Network Working Group
Internet Draft
Intended status: Standards Track

Xufeng Liu
Ericsson
Vishnu Pavan Beeram
Juniper Networks
Alexander Clemm
Cisco
Igor Bryskin
Aihua Guo
ADVA Optical Networking

Expires: April 27, 2015

October 27, 2014

A Yang module for Traffic Engineering Database (TED)
draft-liu-yang-ted-00

Status of this Memo

Copyright Notice

Abstract

This document defines a YANG module for Traffic Engineering Database.

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].

Table of Contents

1. Introduction

MPLS-TE and GMPLS based Traffic-Engineering (TE) systems provide tools to establish paths through a network in a controlled manner. TE paths are computed by examining the Traffic Engineering Database (TED) and selecting a sequence of links and nodes that are capable of catering to the requirements of the path to be established. The TED contains all the relevant information that a Path computation function needs and is typically constructed from information distributed by link-state protocols like OSPF-TE, ISIS-TE and BGP-LS.

This document defines a YANG [RFC6020] [RFC6021] module for Traffic Engineering Database. This "TED" module contains a set of groupings capturing data related to traffic engineering and can be used as a helper-module for other YANG modules that define OSPF-Topology, ISIS Topology or Abstract TE Topology.

2. Tree Structure

The structure of the groupings in this module are depicted below. Brackets enclose list keys, "rw" means configuration data, "ro" means operational state data, and "?" designates optional nodes.

```
module: ted

grouping ted-node-attributes
   +--rw te-router-id-ipv4?    inet:ipv4-address
   +--rw te-router-id-ipv6?    inet:ipv6-address
   +--rw ipv4-local-address*   [ipv4-prefix]
   |  +--rw ipv4-prefix        inet:ipv4-prefix
   +--rw ipv6-local-address*   [ipv6-prefix]
   |  +--rw ipv6-prefix        inet:ipv6-prefix
   |  +--rw prefix-option?     uint8
   +--rw pcc-capabilities?     pcc-capabilities

grouping ted-link-attributes
   +--rw link-index?                          uint64
   +--rw information-source?                  enumeration
   +--rw credibility-preference?              uint16
   +--rw admin-status?                        enumeration
   +--rw oper-status?                         enumeration
   +--rw area-id?                             binary
   +--rw color?                               uint32
   +--rw max-link-bandwidth?                  decimal64
   +--rw max-resv-link-bandwidth?             decimal64
   +--rw unreserved-bandwidth* [priority]
   |  +--rw priority     uint8
   |  +--rw bandwidth?   decimal64
   +--rw te-default-metric?                   uint32
   +--rw link-protection-type?                enumeration
   +--rw interface-switching-capabilities* [switching-capability]
   |  +--rw switching-capability       ted:switching-capabilities
   |  +--rw encoding?                            ted:encoding-type
   |  +--rw max-lsp-bandwidth* [priority]
   |  |  +--rw priority     uint8
   |  |  +--rw bandwidth?   decimal64
   |  +--rw packet-switch-capable
   |  |  +--rw minimum-lsp-bandwidth?   decimal64
   |  |  +--rw interface-mtu?           uint16
   |  +--rw time-division-multiplex-capable
   |     +--rw minimum-lsp-bandwidth?   decimal64
   |     +--rw indication?              enumeration
```

```
      +--rw srlg
      |  +--rw srlg-values* [srlg-value]
      |     +--rw srlg-value    uint32
      +--rw alt-information-sources* [information-source]
         +--rw information-source                  enumeration
         +--rw credibility-preference?             uint16
         +--rw link-index?                         uint64
         +--rw color?                              uint32
         +--rw max-link-bandwidth?                 decimal64
         +--rw max-resv-link-bandwidth?            decimal64
         +--rw unreserved-bandwidth* [priority]
         |  +--rw priority     uint8
         |  +--rw bandwidth?   decimal64
         +--rw te-default-metric?                  uint32
         +--rw link-protection-type?               enumeration
         +--rw interface-switching-capabilities* [switching-capability]
         |  +--rw switching-capability       ted:switching-capabilities
         |  +--rw encoding?                          ted:encoding-type
         |  +--rw max-lsp-bandwidth* [priority]
         |  |  +--rw priority     uint8
         |  |  +--rw bandwidth?   decimal64
         |  +--rw packet-switch-capable
         |  |  +--rw minimum-lsp-bandwidth?   decimal64
         |  |  +--rw interface-mtu?           uint16
         |  +--rw time-division-multiplex-capable
         |     +--rw minimum-lsp-bandwidth?   decimal64
         |     +--rw indication?              enumeration
         +--rw srlg
            +--rw srlg-values* [srlg-value]
               +--rw srlg-value    uint32
```

