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Multiprotocol Label Switching (MPLS) Traffic Engineering Management
Information Base for Fast Reroute
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This memo defines a portion of the Management Information Base for use with network management protocols in the Internet community. In particular, it describes managed objects used to support two fast reroute (FRR) methods for Multiprotocol Label Switching (MPLS) based traffic engineering (TE). The two methods are one-to-one backup method and facility backup method.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) containing objects used to manage Multiprotocol Label Switching (MPLS)-based fast rerouting features on MPLS Label Switching Routers as defined in [RFC4090]. This MIB module should be used in conjunction with [RFC3811], [RFC3812] and [RFC3813]. Comments should be made directly to the MPLS mailing list at mpls@ietf.org.

1.1. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119 [RFC2119].

2. Terminology

This document uses terminology from the document describing the Multiprotocol Label Switching Architecture [RFC3031] and from the document describing Fast Reroute Extensions to RSVP-TE for LSP Tunnels [RFC4090].

3. The Internet-Standard Management Framework

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

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB module objects are generally accessed through the Simple Network Management Protocol.
(SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

4. Overview of the MIB Modules

The specification [RFC4090] stipulates two different approaches to implementing MPLS TE fast reroute: one-to-one and facility backup.

We define three MIB modules to represent the respective components: general, one-to-one and facility backup. They are:

- MPLS-FRR-GENERAL-STD-MIB: Contains objects that apply to any MPLS LSR (Label Switching Router) implementing MPLS TE fast reroute functionality.
- MPLS-FRR-ONE2ONE-STD-MIB: Contains objects that apply to one-to-one backup method.
- MPLS-FRR-FACILITY-STD-MIB: Contains objects that apply to facility backup method.

Although [RFC4090] specifies that a node is able to support both fast reroute methods simultaneously, common practice has shown that operators choose to configure either one-to-one backup method or facility backup at any given time. So by dividing the MIB modules into three, we allow the developers to choose the MIB modules they want to implement depending on the method supported on that node.

4.1. MPLS-FRR-GENERAL-STD-MIB

This MIB module MUST be implemented if either of the fast reroute methods is implemented.

4.1.1 mplsFrrConstraintsTable

This table contains objects that apply to all LSRs implementing MPLS TE fast reroute functions. In particular, this table defines fast reroute constraints such as bandwidth for a tunnel instance to be protected by using backup LSPs (detour LSPs or bypass tunnels).

This table MUST be implemented at the ingress node of the protected TE tunnel instance to configure backup LSP setup.
4.1.2 mplsFrrTunnelARHopTable
This table extends mplsTunnelARHopTable (defined in the MPLS-TE-STD-MIB [RFC3812]) with fast-reroute objects which specify the local protection type or types of availability, as well as what type or types are actually in-use for each tunnel hop traversed by a protected TE tunnel.

4.1.3 Example of relationship between various tables of MPLS-FRR-GENERAL-STD-MIB

(R1)----(R2)----(R3)----(R4)---(R5)
    \       \       \\    /     \\
(R6)---(R7)------(R8)

Protected LSP: [R1->R2->R3->R4->R5]
R1’s Backup: [R1->R6->R7->R8->R3]

In the above topology the various tables will be populated as below on R1.

mplsFrrGeneralConstraintsTable
{
    mplsFrrGeneralConstraintsIfIndexOrZero = 10, -- Interface to protect
    mplsFrrGeneralConstraintsTunnelIndex = 1, -- Protecting tunnel
    mplsFrrGeneralConstraintsTunnelInstance = 0, -- Use any instance
    mplsFrrGeneralConstraintsProtectionType = 1, -- linkProtection
    mplsFrrGeneralConstraintsSetupPrio = 0,
    mplsFrrGeneralConstraintsHoldingPrio = 0,
    mplsFrrGeneralConstraintsInclAnyAffinity = 0,
    mplsFrrGeneralConstraintsInclAllAffinity = 0,
    mplsFrrGeneralConstraintsExclAnyAffinity = 0,
    mplsFrrGeneralConstraintsHopLimit = 0,
    mplsFrrGeneralConstraintsBandwidth = 0, -- best effort
    mplsFrrGeneralConstraintsStorageType = 2, -- volatile
    mplsFrrGeneralConstraintsRowStatus = 1, -- active
};

mplsFrrGeneralTunnelARHopEntry
{
    mplsFrrGeneralTunnelARHopSessionAttributeFlags = 5,
        -- SEStyleDesired | LocalProtectionDesired
}

mplsFrrGeneralTunnelARHopRROSubObjectFlags = 2
-- LocalProtectionInUse

4.2. MPLS-FRR-ONE2ONE-STD-MIB
This MIB module MUST be implemented if one-to-one backup fastreroute method is implemented.

4.2.1 mplsFrrOne2OnePlrTable
The mplsFrrOne2OnePlrTable contains information about Points of Local Repair (PLR) that initiated detour LSPs to protect tunnel instances. This table MUST be supported for LSRs implementing the one-to-one backup method. In these cases, the detour LSPs are reflected in the mplsFrrOne2OneDetourTable.

4.2.2 mplsFrrOne2OneDetourTable
The mplsFrrOne2OneDetourTable shows the detour LSPs in each node (ingress, transit and egress nodes). An entry of this table represents a detour LSP. Each detour is identified by the following indexes:
- mplsTunnelIndex [RFC3812]:
  set to the tunnel-id of an LSP protected by a detour.
- mplsTunnelInstance [RFC3812]: consists of two parts
  1) the higher 16 bits:  - protected TE tunnel instance
     - uniquely identifies a protected LSP within a tunnel.
  2) the lower 16 bits:  - detour instance
     - uniquely identifies a detour LSP of a protected TE tunnel instance. Multiple detours of the same protected LSP may go through the same node. In this case, the higher 16 bits of the tunnel instance object is used as a detour instance.
- ingress node’s LSR ID (mplsFrrOne2OnePlrTunnelIngressLSRId):
  set to the ingress node of an LSP protected by a detour.
- egress node’s LSR ID (mplsFrrOne2OnePlrTunnelEgressLSRId):
set to the egress node of an LSP protected by a detour. A detour LSP is also considered as an instance of a protected TE tunnel. Therefore, each detour LSP SHOULD have an entry in the mplsTunnelTable (defined in the MPLS-TE-STD-MIB[RFC3812]). The mplsTunnelTable entries are indexed using mplsTunnelIndex, mplsTunnelInstance, mplsTunnelIngressLSRId, and mplsTunnelEgressLSRId. Entries where the higher 16 bits of mplsTunnelInstance are set to zero represent detour TE tunnel instances. All other values of the higher 16 bits represent protected tunnel instances.

This table MUST be supported if one-to-one backup method is used.

4.2.3 Example of relationship between mplsFrrOne2OnePlrTable, mplsFrrOne2OneDetourTable and mplsTunnelTable

This section contains an example depicting the interrelationship between the mplsFrrOne2OnePlrTable, mplsFrrOne2OneDetourTable and mplsTunnelTable tables.

(R1)----(R2)----(R3)----(R4)---(R5)
 \       \       \    /\n(R6)---(R7)------(R8)

Protected LSP: [R1->R2->R3-->R4-->R5]
R1’s Backup: [R1->R6->R7-->R8-->R3]

In the above topology the various tables will be populated as below. In mplsFrrOne2OnePlrTable:

```c
{ mplsFrrOne2OnePlrTunnelIndex = 1,
mplsFrrOne2OnePlrTunnelDetourInstance = 6553601,
--
-- (100  << 16 | 1) = 6553601
-- 100 is the tunnel instance of the protected tunnel.
--
mplsFrrOne2OnePlrTunnelIngressLSRId = 192.0.2.1, --R1
mplsFrrOne2OnePlrTunnelEgressLSRId = 192.0.2.5, --R5
mplsFrrOne2OnePlrId = 192.0.2.1, --
-- R1 is PLR
mplsFrrOne2OnePlrSenderAddrType = ipv4(1),
```

mplsFrrOne2OnePlrSenderAddr = "192.0.2.1", -- R1
mplsFrrOne2OnePlrAvoidNodeAddrType = ipv4(1),
mplsFrrOne2OnePlrAvoidNodeAddr = "192.0.2.2",
        -- R1-R2(Avoid)

