Traffic Engineering Database Management Information Base in support of MPLS-TE/GMPLS

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Abstract

This memo defines the Management Information Base (MIB) objects in order to manage traffic engineering database (TED) information with extension in support of Multi-Protocol Label Switching (MPLS) with traffic engineering (TE) as well as Generalized MPLS (GMPLS) for use with network management protocols.

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1. 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 RFC 3410 [RFC3410].

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

2. Introduction

The OSPF MIB is defined as [RFC4750] and the ISIS MIB as [RFC4444]. On the other side, MPLS/GMPLS based traffic engineering has so far extended OSPF/ISIS routing protocol with TE functionality [RFC4202], [RFC3630], [RFC4205], [RFC3784]. To manage such MPLS-TE/GMPLS networks effectively, routing information associated with MPLS/GMPLS TE parameters (TED) is preferred for the network management, however, there is no clear definition of MPLS/GMPLS TE information in existing MIBs related to OSPF/ISIS.

This memo defines the Management Information Base (MIB) objects for managing TED in support of MPLS-TE/GMPLS for use with network management protocols.

This MIB module should be used in conjunction with OSPF/ISIS MIB as well as other MIBs defined in [RFC3812], [RFC3813], [RFC4802], [RFC4803] for the management of MPLS/GMPLS based traffic engineering information.

3. Overview

3.1 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].

3.2 Terminology

Definitions of key terms for MPLS OAM and GMPLS are found in [RFC4377] and [RFC3945], and the reader is assumed to be familiar with those definitions which are not repeated here.

3.3 Acronyms

GMPLS: Generalized Multi-Protocol Label Switching
4. Motivations

The existing OSPF, ISIS, MPLS and GMPLS MIBs do not provide for the management of all of the extensions to the OSPF and ISIS protocol.

5. Brief description of MIB Objects

The objects described in this section support the management of TED described in [RFC4202], [RFC4203] and [RFC4205] for GMPLS extensions as well as in [RFC3630] and [RFC3784] for MPLS/GMPLS.

5.1 tedTable

The tedTable is basically used to indicate TED information of OSPF-TE or ISIS-TE. However, this table does not contain the information of Local/Remote interface IP address, Interface Switching Capability Descriptor and Shared Risk Link Group information within the sub-TLVs for the Link-TLV.

5.2 teLocalIfIpAddrTable

The teLocalIfIpAddrTable is identical to the Local interface IP address information in a sub-TLV for the Link-TLV. This is independently defined, because the Interface IP Address sub-TLV may appear more than once within the same Link-TLV.

5.3 teRemoteIfIpAddrTable

The teRemoteIfIpAddrTable is identical to the Remote interface IP address information in a sub-TLV of the Link-TLV. This is also independently utilized, because one or more local interface IP address sub TLVs may exist in the same Link-TLV.

5.4 teSwCapTable
The teSwCapTable represents Interface Switching Capability Descriptor information. This is independently defined due to the possibility of multiple appearances of the sub TLV within the same Link-TLV.

5.5 teSrlgTable

The teSrlgTable contains the Sub-TLV information of Shared Risk Link Group (SRLG) information. This is separately defined, because more than one sub TLVs may appear in the same Link-TLV.

6. Example of the TED MIB Module Usage

In this section, we provide an example of the TED MIB module usage. The following indicates the information of a numbered TE link originated in a GMPLS controlled node. When TE link information is retrieved in a MPLS network, GMPLS specific objects such as teLocalIfAddrTable, teRemoteIfAddrTable, teSwCapTable and teSrlgTable are not supported.

Note that the TED MIB modules are only limited to "read-only" access except for tedNotificationEnabled and tedNotificationMaxRate. The TED MIB is designed to be independent of OSPF or ISIS MIBs, however each TE information belongs to a node or a link, which is managed by the routing protocol.

