IP MIB for IP Fast-Reroute
draft-ietf-rtgwg-ipfrr-ip-mib-03

Abstract

This draft 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 relevant for IP routes using IP Fast-Reroute [RFC5714]

Requirements Language

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 [RFC2119].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at http://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on November 28, 2014.
1. Introduction

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it defines the managed objects used for IP routes and interfaces in relation to IP Fast-Reroute. This document uses terminology from [RFC5714] and [RFC5286].

Current work is underway to define mechanisms for determining alternate paths for traffic to use when the original path becomes unavailable due to a local failure. The alternate next-hops can be computed in the context of any IGP.
There are certain configuration attributes for IP Fast-Reroute that should be configured to enable IP Fast Reroute in the context of the IGP. These configuration attributes of IP Fast-Reroute are not covered by this MIB module. Examples include whether IP Fast-Reroute is enabled on a network region (i.e. an OSPF area or IS-IS level) and the desired local hold-down timer [RFC5286], whose proper value is dependent upon the size of the network region.

It is possible for traffic other than IP to depend upon and use the alternate next-hops computed by IP Fast-Reroute. An example would be MPLS traffic whose path is configured via LDP [RFC5036]. The additional details (for example, outgoing MPLS label) pertaining to alternate next-hops that are required by such traffic are not covered by this MIB module.

An IP route may be reachable via multiple primary next-hops which provide equal-cost paths. Where IP Fast-Reroute is enabled, each primary next-hop will be protected by one or more alternate next-hops. Such an alternate next-hop may itself be a primary next-hop.

1.1. The SNMP Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of [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, [RFC2578], STD 58, [RFC2579] and STD 58, [RFC2580].

2. Brief description of MIB Objects

2.1. ipFrrProtectStats Group

The global objects in this group provide summary information related to protection for all IP routes. The information available includes counts of all routes, of all protected routes, of all unprotected routes, of all routes which are protected against a link failure, and of all routes which are protected against a node failure.
2.2. ipFrrInstanceTable

The ipFrrInstanceTable provides information about configuration of IP FRR instantiations on a node. A single node may have multiple instances of IP FRR using different algorithms or protocols.

2.3. ipFrrIfTable

The ipFrrIfTable provides information about configuration of interfaces for IPFRR.

2.4. ipFrrProtectStatsTable

The ipFrrProtectStatsTable complements the ipFrrProtectStats group by providing statistics per IP FRR instance.

2.5. ipFrrAltTable

The ipFrrAltTable extends the inetCidrRouteTable [RFC4292] to provide information about each alternate next-hop associated with a primary next-hop used by a route. Statically configured alternate next-hops associated with primary next-hops can be created.

2.6. ipFrrNoAltTable

The ipFrrNoAltTable extends the inetCidrRouteTable [RFC4292] to provide information about the routes which do not have an alternate next-hop associated with any of the route’s primary next-hop. The entry provides an explanation for the lack of protection.

3. IP Fast-Reroute MIB Module Definitions

IPFRR-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY,
   OBJECT-TYPE,
   Gauge32, Integer32 FROM SNMPv2-SMI -- [RFC2578]
   RowStatus FROM SNMPv2-TC -- [RFC2579]
   MODULE-COMPLIANCE, OBJECT-GROUP FROM SNMPv2-CONF -- [RFC2580]
   InetAddressType, InetAddress FROM INET-ADDRESS-MIB -- [RFC4001]
ifIndex, InterfaceIndex FROM IF-MIB -- [RFC2863]
ip FROM IP-MIB -- [RFC4293]
inetcidrRouteDestType, inetcidrRouteDest, inetcidrRoutePfxLen, inetcidrRoutePolicy, inetcidrRouteNextHopType, inetcidrRouteNextHop FROM IP-FORWARD-MIB -- [RFC4292]

IANAipRouteProtocol FROM IANA-RTPROTO-MIB

;  
ipFrrMIB MODULE-IDENTITY
LAST-UPDATED "201405261200Z" -- May 26, 2014
ORGANIZATION "draft-ietf-rtgwg-ipfrr-ip-mib-03.txt"
CONTACT-INFO
"  
  A S Kiran Koushik
  Cisco Systems Inc.
  EMail: kkoushik@cisco.com

  John W Flick
  Hewlett Packard Company
  EMail: john.flick@hp.com

  Alia Atlas
  Juniper Networks
  Email: akatlas@juniper.net

  Stephane Litkowski
  Orange Business Service
  Email: stephane.litkowski@orange.com

"
DESCRIPTION
"IP MIB module for management of IP Fast-Reroute.