In mplsFrrOne2OneDetourTable:
{
    mplsFrrOne2OnePlrTunnelIndex = 1,
mplsFrrOne2OnePlrTunnelDetourInstance = 6553601,
    --
    -- (100 << 16 | 1) == 6553601
    --
    -- 1 is mplsTunnelInstance for the detour lsp
    -- from mplsTunnelTable. Marked by AAA below.
    -- Shift 16 to put this into the high order bits
    --
    -- 100 is mplsTunnelInstance for the protected tunnel
    -- from the mplsTunnelTable. Marked by BBB below.
    -- Need to OR the index value into low order bits
    -- To get all detour lps of a protected tunnel(of instance 100)
    -- we could do a snmpwalk of the mplsFrrOne2OneDetourEntry
    -- where mplsFrrOne2OnePlrTunnelIndex == 1
    -- mplsFrrOne2OnePlrTunnelDetourInstance == 6553600
    -- The first value would be:
    --   mplsFrrOne2OneDetourActive.1.6553601
    mplsFrrOne2OnePlrTunnelIngressLSRId = 192.0.2.1, --R1
    mplsFrrOne2OnePlrTunnelEgressLSRId = 192.0.2.3, --R3
    mplsFrrOne2OneDetourActive = false(2),
    mplsFrrOne2OneDetourMergedStatus = notMerged(1),
    mplsFrrOne2OneDetourMergedDetourInst = 0,
}

In mplsTunnelTable(protected tunnel entry):
{
    mplsTunnelIndex = 1,
mplsTunnelInstance = 100,-- Indicating protected tunnel
        -- AAA
    mplsTunnelIngressLSRId = 192.0.2.1,
mplsTunnelEgressLSRId = 192.0.2.5,
mplsTunnelName = "R1-R5",
mplsTunnelDescr = "R1-R5",
mplsTunnelIsIf = true (1),
mplsTunnelXCPPointer = 0.0,
mplsTunnelSignallingProto = none (1),
mplsTunnelSetupPrio = 0,
mplsTunnelHoldingPrio = 0,
mplsTunnelSessionAttributes = 0,
mplsTunnelLocalProtectInUse = true(1),
mplsTunnelResourcePointer = mplsTunnelResourceMaxRate.5,
mplsTunnelInstancePriority = 1,
mplsTunnelHopTableIndex = 1,
mplsTunnelIncludeAnyAffinity = 0,
mplsTunnelIncludeAllAffinity = 0,
mplsTunnelExcludeAnyAffinity = 0,
mplsTunnelPathInUse = 1,
mplsTunnelRole = head (1),
}

In mplsTunnelTable(detour lsp entry):
{
    mplsTunnelIndex = 1,
    mplsTunnelInstance = 1,
    -- Indicating detour lsp(higher 16 bits)
    -- BBB
    mplsTunnelIngressLSRId = 192.0.2.1,
    mplsTunnelEgressLSRId = 192.0.2.3,
    mplsTunnelName = "R1-R3",
    mplsTunnelDescr = "R1-R3",
    mplsTunnelIsIf = true (1),
    mplsTunnelXCPointer = 0.0,
    mplsTunnelSignallingProto = none (1),
    mplsTunnelSetupPrio = 0,
    mplsTunnelHoldingPrio = 0,
    mplsTunnelSessionAttributes = 0,
    mplsTunnelLocalProtectInUse = false (0),
    mplsTunnelResourcePointer = mplsTunnelResourceMaxRate.6,
    mplsTunnelInstancePriority = 1,
    mplsTunnelHopTableIndex = 1,
    mplsTunnelIncludeAnyAffinity = 0,
    mplsTunnelIncludeAllAffinity = 0,
    mplsTunnelExcludeAnyAffinity = 0,
    mplsTunnelPathInUse = 1,
    mplsTunnelRole = head (1),
}

4.3 MPLS-FRR-FACILITY-STD-MIB
This MIB module MUST be implemented if facility backup fastreroute method is implemented.
4.3.1 mplsFrrFacilityDBTable
The mplsFrrFacilityDBTable provides information about the fast reroute database for facility-based fast reroute. An entry is created in this table for each tunnel being protected by a backup tunnel. Backup tunnels are defined to protect the tunnels traversing an interface. The protecting tunnel will exist on the PLR as per [RFC4090]. Protected tunnels are the LSPs that traverse the protected link.

4.3.2 Example of relationship between various tables of MPLS-FRR-FACILITY-STD-MIB

```
[R1]---[R2]----[R3]-----[R4]---[R5]
  [R6]==[R7]

Protected LSP 1 : [R1->R2->R3->R4->R5]
Protecting Tunnel 999 : [R2->R6->R7->R4]
```

Facility Backup Technique
-------------------------

In the above topology, the following tables are populated at R2:

```c
{mplsFrrFacilityDBEntry
{mplsFrrFacilityProtectedIfIndex          = 10,
  mplsFrrFacilityProtectingTunnelIndex     = 999,
  mplsFrrFacilityBackupTunnelIndex         = 1,
  mplsFrrFacilityBackupTunnelInstance      = 0,
  mplsFrrFacilityBackupTunnelIngressLSRId  =
  mplsFrrFacilityBackupTunnelEgressLSRId   =
  mplsFrrFacilityDBNumProtectingTunnelOnIf = 1,
  mplsFrrFacilityDBNumProtectedLspOnIf     = 1,
  mplsFrrFacilityDBNumProtectedTunnels     = 1,
  mplsFrrFacilityDBProtectingTunnelStatus  = 1, -- active
  mplsFrrFacilityDBProtectingTunnelResvBw  = 0,
};
```

In mplsTunnelTable(protecting tunnel entry):
```
{mplsTunnelIndex              = 999, -- protecting tunnel index
  mplsTunnelInstance           = 0, -- head
};
```
mplsTunnelIngressLSRId = 192.0.2.2,  
mplsTunnelEgressLSRId = 192.0.2.4,  
mplsTunnelName = "R2-R4",  
mplsTunnelDescr = "R2-R4",  
mplsTunnelIsIf = true (1),  
mplsTunnelXCPointer = 0.0,  
mplsTunnelSignallingProto = none (1),  
mplsTunnelSetupPrio = 0,  
mplsTunnelHoldingPrio = 0,  
mplsTunnelSessionAttributes = 0,  
mplsTunnelLocalProtectInUse = false(1),  
mplsTunnelResourcePointer = mplsTunnelResourceMaxRate.5,  
mplsTunnelInstancePriority = 1,  
mplsTunnelHopTableIndex = 1,  
mplsTunnelIncludeAnyAffinity = 0,  
mplsTunnelIncludeAllAffinity = 0,  
mplsTunnelExcludeAnyAffinity = 0,  
mplsTunnelPathInUse = 1,  
mplsTunnelRole = head (1),  
}  
In mplsTunnelTable( Protected LSP ):  
{  
  mplsTunnelIndex = 1, -- protected lsp tunnel index  
  mplsTunnelInstance = 100,-- Specific instance protected  
  mplsTunnelIngressLSRId = 192.0.2.1,  
  mplsTunnelEgressLSRId = 192.0.2.5,  
  mplsTunnelName = "R1-R5",  
  mplsTunnelDescr = "R1-R5",  
  mplsTunnelIsIf = false(2),  
  mplsTunnelXCPointer = 0.0,  
  mplsTunnelSignallingProto = none (1),  
  mplsTunnelSetupPrio = 0,  
  mplsTunnelHoldingPrio = 0,  
  mplsTunnelSessionAttributes = 0,  
  mplsTunnelLocalProtectInUse = true(1),  
  mplsTunnelResourcePointer = mplsTunnelResourceMaxRate.6,  
  mplsTunnelInstancePriority = 1,  
  mplsTunnelHopTableIndex = 1,  
  mplsTunnelIncludeAnyAffinity = 0,  
  mplsTunnelIncludeAllAffinity = 0,  
  mplsTunnelExcludeAnyAffinity = 0,  
  mplsTunnelPathInUse = 1,  
  mplsTunnelRole = transit(2),  
}  

5. Handling IPv6 Tunnels
As described in [RFC4990], in order to support IPv6 MPLS tunnels in the mplsTunnelTable [RFC3812] all LSRs in the network MUST have a 32-bit LSR ID that can be used to identify the LSR with the existing mplsTunnelIngressLSRId and mplsTunnelEgressLSRId objects which are 32-bit long.

In this MIB, the following objects which refer to ingress/egress LSRs will have then the 32-bit LSR ID to support IPv6 tunnels:
- mplsFrrOne2OnePlrTunnelIngressLSRId and
- mplsFrrOne2OnePlrTunnelEgressLSRId
  objects of the mplsFrrOne2OnePlrTable,
- mplsFrrOne2OnePlrTunnelIngressLSRId and
- mplsFrrOne2OnePlrTunnelEgressLSRId
  objects of the mplsFrrOne2OneDetourTable
- mplsFrrFacilityBackupTunnelIngressLSRId and
- mplsFrrFacilityBackupTunnelEgressLSRId
  objects of the mplsFrrFacilityDBTable

6. MIB Module Definitions

6.1. MPLS-FRR-GENERAL-STD-MIB Module:
-- Start of MPLS-FRR-GENERAL-STD-MIB

MPLS-FRR-GENERAL-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
  MODULE-IDENTITY, OBJECT-TYPE, mib-2,
  Unsigned32,
  Counter32
FROM SNMPv2-SMI -- [RFC2578]

MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF -- [RFC2580]

RowStatus, StorageType
FROM SNMPv2-TC -- [RFC2579]

InterfaceIndexOrZero,
ifGeneralInformationGroup,
ifCounterDiscontinuityGroup
FROM IF-MIB -- [RFC2863]

MplsTunnelIndex, MplsTunnelInstanceIndex,
MplsBitRate,
MplsTunnelAffinity
FROM MPLS-TC-STD-MIB -- [RFC3811]

mplsTunnelGroup, mplsTunnelScalarGroup,
mplsTunnelARHopListIndex, mplsTunnelARHopIndex
FROM MPLS-TE-STD-MIB -- [RFC3812]
mplsFrrGeneralMIB MODULE-IDENTITY
LAST-UPDATED "201106141200Z" -- 14 Jun 2011 12:00:00 GMT
ORGANIZATION "Multiprotocol Label Switching (MPLS) Working Group"
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DESCRIPTION
"Copyright (c) 2011 IETF Trust and the persons identified
as the document authors. All rights reserved. This version
of this MIB module is part of RFC xxxx; See the RFC itself
for full legal notices.
-- RFC EDITOR: please replace xxxx with actual number
-- and remove this note.
This MIB module contains generic object definitions for
MPLS Traffic Engineering Fast Reroute as defined in
RFC4090."