In tedTable:

```
{ 
  tedTeAreaId.0.3221225985.16777264 0
  tedTeRouterId.0.3221225985.16777264 1848783410
  tedTeLinkIdAddrType.0.3221225985.16777264 pointToPoint(1)
  tedTeLinkIdAddr.0.3221225985.16777264 192.0.2.1
  tedTeMetric.0.3221225985.16777264 1
  tedTeMaxBandwidth.0.3221225985.16777264 1376193201
  tedTeUnreservedBandwidthPri0.0.3221225985.16777264 1375888025
  tedTeAdministrativeGroup.0.3221225985.16777264 0
  tedTeLocalId.0.3221225985.16777264 0
  tedTeRemoteId.0.3221225985.16777264 0
  tedTeLinkProtectionType.0.3221225985.1677726401 00 00 00 7
```
7. TED MIB Definitions in support of GMPLS

TED-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Integer32, Unsigned32, transmission,
    NOTIFICATION-TYPE
    FROM SNMPv2-SMI -- RFC2578
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
    FROM SNMPv2-CONF -- RFC2580
    RowPointer, TruthValue
    FROM SNMPv2-TC -- RFC2579
    IANA-GmplsLSPEncodingTypeTC, IANA-GmplsSwitchingTypeTC
    FROM IANA-GMPLS-TC-MIB -- RFC4801
    InetAddress, InetAddressType
    FROM INET-ADDRESS-MIB -- RFC3291

tedMIB MODULE-IDENTITY
    LAST-UPDATED "200807030000Z" -- 03 July 2008 00:00:00 GMT
ORGANIZATION "IETF CCAMP Working Group."
CONTACT-INFO

Tomohiro Otani
otani@kddilabs.jp

Masanori Miyazawa
ma-miyazawa@kddilabs.jp

Thomas D. Nadeau
tnadeau@bt.com

Kenji Kumaki
ke-kumaki@kddilabs.jp

Comments and discussion to ccamp@ietf.org"

DESCRIPTION
"This MIB contains managed object definitions for TED in
support of MPLS/GMPLS TE Database.

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module is part of RFC xxx; see the RFC itself for full legal
notices."

-- Revision history.
REVISION
"200807030000Z" -- 04 July 2008 00:00:00 GMT

DESCRIPTION
"Initial version. Published as RFC xxx."

-- RFC-editor pls fill in yyy
 ::= { transmission yyy }
-- assigned by IANA, see section 8.1 for details

-- Textual Conventions.

-- Top level components of this MIB.

tedNotifications OBJECT IDENTIFIER ::= { tedMIB 0 }
tedObjects OBJECT IDENTIFIER ::= { tedMIB 1 }
tedConformance OBJECT IDENTIFIER ::= { tedMIB 2 }

-- MIB Definitions

--
-- Ted Objects

--
tedNotificationEnabled OBJECT-TYPE
SYNTAX  TruthValue
MAX-ACCESS  read-write
STATUS  current
DESCRIPTION
"If this object is set to true, it enables the generation of
tedTeInfoStatusChange, tedTeCreation and tedTeDeletion
notifications."
DEFVAL  {false}
 ::= { tedObjects 1 }
tedNotificationMaxRate OBJECT-TYPE
SYNTAX        Unsigned32
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION    "A lot of notifications are expected to generate in a node, especially when a network failure occurs and might cause a performance degradation of the node itself. To avoid such a defect, this object provides the maximum number of notifications generated per minute. 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. A value of 0 means no throttling is applied and events may be notified at the rate at which they occur."
DEFVAL        {0}
::= { tedObjects 2 }

--
-- TED Table
--

tedTable OBJECT-TYPE
SYNTAX       SEQUENCE OF TedEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION    "This table indicates multiple TED information which has been supported by [RFC3630]."
::= { tedObjects 3 }
tedEntry OBJECT-TYPE
SYNTAX       TedEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION    "This entry contains TED information commonly utilized in both MPLS and GMPLS."
INDEX { tedAreaId, tedRouterId, tedLinkStateId }
::= { tedTable 1 }

