPS { inetForwardCidrRouteGroup }

::= { ipForwardCompliances 3 }

-- units of conformance

inetForwardCidrRouteGroup OBJECT-GROUP

OBJECTS { inetCidrRouteDiscards,

```

        inetCidrRouteIfIndex, inetCidrRouteType,
        inetCidrRouteProto, inetCidrRouteAge,
        inetCidrRouteNextHopAS, inetCidrRouteMetric1,
        inetCidrRouteMetric2, inetCidrRouteMetric3,
        inetCidrRouteMetric4, inetCidrRouteMetric5,
        inetCidrRouteStatus
    }
    STATUS      current
    DESCRIPTION
        "The IP version independent CIDR Route Table."
    ::= { ipForwardGroups 4 }

-- Deprecated Objects

ipCidrRouteNumber OBJECT-TYPE
    SYNTAX      Gauge32
    MAX-ACCESS  read-only
    STATUS      deprecated

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    DESCRIPTION
        "The number of current ipCidrRouteTable entries that are
         not invalid. This object is deprecated in favor of
         inetCidrRouteNumber and the inetCidrRouteTable."
    ::= { ipForward 3 }

-- IP CIDR Route Table

-- The IP CIDR Route Table obsoletes and replaces the ipRoute
-- Table current in MIB-I and MIB-II and the IP Forwarding Table.
-- It adds knowledge of the autonomous system of the next hop,
-- multiple next hops, and policy routing, and Classless
-- Inter-Domain Routing.

ipCidrRouteTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpCidrRouteEntry
    MAX-ACCESS  not-accessible
    STATUS      deprecated
    DESCRIPTION
        "This entity's IP Routing table. This table has been
         deprecated in favor of the IP version neutral
         inetCidrRouteTable."
    REFERENCE
        "RFC 1213 Section 6.6, The IP Group"
    ::= { ipForward 4 }

ipCidrRouteEntry OBJECT-TYPE
    SYNTAX      IpCidrRouteEntry
    MAX-ACCESS  not-accessible

```

STATUS deprecated

DESCRIPTION

"A particular route to a particular destination, under a particular policy."

INDEX {

ipCidrRouteDest,
ipCidrRouteMask,
ipCidrRouteTos,
ipCidrRouteNextHop
}

::= { ipCidrRouteTable 1 }

IpCidrRouteEntry ::= SEQUENCE {

ipCidrRouteDest IpAddress,
ipCidrRouteMask IpAddress,
ipCidrRouteTos Integer32,
ipCidrRouteNextHop IpAddress,
ipCidrRouteIfIndex Integer32,
ipCidrRouteType INTEGER,
ipCidrRouteProto INTEGER,
ipCidrRouteAge Integer32,
ipCidrRouteInfo OBJECT IDENTIFIER,
ipCidrRouteNextHopAS Integer32,
ipCidrRouteMetric1 Integer32,
ipCidrRouteMetric2 Integer32,

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ipCidrRouteMetric3 Integer32,
ipCidrRouteMetric4 Integer32,
ipCidrRouteMetric5 Integer32,
ipCidrRouteStatus RowStatus

}

ipCidrRouteDest OBJECT-TYPE

SYNTAX IpAddress

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The destination IP address of this route.

This object may not take a Multicast (Class D) address value.

Any assignment (implicit or otherwise) of an instance of this object to a value x must be rejected if the bitwise logical-AND of x with the value of the corresponding instance of the ipCidrRouteMask object is not equal to x."

::= { ipCidrRouteEntry 1 }

ipCidrRouteMask OBJECT-TYPE

SYNTAX IpAddress
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION

"Indicate the mask to be logical-ANDed with the destination address before being compared to the value in the ipCidrRouteDest field. For those systems that do not support arbitrary subnet masks, an agent constructs the value of the ipCidrRouteMask by reference to the IP Address Class.

Any assignment (implicit or otherwise) of an instance of this object to a value x must be rejected if the bitwise logical-AND of x with the value of the corresponding instance of the ipCidrRouteDest object is not equal to ipCidrRouteDest."