Copyright (C) The Internet Society (date).
This version of this MIB module is part of
draft-ietf-rtgwg-ipfrr-ip-mib-03.txt"
REVISION    "201405261200Z" -- May 26, 2014
DESCRIPTION
"Add ipFrrInstanceTable.
Add ipFrrIfTable.
ipFrrProtectStatsTable complements ipFrrProtectStats to have statistics per instance.
Add ipFrrAltMetric2, ipFrrAltMetric3, ipFrrAltBest, ipFrrAltNonBestReason to ipFrrAltEntry.
Add integer values to ipFrrAltType.
Add integer values to ipFrrAltProtectionAvailable.
Changed attachment of ipFrrAltStatus in ipFrrAltEntry."

REVISION "201203131200Z" -- Mar 13, 2012

DESCRIPTION
"Editorial changes. Added new type to ipFrrAltType."

REVISION "200502181200Z" -- February 18, 2005

DESCRIPTION
"Add Set operations on ipFrrAltTable"

REVISION "200502131200Z" -- February 13, 2005

DESCRIPTION
"Initial version."

::= { ip ZZZ } -- To be assigned by IANA

-- Top level components of this MIB module.

ipFrrMIBObjects OBJECT IDENTIFIER ::= { ipFrrMIB 1 }

ipFrrProtectStats OBJECT IDENTIFIER ::= { ipFrrMIBObjects 1 }

-- the IP FRR MIB-Group

-- A collection of objects providing summarized information
-- about the protection availability and type of alternate paths
-- provided by IP Fast-Reroute mechanisms.

ipFrrTotalRoutes OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IPv4 valid routes known by this entity."
 ::= { ipFrrProtectStats 1 }

ipFrrUnprotectedRoutes OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IPv4 valid routes known by this entity which do not have an alternate next-hop associated with any primary next-hop."
ipFrrProtectedRoutes OBJECT-TYPE
   SYNTAX          Gauge32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
      "The number of IPv4 routes known by this entity
      which have at least one alternate next-hop."
   ::= { ipFrrProtectStats 2 }

ipFrrLinkProtectedRoutes OBJECT-TYPE
   SYNTAX          Gauge32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
      "The number of IPv4 routes known by this entity
      for which all alternate next-hops provide link
      protection for their associated primary next-hops."
   ::= { ipFrrProtectStats 3 }

ipFrrNodeProtectedRoutes OBJECT-TYPE
   SYNTAX          Gauge32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
      "The number of IPv4 routes known by this entity
      for which all alternate next-hops provide node
      protection for their associated primary next-hops."
   ::= { ipFrrProtectStats 4 }

ipv6FrrTotalRoutes OBJECT-TYPE
   SYNTAX          Gauge32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
      "The number of IPv6 valid routes known by this entity."
   ::= { ipFrrProtectStats 5 }

ipv6FrrUnprotectedRoutes OBJECT-TYPE
   SYNTAX          Gauge32
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION
      "The number of IPv6 valid routes known by this entity
      which do not have an alternate next-hop associated
      with any primary next-hop."
   ::= { ipFrrProtectStats 7 }
ipv6FrrProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The number of IPv6 routes known by this entity which have at least one alternate next-hop."
::= { ipFrrProtectStats 8 }

ipv6FrrLinkProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The number of IPv6 routes known by this entity for which all alternate next-hops provide link protection for their associated primary next-hops."
::= { ipFrrProtectStats 9 }

ipv6FrrNodeProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The number of IPv6 routes known by this entity for which all alternate next-hops provide node protection for their associated primary next-hops."
::= { ipFrrProtectStats 10 }

-- the IP FRR instance MIB-group
--
-- The ipFrrInstanceTable provides detail on current IPFRR instances activated on the node

ipFrrInstanceTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpFrrInstanceEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "This entity’s IP Fast Reroute Instance table."
::= { ipFrrMIBObjects 4 }

ipFrrInstanceEntry OBJECT-TYPE
SYNTAX     IpFrrInstanceEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry containing information on a particular
IP FRR instance on the node.

