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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 editors, or to the IPv6 Working Group mailing list at ipng@sunroof.eng.sun.com.

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. This document obsoletes [RFC 2096](#).

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[1](#) Revision History

Changes from [draft-ietf-ipv6-rfc2096-update-02.txt](#):

- | | |
|-------------|--|
| 16 Jan 2003 | Changed lower-case 'h' to upper-case 'H' in hex number. |
| 13 Jun 2003 | Updated REVISION and LAST UPDATED dates.
Changed inetCidrRouteDscp to inetCidrRoutePolicy. |
| 17 Jun 2003 | Updated MIB Boilerplate.
Added read-only compliance statement.

Added text to DESCRIPTION clause for inetCidrRouteStatus to indicate a row cannot be modified when it is active.

Removed numbered references from DESCRIPTION clauses.

Removed Unsigned32 from IMPORTS list.

Changed section numbers to conform with ID-nits.

Split references into normative/informative.

Updated security section. |

Changes from [draft-ietf-ipv6-rfc2096-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.

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

22 Aug 2002 Minor editorial changes and clean-up

Changes from [draft-ietf-ipngwg-rfc2096-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.

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.

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2 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](#)].

3 The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to [section 7 of RFC 3410](#) [[RFC3410](#)].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, [RFC 2578](#) [[RFC2578](#)], STD 58, [RFC 2579](#) [[RFC2579](#)] and STD 58, [RFC 2580](#) [[RFC2580](#)].

4 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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5 Definitions

IP-FORWARD-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE,	
IpAddress, Integer32, Gauge32,	
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;

ipForward MODULE-IDENTITY

LAST-UPDATED "200306130000Z"

ORGANIZATION "IETF IPv6 MIB Revision Team"

CONTACT-INFO

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DESCRIPTION

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

REVISION "200306130000Z"

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 "200301130000Z"

DESCRIPTION

"Revised to support CIDR routes."

::= { ip 24 }

inetCidrRouteDiscards OBJECT-TYPE

SYNTAX Counter32

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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 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.

Dynamically created rows will survive an agent reboot."

INDEX {

inetCidrRouteDestType,
inetCidrRouteDest,
inetCidrRoutePfxLen,
inetCidrRoutePolicy,
inetCidrRouteNextHopType,
inetCidrRouteNextHop
}

::= { inetCidrRouteTable 1 }

InetCidrRouteEntry ::= SEQUENCE {

inetCidrRouteDestType InetAddressType,
inetCidrRouteDest InetAddress,
inetCidrRoutePfxLen InetAddressPrefixLength,
inetCidrRoutePolicy OBJECT IDENTIFIER,
inetCidrRouteNextHopType InetAddressType,
inetCidrRouteNextHop InetAddress,
inetCidrRouteIfIndex InterfaceIndex,
inetCidrRouteType INTEGER,
inetCidrRouteProto IANAipRouteProtocol,

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inetCidrRouteAge Integer32,
inetCidrRouteNextHopAS InetAutonomousSystemNumber,
inetCidrRouteMetric1 Integer32,
inetCidrRouteMetric2 Integer32,
inetCidrRouteMetric3 Integer32,
inetCidrRouteMetric4 Integer32,
inetCidrRouteMetric5 Integer32,
inetCidrRouteStatus RowStatus
}

inetCidrRouteDestType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The type of the inetCidrRouteDest address, as defined
in the InetAddress MIB [[RFC3291](#)]."
::= { 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 }

inetCidrRoutePolicy OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

MAX-ACCESS not-accessible

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STATUS current

DESCRIPTION

"Represents the general set of conditions that would
cause the selection of one multipath route (set of next
hops for a given destination) over another (referred to
as policy). The value { 0 0 } shall be used for the
default policy or if no particular policy applies."

::= { inetCidrRouteEntry 4 }

inetCidrRouteNextHopType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The type of the inetCidrRouteNextHop address, as defined in the InetAddress MIB [[RFC3291](#)].

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

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 }
```

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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."

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

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    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 }

inetCidrRouteStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS read-create
    STATUS      current
    DESCRIPTION
        "The row status variable, used according to row
        installation and removal conventions.

        A row entry cannot be modified when the status is
        marked as active(1)."
    ::= { inetCidrRouteEntry 17 }

-- Conformance information

ipForwardConformance
    OBJECT IDENTIFIER ::= { ipForward 5 }

ipForwardGroups
    OBJECT IDENTIFIER ::= { ipForwardConformance 1 }

ipForwardCompliances
    OBJECT IDENTIFIER ::= { ipForwardConformance 2 }

-- Compliance statements

ipForwardFullCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION

```

```

        "When this MIB is implemented for read-create, the
        implementation can claim full compliance."
MODULE -- this module
MANDATORY-GROUPS { inetForwardCidrRouteGroup }
::= { ipForwardCompliances 4 }

ipForwardReadOnlyCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "When this MIB is implemented without support for read-
        create (i.e. in read-only mode), the implementation can
        claim read-only compliance."
MODULE -- this module
MANDATORY-GROUPS { inetForwardCidrRouteGroup }

```

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```

OBJECT      inetCidrRouteIfIndex
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteType
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteNextHopAS
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteMetric1
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteMetric2
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteMetric3
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

```

```

OBJECT      inetCidrRouteMetric4
MIN-ACCESS  read-only
DESCRIPTION

```

```

        "Write access is not required."

OBJECT      inetCidrRouteMetric5
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

OBJECT      inetCidrRouteStatus
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."

::= { ipForwardCompliances 5 }

ipForwardCompliance2 MODULE-COMPLIANCE
    STATUS      deprecated
    DESCRIPTION
        "The compliance statement for systems which have routing
        tables."
    MODULE -- this module
    MANDATORY-GROUPS { inetForwardCidrRouteGroup }

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::= { 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
    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

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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,
        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

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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

```
"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	Contents	Policy	Code	Field	Contents	Policy	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
    "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
        knowledge of the routing protocol by which the route
        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

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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-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 }

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::= { 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 }

-- 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."

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    ::= { 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
    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,

```

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```

    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

```
        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.
```

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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
------------	-----------------	---

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

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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.

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
```

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```
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
        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 }

```

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```

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 }

```

```

-- Obsoleted 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 }

    ::= { 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

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6 Security Considerations

There are a number of management objects defined in this MIB module with 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. These are the tables and objects and their sensitivity/vulnerability:

1. The `inetCidrRouteTable` contains routing and forwarding information that is critical to the operation of the network node (especially routers). Allowing unauthenticated write access to this table can compromise the validity of the forwarding information.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

1. The `inetCidrRouteTable` contains routing and forwarding information that can be used to compromise a network. Specifically, this table can be used to construct a map of the network in preparation for a denial-of-service attack on the network infrastructure.
2. The `inetCidrRouteProto` object identifies the routing protocols in use within a network. This information can be used to determine how a denial-of-service attack should be launched.

SNMP versions prior to SNMPv3 did not include adequate security.

Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [\[RFC3410\]](#), [section 8](#)), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module 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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