3. TED Yang Module

```
   module ted {
     yang-version 1;
     namespace "urn:TBD:params:xml:ns:yang:network:ted";
     // replace with IANA namespace when assigned
     prefix ted;

     import ietf-inet-types {
       prefix "inet";
     }

     organization "TBD";
     contact "TBD";
```

```
     description
       "Helper module to hold trafic engineering attributes for
        any topology on which trafic engineering is enabled.";

     revision 2014-10-27 {
       description
         "Initial revision";
       reference
         "RFC 4220: Traffic Engineering Link Management Information
         Base.
         RFC 6825: Traffic Engineering Database Management Information
         Base in Support of MPLS-TE/GMPLS.
         RFC 4802: Generalized Multiprotocol Label Switching (GMPLS)
         Traffic Engineering Management Information Base";
     }

     typedef switching-capabilities {
       type enumeration {
         enum "psc-1" {
           value 1;
           description
             "Packet-Switch Capable-1 (PSC-1)";
         }
         enum "evpl" {
           value 30;
           description
             "Ethernet Virtual Private Line (EVPL)";
         }
         enum "l2sc" {
           value 51;
           description
             "Layer-2 Switch Capable (L2SC)";
         }
         enum "tdm" {
           value 100;
           description
             "Time-Division-Multiplex Capable (TDM)";
         }
         enum "otn-tdm" {
           value 110;
           description
             "OTN-TDM Capable";
         }
         enum "lsc" {
           value 150;
```

```
          description
            "Lambda-Switch Capable (LSC)";
        }
        enum "fsc" {
          value 200;
          description
            "Fiber-Switch Capable (FSC)";
        }
      }
      description
        "Switching Capabilities of an interface.";
      reference
        "RFC 5307: IS-IS Extensions in Support of Generalized
         Multi-Protocol Label Switching (GMPLS).
         RFC 3812: Multiprotocol Label Switching (MPLS) Traffic
         Engineering (TE) Management Information Base (MIB).
         RFC 7074: Revised Definition of the GMPLS Switching
         Capability and Type Fields.
         RFC 7138: Traffic Engineering Extensions to OSPF
         for GMPLS Control of Evolving G.709 Optical Transport
         Networks.
         RFC 7139: GMPLS Signaling Extensions for Control of Evolving
         G.709 Optical Transport Networks.";
    }

    typedef encoding-type {
      type enumeration {
        enum "not-gmpls" {
          value 0;
          description
            "GMPLS is not in use";
        }
        enum "packet" {
          value 1;
          description
            "Packet";
        }
        enum "ethernet" {
          value 2;
          description
             "Ethernet";
        }
        enum "pdh" {
          value 3;
          description
```

```
            "PDH";
        }
        enum "sdh-sonet" {
          value 5;
          description
            "SDH or SONET";
        }
        enum "digital-wrapper" {
          value 7;
          description
            "Digital Wrapper";
        }
        enum "lambda" {
          value 8;
          description
            "Lambda";
        }
        enum "fiber" {
          value 9;
          description
            "Fiber";
        }
        enum "fiber-channel" {
          value 11;
          description
            "Fiber Channel";
        }
        enum "oduk" {
          value 12;
          description
            "G.709 OKUk (Digital Path)";
        }
        enum "optical-channel" {
          value 13;
          description
            "G.709 Optical Channel";
        }
      }
      description
        "Encoding type of an interface.";
      reference
        "RFC 3471: Generalized Multi-Protocol Label Switching (GMPLS)
         Signaling Functional Description.
         RFC 4328: Generalized Multi-Protocol Label Switching (GMPLS)
         Signaling Extensions for G.709 Optical Transport Networks
         Control.";
```

```
    }

    typedef pcc-capabilities {
      type bits {
        bit path-computation-with-gmpls-link-constraints {
          position 0;
          description "Link constraints";
        }
        bit bidirectional-path-computation {
          position 1;
          description "Bidirectional";
        }
        bit diverse-path-computation {
          position 2;
          description "Diverse";
        }
        bit load-balanced-path-computation {
          position 3;
          description "Load balanced";
        }
        bit synchronized-path-computation {
          position 4;
          description "Synchronized";
        }
        bit support-for-multiple-objective-functions {
          position 5;
          description "Multiple objective functions";
        }
        bit support-for-additive-path-constraints {
          position 6;
          description "Additive path constraints";
        }
        bit support-for-request-prioritization {
          position 7;
          description "Request prioritization";
        }
        bit support-for-multiple-requests-per-message {
          position 8;
          description "Multiple requests per message";
        }
      }
      description
        "Path Computation Capabilities.";
      reference
        "RFC 5088, draft-ietf-pce-disco-protoc-isis-07.txt
         OSPF/ISIS Protocol Extensions for Path Computation Element
```

```
          (PCE) Discovery.";
      }