INDEX { ipFrrInstanceId
 ::= { ipFrrInstanceTable 1 }

IpFrrInstanceEntry ::= SEQUENCE {
    ipFrrInstanceId                       INTEGER,
    ipFrrInstanceProtocol                 IANAipRouteProtocol,
    ipFrrInstanceAlgorithm                INTEGER32,
    ipFrrInstancePerPrefixComputation     INTEGER,
    ipFrrInstanceRowStatus                RowStatus
}

ipFrrInstanceId OBJECT-TYPE
    SYNTAX     Integer32 (1..255)
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION "This object specifies an identificator a of particular IPFR R instance."
 ::= { ipFrrInstanceEntry 1 }

ipFrrInstanceProtocol OBJECT-TYPE
    SYNTAX     IANAipRouteProtocol
    MAX-ACCESS read-create
    STATUS     current
    DESCRIPTION "This object specifies the protocol used by the IPFRR instan ce."
 ::= { ipFrrInstanceEntry 2 }

ipFrrInstanceAlgorithm OBJECT-TYPE
    SYNTAX     INTEGER {
        loopFree(1),
        loopFreeRemote(2),
        loopFreeTI(3),
        mrt(4)
    }
    MAX-ACCESS read-create
    STATUS     current
    DESCRIPTION "This object specifies the algorithm used by the IPFRR insta nce."
 ::= { ipFrrInstanceEntry 3 }

ipFrrInstancePerPrefixComputation OBJECT-TYPE
    SYNTAX     INTEGER {
        false(0),
        true(1)
    }
MAX-ACCESS read-create
STATUS  current
DESCRIPTION
"This object specifies if per prefix computation is used."
::= { ipFrrInstanceEntry 4 }

ipFrrInstanceRowStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"."
::= { ipFrrInstanceEntry 5 }

-- the IP FRR Interface MIB-Group
--
-- ipFrrIfTable provides information on configuration
-- of interfaces for IPFRR

ipFrrIfTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpFrrIfEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"This entity’s IP Fast Reroute Alternates Interface configuration table."
::= { ipFrrMIBObjects 5 }

IpFrrIfEntry OBJECT-TYPE
SYNTAX     IpFrrIfEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An entry containing information on a particular instance of an IPFRR interface."

INDEX { ipFrrInstanceId,
    ifIndex
}
::= { ipFrrIfTable 1 }

IpFrrIfEntry ::= SEQUENCE {
    ipFrrIfProtectionType           BITS,
    ipFrrIfCandidate                INTEGER,
    ipFrrIfRowStatus                    RowStatus
}
ipFrrIfProtectionType OBJECT-TYPE
SYNTAX     BITS {
    nodeProtect(0),
    linkProtect(1),
    nodelinkProtect(2)
}
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
    "This object specifies the scope of protection requested for
    the protection of the destinations.
    nodeProtect means node protection only compared to nodelink
    Protect which means node protection
    if available and link protection if not available."
 ::= { ipFrrIfEntry 1 }

ipFrrIfCandidate OBJECT-TYPE
SYNTAX     INTEGER {
    false (0),
    true (1)
}
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
    "This object specifies the scope of protection requested for
    the protection of the destinations.
    nodeProtect means node protection only compared to nodelink
    Protect which means node protection
    if available and link protection if not available."
 ::= { ipFrrIfEntry 2 }

ipFrrIfRowStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
    "."
 ::= { ipFrrIfEntry 3 }

-- the IP FRR Stats MIB-Group
--
-- ipFrrProtectStatsTable provides provides
-- protection availability and type of alternate paths
-- provided by IP Fast-Reroute mechanisms per IPFRR instance.

