Network Working Group
Request for Comments: 2096
Obsoletes: 1354
Category: Standards Track

F. Baker
Cisco Systems

January 1997

IP Forwarding Table MIB

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Table of Contents

1. Introduction 1
2. The SNMP Network Management Framework 2
2.1 Object Definitions 2
3. Overview 2
4. Definitions 3
5. Acknowledgements 20
6. References 20
7. Security Considerations 21
8. Author's Address 21

1. Introduction

This memo defines an update to RFC 1354, "IP Forwarding Table MIB", for Classless Inter-Domain Routing (CIDR). That document was developed by the Router Requirements Working Group as an update to RFC 1213's ipRouteTable, with the display of multiple routes as a primary objective. The significant difference between this MIB and RFC 1354 is the recognition (explicitly discussed but by consensus left to future work) that CIDR routes may have the same network number but different network masks. Note that this MIB obsoletes a number of objects from RFC 1354. The reader should pay careful attention to the STATUS field.

2. The SNMP Network Management Framework

The SNMP Network Management Framework presently consists of three major components. They are:

- o the SMI, described in RFC 1902 [1], - the mechanisms used for describing and naming objects for the purpose of management.
- o the MIB-II, STD 17, RFC 1213 [2], - the core set of managed objects for the Internet suite of protocols.
- o the protocol, RFC 1157 [6] and/or RFC 1905 [4], - the protocol for accessing managed information.

Textual conventions are defined in RFC 1903 [3], and conformance statements are defined in RFC 1904 [5].

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

2.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) defined in the SMI. In particular, each object object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to refer to the object type.

3. Overview

The MIB consists of two tables and two global objects.

(1) The object ipForwardNumber indicates the number of current routes. This is primarily to avoid having to read the table in order to determine this number.

(2) The ipForwardTable updates the RFC 1213 ipRouteTable to display multipath IP Routes. This is in turn obsoleted by the ipCidrRouteTable.

(3) The ipCidrRouteTable updates the RFC 1213 ipRouteTable to display multipath IP Routes having the same network number but differing network masks.

4. Definitions

```
IP-FORWARD-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, IpAddress, Integer32, Gauge32
        FROM SNMPv2-SMI
    RowStatus
        FROM SNMPv2-TC
    ip
        FROM RFC1213-MIB
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF;

ipForward MODULE-IDENTITY
    LAST-UPDATED "9609190000Z"     -- Thu Sep 26 16:34:47 PDT 1996
    ORGANIZATION "IETF OSPF Working Group"
    CONTACT-INFO
     "        Fred Baker
      Postal: Cisco Systems
              519 Lado Drive
              Santa Barbara, California 93111

      Phone:  +1 805 681 0115
      Email:  fred@cisco.com
      "
    DESCRIPTION
            "The MIB module for the display of CIDR multipath IP Routes."
    REVISION      "9609190000Z"
    DESCRIPTION
            "Revisions made by the OSPF WG."
    ::= { ip 24 }

ipCidrRouteNumber OBJECT-TYPE
    SYNTAX   Gauge32
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
       "The number of current ipCidrRouteTable entries
       that are not invalid."
    ::= { 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   current
    DESCRIPTION
       "This entity's IP Routing table."
    REFERENCE
       "RFC 1213 Section 6.6, The IP Group"
    ::= { ipForward 4 }

ipCidrRouteEntry OBJECT-TYPE
    SYNTAX   IpCidrRouteEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
       "A particular route to  a  particular  destina-
       tion, 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   current
    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   current
    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 Ad-
       dress 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 ipCidrRoute-
       Dest."
    ::= { 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
    MAX-ACCESS read-only
    STATUS   current
    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   current
    DESCRIPTION
       "On remote routes, the address of the next sys-
       tem en route; Otherwise, 0.0.0.0."
```

```
    ::= { ipCidrRouteEntry 4 }

ipCidrRouteIfIndex OBJECT-TYPE
    SYNTAX   Integer32
    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."
    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   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 destina-
       tion.

       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   current
    DESCRIPTION
       "The routing mechanism via which this route was
       learned.  Inclusion of values for gateway rout-
       ing protocols is not  intended  to  imply  that
       hosts should support those protocols."
    ::= { ipCidrRouteEntry 7 }

ipCidrRouteAge 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."
    DEFVAL  { 0 }
    ::= { ipCidrRouteEntry 8 }

ipCidrRouteInfo OBJECT-TYPE
    SYNTAX   OBJECT IDENTIFIER
    MAX-ACCESS read-create
    STATUS   current
    DESCRIPTION
       "A reference to MIB definitions specific to the
       particular  routing protocol which is responsi-
       ble 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  identif-
```

```
       ier, 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   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
       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   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
       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   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
       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   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
       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   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
       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   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
       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   current
    DESCRIPTION
       "The row status variable, used according to
       row installation and removal conventions."
    ::= { ipCidrRouteEntry 16 }

-- conformance information

ipForwardConformance OBJECT IDENTIFIER ::= { ipForward 5 }
```

```
ipForwardGroups      OBJECT IDENTIFIER ::= { ipForwardConformance 1 }
ipForwardCompliances OBJECT IDENTIFIER ::= { ipForwardConformance 2 }

-- compliance statements

ipForwardCompliance MODULE-COMPLIANCE
   STATUS  current
   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  current
    DESCRIPTION
       "The CIDR Route Table."
    ::= { ipForwardGroups 3 }

-- Obsoleted Definitions - Objects

ipForwardNumber OBJECT-TYPE
    SYNTAX   Gauge32
    MAX-ACCESS read-only
    STATUS   obsolete
    DESCRIPTION
       "The number of current  ipForwardTable  entries
       that are not invalid."
    ::= { ipForward 1 }

--  IP Forwarding Table

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