TedEntry ::= SEQUENCE {
tedAreaId                    Unsigned32,
tedRouterId                  Unsigned32,
tedLinkStateId               Unsigned32,
tedLinkInformationSource     INTEGER,
tedLinkInformationData       RowPointer,
tedLinkType                  INTEGER,
tedRouterIdAddrType          InetAddressType,
tedRouterIdAddr              InetAddress,
tedLinkIdAddrType            InetAddressType,
tedLinkIdAddr                InetAddress,
tedMetric                    Integer32,
tedMaxBandwidth              Unsigned32,
tedMaxReservableBandwidth    Unsigned32,
tedUnreservedBandwidthPri0    Unsigned32,
tedUnreservedBandwidthPri1    Unsigned32,
tedUnreservedBandwidthPri2    Unsigned32,
tedUnreservedBandwidthPri3    Unsigned32,
tedUnreservedBandwidthPri4    Unsigned32,
tedUnreservedBandwidthPri5    Unsigned32,
tedUnreservedBandwidthPri6    Unsigned32,
tedUnreservedBandwidthPri7    Unsigned32,
tedAdministrativeGroup       Integer32,
tedLocalId                   Integer32,
tedRemoteId                  Integer32,
tedLinkProtectionType        BITS


tedAreaId OBJECT-TYPE
SYNTAX       Unsigned32 (1..4294967295)
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicates the area identifier of the IGP. If OSPF is used to advertise LSA, this represents an ospfArea. If ISIS is used, this represents an area address. Otherwise, this represents zero."
::= { tedEntry 1 }

tedRouterId OBJECT-TYPE
SYNTAX       Unsigned32 (1..4294967295)
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicates the router identifier. If OSPF is used to advertise LSA, this represents a Router ID. If ISIS is used, this represents a System ID. Otherwise, this represents zero."
::= { tedEntry 2 }

tedLinkStateId OBJECT-TYPE
SYNTAX       Unsigned32 (1..4294967295)
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicates the link state identifier. If OSPF is used, this represents an ospfLsdbID. If ISIS is used, this represents an isisLSPID. Otherwise, this represents a unique identifier within a node."
::= { tedEntry 3 }

tedLinkInformationSource OBJECT-TYPE
SYNTAX       INTEGER {
unknown(0),
locallyConfigured(1),
ospf(2),
isis(3),
other(4)
tedLinkInformationData OBJECT-TYPE
SYNTAX         RowPointer
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION
"This object cross-references the source of the information about this TE link and should be interpreted in the context of tedLinkInformationSource.
If tedLinkInformationSource has the value unknown(0), this object SHOULD contain a value of zeroDotZero.
If tedLinkInformationSource has the value locallyConfigured(1), this object MAY contain the identifier of the corresponding row entry in the teLinkTable of TE-LINK-STD-MIB[RFC4220], the identifier of the corresponding row in a local proprietary TE link MIB module, or the value of zeroDotZero otherwise.
If tedLinkInformationSource has the value ospf(2), this object MAY contain the identifier of the corresponding row entry in the ospfLocalLsdbTable of OSPF-MIB [RFC4750], or the value of zeroDotZero otherwise.
If tedLinkInformationSource has the value isis(3) this object MAY contain the identifier of the corresponding row entry in the isisAreaAddr of ISIS-MIB [RFC4444], or the value of zeroDotZero otherwise.
If tedLinkInformationSource has the value other(4) this object MAY contain the identifier of the corresponding row entry a local proprietary MIB module, or the value of zeroDotZero otherwise."
::= { tedEntry 5 }

}
DESCRIPTION
"This object indicates the TE-Router ID address type. Only values unknown(0), ipv4(1) or ipv6(2) must be supported."
 ::= { tedEntry 7 }

tedRouterIdAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates the TE-Router ID."
 ::= { tedEntry 8 }

tedLinkIdAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates the address type of the TE Link ID. Only values unknown(0), ipv4(1) or ipv6(2) must be supported."
 ::= { tedEntry 9 }

tedLinkIdAddr OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the Router ID of the neighbor in the case of point-to-point links. This also indicates the interface address of the designated router in the case of multi-access links."
 ::= { tedEntry 10 }

tedMetric OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the traffic engineering metric value of the TE link."
 ::= { tedEntry 11 }

