IP Forwarding Table MIB

Status of this Memo

   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.

Copyright Notice

Table of Contents

Revision History

   [Note to RFC Editor: Please remove prior to publication]

   Changes from draft-ietf-ipv6-rfc2096-update-05.txt:

   07 Jan 2004   Corrected editor information

                 Changed mailing list information

                 Limited InetAddress objects to (ipv4, ipv6, ipv4z,
                 ipv6z)

                 Updated MODULE-IDENTITY REVISION clause to detail the
                 replacement of ipCidrRouteTable with
                 inetCidrRouteTable

                 Updated DESCRIPTION clause of ipForwardCompliance to
                 indicate the replacement of ipForwardCompliance with
                 ipForwardFullCompliance and
                 ipForwardReadOnlyCompliance

                 Added statement to DESCRIPTION clause of
                 ipForwardCidrRouteGroup pointing out its replacement
                 with inetForwardCidrRouteGroup

                 Added detail to section 3 on relationship of this MIB
                 with previous versions

                 Fixed references within DESCRIPTION clauses

Added SYNTAX statements to read-only OBJECTs

21 Jan 2004   Added clarifying text to Introduction on the usage of
               the MIB definition

               Enhanced Overview section to include explicit text on

               relationship to other RFCs

               Clarified DESCRIPTION text for inetCidrRouteDiscards

               Added text to DESCRIPTION clause of
               inetCidrRouteIfIndex to allow the value of 0

28 Jan 2004   Added range of (0..128) to inetCidrRoutePfxLen

Changes from draft-ietf-ipv6-rfc2096-update-04.txt:

28 Aug 2003   Corrected copyright statement in DESCRIPTION clause

               Added inetCidrRouteNumber to
               inetForwardCidrRouteGroup conformance statement

               Removed SIZE constraints for inetCidrRouteDest and
               inetCidrRouteNextHop

               Added constraints statement to DESCRIPTION clause of
               inetCidrRouteEntry

               Added Intellectual Property section per requirements
               of RFC 2026

               Removed reference to RFC 2026

               Removed ipForwardCompliance2

               Changed definition of inetCidrRouteAge from Integer32
               to Gauge32

Changes from draft-ietf-ipv6-rfc2096-update-03.txt:

27 Jun 2003   Updated text to DESCRIPTION of inetCidrRouteDiscards

               Re-instated inetCidrRouteNumber

               Added references for IF-MIB, IP-MIB, and IANA-
               RTPROTO-MIB

Changed reference to RFC 2096 from normative to informative

Added RFC editor note to remove Revision History at publication time

Updated REVISION clause

Added section describing changes from RFC 2096

Added REVISION clause for original publication as RFC

1354

Added MIB Copyright statement to DESCRIPTION

Changes from draft-ietf-ipv6-rfc2096-update-02.txt:

 16 Jan 2003   Changed lower-case 'h' to upper-case 'H' in hex
               number.

               Updated REVISION and LAST UPDATED dates.
 13 Jun 2003   Changed inetCidrRouteDscp to inetCidrRoutePolicy.

               Updated MIB Boilerplate.
 17 Jun 2003   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.

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.

              Changed name to draft-ietf-ipv6-rfc-2096-update-*.txt
13 Jul 2002   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.

1 Introduction

This document defines a portion of the Management Information Base
(MIB) for use in managing objects related to the forwarding of
Internet Protocol (IP) packets in an IP version-independent manner.

It should be noted that the MIB definition described herein does
not support multiple instances based on the same address family
type. However, it does support an instance of the MIB per address
family.

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 from inetCidrRouteTable for any
      reason. This object replaces the ipRoutingDiscards and
      ipv6DiscardedRoutes objects.

   3. The inetCidrRouteTable provides the ability to display IP
      version-independent multipath CIDR routes.

4.1 Relationship to other MIBs

This MIB definition contains several deprecated and obsolete tables
and objects. The following subsections describe the relationship
between these objects and other MIB modules.

4.1.1   RFC 1213

The ipRouteTable object was originally defined in RFC 1213. It was
updated by ipForwardTable in RFC 1354.

4.1.2   RFC 1354

The ipForwardTable object replaced the ipRouteTable object from RFC
1213. It was in turn obsoleted by the ipCidrRouteTable defined in
RFC 2096.

In addition, RFC 1354 introduced ipForwardNumber. This object
reflects the number of entries found in ipForwardTable. It was
obsoleted by ipCidrRouteNumber, defined in RFC 2096.

4.1.3   RFC 2096

In RFC 2096, the ipCidrRouteTable and ipCidrRouteNumber were
introduced. The ipCidrRouteTable object supports multipath IP
routes having the same network number but differing network masks.
The number of entries in that table is reflected in
ipCidrRouteNumber. These objects are deprecated by the definitions
contained in this MIB definition.