```
--  support, and policy routing support.

ipForwardTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IpForwardEntry
    MAX-ACCESS not-accessible
    STATUS   obsolete
    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  destina-
       tion, 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 Ad-
       dress 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 ipForward-
       Dest."
    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
    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 ipForwardPro-
       to 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  ei-
       ther 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 sys-
       tem 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 destina-
       tion.

       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 iden-
```

```
       tified    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 current-
       ly  in  use.  Proper interpretation of such en-
       tries requires examination of the relevant  ip-
       ForwardType 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 rout-
       ing 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 responsi-
        ble 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  identif-
        ier, 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
```

5. Acknowledgements

This work was originally performed by the Router Requirements Working Group at the request of the OSPF Working Group. This update was performed under the auspices of the OSPF Working Group. John Moy of Proteon Incorporated is the chair.

6. References

[1] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Structure of Management Information for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1442, SNMP Research, Inc., Hughes LAN Systems, Dover Beach Consulting, Inc., Carnegie Mellon University, April 1993.

[2] Galvin, J., and K. McCloghrie, "Administrative Model for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1445, Trusted Information Systems, Hughes LAN Systems, April 1993.

[3] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Protocol Operations for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1448, SNMP Research, Inc., Hughes LAN Systems, Dover Beach Consulting, Inc., Carnegie Mellon University, April 1993.

[4] McCloghrie, K., and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets - MIB-II", STD 17, RFC 1213, Hughes LAN Systems, Performance Systems International, March 1991.

[5] Postel, J., "Internet Protocol", STD 5, RFC 791, USC/Information Sciences Institute, September 1981.

[6] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Textual Conventions for version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1443, SNMP Research, Inc., Hughes LAN Systems, Dover Beach Consulting, Inc., Carnegie Mellon University, April 1993.

[7] Baker, F., "IP Forwarding Table MIB", RFC 1354, July 1992.

7. Security Considerations

Security is an objective not in this MIB view.

8. Author's Address

Fred Baker
Cisco Systems
519 Lado Drive
Santa Barbara, California 93111

Phone: +1 805 681 0115
EMail: fred@cisco.com