tedMaxBandwidth OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the maximum bandwidth that can be used on this link in this direction."
 ::= { tedEntry 12 }

tedMaxReservableBandwidth OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS  read-only  
STATUS       current  
DESCRIPTION  
"This indicates the maximum bandwidth that may be reserved on 
this link in this direction."
::= { tedEntry 13 }

   tedUnreservedBandwidthPri0 OBJECT-TYPE
      SYNTAX       Unsigned32 (0..4294967295)
      UNITS       "Byte per seconds"
      MAX-ACCESS  read-only 
      STATUS      current 
      DESCRIPTION  
      "This indicates the amount of bandwidth not yet reserved at the 
priority 0."
::= { tedEntry 14 }

   tedUnreservedBandwidthPri1 OBJECT-TYPE
      SYNTAX       Unsigned32 (0..4294967295)
      UNITS       "Byte per seconds"
      MAX-ACCESS  read-only 
      STATUS      current 
      DESCRIPTION  
      "This indicates the amount of bandwidth not yet reserved at the 
priority 1."
::= { tedEntry 15 }

   tedUnreservedBandwidthPri2 OBJECT-TYPE
      SYNTAX       Unsigned32 (0..4294967295)
      UNITS       "Byte per seconds"
      MAX-ACCESS  read-only 
      STATUS      current 
      DESCRIPTION  
      "This indicates the amount of bandwidth not yet reserved at the 
priority 2."
::= { tedEntry 16 }

   tedUnreservedBandwidthPri3 OBJECT-TYPE
      SYNTAX       Unsigned32 (0..4294967295)
      UNITS       "Byte per seconds"
      MAX-ACCESS  read-only 
      STATUS      current 
      DESCRIPTION  
      "This indicates the amount of bandwidth not yet reserved at the 
priority 3."
::= { tedEntry 17 }

   tedUnreservedBandwidthPri4 OBJECT-TYPE
      SYNTAX       Unsigned32 (0..4294967295)
      UNITS       "Byte per seconds"
      MAX-ACCESS  read-only 
      STATUS      current 
      DESCRIPTION  

"This indicates the amount of bandwidth not yet reserved at the priority 4."
::= { tedEntry 18 }

tedUnreservedBandwidthPri5 OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the amount of bandwidth not yet reserved at the priority 5."
::= { tedEntry 19 }

tedUnreservedBandwidthPri6 OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the amount of bandwidth not yet reserved at the priority 6."
::= { tedEntry 20 }

tedUnreservedBandwidthPri7 OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the amount of bandwidth not yet reserved at the priority 7."
::= { tedEntry 21 }

tedAdministrativeGroup OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the Administrative Group which the link belong to. Since the value is a bit mask, the link can belong to multiple groups. This is also called Resource Class/Color."
::= { tedEntry 22 }

tedLocalId OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This indicates the Link local identifier of an unnumbered link."
::= { tedEntry 23 }

tedRemoteId OBJECT-TYPE
SYNTAX       Integer32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This indicates the Link remote identifier of an unnumbered link."
::= { tedEntry 24 }

tedLinkProtectionType OBJECT-TYPE
SYNTAX       BITS {
 extraTraffic(0),
 unprotected(1),
 shared (2),
 dedicatedOneToOne (3),
 dedicatedOnePlusOne(4),
 enhanced(5) }
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicates the protection type of the TE link."
::= { tedEntry 25 }

--
-- TED Local Interface IP Address Table
--
tedLocalIfAddrTable OBJECT-TYPE
SYNTAX       SEQUENCE OF TedLocalIfAddrEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This table contains the IP address information of a local TE link."
::= { tedObjects 4 }

tedLocalIfAddrEntry OBJECT-TYPE
SYNTAX       TedLocalIfAddrEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This entry contains the IP address information of the local TE link."
INDEX { tedAreaId, tedRouterId, tedLinkStateId, tedLocalIfAddrIndex }
::= { tedLocalIfAddrTable 1 }