ipFrrProtectStatsTable OBJECT-TYPE
SYNTAX     SEQUENCE OF IpFrrProtectStatsEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"This entity’s IP Fast Reroute Alternates statistics table.
"
 ::= { ipFrrMIBObjects 6 }

ipFrrProtectStatsEntry OBJECT-TYPE
SYNTAX     IpFrrProtectStatsEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
 "An entry containing information on a particular instance of IPFRR.
",

INDEX { ipFrrInstanceId
 }
 ::= { ipFrrProtectStatsTable 1 }

IpFrrProtectStatsEntry ::= SEQUENCE {
   ipFrrStatsTotalRoutes       Gauge32,
   ipFrrStatsUnprotectedRoutes     Gauge32,
   ipFrrStatsProtectedRoutes       Gauge32,
   ipFrrStatsLinkProtectedRoutes       Gauge32,
   ipFrrStatsNodeProtectedRoutes       Gauge32,
   ipv6FrrStatsTotalRoutes     Gauge32,
   ipv6FrrStatsUnprotectedRoutes       Gauge32,
   ipv6FrrStatsProtectedRoutes     Gauge32,
   ipv6FrrStatsLinkProtectedRoutes     Gauge32,
   ipv6FrrStatsNodeProtectedRoutes     Gauge32
}

ipFrrStatsTotalRoutes    OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The number of valid routes known by this entity."
 ::= { ipFrrProtectStatsEntry 1 }

ipFrrStatsUnprotectedRoutes    OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The number of valid routes known by this entity which do not have an alternate next-hop associated with any primary next-hop."
 ::= { ipFrrProtectStatsEntry 2 }

ipFrrStatsProtectedRoutes    OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of routes known by this entity
which have at least one alternate next-hop."
::= { ipFrrProtectStatsEntry 3 }

ipFrrStatsLinkProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of routes known by this entity
for which all alternate next-hops provide link
protection for their associated primary next-hops."
::= { ipFrrProtectStatsEntry 4 }

ipFrrStatsNodeProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of routes known by this entity
for which all alternate next-hops provide node
protection for their associated primary next-hops."
::= { ipFrrProtectStatsEntry 5 }

ipv6FrrStatsTotalRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of valid IPv6 routes known by this entity."
::= { ipFrrProtectStatsEntry 6 }

ipv6FrrStatsUnprotectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of valid IPv6 routes known by this entity
which do not have an alternate next-hop associated
with any primary next-hop."
::= { ipFrrProtectStatsEntry 7 }

ipv6FrrStatsProtectedRoutes OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IPv6 routes known by this entity which have at least one alternate next-hop."
::= { ipFrrProtectStatsEntry 8 }

ipv6FrrStatsLinkProtectedRoutes OBJECT-TYPE
SYNTAX   Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IPv6 routes known by this entity for which all alternate next-hops provide link protection for their associated primary next-hops."
::= { ipFrrProtectStatsEntry 9 }

ipv6FrrStatsNodeProtectedRoutes OBJECT-TYPE
SYNTAX   Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of IPv6 routes known by this entity for which all alternate next-hops provide node protection for their associated primary next-hops."
::= { ipFrrProtectStatsEntry 10 }

-- the IP FRR Alternate MIB-Group
--
-- The ipFrrAltTable extends the inetCidrRouteTable to indicate
-- the alternate next-hop(s) associated with each primary
-- next-hop. The additional indices (ipFrrAltNextHopType and
-- ipFrrAltNextHop) allow for multiple alternate paths for a
-- given primary next-hop.

ipFrrAltTable OBJECT-TYPE
SYNTAX   SEQUENCE OF IpFrrAltEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "This entity’s IP Fast Reroute Alternates table."
::= { ipFrrMIBObjects 2 }

ipFrrAltEntry OBJECT-TYPE
SYNTAX   IpFrrAltEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

"An entry containing information on a particular route, one of its particular (primary) next-hops and one of the associated alternate next-hops.