::= { ipCidrRouteEntry 2 }

-- The following convention is included for specification
-- of TOS Field contents. At this time, the Host Requirements
-- and the Router Requirements documents disagree on the width
-- of the TOS field. This mapping describes the Router
-- Requirements mapping, and leaves room to widen the TOS field
-- without impact to fielded systems.

ipCidrRouteTos OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION

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"The policy specifier is the IP TOS Field. The encoding of IP TOS is as specified by the following convention. Zero indicates the default path if no more specific policy applies.

```
+-----+-----+-----+-----+-----+-----+-----+
|               |               |               |               |
| PRECEDENCE    | TYPE OF SERVICE | 0 |
|               |               |   |
+-----+-----+-----+-----+-----+-----+-----+
```

IP TOS		IP TOS	
Field	Policy	Field	Policy
Contents	Code	Contents	Code
0 0 0 0	==> 0	0 0 0 1	==> 2

0 0 1 0 ==>	4	0 0 1 1 ==>	6
0 1 0 0 ==>	8	0 1 0 1 ==>	10
0 1 1 0 ==>	12	0 1 1 1 ==>	14
1 0 0 0 ==>	16	1 0 0 1 ==>	18
1 0 1 0 ==>	20	1 0 1 1 ==>	22
1 1 0 0 ==>	24	1 1 0 1 ==>	26
1 1 1 0 ==>	28	1 1 1 1 ==>	30"

::= { ipCidrRouteEntry 3 }

ipCidrRouteNextHop OBJECT-TYPE

SYNTAX IpAddress
 MAX-ACCESS read-only
 STATUS deprecated
 DESCRIPTION
 "On remote routes, the address of the next system en
 route; Otherwise, 0.0.0.0."
 ::= { ipCidrRouteEntry 4 }

ipCidrRouteIfIndex OBJECT-TYPE

SYNTAX Integer32
 MAX-ACCESS read-create
 STATUS deprecated
 DESCRIPTION
 "The ifIndex value which identifies the local interface
 through which the next hop of this route should be
 reached."
 DEFVAL { 0 }
 ::= { ipCidrRouteEntry 5 }

ipCidrRouteType OBJECT-TYPE

SYNTAX INTEGER {
 other (1), -- not specified by this MIB
 reject (2), -- route which discards traffic
 local (3), -- local interface
 remote (4) -- remote destination
 }
 MAX-ACCESS read-create
 STATUS deprecated
 DESCRIPTION

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"The type of route. Note that local(3) refers to a route for which the next hop is the final destination; remote(4) refers to a route for which the next hop is not the final destination.

Routes which do not result in traffic forwarding or rejection should not be displayed even if the implementation keeps them stored internally.

reject (2) refers to a route which, if matched,
discards the message as unreachable. This is used in
some protocols as a means of correctly aggregating
routes."

::= { ipCidrRouteEntry 6 }

ipCidrRouteProto OBJECT-TYPE

```
SYNTAX      INTEGER {
    other      (1),  -- not specified
    local      (2),  -- local interface
    netmgmt    (3),  -- static route
    icmp       (4),  -- result of ICMP Redirect

    -- the following are all dynamic
    -- routing protocols
    egp        (5),  -- Exterior Gateway Protocol
    ggp        (6),  -- Gateway-Gateway Protocol
    hello      (7),  -- FuzzBall HelloSpeak
    rip        (8),  -- Berkeley RIP or RIP-II
    isIs       (9),  -- Dual IS-IS
    esIs       (10), -- ISO 9542
    ciscoIgrp  (11), -- Cisco IGRP
    bbnSpfIgp  (12), -- BBN SPF IGP
    ospf       (13), -- Open Shortest Path First
    bgp        (14), -- Border Gateway Protocol
    idpr       (15), -- InterDomain Policy Routing
    ciscoEigrp (16)  -- Cisco EIGRP
}
MAX-ACCESS read-only
STATUS      deprecated
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."
::= { ipCidrRouteEntry 7 }
```