-- Revision history.
REVISION
"201106141200Z" -- 14 Jun 2011 12:00:00 GMT
DESCRIPTION
"Initial version. Published as RFC xxxx."
-- RFC-editor pls fill in xxxx
::= { mib-2 XXX }
-- RFC-editor please fill in
-- yyy with value assigned by IANA,
-- see section 8.1 for details

-- Top level components of this MIB module.
mplsFrrGeneralObjects
OBJECT IDENTIFIER ::= { mplsFrrGeneralMIB 1 }

mplsFrrGeneralProtectionMethod OBJECT-TYPE
SYNTAX INTEGER {
  unknown(1),
  oneToOneBackup(2),
  facilityBackup(3)
}
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"Indicates which protection method is to be used for fast reroute on this device. Some devices may require a reboot if this variable is to take affect after being modified."
::= { mplsFrrGeneralObjects 1 }

mplsFrrGeneralIngressTunnelInstances OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of tunnel instances for either detour LSPs or bypass tunnels for which this LSR is the ingress."
::= { mplsFrrGeneralObjects 2 }

-- General FRR Table Section
--
-- These tables apply to both types of FRR
-- and should be implemented by all LSRs supporting FRR.
--
-- MPLS Fast Reroute Constraints table
mplsFrrGeneralConstraintsTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsFrrGeneralConstraintsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table shows detour LSP or bypass tunnel setup constraints."
::= { mplsFrrGeneralObjects 3 }

mplsFrrGeneralConstraintsEntry OBJECT-TYPE
SYNTAX MplsFrrGeneralConstraintsEntry
MAX-ACCESS not-accessible
STATUS current
An entry in this table represents detour LSP or bypass tunnel setup constraints for an interface or link to be protected by detour LSPs or a bypass tunnel. Once the LSP or tunnel instance to be protected is identified in the mplsTunnelTable, the corresponding mplsTunnelIfIndex value of that tunnel can be used to get the ifIndex of the underlying physical interface using the ifStackTable. That ifIndex of the underlying physical interface will be used as mplsFrrGeneralConstraintsIfIndexOrZero in this table to protect the LSPs or tunnel instances determined earlier.

It is recommended that ifIndex persistence be enabled across re-initializations. If persistence is not implemented then the value of mplsFrrGeneralConstraintsIfIndexOrZero in this table cannot be guaranteed across restarts and all entries in this table MUST NOT be persistent, or the values of mplsFrrGeneralConstraintsIfIndexOrZero MUST be reconstructed on restart.

SNMP Engines must only allow entries in this table to be created for tunnel instances that require fast-reroute as indicated by the presence of the FAST_REROUTE Object in the signaling for the LSP in question. An entry in this table can be created only if a corresponding entry in mplsTunnelTable exists with the same mplsTunnelIndex as mplsFrrGeneralConstraintsTunnelIndex.

Entries in this table are deleted when the corresponding entries in mplsTunnelTable are deleted. It is recommended that entries in this table be persisted across reboots. Entries indexed with mplsFrrGeneralConstraintsIfIndexOrZero set to 0 apply to all interfaces on this device for which the FRR feature can operate. If the mplsTunnelInstance object is set to a value of 0, it indicates that the mplsTunnelEntry contains a tunnel ingress. This is typically how configuration of this feature is performed on devices where the actual protection LSP used is left up to the protecting tunnel. However, in cases where static configuration is possible, any valid tunnel instance is possible; however, it is STRONGLY RECOMMENDED that the instance index SHOULD use the following convention to identify backup LSPs:
- lower 16 bits : protected tunnel instance
INDEX { mplsFrrGeneralConstraintsIfIndexOrZero, mplsFrrGeneralConstraintsTunnelIndex, mplsFrrGeneralConstraintsTunnelInstance }

::= { mplsFrrGeneralConstraintsTable 1 }

MplsFrrGeneralConstraintsEntry ::= SEQUENCE {
  mplsFrrGeneralConstraintsIfIndexOrZero   InterfaceIndexOrZero,
  mplsFrrGeneralConstraintsTunnelIndex     MplsTunnelIndex,
  mplsFrrGeneralConstraintsTunnelInstance  MplsTunnelInstanceIndex,
  mplsFrrGeneralConstraintsProtectionType  INTEGER,
  mplsFrrGeneralConstraintsSetupPrio       Unsigned32,
  mplsFrrGeneralConstraintsHoldingPrio     Unsigned32,
  mplsFrrGeneralConstraintsInclAnyAffinity MplsTunnelAffinity,
  mplsFrrGeneralConstraintsInclAllAffinity MplsTunnelAffinity,
  mplsFrrGeneralConstraintsExclAnyAffinity MplsTunnelAffinity,
  mplsFrrGeneralConstraintsExclAllAffinity MplsTunnelAffinity,
  mplsFrrGeneralConstraintsHopLimit        Unsigned32,
  mplsFrrGeneralConstraintsBandwidth       MplsBitRate,
  mplsFrrGeneralConstraintsStorageType     StorageType,
  mplsFrrGeneralConstraintsRowStatus       RowStatus
}

mplsFrrGeneralConstraintsIfIndexOrZero OBJECT-TYPE
SYNTAX        InterfaceIndexOrZero
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
  "Uniquely identifies an interface which a fast reroute
  protection tunnel is configured to potentially protect
  in the event of a fault. Entries with this index set to
  0 indicates that the protection tunnel configured protects
  all interfaces on this device (i.e.: node protection)."
::= { mplsFrrGeneralConstraintsEntry 1 }

mplsFrrGeneralConstraintsTunnelIndex OBJECT-TYPE
SYNTAX        MplsTunnelIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
  "Uniquely identifies a tunnel in the mplsTunnelTable which
  is configured to possibly protect the interface(s) specified
  by mplsFrrGeneralConstraintsIfIndexOrZero in the event of a
  fault."
REFERENCE "mplsTunnelTable from RFC3812."
::= { mplsFrrGeneralConstraintsEntry 2 }

mplsFrrGeneralConstraintsTunnelInstance OBJECT-TYPE
SYNTAX        MplsTunnelInstanceIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies an existing instance of this tunnel for which fast reroute is requested. Note that a value of 0 indicates that the configuration points at a tunnel head (as specified in RFC3812). This is typically how configuration of this feature is performed on devices where the actual protection LSP used is left up to the protecting tunnel. However, in cases where static configuration is possible, any valid tunnel instance is permissible. In these cases, it is recommended that the instance index follow the following convention as to make identification of backup LSPs easier:
- lower 16 bits: protected tunnel instance
- higher 16 bits: must be all zeros"

