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.

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This Internet-Draft will expire on December 15, 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"
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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 "201406131200Z" -- Jun 13, 2014
DESCRIPTION
"Add ipFrrTunnelType in ipFrrAltEntry
Modify ipFrrAltType"
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.
Added IPv6 objects in ipFrrProtectStats."
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."
::= { ipFrrProtectStats 2 }

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 3 }

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 4 }

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 5 }

ipv6FrrTotalRoutes OBJECT-TYPE
SYNTAX   Gauge32
MAX-ACCESS read-only
STATUS   current
DESCRIPTION
 "The number of IPv6 valid routes known by this entity."
::= { ipFrrProtectStats 6 }

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 IP FRR instance."

 ::= { ipFrrInstanceEntry 1 }

ipFrrInstanceProtocol OBJECT-TYPE
SYNTAX IANAipRouteProtocol
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This object specifies the protocol used by the IPFRR instance."

 ::= { 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 instance."

 ::= { 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,
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
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,
ipFrrTunnelType 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
loopFreeNH        (5),  -- loop free alternate using a configured tunnel toward the nexthop
loopFreeNNH       (6),  -- loop free alternate using a configured tunnel toward the nextnexthop
loopFreeTI        (7),  -- loop free alternate using topology independent algorithm
mrt               (8)   -- 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:

1. Other: Type not defined
2. Equal Cost: Primary path
3. Loop Free: Loop free alternate
4. Loop Free Remote: Remote loop free alternate
5. Loop Free NH: Loop free alternate using a configured tunnel toward the nexthop
6. Loop Free NNH: Loop free alternate using a configured tunnel toward the nextnexthop
7. Loop Free TI: Loop free alternate using topology independent algorithm
8. MRT: Maximally Redundant Trees"
equalCost : The alternate next-hop is another primary next-hop.

loopFreeConnected : loop free alternate (LFA as described in RFC5286)

loopFreeRemote : remote LFA (as described in draft-ietf-rtgwg-remote-lfa)

loopFreeNH : loop free alternate using a configured tunnel toward the next-hop (link protection only)

loopFreeNNH : loop free alternate using a configured tunnel toward the next-hop (node protection)

loopFreeTI : loop free alternate using topology independent algorithm

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 }

ipFrrTunnelType OBJECT-TYPE
SYNTAX INTEGER {
  none              (1), -- No tunnel used
  other             (2), -- type not defined
  LDP               (3), -- LDP tunnel
  IP                (4), -- IP based tunnel (GRE, IPIP, L2TP ...)
  SPRING MPLS       (5), -- SPRING tunnel using MPLS dataplane
  SPRING IPv6       (6), -- SPRING tunnel using IPv6 dataplane
  RSVP-TE           (7), -- RSVP-TE tunnel
  MULTI-TOPOLOGY LDP(8) -- LDP tunnel on another topology
}

MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The type of tunnel used to reach the alternate. The supported types are as follows:

none : No tunnel used

LDP : use LDP tunnel to reach the alternate (typically the case of rLFA)
IP : use IP based tunnel to reach the alternate

SPRING MPLS or SPRING IPv6 : use SPRING based tunnel (typically the case of TI-LFA)
RSVP-TE : use a RSVP-TE LSP to reach the alternate

MULTI-TOPOLOGY LDP : use an LDP tunnel based on another topology (typically the case of MRT)

::= { ipFrrAltEntry 5 }

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 6 }

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 7 }

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
::= { ipFrrAltEntry 8 }

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 9 }

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 10 }

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 11 }

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 12 }

-- 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 }

ipFrrMIBComplings
  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    InetSocketAddress { 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
STATUS current
DESCRIPTION
"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, Don Fedyk and Bruno Decraene.

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


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