A Yang module for Traffic Engineering Database (TED)
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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].

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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
3. TED Yang Module

module ted {
  yang-version 1;
  // replace with IANA namespace when assigned
  prefix ted;

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

  organization "TBD";
  contact "TBD";
description
  "Helper module to hold traffic engineering attributes for any topology on which traffic 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;
    }
  }
}
enum "fsc" {
    value 200;
    description
    "Fiber-Switch Capable (FSC)";
}

description
"Switching Capabilities of an interface.";

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 ONUk (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.";
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
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 information 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 seen 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


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.

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