4.1.4 RFC 2011 and 2465

RFC 2011 contains the ipRoutingDiscards object which counts the
number of valid routes which have been removed from the
ipCidrRouteTable object. The corresponding ipv6DiscardedRoutes
object is defined in RFC 2465. These objects are deprecated in
favor of the version-independent object inetCidrRouteDiscards
defined in this MIB.

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,

```
         InetAutonomousSystemNumber        FROM INET-ADDRESS-MIB;

 ipForward MODULE-IDENTITY
     LAST-UPDATED "200401281200Z"
     ORGANIZATION
           "IETF IPv6 Working Group
            http://www.ietf.org/html.charters/ipv6-charter.html"
     CONTACT-INFO
           "Editor:
            Brian Haberman
            Caspian Networks
            753 Bridgewater Drive
            Sykesville, MD  21784

            Phone: +1 410 552-1421
            Email: brian@innovationslab.net

            Send comments to <ipv6@ietf.org>"
     DESCRIPTION
           "The MIB module for the management of CIDR multipath IP
            Routes.

            Copyright (C) The Internet Society (2004). This version
            of this MIB module is a part of RFC xxxx; see the RFC
            itself for full legal notices."
     -- RFC Ed : replace xxxx with actual RFC number & remove note

     REVISION      "200401281200Z"
     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.   These changes include:

            Adding inetCidrRouteDiscards as a replacement for the
            deprecated ipRoutingDiscards and ipv6DiscardedRoutes
            objects.
```

Haberman   Expires July 2004   8
IP Forwarding Table MIB   January 2004

```
            Adding a new conformance statement to support the
            implementation of the IP Forwarding MIB in a
            read-only mode.

            The inetCidrRouteTable replaces the IPv4-specific
            ipCidrRouteTable, its related objects, and related
            conformance statements.

            Published as RFC xxxx."
     -- RFC Ed : replace xxxx with actual RFC number & remove note
```

```
     REVISION        "199609190000Z"
     DESCRIPTION
             "Revised to support CIDR routes.
              Published as RFC 2096."

     REVISION        "199207022156Z"
     DESCRIPTION
             "Initial version, published as RFC 1354."
     ::= { ip 24 }

inetCidrRouteNumber OBJECT-TYPE
     SYNTAX     Gauge32
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "The number of current inetCidrRouteTable entries that
              are not invalid."
::= { ipForward 6 }

inetCidrRouteDiscards OBJECT-TYPE
     SYNTAX     Counter32
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "The number of valid route entries discarded from
              inetCidrRouteTable.  Discarded route entries do not
              appear in inetCidrRouteTable.  One possible reason for
              discarding an entry would be to free-up buffer space
              for other route table 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 (as reflected in the
             inetCidrRoutePolicy object).

             Dynamically created rows will survive an agent reboot.

             Implementers need to be aware that if the total number
             of elements (octets or sub-identifiers) in
             inetCidrRouteDest, inetCidrRoutePolicy, and
             inetCidrRouteNextHop exceeds 111 then OIDs of column
             instances in this table will have more than 128 sub-
             identifiers and cannot be accessed using SNMPv1,
             SNMPv2c, or SNMPv3."
    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,
        inetCidrRouteAge          Gauge32,
        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.

             Only those address types that may appear in an actual
             routing table are allowed as values of this object."
    REFERENCE "RFC 3291"
    ::= { inetCidrRouteEntry 1 }

inetCidrRouteDest OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "The destination IP address of this route.

             The type of this address is determined by the value of
             the inetCidrRouteDestType object.

             The values for the index objects inetCidrRouteDest and
             inetCidrRoutePfxLen must be consistent.  When the value
             of inetCidrRouteDest is x, then the bitwise logical-AND
             of x with the value of the mask formed from the
             corresponding index object inetCidrRoutePfxLen MUST be
             equal to x.  If not, then the index pair is not
             consistent and an inconsistentName error must be
             returned on SET or CREATE requests."
    ::= { inetCidrRouteEntry 2 }

inetCidrRoutePfxLen OBJECT-TYPE
    SYNTAX      InetAddressPrefixLength (0..128)
    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.

             The values for the index objects inetCidrRouteDest and
             inetCidrRoutePfxLen must be consistent.  When the value
             of inetCidrRouteDest is x, then the bitwise logical-AND
             of x with the value of the mask formed from the
             corresponding index object inetCidrRoutePfxLen MUST be
             equal to x.  If not, then the index pair is not
             consistent and an inconsistentName error must be
```

```
                returned on SET or CREATE requests."
      ::= { inetCidrRouteEntry 3 }


  inetCidrRoutePolicy OBJECT-TYPE
      SYNTAX      OBJECT IDENTIFIER
      MAX-ACCESS not-accessible
```

```
      STATUS      current
      DESCRIPTION
            "This object is an opaque object without any defined
             semantics.  Its purpose is to serve as an additional
             index which may delineate between multiple entries to
             the same destination.  The value { 0 0 } shall be used
             as the default value for this object."
      ::= { 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.

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

             Only those address types that may appear in an actual
             routing table are allowed as values of this object."
      REFERENCE "RFC 3291"
      ::= { inetCidrRouteEntry 5 }


  inetCidrRouteNextHop OBJECT-TYPE
      SYNTAX      InetAddress
      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.

             The type of this address is determined by the value of
             the inetCidrRouteNextHopType object."
      ::= { 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.  A value of 0 is valid and represents the
             scenario where no interface is specified."
    ::= { 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     Gauge32
     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
```