TedLocalIfAddrEntry ::= SEQUENCE {
 tedLocalIfAddrIndex   Unsigned32,
 tedLocalIfAddrType    InetAddressType,
 tedLocalIfAddr        InetAddress
}

tedLocalIfAddrIndex OBJECT-TYPE

SYNTAX        Unsigned32(0..4294967295)
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION   
               "This indicates the index to identify multiple local TE links."
 ::= { tedLocalIfAddrEntry 1 }

TedLocalIfAddrType OBJECT-TYPE
SYNTAX        InetAddressType
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   
               "This object indicates the address type of the local TE link. 
               Only values unknown(0), ipv4(1) or ipv6(2) have to be supported."
 ::= { tedLocalIfAddrEntry 2 }

TedLocalIfAddr OBJECT-TYPE
SYNTAX        InetAddress
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION   
               "This object indicates the address of the local TE link."
 ::= { tedLocalIfAddrEntry 3 }

--
-- TED Remote Interface IP Address Table
--

TedRemoteIfAddrTable OBJECT-TYPE
SYNTAX        SEQUENCE OF TedRemoteIfAddrEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION   
               "This table contains the IP address information of a remote TE 
               link."
 ::= { tedObjects 5 }

TedRemoteIfAddrEntry OBJECT-TYPE
SYNTAX        TedRemoteIfAddrEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION   
               "This entry contains the IP address information of the remote 
               TE link."
INDEX { tedAreaId, tedRouterId, tedLinkStateId, 
        tedRemoteIfAddrIndex }
 ::= { tedRemoteIfAddrTable 1 }

TedRemoteIfAddrEntry ::= SEQUENCE {
  tedRemoteIfAddrIndex        Unsigned32,
  tedRemoteIfAddrType         InetAddressType,
  tedRemoteIfAddr             InetAddress 
}
tedRemoteIfAddrIndex OBJECT-TYPE
SYNTAX     Unsigned32(0..4294967295)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
   "This indicates the index to identify multiple remote TE links."
 ::= { tedRemoteIfAddrEntry 1 }

tedRemoteIfAddrType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "This object indicates the address type of the remote TE link."
 ::= { tedRemoteIfAddrEntry 2 }

tedRemoteIfAddr OBJECT-TYPE
SYNTAX     InetAddress
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "This object indicates the address of the remote TE link."
 ::= { tedRemoteIfAddrEntry 3 }

--
-- TED Switch Capable Table
--

tedSwCapTable OBJECT-TYPE
SYNTAX     SEQUENCE OF TedSwCapEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
   "This table contains the GMPLS TED switching capability information."
 ::= { tedObjects 6 }

tedSwCapEntry OBJECT-TYPE
SYNTAX     TedSwCapEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
   "This entry relates each TE link with its GMPLS TE switching capability information. If the MIB deals with only OSPF-TE information, the value of each object related with GMPLS TE extensions should be null."
INDEX { tedAreaId, tedRouterId, tedLinkStateId, tedSwCapIndex }
 ::= { tedSwCapTable 1 }

TedSwCapEntry ::= SEQUENCE {
    tedSwCapIndex Unsigned32,
    tedSwCapSwitchingType IANAgmplsSwitchingTypeTC,}
tedSwCapEncoding OBJECT-TYPE
SYNTAX IANA-Gmpls-LSPEncodingTypeTC
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object indicates the GMPLS encoding type assigned to the TE link."
::= { tedSwCapEntry 3 }

tedSwCapMaxLspBandwidthPri0 OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object indicates the maximum bandwidth of the TE link at the priority 0 for GMPLS LSP creation."
::= { tedSwCapEntry 4 }

tedSwCapMaxLspBandwidthPri1 OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This object indicates the maximum bandwidth of the TE link at the priority 1 for GMPLS LSP creation."
::= { tedSwCapEntry 5 }

tedSwCapMaxLspBandwidthPri2  OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This object indicates the maximum bandwidth of the TE link at the priority 2 for GMPLS LSP creation."
::= { tedSwCapEntry 6 }

tedSwCapMaxLspBandwidthPri3  OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This object indicates the maximum bandwidth of the TE link at the priority 3 for GMPLS LSP creation."
::= { tedSwCapEntry 7 }