ipCidrRouteAge OBJECT-TYPE

```
SYNTAX      Integer32
MAX-ACCESS read-only
STATUS      deprecated
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
```

```

        was learned."
    DEFVAL { 0 }
    ::= { ipCidrRouteEntry 8 }

ipCidrRouteInfo OBJECT-TYPE
    SYNTAX      OBJECT IDENTIFIER
    MAX-ACCESS  read-create
    STATUS      deprecated
    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 ipCidrRouteProto value.  If this information is
        not present, its value should be set to the OBJECT
        IDENTIFIER { 0 0 }, which is a syntactically valid
        object identifier, and any implementation conforming to
        ASN.1 and the Basic Encoding Rules must be able to
        generate and recognize this value."
    ::= { ipCidrRouteEntry 9 }

ipCidrRouteNextHopAS OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      deprecated
    DESCRIPTION
        "The Autonomous System Number of the Next Hop.  The
        semantics of this object are determined by the routing-
        protocol specified in the route's ipCidrRouteProto
        value.  When this object is unknown or not relevant its
        value should be set to zero."
    DEFVAL { 0 }
    ::= { ipCidrRouteEntry 10 }

ipCidrRouteMetric1 OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      deprecated
    DESCRIPTION
        "The primary routing metric for this route.  The
        semantics of this metric are determined by the routing-
        protocol specified in the route's ipCidrRouteProto
        value.  If this metric is not used, its value should be
        set to -1."
    DEFVAL { -1 }
    ::= { ipCidrRouteEntry 11 }

ipCidrRouteMetric2 OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      deprecated
    DESCRIPTION

```

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-

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protocol specified in the route's ipCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { ipCidrRouteEntry 12 }

ipCidrRouteMetric3 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's ipCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { ipCidrRouteEntry 13 }

ipCidrRouteMetric4 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's ipCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { ipCidrRouteEntry 14 }

ipCidrRouteMetric5 OBJECT-TYPE

SYNTAX Integer32
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's ipCidrRouteProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }
::= { ipCidrRouteEntry 15 }

ipCidrRouteStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS deprecated

DESCRIPTION

"The row status variable, used according to row
installation and removal conventions."

::= { ipCidrRouteEntry 16 }

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-- compliance statements

ipForwardCompliance MODULE-COMPLIANCE

STATUS deprecated

DESCRIPTION

"The compliance statement for SNMPv2 entities which
implement the ipForward MIB."

MODULE -- this module

MANDATORY-GROUPS { ipForwardCidrRouteGroup }

::= { ipForwardCompliances 1 }

-- units of conformance

ipForwardCidrRouteGroup OBJECT-GROUP

OBJECTS { ipCidrRouteNumber,
ipCidrRouteDest, ipCidrRouteMask, ipCidrRouteTos,
ipCidrRouteNextHop, ipCidrRouteIfIndex,
ipCidrRouteType, ipCidrRouteProto, ipCidrRouteAge,
ipCidrRouteInfo, ipCidrRouteNextHopAS,
ipCidrRouteMetric1, ipCidrRouteMetric2,
ipCidrRouteMetric3, ipCidrRouteMetric4,
ipCidrRouteMetric5, ipCidrRouteStatus
}

STATUS deprecated

DESCRIPTION

"The CIDR Route Table."

::= { ipForwardGroups 3 }

-- Obsoleted Definitions - Objects

ipForwardNumber OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

```
        "The number of current ipForwardTable entries that are
        not invalid."
 ::= { ipForward 1 }
```

```
-- IP Forwarding Table
```

```
-- The IP Forwarding Table obsoletes and replaces the ipRoute
-- Table current in MIB-I and MIB-II. It adds knowledge of
-- the autonomous system of the next hop, multiple next hop
-- support, and policy routing support.
```

```
ipForwardTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpForwardEntry
    MAX-ACCESS  not-accessible
    STATUS      obsolete
```

```
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```

```
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```

DESCRIPTION

```
"This entity's IP Routing table."
```

REFERENCE

```
"RFC 1213 Section 6.6, The IP Group"
```

```
::= { ipForward 2 }
```

```
ipForwardEntry OBJECT-TYPE
```

```
    SYNTAX      IpForwardEntry
    MAX-ACCESS  not-accessible
    STATUS      obsolete
```

DESCRIPTION

```
"A particular route to a particular destination, under a
particular policy."
```

INDEX {

```
    ipForwardDest,
    ipForwardProto,
    ipForwardPolicy,
    ipForwardNextHop
}
```

```
::= { ipForwardTable 1 }
```

```
IpForwardEntry ::= SEQUENCE {
```

```
    ipForwardDest      IpAddress,
    ipForwardMask       IpAddress,
    ipForwardPolicy     Integer32,
    ipForwardNextHop    IpAddress,
    ipForwardIfIndex    Integer32,
    ipForwardType       INTEGER,
    ipForwardProto      INTEGER,
    ipForwardAge        Integer32,
    ipForwardInfo       OBJECT IDENTIFIER,
    ipForwardNextHopAS  Integer32,
```

```

        ipForwardMetric1    Integer32,
        ipForwardMetric2    Integer32,
        ipForwardMetric3    Integer32,
        ipForwardMetric4    Integer32,
        ipForwardMetric5    Integer32
    }

```

ipForwardDest OBJECT-TYPE

```

SYNTAX      IPAddress
MAX-ACCESS  read-only
STATUS      obsolete
DESCRIPTION

```

"The destination IP address of this route. An entry with a value of 0.0.0.0 is considered a default route.