Haberman   Expires July 2004   13
IP Forwarding Table MIB   January 2004

```
            "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."
     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 }

    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.

             There are a number of INDEX objects that cannot be
             represented in the form of OBJECT clauses in SMIv2,
             but for which there are compliance requirements,
             expressed in OBJECT clause form in this description:
```

```
             -- OBJECT       inetCidrRouteDestType
             -- SYNTAX       InetAddressType (ipv4(1), ipv6(2),
             --                          ipv4z(3), ipv6z(4))
             -- DESCRIPTION
             --     This MIB requires support for global and
             --     non-global ipv4 and ipv6 addresses.
             --
             -- OBJECT       inetCidrRouteDest
             -- SYNTAX       InetAddress (SIZE (4 | 8 | 16 | 20))
             -- DESCRIPTION
             --     This MIB requires support for global and
             --     non-global IPv4 and IPv6 addresses.
             --
```

```
            -- OBJECT       inetCidrRouteNextHopType
            -- SYNTAX       InetAddressType (unknown(0), ipv4(1),
            --                               ipv6(2), ipv4z(3)
            --                               ipv6z(4))
            -- DESCRIPTION
            --     This MIB requires support for global and
            --     non-global ipv4 and ipv6 addresses.
            --
            -- OBJECT       inetCidrRouteNextHop
            -- SYNTAX       InetAddress (SIZE (0 | 4 | 8 | 16 | 20))
            -- DESCRIPTION
            --     This MIB requires support for global and
            --     non-global IPv4 and IPv6 addresses.
            "

    MODULE -- this module
    MANDATORY-GROUPS { inetForwardCidrRouteGroup }

    OBJECT        inetCidrRouteStatus
    SYNTAX        RowStatus { active(1), notInService (2) }
    WRITE-SYNTAX  RowStatus { active(1), notInService (2),
                             createAndGo(4), destroy(6) }
    DESCRIPTION  "Support for createAndWait is not required."

    ::= { ipForwardCompliances 3 }

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 }

    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
    SYNTAX      RowStatus { active(1) }
    MIN-ACCESS  read-only
    DESCRIPTION
       "Write access is not required."

    ::= { ipForwardCompliances 4 }

-- units of conformance

inetForwardCidrRouteGroup OBJECT-GROUP
    OBJECTS { inetCidrRouteDiscards,
            inetCidrRouteIfIndex, inetCidrRouteType,
            inetCidrRouteProto, inetCidrRouteAge,
            inetCidrRouteNextHopAS, inetCidrRouteMetric1,
            inetCidrRouteMetric2, inetCidrRouteMetric3,
            inetCidrRouteMetric4, inetCidrRouteMetric5,
            inetCidrRouteStatus, inetCidrRouteNumber
        }
```

```
    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
        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
           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    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
            "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
                  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 }
    ::= { 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.

            This compliance statement has been deprecated and
            replaced with ipForwardFullCompliance and
            ipForwardReadOnlyCompliance."

    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.

            This group has been deprecated and replaced with
            inetForwardCidrRouteGroup."
    ::= { 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,
        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.
```

```
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
    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
                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 }


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
```

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.

7 **Intellectual Property Statement**

8 Changes from RFC 2096

This document updates RFC 2096 in the following ways:

1. Replaces ipCidrRouteTable with inetCidrRouteTable. This
   applies to corresponding objects and conformance statements.
2. Utilized the InetAddress TC to support IP version-independent
   implementations of the forwarding MIB. This gives common
   forwarding MIB support for IPv4 and IPv6.
3. Created a read-only conformance statement to support
   implementations that only wish to retrieve data.
4. Created the inetCidrRouteDiscards object to replace the
   deprecated ipRoutingDiscards and ipv6DiscardedRoutes objects.

The inetCidrRouteTable retains the logical structure of the
ipCidrRouteTable in order to allow the easy upgrade of existing
IPv4 implementations to the version-independent MIB.

9 **Normative References**

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-- time as this document, please update this reference and the two
-- citations in the document. Afterwards, please remove this note.

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10 **Informative References**

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          1997.

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