Implementers need to be aware that if the total number of elements (octets or sub-identifiers) in inetCidrRouteDest, inetCidrRoutePolicy, inetCidrRouteNextHop, and ipFrrAltNextHop exceeds 107 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,
ipFrrAltNextHopType,
ipFrrAltNextHop
}
::= { ipFrrAltTable 1 }

IpFrrAltEntry ::= SEQUENCE {
ipFrrAltNextHopType               InetAddressType,
ipFrrAltNextHop                  InetAddress,
ipFrrAltIfIndex                  InterfaceIndex,
ipFrrAltType                     INTEGER,
ipFrrAltProtectionAvailable      BITS,
ipFrrAltMetric1                  Integer32,
ipFrrAltMetric2                  Integer32,
ipFrrAltMetric3                  Integer32,
ipFrrAltBest                     INTEGER,
ipFrrAltNonBestReason            OCTET STRING,
ipFrrAltStatus                   RowStatus
}
ipFrrAltNextHopType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"The type of the ipFrrNextHop 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 4001"
::= { ipFrrAltEntry 1 }

ipFrrAltNextHop OBJECT-TYPE
SYNTAX     InetAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
 "The address of the next system along the alternate route.

The type of this address is determined by the value of the ipFrrAltNextHopType."
::= { ipFrrAltEntry 2 }

ipFrrAltIfIndex 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 alternate route should be reached."
::= { ipFrrAltEntry 3 }

ipFrrAltType OBJECT-TYPE
SYNTAX   INTEGER {
      other             (1), -- type not defined
      equalCost         (2), -- primary path
      loopFree          (3), -- loop free alternate
      loopFreeRemote    (4), -- remote loop free alternate
      loopFreeTunnel    (5), -- loop free alternate using a configured tunnel
      loopFreeTI        (6), -- loop free alternate using topology independent algorithm
      mrt               (7)  -- Maximally Redundant Trees
    }
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
 "The type of alternate which is provided by the alternate next-hop. The supported types are as follows:

equalCost : The alternate next-hop is another primary next-hop.

loopFree : directed connected LFA as described in RFC5286

loopFreeRemote : remote LFA as described in draft-ietf-rtg-wg-remote-lfa
loopFreeTunnel : remote LFA reachable through a RSVP-TE or GRE tunnel

loopFreeTI : remote LFA reachable through a SPRING tunnel

other : The mechanism by which the alternate next-hop can be used is not specified.

MRT : Maximally Redundant Trees, where each destination has two MRTs associated with it. These two trees are referred as blue and red MRTs. See draft-ietf-rtgwg-mrt-frr-architecture-00.

::= { ipFrrAltEntry 4 }

ipFrrAltProtectionAvailable OBJECT-TYPE
SYNTAX BITS {
   nodeProtect(0),
   linkProtect(1),
   srlgProtect(2),
   downstreamProtect(3),
   unknownProtection(4)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object specifies the scope of protection for which this alternate next-hop can provide failure protection. The alternate next-hop should provide one or more of node-protection and link-protection. If the protection provided by the alternate next-hop is unknown, then only unknownProtection should be specified. Specifying unknownProtection with any other type of protection is not supported."
::= { ipFrrAltEntry 5 }

ipFrrAltMetric1 OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This is the primary routing metric for this alternate path to the destination IP address. If the alternate path metric is unknown, the value should be set to -1."
::= { ipFrrAltEntry 6 }

ipFrrAltMetric2 OBJECT-TYPE
SYNTAX     Integer32
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This is the primary routing metric for this alternate path from the PLR to the alternate. If the alternate path metric is unknown, the value should be set to -1."
::= { ipFrrAltEntry 7 }

ipFrrAltMetric3 OBJECT-TYPE
SYNTAX     Integer32
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This is the primary routing metric for this alternate path from the alternate to the destination. If the alternate path metric is unknown, the value should be set to -1."
::= { ipFrrAltEntry 8 }

ipFrrAltBest OBJECT-TYPE
SYNTAX     INTEGER { false(0), true(1) }
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This object provides information if the alternate is the best one."
::= { ipFrrAltEntry 9 }

ipFrrAltNonBestReason OBJECT-TYPE
SYNTAX     OCTET STRING (SIZE (0..255))
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This object provides reason why an alternate is not the best one."
::= { ipFrrAltEntry 10 }

ipFrrAltStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The row status variable, used according to row installation and removal conventions."
::= { ipFrrAltEntry 11 }