This object may not take a Multicast (Class D) address value.

Any assignment (implicit or otherwise) of an instance of this object to a value x must be rejected if the bitwise logical-AND of x with the value of the corresponding instance of the ipForwardMask object is

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```

        not equal to x."
    ::= { ipForwardEntry 1 }

```

ipForwardMask OBJECT-TYPE

```

SYNTAX      IPAddress
MAX-ACCESS  read-create
STATUS      obsolete
DESCRIPTION

```

"Indicate the mask to be logical-ANDed with the destination address before being compared to the value in the ipForwardDest field. For those systems that do not support arbitrary subnet masks, an agent constructs the value of the ipForwardMask by reference to the IP Address Class.

Any assignment (implicit or otherwise) of an instance of this object to a value x must be rejected if the bitwise logical-AND of x with the value of the corresponding instance of the ipForwardDest object is not equal to ipForwardDest."

```

DEFVAL { '00000000'h } -- 0.0.0.0
::= { ipForwardEntry 2 }

```

-- The following convention is included for specification
-- of TOS Field contents. At this time, the Host Requirements

-- and the Router Requirements documents disagree on the width
 -- of the TOS field. This mapping describes the Router
 -- Requirements mapping, and leaves room to widen the TOS field
 -- without impact to fielded systems.

ipForwardPolicy OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

"The general set of conditions that would cause the selection of one multipath route (set of next hops for a given destination) is referred to as 'policy'.

Unless the mechanism indicated by ipForwardProto specifies otherwise, the policy specifier is the IP TOS Field. The encoding of IP TOS is as specified by the following convention. Zero indicates the default path if no more specific policy applies.

+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
	PRECEDENCE		TYPE OF SERVICE		0		
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+	+-----+

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IP TOS		IP TOS	
Field	Policy	Field	Policy
Contents	Code	Contents	Code
0 0 0 0 ==>	0	0 0 0 1 ==>	2
0 0 1 0 ==>	4	0 0 1 1 ==>	6
0 1 0 0 ==>	8	0 1 0 1 ==>	10
0 1 1 0 ==>	12	0 1 1 1 ==>	14
1 0 0 0 ==>	16	1 0 0 1 ==>	18
1 0 1 0 ==>	20	1 0 1 1 ==>	22
1 1 0 0 ==>	24	1 1 0 1 ==>	26
1 1 1 0 ==>	28	1 1 1 1 ==>	30

Protocols defining 'policy' otherwise must either define a set of values which are valid for this object or must implement an integer-instanced policy table for which this object's value acts as an index."


```
::= { ipForwardEntry 3 }
```

ipForwardNextHop OBJECT-TYPE

SYNTAX IpAddress

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

 "On remote routes, the address of the next system en
 route; Otherwise, 0.0.0.0."

```
::= { ipForwardEntry 4 }
```

ipForwardIfIndex OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

 "The ifIndex value which identifies the local interface
 through which the next hop of this route should be
 reached."

DEFVAL { 0 }