::= { mplsFrrGeneralConstraintsEntry 3 }

mplsFrrGeneralConstraintsProtectionType OBJECT-TYPE
SYNTAX INTEGER { linkProtection(1),
   nodeProtection(2) }
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Indicates type of the resource protection:
linkProtection(1) indicates that this tunnel is setup to protect a particular link’s resources.
nodeProtection(2) indicates that this tunnel is setup to protect an entire node from failure.
"
REFERENCE "Section 3 in RFC4090."
DEFVAL { nodeProtection }
::= { mplsFrrGeneralConstraintsEntry 4 }

mplsFrrGeneralConstraintsSetupPrio OBJECT-TYPE
SYNTAX Unsigned32 (0..7)
MAX-ACCESS read-create
STATUS current
DESCRIPTION "Indicates the setup priority of the detour LSP or bypass tunnel."
REFERENCE "Section 4.7 in RFC 3209"
DEFVAL { 7 }
::= { mplsFrrGeneralConstraintsEntry 5 }
mplsFrrGeneralConstraintsHoldingPrio OBJECT-TYPE
SYNTAX        Unsigned32 (0..7)
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
 "Indicates the holding priority for detour LSP
 or bypass tunnel."
REFERENCE
 "Section 4.7 RFC 3209"
DEFVAL { 0 }
::= { mplsFrrGeneralConstraintsEntry 6 }

mplsFrrGeneralConstraintsInclAnyAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
 "Indicates the include-any link constraint for the
detour LSP or bypass tunnel. A link satisfies the
include-any constraint if and only if the constraint
is zero, or the link and the constraint have a
resource class in common."
REFERENCE
 "Section 4.7 in RFC 3209"
DEFVAL { 0 }
::= { mplsFrrGeneralConstraintsEntry 7 }

mplsFrrGeneralConstraintsInclAllAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
 "Indicates the include-all link constraint for the
detour LSP or bypass tunnel. A link satisfies the
include-all constraint if and only if the link contains
all of the administrative groups specified in the
constraint."
REFERENCE
 "Section 4.7 in RFC 3209"
DEFVAL { 0 }
::= { mplsFrrGeneralConstraintsEntry 8 }

mplsFrrGeneralConstraintsExclAnyAffinity OBJECT-TYPE
SYNTAX        MplsTunnelAffinity
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
 "Indicates the exclude-any link constraint for the
detour LSP or bypass tunnel. A link satisfies the
exclude-any constraint if and only if the link contains
none of the administrative groups specified in the
mplsFrrGeneralConstraintsHopLimit OBJECT-TYPE
SYNTAX        Unsigned32(0..255)
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The maximum number of hops that the detour LSP or bypass tunnel may traverse."
REFERENCE
"Section 4.1 in RFC4090."
DEFVAL { 32 }
::= { mplsFrrGeneralConstraintsEntry 10 }

mplsFrrGeneralConstraintsBandwidth OBJECT-TYPE
SYNTAX        MplsBitRate
UNITS         "kilobits per second"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The maximum bandwidth specifically reserved for a detour LSP or bypass tunnel, in units of thousands of bits per second (Kbps). Note that setting this value to 0 indicates best-effort treatment."
DEFVAL { 0 }
::= { mplsFrrGeneralConstraintsEntry 11 }

mplsFrrGeneralConstraintsStorageType OBJECT-TYPE
SYNTAX        StorageType
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"The storage type for this configuration entry. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."
DEFVAL { volatile }
::= { mplsFrrGeneralConstraintsEntry 12 }

mplsFrrGeneralConstraintsRowStatus OBJECT-TYPE
SYNTAX        RowStatus
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
"This object is used to create, modify, and/or delete a row in this table. When a row in this table is in active(1) state, no objects in that row can be modified except mplsFrrGeneralConstraintsRowStatus and mplsFrrGeneralConstraintsStorageType."
::= { mplsFrrGeneralConstraintsEntry 13 }
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-- MPLS Fast Reroute Tunnel Actual Route Hop table

mplsFrrGeneralTunnelARHopTable OBJECT-TYPE
SYNTAX             SEQUENCE OF MplsFrrGeneralTunnelARHopEntry
MAX-ACCESS         not-accessible
STATUS             current
DESCRIPTION
"This table sparsely extends mplsTunnelARHopTable defined in the MPLS-TE-STD-MIB MIB module with fast-reroute objects. These objects specify the status of local protection including availability and active use, on a per-hop basis, of hops traversed by a protected tunnel."
::= { mplsFrrGeneralObjects 4 }

mplsFrrGeneralTunnelARHopEntry OBJECT-TYPE
SYNTAX             MplsFrrGeneralTunnelARHopEntry
MAX-ACCESS         not-accessible
STATUS             current
DESCRIPTION
"This entry contains fast-reroute protection status of a single protected tunnel hop."
INDEX {
    mplsTunnelARHopListIndex,
    mplsTunnelARHopIndex
}
 ::= { mplsFrrGeneralTunnelARHopTable 1 }

MplsFrrGeneralTunnelARHopEntry ::= SEQUENCE {
    mplsFrrGeneralTunnelARHopSessionAttributeFlags   BITS,
    mplsFrrGeneralTunnelARHopRROSubObjectFlags       BITS
}

mplsFrrGeneralTunnelARHopSessionAttributeFlags OBJECT-TYPE
SYNTAX            BITS { ARHopSessionAttrFlagsUnsupported(0),
LocalProtectionDesired(1),
LabelRecordingDesired(2),
SEStyleDesired(3),
BandwidthProtectionDesired(4),
NodeProtectionDesired(5) }
MAX-ACCESS                   read-only
STATUS                       current
DESCRIPTION
"This object indicates the desired values for the associated SESSION_ATTRIBUTE flags. Note that since this object is a BITS type, the bits may be set to indicate various desired combinations of the SESSION ATTRIBUTE flags. If SESSION_ATTRIBUTE flags are not supported, then this object contains the value of ARHopSessionAttrFlagsUnsupported(0)."
REFERENCE
MPLS Fast-reroute MIB Sep 1, 2011

"See section 4.3 of RFC4090 for SESSION_ATTRIBUTE flags."

 ::= { mplsFrrGeneralTunnelARHopEntry 1 }

mplsFrrGeneralTunnelARHopRROSubObjectFlags OBJECT-TYPE
SYNTAX BITS {
  ARHopRROSubObjectFlagsUnsupported(0),
  LocalProtectionAvailable(1),
  LocalProtectionInUse(2),
  BandwidthProtection(3),
  NodeProtection(4)
}

MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "This object indicates the flags that are currently in use by the associated RRO sub-object. Note that since this object is a BITS type, the bits may be set to indicate various combinations of the flags. If RRO sub-object is not supported, then this object contains the value of ARHopRROSubObjectFlagsUnsupported(0)."
REFERENCE
  "See section 4.4 of RFC4090."
 ::= { mplsFrrGeneralTunnelARHopEntry 2 }

-- Notifications
-- Module Conformance Statement
mplsFrrGeneralCompliances
  OBJECT IDENTIFIER ::= {mplsFrrGeneralConformance 1 }
mplsFrrGeneralGroups
  OBJECT IDENTIFIER ::= {mplsFrrGeneralConformance 2 }
mplsFrrGeneralModuleFullCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "Compliance statements for SNMP Engines that support the MPLS-FRR-GENERAL-STD-MIB MIB module."

MODULE IF-MIB -- The Interfaces Group MIB module, RFC 2863.
MANDATORY-GROUPS {
  ifGeneralInformationGroup,
  ifCounterDiscontinuityGroup
}

MODULE MPLS-TE-STD-MIB -- The MPLS Traffic Engineering -- MIB module, RFC 3812
MANDATORY-GROUPS {
  mplsTunnelGroup,
  mplsTunnelScalarGroup
}

MODULE -- this module
MANDATORY-GROUPS {
    mplsFrrGeneralScalarGroup,
    mplsFrrGeneralTunnelARHopGroup,
    mplsFrrGeneralConstraintsGroup
}
OBJECT mplsFrrGeneralConstraintsRowStatus
SYNTAX RowStatus { active(1), notInService(2) }
WRITE-SYNTAX RowStatus { active(1), notInService(2),
    createAndGo(4), destroy(6) }
DESCRIPTION "Support for createAndWait and notReady is not required."
 ::= { mplsFrrGeneralCompliances 1 }

mplsFrrGeneralModuleReadOnlyCompliance
MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance statements for SNMP Engines that support the MPLS-FRR-GENERAL-STD-MIB MIB module."

MODULE
MANDATORY-GROUPS {
    mplsFrrGeneralScalarGroup,
    mplsFrrGeneralTunnelARHopGroup,
    mplsFrrGeneralConstraintsGroup
}

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

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

OBJECT mplsFrrGeneralConstraintsHoldingPrio
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."
OBJECT mplsFrrGeneralConstraintsInclAnyAffinity
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsInclAllAffinity
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsExclAnyAffinity
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsBandwidth
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsProtectionType
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsHopLimit
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsStorageType
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
OBJECT mplsFrrGeneralConstraintsRowStatus
SYNTAX RowStatus { active(1) }
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."
 ::= { mplsFrrGeneralCompliances 2 }

-- Units of conformance
mplsFrrGeneralScalarGroup OBJECT-GROUP
OBJECTS {
mplsFrrGeneralIngressTunnelInstances,
mplsFrrGeneralProtectionMethod
}

DESCRIPTION
"Objects that are required to display general fast reroute information."
::= { mplsFrrGeneralGroups 1 }

mplsFrrGeneralConstraintsGroup OBJECT-GROUP
OBJECTS {
  mplsFrrGeneralConstraintsProtectionType,
  mplsFrrGeneralConstraintsSetupPrio,
  mplsFrrGeneralConstraintsHoldingPrio,
  mplsFrrGeneralConstraintsInclAnyAffinity,
  mplsFrrGeneralConstraintsInclAllAffinity,
  mplsFrrGeneralConstraintsExclAnyAffinity,
  mplsFrrGeneralConstraintsHopLimit,
  mplsFrrGeneralConstraintsBandwidth,
  mplsFrrGeneralConstraintsStorageType,
  mplsFrrGeneralConstraintsRowStatus
}

