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Multiprotocol Label Switching (MPLS) Traffic Engineering Management  
Information Base for Fast Reroute  
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#### Abstract

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.

#### Table of Contents

|                       |   |                    |
|-----------------------|---|--------------------|
| <a href="#">1.</a>    | Introduction.....   | <a href="#">2</a>  |
| <a href="#">1.1.</a>  | Conventions Used in This Document.....  | <a href="#">2</a>  |
| <a href="#">2.</a>    | Terminology.....  | <a href="#">2</a>  |
| <a href="#">3.</a>    | The Internet-Standard Management Framework.....   | <a href="#">3</a>  |
| <a href="#">4.</a>    | Overview of the MIB Modules.....  | <a href="#">3</a>  |
| <a href="#">4.1.</a>  | MPLS-FRR-GENERAL-STD-MIB.....   | <a href="#">3</a>  |
| <a href="#">4.1.1</a> | mplsFrrConstraintsTable.....  | <a href="#">4</a>  |
| <a href="#">4.1.2</a> | mplsFrrTunnelARHopTable.....  | <a href="#">5</a>  |
| <a href="#">4.1.3</a> | <b>Example of relationship between various tables of<br/>MPLS-FRR-GENERAL-STD-MIB.....</b>                            | <a href="#">5</a>  |
| <a href="#">4.2.</a>  | MPLS-FRR-ONE2ONE-STD-MIB.....   | <a href="#">6</a>  |
| <a href="#">4.2.1</a> | mplsFrrOne2OnePlrTable.....   | <a href="#">6</a>  |
| <a href="#">4.2.2</a> | mplsFrrOne2OneDetourTable.....  | <a href="#">6</a>  |
| <a href="#">4.2.3</a> | <b>Example of relationship between mplsFrrOne2OnePlrTable,<br/>mplsFrrOne2OneDetourTable and mplsTunnelTable.....</b> | <a href="#">7</a>  |
| <a href="#">4.3</a>   | MPLS-FRR-FACILITY-STD-MIB.....  | <a href="#">9</a>  |
| <a href="#">4.3.1</a> | mplsFrrFacilityDBTable.....   | <a href="#">10</a> |
| <a href="#">4.3.2</a> | <b>Example of relationship between various tables of<br/>MPLS-FRR-FACILITY-STD-MIB.....</b>                           | <a href="#">10</a> |
| <a href="#">5.</a>    | Handling IPv6 Tunnels.....  | <a href="#">11</a> |
| <a href="#">6.</a>    | MIB Module Definitions.....   | <a href="#">12</a> |
| <a href="#">6.1</a>   | MPLS-FRR-GENERAL-STD-MIB Module Definitions.....  | <a href="#">12</a> |

|                      |  |                    |
|----------------------|--|--------------------|
| <a href="#">6.2</a>  | MPLS-FRR-ONE2ONE-STD-MIB Module Definitions.....       | <a href="#">24</a> |
| <a href="#">6.3</a>  | MPLS-FRR-FACILITY-STD-MIB Module Definitions.....      | <a href="#">34</a> |
| <a href="#">7.</a>   | Security Considerations.....                           | <a href="#">45</a> |
| <a href="#">8.</a>   | IANA Considerations.....                               | <a href="#">46</a> |
| <a href="#">8.1</a>  | IANA Considerations for MPLS-FRR-GENERAL-STD-MIB.....  | <a href="#">46</a> |
| <a href="#">8.2</a>  | IANA Considerations for MPLS-FRR-ONE2ONE-STD-MIB.....  | <a href="#">46</a> |
| <a href="#">8.3</a>  | IANA Considerations for MPLS-FRR-FACILITY-STD-MIB..... | <a href="#">46</a> |
| <a href="#">9.</a>   | Acknowledgments.....                                   | <a href="#">47</a> |
| <a href="#">10.</a>  | References.....  | <a href="#">47</a> |
| <a href="#">10.1</a> | Normative References.....                              | <a href="#">47</a> |
| <a href="#">10.2</a> | Informative References.....                            | <a href="#">48</a> |
| <a href="#">11.</a>  | Editors' Addresses.....                                | <a href="#">48</a> |
| <a href="#">12.</a>  | Contributors' Addresses.....                           | <a href="#">48</a> |

## **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](mailto: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

constraints.