-- the IP FRR No Alternate MIB-Group
--
-- The ipFrrNoAltTable extends the inetCidrRouteTable
-- to indicate which routes are unprotected and the reason
-- why. The indices do not include the primary next-hop because
-- the lack of protection is for the route. This allows easy
-- access to the set of unprotected routes that would be
-- affected by a local failure of their primary next-hop.

ipFrrNoAltTable OBJECT-TYPE
  SYNTAX     SEQUENCE OF IpFrrNoAltEntry
  MAX-ACCESS not-accessible
  STATUS     current
  DESCRIPTION
    "This entity’s IP Fast Reroute Unprotected Routes
    table."
  ::= { ipFrrMIBObjects 3 }

ipFrrNoAltEntry OBJECT-TYPE
  SYNTAX     IpFrrNoAltEntry
  MAX-ACCESS not-accessible
  STATUS     current
  DESCRIPTION
    "An entry containing the reason why a route does not
    have an alternate next-hop. The existence of an
    entry for a route indicates that there is no
    alternate next-hop."
  INDEX { inetCidrRouteDestType,
         inetCidrRouteDest,
         inetCidrRoutePfxLen
  }
  ::= { ipFrrNoAltTable 1 }

IpFrrNoAltEntry ::= SEQUENCE {
  ipFrrNoAltCause INTEGER
}

ipFrrNoAltCause OBJECT-TYPE
  SYNTAX     INTEGER {
    ipFrrUnavailable   (1), -- No valid alternate(s)
    localAddress      (2), -- local/internal address
    ipFrrDisabled     (3), -- Protection not enabled
    other             (4)  -- unknown or other cause
  }
  MAX-ACCESS read-only
  STATUS     current
  DESCRIPTION
    "For valid routes without an alternate next-hop, this
    object enumerates the reason why no protection is
available. The possibilities are as follows.

ipFrrUnavailable : The supported IP Fast-Reroute mechanisms could not find a safe alternate next-hop.

localAddress : The route represents a local address. This system is the destination so no alternate path is possible or necessary.

ipFrrDisabled : Finding of alternate next-hops is operationally disabled.

other : The reason is unknown or different from those specifically enumerated possible causes.

 ::= { ipFrrNoAltEntry 1 }

-- conformance information

ipFrrMIBConformance
 OBJECT IDENTIFIER ::= { ipFrrMIB 2 }

ipFrrMIBCompliances
 OBJECT IDENTIFIER ::= { ipFrrMIBConformance 1 }

ipFrrMIBGroups
 OBJECT IDENTIFIER ::= { ipFrrMIBConformance 2 }

-- compliance statements

ipFrrMIBCompliance MODULE-COMPLIANCE
 STATUS deprecated
 DESCRIPTION "Minimum requirements to state conformity to this MIB. Supporting only IP v4 addresses This is deprecated in favor of ipFrrMIBInetCompliance

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), ipv4z(3) }
MIN-ACCESS  read-only
DESCRIPTION
 A (deprecated) complying implementation at this
level is required to support IPv4 addresses only. This compliance level is defined so an implementation only needs to support the addresses it actually supports on the device.

OBJECT      inetCidrRouteNextHopType
SYNTAX      InetAddressType { ipv4(1), ipv4z(3) }
MIN-ACCESS  read-only
DESCRIPTION
  A (deprecated) complying implementation at this level is required to support IPv4 addresses only. This compliance level is defined so an implementation only needs to support the addresses it actually supports on the device.

OBJECT      ipFrrAltNextHopType
SYNTAX      InetAddressType { ipv4(1), ipv4z(3) }
MIN-ACCESS  read-only
DESCRIPTION
  A (deprecated) complying implementation at this level is required to support IPv4 addresses only. This compliance level is defined so an implementation only needs to support the addresses it actually supports on the device.