DESCRIPTION
"Objects that are required to configure fast reroute constraints at the ingress LSR of the tunnel that requires fast reroute service."
::= { mplsFrrGeneralGroups 2 }

mplsFrrGeneralTunnelARHopGroup OBJECT-GROUP
OBJECTS {
  mplsFrrGeneralTunnelARHopSessionAttributeFlags,
  mplsFrrGeneralTunnelARHopRRGSubObjectFlags
}

DESCRIPTION
"Objects that are required to present per hop fast-reroute protection status."
::= { mplsFrrGeneralGroups 3 }

END

-- End of MPLS-FRR-GENERAL-STD-MIB

6.2. MPLS-FRR-ONE2ONE-STD-MIB

-- Start of MPLS-FRR-ONE2ONE-STD-MIB

MPLS-FRR-ONE2ONE-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
MODULE-IDENTITY, OBJECT-TYPE, mib-2,
Integer32, Gauge32
FROM SNMPv2-SMI

MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF

TruthValue
FROM SNMPv2-TC

MplsTunnelIndex, MplsTunnelInstanceIndex,
MplsLsrIdentifier
FROM MPLS-TC-STD-MIB

InetAddressType, InetAddress
FROM INET-ADDRESS-MIB

mplsFrrGeneralScalarGroup, mplsFrrGeneralTunnelARHopGroup,
mplsFrrGeneralConstraintsGroup
FROM MPLS-FRR-GENERAL-STD-MIB

mplsFrrOne2OneMIB MODULE-IDENTITY

LAST-UPDATED "201106141200Z" -- 14 Jun 2011 12:00:00 GMT

ORGANIZATION "Multiprotocol Label Switching (MPLS) Working Group"

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DESCRIPTION

"Copyright (c) 2011 IETF Trust and the persons identified
as the document authors. All rights reserved. This version
of this MIB module is part of RFC xxxx; See the RFC itself
for full legal notices.

-- RFC EDITOR: please replace xxxx with actual number

This MIB module contains object definitions for MPLS Traffic Engineering one-to-one backup method for Fast Reroute as defined in RFC4090.

REVISED

201106141200Z -- 14 Jun 2011 12:00:00 GMT

DESCRIPTION

"Initial version. Published as RFC xxxx."

::= { mib-2 YYY } -- RFC-editor please fill in xxxx

-- yyy with value assigned by IANA,
-- see section 8.2 for details

-- Top level components of this MIB module.

mplsFrrOne2OneObjects OBJECT IDENTIFIER

::= { mplsFrrOne2OneMIB 1 }

mplsFrrOne2OneConformance OBJECT IDENTIFIER

::= { mplsFrrOne2OneMIB 2 }

-- Scalar objects defined for 1-to-1 style FRR

mplsFrrIncomingDetourLSPs OBJECT-TYPE
SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of detour LSPs entering the device."

::= { mplsFrrOne2OneObjects 1 }

mplsFrrOutgoingDetourLSPs OBJECT-TYPE
SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of detour LSPs leaving the device."

::= { mplsFrrOne2OneObjects 2 }

mplsFrrOne2OneDetourOriginating OBJECT-TYPE
SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of detour LSPs originating at this PLR."

::= { mplsFrrOne2OneObjects 3 }
mplsFrrActiveProtectedLSPs OBJECT-TYPE
SYNTAX        Gauge32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
"Indicates the number of LSPs currently protected by
the FRR feature where this device acts as the PLR
for those LSPs."
::= { mplsFrrOne2OneObjects 4 }

mplsFrrOne2OnePlrTable  OBJECT-TYPE
SYNTAX        SEQUENCE OF MplsFrrOne2OnePlrEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"This table shows a list of protected TE tunnels with
the corresponding protecting tunnel, as well as the PLR
where the protecting tunnel that initiated the detour
LSPs traverse this node."
::= { mplsFrrOne2OneObjects 5 }

mplsFrrOne2OnePlrEntry  OBJECT-TYPE
SYNTAX        MplsFrrOne2OnePlrEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry in this table represents a protected tunnel LSP
together with its detour tunnel instance. An entry in
this table is only created by an SNMP engine as instructed
by an MPLS signaling protocol. The entries of this table are present in all LSRs on the path
of the detour LSP. The objects mplsFrrOne2OnePlrSenderAddrType and mplsFrrOne2OnePlrSenderAddr can be modified after the row
is created. The objects mplsFrrOne2OnePlrTunnelIndex,
mplsFrrOne2OnePlrTunnelDetourInstance, mplsFrrOne2OnePlrTunnelIngressLSRId
and mplsFrrOne2OnePlrTunnelEgressLSRId have the same values as the objects mplsTunnelIndex, mplsTunnelInstance, mplsTunnelIngressLSRId and mplsTunnelEgressLSRId of the detour
tunnel instance created in the mplsTunnelTable
(MPLS-TE-STD-MIB).
The entries in this table will be deleted when the corresponding entries in the mplsTunnelTable are deleted.

INDEX { mplsFrrOne2OnePlrTable 1 }
::= { mplsFrrOne2OnePlrTable 1 }

MplsFrrOne2OnePlrEntry ::= SEQUENCE {
  mplsFrrOne2OnePlrTunnelIndex         MplsTunnelIndex,  
  mplsFrrOne2OnePlrTunnelDetourInstance  MplsTunnelInstanceIndex,  
  mplsFrrOne2OnePlrTunnelIngressLSRId   MplsLsrIdentifier,  
  mplsFrrOne2OnePlrTunnelEgressLSRId    MplsLsrIdentifier,  
  mplsFrrOne2OnePlrId             MplsLsrIdentifier,  
  mplsFrrOne2OnePlrSenderAddrType InetAddressType,  
  mplsFrrOne2OnePlrSenderAddr     InetAddress,  
  mplsFrrOne2OnePlrAvoidNodeAddrType InetAddressType,  
  mplsFrrOne2OnePlrAvoidNodeAddr     InetAddress
}

mplsFrrOne2OnePlrTunnelIndex OBJECT-TYPE
SYNTAX        MplsTunnelIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies a tunnel between a pair of LSRs from the mplsTunnelEntry."
::= { mplsFrrOne2OnePlrEntry 1 }

mplsFrrOne2OnePlrTunnelDetourInstance OBJECT-TYPE
SYNTAX        MplsTunnelInstanceIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies a detour instance of a tunnel from the mplsTunnelEntry.
- lower 16 bits : protected tunnel instance
- higher 16 bits: detour instance"
::= { mplsFrrOne2OnePlrEntry 2 }

mplsFrrOne2OnePlrTunnelIngressLSRId OBJECT-TYPE
SYNTAX MplsLsrIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The purpose of this object is to uniquely identify a tunnel within a network. When the MPLS signalling protocol is rsvp(2) this object SHOULD contain the same value as the Extended Tunnel Id field in the SESSION object. When the MPLS signalling protocol is crldp(3) this object SHOULD contain the same value as the Ingress LSR Router ID field in the LSPID TLV object. This value represents the head-end of the protected tunnel instance."
REFERENCE "Section 4.7 in RFC3209"
 ::= { mplsFrrOne2OnePlrEntry 3 }

mplsFrrOne2OnePlrTunnelEgressLSRId OBJECT-TYPE
SYNTAX MplsLsrIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Specifies the egress LSR ID of the protected tunnel instance."
 ::= { mplsFrrOne2OnePlrEntry 4 }

mplsFrrOne2OnePlrId OBJECT-TYPE
SYNTAX MplsLsrIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "This value represents the PLR that has initiated a detour LSP to protect a tunnel instance. This value is signalled via the DETOUR object defined in MPLS RSVP protocol."
REFERENCE "Section 4.2 of RFC4090"
 ::= { mplsFrrOne2OnePlrEntry 5 }

mplsFrrOne2OnePlrSenderAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-write
STATUS current
DESCRIPTION "Denotes the address type of this detour instance’s sender address."
DEFVAL { ipv4 } ::= { mplsFrrOne2OnePlrEntry 6 }
mplsFrrOne2OnePlrSenderAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The IP address of the PLR which has initiated the detour LSP. The type of this address is determined by the value of the mplsFrrOne2OnePlrSenderAddrType object."
 ::= { mplsFrrOne2OnePlrEntry 7 }
mplsFrrOne2OnePlrAvoidNodeAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Denotes the address type of the node that this PLR tries to avoid."
DEFVAL { ipv4 } ::= { mplsFrrOne2OnePlrEntry 8 }
mplsFrrOne2OnePlrAvoidNodeAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP address of the node that this PLR tries to avoid. The type of this address is determined by the value of the mplsFrrOne2OnePlrAvoidNodeAddrType object. This value is signalled via the DETOUR object defined in MPLS RSVP protocol."
REFERENCE "Section 4.2 of RFC4090"
 ::= { mplsFrrOne2OnePlrEntry 9 }
-- MPLS One-To-One Fast Reroute Detour table.
mplsFrrOne2OneDetourTable OBJECT-TYPE
SYNTAX SEQUENCE OF MplsFrrOne2OneDetourEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "This table shows detour LSPs."
 ::= { mplsFrrOne2OneObjects 6 }
mplsFrrOne2OneDetourEntry OBJECT-TYPE
SYNTAX MplsFrrOne2OneDetourEntry
An entry in this table represents a detour. An entry in this table is only created by an SNMP engine as instructed by an MPLS signaling protocol.