#### 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

```

```

mplsFrrGeneralTunnelARHopRRSubObjectFlags = 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 inter relationship between the `mplsFrrOne2OnePlrTable`, `mplsFrrOne2OneDetourTable` and `mplsTunnelTable` tables.

```
(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.

In `mplsFrrOne2OnePlrTable`:

```
{
  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 lsps 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),
  mplsTunnelXCPointer     = 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:

```

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
      FROM SNMPv2-CONF
      FROM SNMPv2-TC
      FROM IF-MIB
      FROM MPLS-TC-STD-MIB
      FROM MPLS-TE-STD-MIB
    mplsTunnelIndex, mplsTunnelInstanceIndex,
    mplsBitRate,
    mplsTunnelAffinity
      FROM MPLS-TC-STD-MIB
    mplsTunnelGroup, mplsTunnelScalarGroup,
    mplsTunnelARHopListIndex, mplsTunnelARHopIndex
      FROM MPLS-TE-STD-MIB
  ;
```

## 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 }

mplsFrrGeneralConformance

OBJECT IDENTIFIER ::= { mplsFrrGeneralMIB 2 }

-- MPLS Fast Reroute generic scalars.

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

## DESCRIPTION

"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 presense 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

- higher 16 bits: must be all zeros

"

REFERENCE "[Section 4.1 of RFC4090](#) and [Section 6.1](#) from [RFC 3812](#)."

```
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,
  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

Nadeau, et al.

Expires Mar 2012

[Page 16]

"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

```
constraint."
REFERENCE
  "Section 4.7 in RFC 3209"
DEFVAL { 0 }
 ::= { mplsFrrGeneralConstraintsEntry 9 }
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 }

Nadeau, et al.

Expires Mar 2012

[Page 19]

-- 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,
    mplsFrrGeneralTunnelARHopRRROSubObjectFlags     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

"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
    }
STATUS          current
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
}
STATUS          current
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,
    mplsFrrGeneralTunnelARHopRRROSubObjectFlags
}
STATUS          current
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 -- [RFC2578]
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF -- [RFC2580]
    TruthValue
        FROM SNMPv2-TC -- [RFC2579]
    MplsTunnelIndex, MplsTunnelInstanceIndex,
    MplsLsrIdentifier
        FROM MPLS-TC-STD-MIB -- [RFC3811]
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB -- [RFC4001]
    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"
    CONTACT-INFO
        "
            Riza Cetin
            Email: riza.cetin@alcatel.be
            Thomas D. Nadeau
            Email: tom.nadeau@bt.com
            A S Kiran Koushik
            Email: kkoushik@cisco.com
            Stefaan De Cnodder
            Email: Stefaan.de_cnodder@alcatel.be
            Der-Hwa Gan
            Email: dhg@juniper.net
        "
    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 object definitions for
    MPLS Traffic Engineering one-to-one 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 xxxx
::= { mib-2 YYY } -- RFC-editor please fill in
    -- 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 }
--
-- One-to-One Specific Tables
--
-- Tables in this section pertain only to the 1-1
-- style of FRR.
--
-- MPLS Fast Reroute Point of Local Repair table
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 { mplsFrrOne2OnePlrTunnelIndex,      -- from MPLS-TE-STD-MIB
        mplsFrrOne2OnePlrTunnelDetourInstance, -- mplsTunnelTable
        mplsFrrOne2OnePlrTunnelIngressLSRId, -- Tunnels must exist
        mplsFrrOne2OnePlrTunnelEgressLSRId,  -- a priori
        mplsFrrOne2OnePlrId      }
 ::= { 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

"Sectopn 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

```



```

MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
  "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
  mplsFrrOne2OnePlrTunnelDetourInstance, -- 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

```

"Multiprotocol Label Switching (MPLS) Working Group"  
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"

DESCRIPTION

"Copyright (C) 2011 The IETF Trust. 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 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 xxxx  
::= { mib-2 ZZZ } -- RFC-editor please fill in  
-- yyy 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."

```

 ::= { mplsFrrFacilityDBEntry 11 }
-- 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,
            mplsFrrFacilityDBGGroup,
            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,
    mplsFrrFacilityDBGGroup,
    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 }
mplsFrrFacilityDBGGroup 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

```

-- End of MPLS-FRR-FACILITY-STD-MIB

## 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:

- o 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:

- o the mplsFrrOne2OnePlrTable (mplsFrrOne2OnePlrSenderAddr, mplsFrrOne2OnePlrAvoidNodeAddr, etc.), mplsFrrOne2OneDetourTable (mplsFrrOne2OneDetourActive, mplsFrrOne2OneDetourMergedDetourInst, etc.), and mplsFrrGeneralTunnelARHopTable(mplsFrrGeneralTunnelARHopSessionAttributeFlags, mplsFrrGeneralTunnelARHopRR0SubObjectFlags, 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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