""

 MODULE -- this module
MANDATORY-GROUPS { ipFrrBasicGroup }
::= { ipFrrMIBCompliances 1 }

ipFrrMIBInetCompliance MODULE-COMPLIANCE
STATUS      current
DESCRIPTION
  "Full conformity to this MIB."

 MODULE -- this module
MANDATORY-GROUPS { ipFrrBasicGroup }

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

::= { ipFrrMIBCompliances 2 }

ipFrrReadOnlyCompliance MODULE-COMPLIANCE
When this MIB is implemented without support for read-create (i.e. in read-only mode), then that implementation can claim read-only compliance. In that case, ipFrrAlt group can be monitored but cannot be configured with this MIB.

MODULE
MANDATORY-GROUPS { ipFrrBasicGroup }

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

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

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

OBJECT  ipFrrAltMetric1
MIN-ACCESS  read-only
DESCRIPTION
"Write access is not required."

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

::= { ipFrrMIBCompliances 3 }

-- units of conformance
ipFrrBasicGroup OBJECT-GROUP
OBJECTS {ipFrrTotalRoutes, ipFrrUnprotectedRoutes, ipFrrProtectedRoutes, ipFrrLinkProtectedRoutes, ipFrrNodeProtectedRoutes, ipv6FrrTotalRoutes, ipv6FrrUnprotectedRoutes,}
ipv6FrrProtectedRoutes,
ipv6FrrLinkProtectedRoutes,
ipv6FrrNodeProtectedRoutes,
ipFrrAltIfIndex,
ipFrrAltType,
ipFrrAltProtectionAvailable,
ipFrrAltMetric1,
ipFrrAltMetric2,
ipFrrAltMetric3,
ipFrrAltNonBestReason,
ipFrrAltBest,
ipFrrAltStatus,
ipFrrNoAltCause,
ipFrrInstanceAlgorithm,
ipFrrInstanceProtocol,
ipFrrInstancePerPrefixComputation,
ipFrrInstanceRowStatus,
ipFrrIfCandidate,
ipFrrIfProtectionType,
ipFrrIfRowStatus,
ipFrrStatsTotalRoutes,
ipFrrStatsUnprotectedRoutes,
ipFrrStatsProtectedRoutes,
ipFrrStatsLinkProtectedRoutes,
ipFrrStatsNodeProtectedRoutes,
ipv6FrrStatsTotalRoutes,
ipv6FrrStatsUnprotectedRoutes,
ipv6FrrStatsProtectedRoutes,
ipv6FrrStatsLinkProtectedRoutes,
ipv6FrrStatsNodeProtectedRoutes

} STATUS  current
DESCRIPTION  "The entire collection of objects defined in this MIB for management of IP Fast Reroute."
::= { ipFrrMIBGroups 1 }

END

4. 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. The ipFrrAltTable contains routing and forwarding information that is critical to the operation of the network in the event of a local failure. Allowing unauthenticated write access to this table can compromise the validity of the alternate 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 access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

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 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 them.

5. Acknowledgements

The authors would like to acknowledge contributions made by Bill Anderson and Don Fedyk and thank them.

6. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER value recorded in the SMI Numbers registry.

The IANA is requested to assign { ip ZZZ } to the IPFRR-MIB MIB module specified in this document.

Editor’s Note (to be removed prior to publication): the IANA is requested to assign a value for "ZZZ" under the ip subtree and to record the assignments in the SMI Numbers registry. When the assignments have been made, the RFC Editor is asked to replace "ZZZ"
(here and in the MIB modules) with the assigned value and to remove this note.

7. References

7.1. Normative References


7.2. Informative References


Authors’ Addresses

Alia Atlas
Juniper Networks

Email: akatlas@juniper.net

A S Kiran Koushik
Cisco Systems

Email: kkoushik@cisco.com

John Flick
Hewlett-Packard

Email: john.flick@hp.com

Stephane Litkowski
Orange

Email: stephane.litkowski@orange.com