INDEX {
    mplsFrrOne2OnePlrTunnelIndex, -- from MPLS-TE-STD-MIB
    mplsFrrOne2OnePlrTunnelDetourInstanceId, -- mplsTunnelTable
    mplsFrrOne2OnePlrTunnelIngressLSRId, -- Tunnels must exist
    mplsFrrOne2OnePlrTunnelEgressLSRId -- a priori
}

 ::= { mplsFrrOne2OneDetourTable 1 }

MplsFrrOne2OneDetourEntry ::= SEQUENCE {
    mplsFrrOne2OneDetourActive TruthValue,
    mplsFrrOne2OneDetourMergedStatus INTEGER,
    mplsFrrOne2OneDetourMergedDetourInst MplsTunnelInstanceIndex
}

mplsFrrOne2OneDetourActive OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates whether or not the main LSP has switched over to this detour LSP.
If the value of this object is 'true', then it means that the main LSP has switched over to this detour LSP. Otherwise it contains a value of 'false'.
This is only relevant for detours originated by this node."

 ::= { mplsFrrOne2OneDetourEntry 1 }

mplsFrrOne2OneDetourMergedStatus OBJECT-TYPE
SYNTAX INTEGER { notMerged(1),
    mergedWithProtectedTunnel(2),
    mergedWithDetour(3) }
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This value represents whether or not this detour is merged.
This value is set to notMerged(1) if this detour is not merged.
This value is set to mergedWithProtectedTunnel(2) if this detour is merged with the protected tunnel. This value is mergedWithDetour(3) if this detour is merged with another detour protecting the same tunnel."
::= { mplsFrrOne2OneDetourEntry 2 }
mplsFrrOne2OneDetourMergedDetourInst OBJECT-TYPE
SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "This value represents the mplsTunnelInstance of the detour
with which this detour is merged. This object is only valid
when mplsFrrOne2OneDetourMergedStatus is set to
mergedWithDetour(3).
- lower 16 bits : protected tunnel instance
- higher 16 bits: detour instance"
 ::= { mplsFrrOne2OneDetourEntry 3 }

-- Module Conformance Statement

mplsFrrOne2OneCompliances
OBJECT IDENTIFIER ::= {mplsFrrOne2OneConformance 1 }
mplsFrrOne2OneGroups
OBJECT IDENTIFIER ::= {mplsFrrOne2OneConformance 2 }
mplsFrrOne2OneModuleFullCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
 "Compliance statements for SNMP Engines that support the
MPLS-FRR-ONE2ONE-STD-MIB MIB module."
MODULE MPLS-FRR-GENERAL-STD-MIB -- MPLS FRR Generic MIB
MANDATORY-GROUPS {
  mplsFrrGeneralScalarGroup,
  mplsFrrGeneralTunnelARHopGroup,
  mplsFrrGeneralConstraintsGroup
}

MODULE -- this module
MANDATORY-GROUPS {
  mplsFrrOne2OneScalarsGroup,
  mplsFrrOne2OnePLRDetourGroup,
  mplsFrrOne2OnePlrGroup
}
 ::= { mplsFrrOne2OneCompliances 1 }
mplsFrrOne2OneModuleReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance statements for SNMP Engines that support the
MPLS-FRR-ONE2ONE-STD-MIB MIB module."

MODULE
  MANDATORY-GROUPS {
    mplsFrrOne2OneScalarsGroup,
    mplsFrrOne2OnePLRDetourGroup,
    mplsFrrOne2OnePlrGroup
  }
  -- mplsFrrOne2OnePlrTable
OBJECT    mplsFrrOne2OnePlrSenderAddrType
MIN-ACCESS read-only
DESCRIPTION
  "Write access is not required."
OBJECT    mplsFrrOne2OnePlrSenderAddr
MIN-ACCESS read-only
DESCRIPTION
  "Write access is not required."
::= { mplsFrrOne2OneCompliances 2 }

-- Units of conformance
mplsFrrOne2OneScalarsGroup OBJECT-GROUP
OBJECTS {
  mplsFrrIncomingDetourLSPs,
  mplsFrrOutgoingDetourLSPs,
  mplsFrrOne2OneDetourOriginating,
  mplsFrrActiveProtectedLSPs
}
STATUS        current
DESCRIPTION
  "Objects that are required for general One-2-One PLR
  information."
::= { mplsFrrOne2OneGroups 1 }

mplsFrrOne2OnePLRDetourGroup OBJECT-GROUP
OBJECTS {
  mplsFrrOne2OneDetourActive,
  mplsFrrOne2OneDetourMergedStatus,
  mplsFrrOne2OneDetourMergedDetourInst
}
STATUS        current
DESCRIPTION
  "Objects that are required to present the detour LSP
  information at the detour ingress, transit and egress LSRs."
::= { mplsFrrOne2OneGroups 2 }

mplsFrrOne2OnePlrGroup OBJECT-GROUP
OBJECTS {
    mplsFrrOne2OnePlrSenderAddrType,
    mplsFrrOne2OnePlrSenderAddr,
    mplsFrrOne2OnePlrAvoidNodeAddrType,
    mplsFrrOne2OnePlrAvoidNodeAddr
}
STATUS current
DESCRIPTION
"Objects that are required to represent the FRR
One-2-One PLR information."
 ::= { mplsFrrOne2OneGroups 3 }
END

-- End of MPLS-FRR-ONE2ONE-STD-MIB

6.3. MPLS-FRR-FACILITY-STD-MIB
-- Start of MPLS-FRR-FACILITY-STD-MIB
MPLS-FRR-FACILITY-STD-MIB DEFINITIONS ::= BEGIN
IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, mib-2,
    Integer32, NOTIFICATION-TYPE, Gauge32
    FROM SNMPv2-SMI                            -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP,
    NOTIFICATION-GROUP
    FROM SNMPv2-CONF                           -- [RFC2580]
    TruthValue
    FROM SNMPv2-TC                             -- [RFC2579]
    InterfaceIndex
    FROM IF-MIB                                -- [RFC2863]
    MplsTunnelIndex, MplsTunnelInstanceIndex,
    MplsLsrIdentifier, MplsBitRate
    FROM MPLS-TC-STD-MIB                       -- [RFC3811]
    mplsFrrGeneralScalarGroup, mplsFrrGeneralTunnelARHopGroup,
    mplsFrrGeneralConstraintsGroup
    FROM MPLS-FRR-GENERAL-STD-MIB
;
mplsFrrFacilityMIB MODULE-IDENTITY
LAST-UPDATED "201106141200Z" -- 14 Jun 2011 12:00:00 GMT
ORGANIZATION
This MIB module contains object definitions for
MPLS Traffic Engineering facility backup method for
Fast Reroute as defined in RFC4090."

-- Revision history.
REVISION
"201106141200Z" -- 14 Jun 2011 12:00:00 GMT
DESCRIPTION
"Initial version. Published as RFC xxxx."
-- RFC-editor pls fill in yyyy
 ::= { mib-2 ZZZ } -- RFC-editor please fill in
    -- yyyy with value assigned by IANA,
    -- see section 8.3 for details

-- Top level components of this MIB module.
  mplsFrrFacilityNotifications OBJECT IDENTIFIER
    ::= { mplsFrrFacilityMIB 0 }
  mplsFrrFacilityObjects OBJECT IDENTIFIER
    ::= { mplsFrrFacilityMIB 1 }
  mplsFrrFacilityConformance OBJECT IDENTIFIER
    ::= { mplsFrrFacilityMIB 2 }
-- Scalar objects defined for Facility Backup style FRR
mplsFrrConfiguredInterfaces OBJECT-TYPE
  SYNTAX        Integer32(0..2147483647)
  MAX-ACCESS    read-only
  STATUS        current
  DESCRIPTION
    "Indicates the number of MPLS interfaces configured for
    protection."
  DEFVAL { 0 }
 ::= { mplsFrrFacilityObjects 1 }
mplsFrrActiveInterfaces OBJECT-TYPE
  SYNTAX        Gauge32
  MAX-ACCESS    read-only
  STATUS        current
  DESCRIPTION
    "Indicates the number of interfaces currently being
    protected. This value MUST be less than or equal
    to mplsFrrConfiguredInterfaces."
  DEFVAL { 0 }
 ::= { mplsFrrFacilityObjects 2 }
mplsFrrConfiguredBypassTunnels OBJECT-TYPE
  SYNTAX        Gauge32
  MAX-ACCESS    read-only
  STATUS        current
  DESCRIPTION
    "Indicates the number of bypass tunnels configured to
    protect TE tunnels on this LSR."
  DEFVAL { 0 }
 ::= { mplsFrrFacilityObjects 3 }
mplsFrrActiveBypassTunnels OBJECT-TYPE
  SYNTAX        Gauge32
  MAX-ACCESS    read-only
  STATUS        current
  DESCRIPTION
    "Indicates the number of bypass tunnels indicated in
    mplsFrrConfiguredBypassTunnels whose operStatus
    is up(1) indicating that they are currently protecting
    TE tunnels on this LSR."
  DEFVAL { 0 }
 ::= { mplsFrrFacilityObjects 4 }
mplsFrrFacilityNotificationsEnabled OBJECT-TYPE
SYNTAX            TruthValue
MAX-ACCESS        read-write
STATUS            current
DESCRIPTION
"Enables or disables FRR notifications defined in this
MIB module. Notifications are disabled by default.
This object is needed to control the notifications
emitted by this implementation."
DEFVAL { false }
::= { mplsFrrFacilityObjects 5 }