 tedSwCapMaxLspBandwidthPri4 OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This object indicates the maximum bandwidth of the TE link at the priority 4 for GMPLS LSP creation."
::= { tedSwCapEntry 8 }

 tedSwCapMaxLspBandwidthPri5 OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"This object indicates the maximum bandwidth of the TE link at the priority 5 for GMPLS LSP creation."
::= { tedSwCapEntry 9 }

tedSwCapMaxLspBandwidthPri6 OBJECT-TYPE
SYNTAX       Unsigned32 (0..4294967295)
UNITS        "Byte per seconds"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicates the maximum bandwidth of the TE link at the priority 6 for GMPLS LSP creation."
::= { tedSwCapEntry 10 }

tedSwCapMaxLspBandwidthPri7 OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates the maximum bandwidth of the TE link at the priority 7 for GMPLS LSP creation."
::= { tedSwCapEntry 11 }

tedSwCapMinLspBandwidth OBJECT-TYPE
SYNTAX Unsigned32 (0..4294967295)
UNITS "Byte per seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates the minimum bandwidth of the TE link for GMPLS LSP creation if the switching capability field is TDM, PSC-1, PSC-2, PSC-3, or PSC-4."
::= { tedSwCapEntry 12 }

tedSwCapIfMtu OBJECT-TYPE
SYNTAX Integer32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates the MTU of the local or remote TE link"
::= { tedSwCapEntry 13 }

tedSwCapIndication OBJECT-TYPE
SYNTAX INTEGER {
  standard (0),
  arbitrary (1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates whether the interface supports Standard or Arbitrary SONET/SDH."
::= { tedSwCapEntry 14 }

--
-- TED SRLG Table
--

tedSrlgTable OBJECT-TYPE
SYNTAX SEQUENCE OF TedSrlgEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table contains the SRLG information of the TE link."
::= { tedObjects 7 }

tedSrlgEntry OBJECT-TYPE
SYNTAX       TedSrlgEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This entry relates each TE link with its SRLG information."
INDEX { tedAreaId, tedRouterId, tedLinkStateId, tedSrlgIndex }
::= { tedSrlgTable 1 }

TedSrlgEntry ::= SEQUENCE {
   tedSrlgIndex   Unsigned32,
   tedSrlg        Integer32
}

tedSrlgIndex OBJECT-TYPE
SYNTAX       Unsigned32(0..4294967295)
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"This index is utilized to identify multiple SRLG values on a
local or remote TE link."
::= { tedSrlgEntry 1 }

tedSrlg OBJECT-TYPE
SYNTAX       Integer32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"This object indicate the SRLG value assigned to a local or
remote TE link"
::= { tedSrlgEntry 2 }

--
-- Notifications
--

tedStatusChange NOTIFICATION-TYPE
OBJECTS  {
   tedAreaId, tedRouterId, tedLinkStateId
}
STATUS       current
DESCRIPTION
"This notification signifies that there has been change in TE
information of tedTable, teLocalIfIpAddrTable, teRemoteIfIpAddrTable,
teSwCapTable and teSrlgTable. For example, this should be generated
when tedUnreservedBandwidth is changed to create or delete LSP using
registered TE link."
::= { tedNotifications 1 }

tedCreation NOTIFICATION-TYPE
OBJECTS  
   {  
   tedAreaId, tedRouterId, tedLinkStateId  
   }

STATUS   current

DESCRIPTION
   "This notification signifies that there has been new 
registration in ted table by receiving new TE link information. For 
example, this should be generated when new index (tedAreaId, 
tedRouterId and tedLinkStateId) is registered in TED table."
::= { tedNotifications 2 }

-- Conformance Statement

tedGroups
   OBJECT IDENTIFIER ::= { tedConformance 1 }

tedCompliances
   OBJECT IDENTIFIER ::= { tedConformance 2 }

-- Module Compliance

teModuleFullCompliance MODULE-COMPLIANCE
   STATUS   current
   DESCRIPTION
      "Compliance statement for agents provides full support for the 
TED MIB."
   MODULE -- this module
      MANDATORY-GROUPS   { tedMainGroup, 
         tedObjectsGroup  
   }

GROUP tedNotificationGroup
   DESCRIPTION
      "This group is mandatory for those implementations that can implement 
the notifications contained in this group."