      grouping ted-node-attributes {
        description
          "Identifier to uniquely identify a node in TED";
        reference
          "RFC 5305, RFC 6119: IPv6 Traffic Engineering in IS-IS/OSPF";
        leaf te-router-id-ipv4 {
          type inet:ipv4-address;
          description
            "Globally unique IPv4 Traffic Engineering Router ID.";
        }
        leaf te-router-id-ipv6 {
          type inet:ipv6-address;
          description
            "Globally unique IPv6 Traffic Engineering Router ID";
        }
        list ipv4-local-address {
          key "ipv4-prefix";
          description
            "List of IPv4 Local Address(OSPF). RFC 5786";

          leaf ipv4-prefix {
            type inet:ipv4-prefix;
            description
              "Local IPv4 address for the node";
          }
        }
        list ipv6-local-address {
          key "ipv6-prefix";
          description
            "List of IPv6 Local Address.";
          reference
            "RFC 5786: Advertising a Router's Local Addresses
             in OSPF Traffic Engineering (TE) Extensions";
          leaf ipv6-prefix {
            type inet:ipv6-prefix;
            description
              "Local IPv6 address for the node";
          }
          leaf prefix-option {
            type uint8;
            description
               "IPv6 prefix option.";
          }
```

```
      }
      leaf pcc-capabilities {
        type pcc-capabilities;
        description
          "OSPF/ISIS PCC capabilities";
      }
    }

    grouping ted-link-info-attributes {
      description
        "Advertised TE informaton attributes.";
      leaf information-source {
        type enumeration {
          enum "unknown" {
            description "The source is unknown";
          }
          enum "locally-configured" {
            description "Configured TE link";
          }
          enum "ospfv2" {
            description "OSPFv2";
          }
          enum "ospfv3" {
            description "OSPFv3";
          }
          enum "isis" {
            description "ISIS";
          }
          enum "other" {
            description "Other source";
          }
        }
        description
          "Indicates the source of the information about the link";
      }
      leaf credibility-preference {
        type uint16;
        description
          "The preference value to calculate the traffic engineering
          database credibility value used for tie-break selection
          between different information-source values.
          Higher value is more preferable.";
      }
      leaf link-index {
        type uint64;
        description
```

```
          "The link identifier.  If OSPF is used, this represents an
          ospfLsdbID.  If IS-IS is used, this represents an isisLSPID.
          If a locally configured link is used, this object represents
          an unique value, which is locally defined in a router.";
        }
        leaf color {
          type uint32;
          description
            "Administrative group or color of the link";
        }
        leaf max-link-bandwidth {
          type decimal64 {
            fraction-digits 2;
          }
          description
            "Maximum bandwidth that can be see on this link in this
            direction. Units in bytes per second";
        }

        leaf max-resv-link-bandwidth {
          type decimal64 {
            fraction-digits 2;
          }
          description
            "Maximum amount of bandwidth that can be reserved in this
            direction in this link. Units in bytes per second";
        }
        list unreserved-bandwidth {
          key "priority";
          max-elements "8";
          description
            "Unreserved bandwidth for 0-7 priority levels. Units in
            bytes per second";
          leaf priority {
            type uint8 {
              range "0..7";
            }
            description "Priority";
          }
          leaf bandwidth {
            type decimal64 {
              fraction-digits 2;
            }
            description
              "Unreserved bandwidth for this level";
          }
```

```
      }
      leaf te-default-metric {
        type uint32;
        description
          "Traffic Engineering Metric";
      }
      leaf link-protection-type {
        type enumeration {
          enum "unprotected" {
            description "unprotected";
          }
          enum "extra-traffic" {
            description "Extra traffic";
          }
          enum "shared" {
            description "Shared";
          }
          enum "1-for-1" {
            description "One for one protection";
          }
          enum "1-plus-1" {
            description "One plus one protection";
          }
          enum "enhanced" {
            description "Enhanced protection";
          }
        }
        description
          "Link Protection Type desired for this link";
      }
      list interface-switching-capabilities {
        key "switching-capability";
        description
          "List of interface capabilities for this interface";
        leaf switching-capability {
          type ted:switching-capabilities;
          description
            "Switching Capability for this interface";
        }
        leaf encoding {
          type ted:encoding-type;
          description
            "Encoding supported by this interface";
        }
        list max-lsp-bandwidth {
          key "priority";
```

```
          max-elements "8";