mplsFrrFacilityNotificationsMaxRate OBJECT-TYPE
SYNTAX            Gauge32
UNITS        "Notifications per Second"
MAX-ACCESS        read-write
STATUS            current
DESCRIPTION
"This variable indicates the maximum number of
notifications issued per second. If events occur
more rapidly, the implementation may simply fail to
emit these notifications during that period, or may
queue them until an appropriate time. In case the
implementation chooses to drop the events during
throttling instead of queuing them to be sent at a later
time, it is assumed that there will be no indication
that events are being thrown away.
A value of 0 means no throttling is applied and
events may be generated at the rate at which they occur."
DEFVAL       { 0 }
::= { mplsFrrFacilityObjects 6 }

--
-- Facility-based FRR-specific Tables
--
-- Tables in this section pertain only to the facility-
-- based style of FRR.
--

mplsFrrFacilityDBTable OBJECT-TYPE
SYNTAX            SEQUENCE OF MplsFrrFacilityDBEntry
MAX-ACCESS        not-accessible
STATUS            current
DESCRIPTION
"The mplsFrrFacilityDBTable provides information about the
fast reroute database. Each entry belongs to a protected
interface, protecting backup tunnel and protected tunnel.
MPLS interfaces defined on this node are protected by
backup tunnels and are indicated by the index
mplsFrrFacilityProtectedIfIndex. If the interface index is
set to 0, this indicates that the remaining indexes apply
to all configured protected interfaces.

Note that all objects in this table are read-only and
if new objects are added to this table, they should also
be read-only.

It is recommended that ifIndex persistence be enabled
across re-initializations.
If persistence is not implemented then the value of
mplsFrrFacilityProtectedIfIndex in this
table cannot be guaranteed across restarts and all entries
in this table MUST NOT be persistent, or the values of
mplsFrrFacilityProtectedIfIndex MUST be reconstructed
on restart.
It is recommended that entries in this table be persisted
across reboots.
The protecting tunnel is indicated by the
index mplsFrrFacilityProtectingTunnelIndex and
represents a valid mplsTunnelEntry. Note that the tunnel
instance index of the protecting tunnel may be set to 0
which indicates the tunnel head interface for the
protecting tunnel, as per RFC3812, but it may also be
defined using the following semantics:
- lower 16 bits : protected tunnel instance
- higher 16 bits: must be all zeros

::= { mplsFrrFacilityObjects 7 }
mplsFrrFacilityDBEntry OBJECT-TYPE
SYNTAX        MplsFrrFacilityDBEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"An entry in the mplsFrrFacilityDBTable represents a single
protected LSP, protected by a backup tunnel on a
specific protected interface, or if the interface
index is set to 0, on all interfaces. Note that for
brevity, managers should consult the mplsTunnelTable
present in the MPLS-TE-STD-MIB MIB module for
additional information about the protecting and protected
tunnels, and the ifEntry in the IF-MIB MIB module
for the protected interface."

INDEX {
  mplsFrrFacilityProtectedIfIndex,  -- protected ifIndex
  mplsFrrFacilityProtectingTunnelIndex,-- protecting TE tun
  mplsFrrFacilityBackupTunnelIndex,  -- protected TE tun
  mplsFrrFacilityBackupTunnelInstance, -- LSP
  mplsFrrFacilityBackupTunnelIngressLSRId,
  mplsFrrFacilityBackupTunnelEgressLSRId }

::= { mplsFrrFacilityDBTable 1 }
MplsFrrFacilityDBEntry ::= SEQUENCE {
  mplsFrrFacilityProtectedIfIndex          InterfaceIndex,
  mplsFrrFacilityProtectingTunnelIndex     MplsTunnelIndex,
  mplsFrrFacilityBackupTunnelIndex         MplsTunnelIndex,
  mplsFrrFacilityBackupTunnelInstance      MplsTunnelInstanceIndex,
  mplsFrrFacilityBackupTunnelIngressLSRId  MplsLsrIdentifier,
  mplsFrrFacilityBackupTunnelEgressLSRId   MplsLsrIdentifier,
  mplsFrrFacilityDBNumProtectingTunnelOnIf Gauge32,
  mplsFrrFacilityDBNumProtectedLspOnIf     Gauge32,
  mplsFrrFacilityDBNumProtectedTunnels     Gauge32,
  mplsFrrFacilityDBProtectingTunnelStatus  INTEGER,
  mplsFrrFacilityDBProtectingTunnelResvBw MplsBitRate
}

mplsFrrFacilityProtectedIfIndex OBJECT-TYPE
SYNTAX        InterfaceIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies the interface configured for FRR protection. If this object is set to 0, this indicates that the remaining indexing combinations for this row apply to all interfaces on this device for which the FRR feature can operate."
::= { mplsFrrFacilityDBEntry 1 }

mplsFrrFacilityProtectingTunnelIndex OBJECT-TYPE
SYNTAX        MplsTunnelIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies the mplsTunnelEntry primary index for the tunnel head interface designated to protect the interface as specified in the mplsFrrFacilityProtectedIfIndex (and all of the tunnels using this interface). Note that the corresponding mplsTunnelInstance MUST BE 0 as per the indexing convention stipulated."
REFERENCE
"Section 6.1 of RFC3812"
::= { mplsFrrFacilityDBEntry 2 }

mplsFrrFacilityBackupTunnelIndex OBJECT-TYPE
SYNTAX        MplsTunnelIndex
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"Uniquely identifies the mplsTunnelEntry primary index for the TE tunnel LSP being protected on the interface as specified by mplsFrrFacilityProtectedIfIndex."
::= { mplsFrrFacilityDBEntry 3 }

mplsFrrFacilityBackupTunnelInstance OBJECT-TYPE
SYNTAX MplsTunnelInstanceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Uniquely identifies the mplsTunnelEntry secondary index
for the TE tunnel LSP being protected on the
interface as specified by mplsFrrFacilityProtectedIfIndex."
 ::= { mplsFrrFacilityDBEntry 4 }

mplsFrrFacilityBackupTunnelIngressLSRId OBJECT-TYPE
SYNTAX MplsLsrIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Uniquely identifies the mplsTunnelEntry third index
for the TE tunnel LSP being protected on the
interface as specified by mplsFrrFacilityProtectedIfIndex."
REFERENCE "Section 6.1 of RFC3812"
 ::= { mplsFrrFacilityDBEntry 5 }

mplsFrrFacilityBackupTunnelEgressLSRId OBJECT-TYPE
SYNTAX MplsLsrIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Uniquely identifies the mplsTunnelEntry fourth index
for the TE tunnel LSP being protected on the
interface as specified by mplsFrrFacilityProtectedIfIndex."
 ::= { mplsFrrFacilityDBEntry 6 }

mplsFrrFacilityDBNumProtectingTunnelOnIf OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of backup tunnels protecting the
interface specified by mplsFrrFacilityProtectedIfIndex."
 ::= { mplsFrrFacilityDBEntry 7 }

mplsFrrFacilityDBNumProtectedLspOnIf OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of LSPs currently being protected on
the interface specified by mplsFrrFacilityProtectedIfIndex."
 ::= { mplsFrrFacilityDBEntry 8 }
mplsFrrFacilityDBNumProtectedTunnels OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of tunnels protected on the interface specified by mplsFrrFacilityProtectedIfIndex."
::= { mplsFrrFacilityDBEntry 9 }

mplsFrrFacilityDBProtectingTunnelStatus OBJECT-TYPE
SYNTAX INTEGER {
active(1),
ready(2),
partial(3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Specifies the state of the protecting tunnel as specified by mplsFrrFacilityProtectingTunnelIndex.
active  This tunnel’s label has been placed in the LFIB and is ready to be applied to incoming packets.
ready -  This tunnel’s label entry has been created but is not yet in the LFIB.
partial - This tunnel’s label entry has not been fully created."
::= { mplsFrrFacilityDBEntry 10 }

mplsFrrFacilityDBProtectingTunnelResvBw OBJECT-TYPE
SYNTAX MplsBitRate
UNITS "kilobits per second"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Specifies the amount of bandwidth in units of ‘1,000 bits per second’, actually reserved by the protecting tunnel for facility backup purposes. This value is repeated here from the MPLS-TE-STD-MIB MIB module because the tunnel entry will reveal the bandwidth reserved by the signaling protocol, which is typically 0 for backup tunnels so as to not over-book bandwidth. However, internal reservations are typically made on the PLR, thus this value should be revealed here as it is often different from mplsTunnelResourceMeanRate found in the MPLS-TE-STD-MIB MIB module."