::= { tedCompliances 1 }

--

-- Read Only Compliance
--

teModuleReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance requirement for implementations only provide read-
only support for TED. Such devices can then be monitored but cannot
be configured using this MIB module."

MODULE -- this module
MANDATORY-GROUPS { tedMainGroup
}
::= { tedCompliances 2 }

-- Units of conformance.
tedMainGroup OBJECT-GROUP
OBJECTS {
tedAreaId ,
tedRouterId ,
tedLinkStateId ,
tedLinkInformationSource ,
tedLinkType ,
tedRouterIdAddrType ,
tedRouterIdAddr ,
tedLinkIdAddrType ,
tedLinkIdAddr ,
tedMetric ,
tedMaxBandwidth ,
tedMaxReservableBandwidth ,
tedUnreservedBandwidthPri0 ,
tedUnreservedBandwidthPri1 ,
tedUnreservedBandwidthPri2 ,
tedUnreservedBandwidthPri3 ,
tedUnreservedBandwidthPri4 ,
tedUnreservedBandwidthPri5 ,
tedUnreservedBandwidthPri6 ,
tedUnreservedBandwidthPri7 ,
tedAdministrativeGroup ,
tedLocalId ,
tedRemoteId ,
tedLinkProtectionType ,
tedLinkInformationData ,
tedLocalIfAddrType ,
tedLocalIfAddr ,
tedRemoteIfAddrType ,
tedRemoteIfAddr ,
tedSwCapSwitchingType ,
tedSwCapEncoding ,
tedSwCapMaxLspBandwidthPri0 ,
tedSwCapMaxLspBandwidthPri1 ,
tedSwCapMaxLspBandwidthPri2 ,
tedSwCapMaxLspBandwidthPri3 ,
tedSwCapMaxLspBandwidthPri4 ,
tedSwCapMaxLspBandwidthPri5 ,
tedSwCapMaxLspBandwidthPri6 ,
tedSwCapMaxLspBandwidthPri7 ,
tedSwCapMinLspBandwidth ,
tedSwCapIfMtu ,
}
8. Security Consideration

There are some management objects defined in this MIB module that have a MAX-ACCESS clause of read-write and/or read-create. So, if this MIB module is implemented correctly, then there is no risk that an intruder can alter or create any management objects of this MIB module via direct SNMP SET operations.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET 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:

- tedTable, teLocalIfAddrTable, teRemoteIfAddrTable, teSWcapTable and teSrlgTable contain topology information for the MPLS/GMPLS network. If an administrator does not want to reveal this information, then these tables should be considered sensitive/vulnerable.
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 this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principles (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

9. IANA Considerations

The following "IANA Considerations" subsection requests IANA for a new assignment under the transmission subtree. New assignments can only be made via a Standards Action as specified in [RFC5226].

9.1 IANA Considerations for TED-MIB

The IANA is requested to assign \{ transmission XXX \} to the TED-MIB module specified in this document.

10. References

10.1 Normative References


10.2 Informative References


11. Acknowledgment

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12. Authors’ Addresses

Tomohiro Otani
KDDI Corporation
KDDI Bldg,
2-3-2, Nishishinjuku, Shinjuku-ku, Tokyo,
163-8003, Japan
Email: tm-otani@kddi.com

Masanori Miyazawa
KDDI R&D Laboratories, Inc.
2-1-15 Ohara Fujimino, Saitama,
356-8502, Japan.
Phone: +81-49-278-7559
Email: ma-miyazawa@kddilabs.jp

Thomas D. Nadeau
BT
Email: tom.nadeau@bt.com

Kenji Kumaki
KDDI Corporation
Garden Air Tower
Iidabashi, Chyoda-ku, Tokyo,
102-8460, Japan
Email: ke-kumaki@kddi.com

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