          description
            "Maximum LSP Bandwidth at priorities 0-7";
          leaf priority {
            type uint8 {
              range "0..7";
            }
            description "Priority";
          }
          leaf bandwidth {
            type decimal64 {
              fraction-digits 2;
            }
            description
              "Max LSP Bandwidth for this level";
          }
        }
        container packet-switch-capable {
          when "../switching-capability = PSC-1  or "
            +"../switching-capability = PSC-2 or "
            +"../switching-capability = PSC-3 or "
            +"../switching-capability = PSC-4" {
            description "Valid only for PSC";
          }
          description
            "Interface has packet-switching capabilities";
          leaf minimum-lsp-bandwidth {
            type decimal64 {
              fraction-digits 2;
            }
            description
              "Minimum LSP Bandwidth. Units in bytes per second";
          }
          leaf interface-mtu {
            type uint16;
            description
              "Interface MTU";
          }
        }
        container time-division-multiplex-capable {
          when "../switching-capability = TDM" {
            description "Valid only for TDM";
          }
          description
            "Interface has time-division multiplex capabilities";
```

```
          leaf minimum-lsp-bandwidth {
            type decimal64 {
              fraction-digits 2;
            }
            description
              "Minimum LSP Bandwidth. Units in bytes per second";
          }
          leaf indication {
            type enumeration {
              enum "standard" {
                description "Indicates support of standard SONET/SDH";
              }
              enum "arbitrary" {
                description "Indicates support of arbitrary
                             SONET/SDH";

              }
            }
            description
              "Indication whether the interface supports Standard or
               Arbitrary SONET/SDH";
          }
        }
      }
      container srlg {
        description
          "Shared Risk Link Group Attributes";
        uses srlg-attributes;
      }
    }

    grouping ted-link-attributes {
      description
        "TED Attributes associated with the link.";
      reference
        "RFC 3630, RFC 3784: IS-IS / OSPF Traffic Engineering (TE)";
      leaf admin-status {
        type enumeration {
          enum up {
            value 1;
            description
              "Enabled.";
          }
          enum down {
            value 2;
            description
              "Disabled.";
```

```
          }
          enum testing {
            value 3;
            description
              "In some test mode.";
          }
        }
        description
          "The desired state of the link.";
        }
      leaf oper-status {
        type enumeration {
          enum up {
            value 1;
            description
              "Operational up";
          }
          enum down {
            value 2;
            description
              "Operational down.";
          }
          enum testing {
            value 3;
            description
              "In some test mode";
          }
          enum unknown {
            value 4;
            description
              "Status cannot be determined for some reason.";
          }
        }
        description
          "The current operational state of the link.";
      }
      leaf area-id {
        type binary {
          length 1..13;
        }
        description
          "This object indicates the area identifier of the IGP.
          If OSPF is used to advertise LSA, this represents an
          ospfArea. If IS-IS is used, this represents an area address.
          Otherwise, this is zero.";
      }
```

```
      uses ted-link-info-attributes;
      list alt-information-sources {
        key "information-source";
        description
          "A list of information sources";
        uses ted-link-info-attributes;
      }
    }

    grouping srlg-attributes {
      description
        "Shared Risk Link Group Attributes";
      reference
        "RFC 5307, RFC 4203: ISIS / OSPF Extensions in Support of
         Generalized Multi-Protocol Label Switching (GMPLS)";
      list srlg-values {
        key "srlg-value";
        description
          "List of Shared Risk Link Group this interface belongs to.";
        leaf srlg-value {
          type uint32;
          description
            "Shared Risk Link Group value";
        }
      }
    }
  }
```

4. Security Considerations

The YANG module by itself does not create any security implications.

5. IANA Considerations

TBD

6. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC6020] Bjorklund, M., "YANG - A Data Modeling language for the Network Configuration Protocol (NETCONF)", RFC 6020, October 2010.

[RFC6021] Schoenwaelder, J., "Common YANG Data Types", RFC 6021, October 2010.

7. Acknowledgments

The authors of this draft would like to thank the authors/contributors of <draft-clemm-i2rs-yang-network-topo> for laying the foundation for Topology specific YANG modules.

Authors' Addresses

Xufeng Liu
Ericsson
Xufeng.liu@ericsson.com

Vishnu Pavan Beeram
Juniper Networks
Email: vbeeram@juniper.net

Alexander Clemm
Cisco
alex@cisco.com

Igor Bryskin
ADVA Optical Networking
Email: ibryskin@advaoptical.com

Aihua Guo
ADVA Optical Networking
Email: aguo@advaoptical.com