-- Notifications
mplsFrrFacilityInitialBackupTunnelInvoked  NOTIFICATION-TYPE
  OBJECTS { mplsFrrFacilityDBNumProtectingTunnelOnIf,
            mplsFrrFacilityDBNumProtectedLspOnIf,
            mplsFrrFacilityDBNumProtectedTunnels,
            mplsFrrFacilityDBProtectingTunnelStatus,
            mplsFrrFacilityDBProtectingTunnelResvBw }
  STATUS      current
  DESCRIPTION
  "This notification is generated when a tunnel running over an
  interface as specified in the mplsFrrConstraintsTable is
  initially protected by the backup tunnel also specified in the
  mplsFrrConstraintsTable. In some implementations there may be
  a difference between when the control plane triggers
  this notification and when the hardware is programmed to
  utilize the protection path. Due to the urgency of this
  operation, it is acceptable for the control plane to
  either issue this notification before or after it programs
  the hardware. In cases where it is the latter approach,
  the notification MUST be sent immediately after the
  data plane has been altered.
  This notification should not be generated
  for each subsequent tunnel that is backed up by the FRR feature
  on this LSR, as this may result in potential scaling issues
  with regard to LSR performance and network load. Note also
  that notifications MUST be generated in accordance with the
  mplsFrrNotificationsMaxRate."
  ::= { mplsFrrFacilityNotifications 1 }

mplsFrrFacilityFinalTunnelRestored NOTIFICATION-TYPE
  OBJECTS { mplsFrrFacilityDBNumProtectingTunnelOnIf,
            mplsFrrFacilityDBNumProtectedLspOnIf,
            mplsFrrFacilityDBNumProtectedTunnels,
            mplsFrrFacilityDBProtectingTunnelStatus,
            mplsFrrFacilityDBProtectingTunnelResvBw }
  STATUS      current
  DESCRIPTION
  "This notification is generated when the final tunnel that is
  being protected by a backup tunnel as specified in the
  mplsFrrConstraintsTable is restored to normal operation. This
  notification should not be generated for each restored tunnel,
  as this may result in potential scaling issues with regard to
  LSR performance and network load. Note also that
notifications MUST be generated in accordance with the mplsFrrNotificationsMaxRate."
::= { mplsFrrFacilityNotifications 2 }

-- Module Conformance Statement
mplsFrrFacilityCompliances
OBJECT IDENTIFIER ::= {mplsFrrFacilityConformance 1 }

mplsFrrFacilityGroups
OBJECT IDENTIFIER ::= {mplsFrrFacilityConformance 2 }

mplsFrrFacilityModuleFullCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance statements for SNMP Engines that support the
MPLS-FRR-FACILITY-STD-MIB MIB module."

MODULE MPLS-FRR-GENERAL-STD-MIB  -- MPLS FRR Generic MIB
MANDATORY-GROUPS {
  mplsFrrGeneralScalarGroup,
  mplsFrrGeneralTunnelARHopGroup,
  mplsFrrGeneralConstraintsGroup
}

MODULE -- this module
MANDATORY-GROUPS {
  mplsFrrFacilityScalarGroup,
  mplsFrrFacilityDBGroup,
  mplsFrrFacilityNotificationsGroup
}
::= { mplsFrrFacilityCompliances 1 }

mplsFrrFacilityModuleReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance statements for SNMP Engines that support
MPLS-FRR-FACILITY-STD-MIB MIB module."

MODULE MPLS-FRR-GENERAL-STD-MIB  -- MPLS FRR Generic MIB
MANDATORY-GROUPS {
  mplsFrrGeneralScalarGroup,
  mplsFrrGeneralTunnelARHopGroup,
  mplsFrrGeneralConstraintsGroup
}

MODULE -- this module
MANDATORY-GROUPS {
  mplsFrrFacilityScalarGroup,
  mplsFrrFacilityDBGroup,
  mplsFrrFacilityNotificationsGroup
}

::= { mplsFrrFacilityCompliances 2 }
-- Units of conformance
mplsFrrFacilityScalarGroup OBJECT-GROUP
  OBJECTS { mplsFrrConfiguredInterfaces,
    mplsFrrActiveInterfaces,
    mplsFrrConfiguredBypassTunnels,
    mplsFrrActiveBypassTunnels,
    mplsFrrFacilityNotificationsEnabled,
    mplsFrrFacilityNotificationsMaxRate
  }
  STATUS        current
  DESCRIPTION
  "Objects that are required to represent the FRR
  Facility Route Database information."
::= { mplsFrrFacilityGroups 1 }
mplsFrrFacilityDBGroup OBJECT-GROUP
  OBJECTS { mplsFrrFacilityDBNumProtectingTunnelOnIf,
    mplsFrrFacilityDBNumProtectedLspOnIf,
    mplsFrrFacilityDBNumProtectedTunnels,
    mplsFrrFacilityDBProtectingTunnelStatus,
    mplsFrrFacilityDBProtectingTunnelResvBw
  }
  STATUS        current
  DESCRIPTION
  "Objects that are required to represent the FRR
  Facility Route Database information."
::= { mplsFrrFacilityGroups 2 }
mplsFrrFacilityNotificationsGroup NOTIFICATION-GROUP
  NOTIFICATIONS { mplsFrrFacilityInitialBackupTunnelInvoked,
    mplsFrrFacilityFinalTunnelRestored
  }
  STATUS        current
  DESCRIPTION
  "Objects that are required to represent FRR notifications."
::= { mplsFrrFacilityGroups 3 }
END
7. Security Considerations

It is clear that these MIB modules are potentially useful for monitoring of MPLS LSRs supporting fast reroute. This MIB module can also be used for configuration of certain objects, and anything that can be configured can be incorrectly configured, with potentially disastrous results.

There are a number of management objects defined in these MIB modules with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

- The `mplsFrrGeneralConstraintsTable` (mplsFrrGeneralConstraintsProtectionType, mplsFrrGeneralConstraintsSetupPrio, etc.) and some objects in the `mplsFrrScalarGroup` (mplsFrrGeneralProtectionMethod, mplsFrrFacilityNotificationsEnabled, etc.) contain objects which may be used to provision MPLS fast reroute features. Unauthorized access to these objects could result in disruption of traffic on the network.

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

- The `mplsFrrOne2OnePlrTable` (mplsFrrOne2OnePlrSenderAddr, mplsFrrOne2OnePlrAvoidNodeAddr, etc.), `mplsFrrOne2OneDetourTable` (mplsFrrOne2OneDetourActive, mplsFrrOne2OneDetourMergedDetourInst, etc.), and `mplsFrrGeneralTunnelARHopTable` (mplsFrrGeneralTunnelARHopSessionAttributeFlags, mplsFrrGeneralTunnelARHopRROSubObjectFlags, etc.) tables and some objects contained in the `mplsFrrScalarGroup` (mplsFrrGeneralProtectionMethod, mplsFrrActiveInterfaces, etc.) collectively show the MPLS fast reroute interfaces, tunnels, and other associated fast reroute feature configurations as well as their linkages to other MPLS-related configuration and/or performance statistics. Administrators not wishing to reveal this information should
consider these objects sensitive/vulnerable and take precautions so they are not revealed.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in these MIB modules.

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 these MIB modules, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

8. IANA Considerations

The MIB modules in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

8.1. IANA Considerations for MPLS-FRR-GENERAL-STD-MIB

The IANA is requested to assign { mib-2 XXX } to the MPLS-FRR-GENERAL-STD-MIB MIB module specified in this document.

8.2. IANA Considerations for MPLS-FRR-ONE2ONE-STD-MIB

The IANA is requested to assign { mib-2 YYY } to the MPLS-FRR-ONE2ONE-STD-MIB MIB module specified in this document.

8.3. IANA Considerations for MPLS-FRR-FACILITY-STD-MIB

The IANA is requested to assign { mib-2 ZZZ } to the MPLS-FRR-FACILITY-STD-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 "XXX", "YYY" and "ZZZ" under the mib-2 subtree and to record the assignments in the SMI Numbers registry. When the assignments have been made, the RFC Editor is asked to replace "XXX", "YYY" and "ZZZ" (here and in the MIB modules) with the assigned values and to remove this note.
9. Acknowledgments
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10.2 Informative References


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