```
::= { ipForwardEntry 5 }
```

ipForwardType OBJECT-TYPE

SYNTAX INTEGER {

 other (1), -- not specified by this MIB

 invalid (2), -- logically deleted

 local (3), -- local interface

 remote (4) -- remote destination

 }

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

 "The type of route. Note that local(3) refers to a
 route for which the next hop is the final destination;
 remote(4) refers to a route for which the next hop is
 not the final destination.

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Setting this object to the value invalid(2) has the effect of invalidating the corresponding entry in the ipForwardTable object. That is, it effectively disassociates 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 ipForwardType object."

DEFVAL { invalid }

::= { ipForwardEntry 6 }

ipForwardProto OBJECT-TYPE

SYNTAX INTEGER {
 other (1), -- not specified
 local (2), -- local interface
 netmgmt (3), -- static route
 icmp (4), -- result of ICMP Redirect

 -- the following are all dynamic
 -- routing protocols
 egp (5), -- Exterior Gateway Protocol
 ggp (6), -- Gateway-Gateway Protocol
 hello (7), -- FuzzBall HelloSpeak
 rip (8), -- Berkeley RIP or RIP-II
 is-is (9), -- Dual IS-IS
 es-is (10), -- ISO 9542
 ciscoIgrp (11), -- Cisco IGRP
 bbnSpfIgp (12), -- BBN SPF IGP
 ospf (13), -- Open Shortest Path First
 bgp (14), -- Border Gateway Protocol
 idpr (15) -- InterDomain Policy Routing
}

MAX-ACCESS read-only

STATUS obsolete

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."

::= { ipForwardEntry 7 }

ipForwardAge OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS obsolete

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

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knowledge of the routing protocol by which the route
was learned."

DEFVAL { 0 }

::= { ipForwardEntry 8 }

ipForwardInfo OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

MAX-ACCESS read-create

STATUS obsolete

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 ipForwardProto value. If this information is not present, its value should be set to the OBJECT IDENTIFIER { 0 0 }, which is a syntactically valid object identifier, and any implementation conforming to ASN.1 and the Basic Encoding Rules must be able to generate and recognize this value."

::= { ipForwardEntry 9 }

ipForwardNextHopAS OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

"The Autonomous System Number of the Next Hop. When this is unknown or not relevant to the protocol indicated by ipForwardProto, zero."

DEFVAL { 0 }

::= { ipForwardEntry 10 }

ipForwardMetric1 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

"The primary routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's ipForwardProto value. If this metric is not used, its value should be set to -1."

DEFVAL { -1 }

::= { ipForwardEntry 11 }

ipForwardMetric2 OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS obsolete

DESCRIPTION

"An alternate routing metric for this route. The semantics of this metric are determined by the routing-protocol specified in the route's ipForwardProto value. If this metric is not used, its value should be set to

```
        -1."
    DEFVAL { -1 }
    ::= { ipForwardEntry 12 }

ipForwardMetric3 OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      obsolete
    DESCRIPTION
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the routing-
        protocol specified in the route's ipForwardProto value.
        If this metric is not used, its value should be set to
        -1."
    DEFVAL { -1 }
    ::= { ipForwardEntry 13 }

ipForwardMetric4 OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      obsolete
    DESCRIPTION
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the routing-
        protocol specified in the route's ipForwardProto value.
        If this metric is not used, its value should be set to
        -1."
    DEFVAL { -1 }
    ::= { ipForwardEntry 14 }

ipForwardMetric5 OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      obsolete
    DESCRIPTION
        "An alternate routing metric for this route.  The
        semantics of this metric are determined by the routing-
        protocol specified in the route's ipForwardProto value.
        If this metric is not used, its value should be set to
        -1."
    DEFVAL { -1 }
    ::= { ipForwardEntry 15 }

-- Obsolete Definitions - Groups
-- compliance statements

ipForwardOldCompliance MODULE-COMPLIANCE
    STATUS      obsolete
```

DESCRIPTION

"The compliance statement for SNMP entities which
implement the ipForward MIB."

MODULE -- this module

MANDATORY-GROUPS { ipForwardMultiPathGroup }

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::= { ipForwardCompliances 2 }

ipForwardMultiPathGroup OBJECT-GROUP

OBJECTS { ipForwardNumber,
ipForwardDest, ipForwardMask, ipForwardPolicy,
ipForwardNextHop, ipForwardIfIndex, ipForwardType,
ipForwardProto, ipForwardAge, ipForwardInfo,
ipForwardNextHopAS,
ipForwardMetric1, ipForwardMetric2, ipForwardMetric3,
ipForwardMetric4, ipForwardMetric5
}

STATUS obsolete

DESCRIPTION

"IP Multipath Route Table."

::= { ipForwardGroups 2 }

END

10 Security Considerations

There are a number of management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

There are a number of managed objects in this MIB that may contain sensitive information. These are:

The routing table can be used to discover information about the network topology within a domain.

It is thus important to control even GET access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to whom on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model [RFC 2574](#) [13] and the View-based Access Control Model [RFC 2575](#) [16] is recommended.

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

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[12](#) Authors and Acknowledgements

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