Network Working Group   X. Liu
Internet-Draft   Jabil
Intended status: Standards Track   I. Bryskin
Expires: May 3, 2018   Huawei Technologies
                                                             V. Beeram
                                                      Juniper Networks
                                                              T. Saad
                                                     Cisco Systems Inc
                                                              H. Shah
                                                                 Ciena
                                                         S. Litkowski
                                               Orange Business Service
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YANG Data Model for SR and SR TE Topologies
draft-liu-teas-yang-sr-te-topo-04

Abstract

   This document defines a YANG data model for Segment Routing (SR)
   topology and Segment Routing (SR) traffic engineering (TE) topology.

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

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   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on May 3, 2018.

Table of Contents

1. Introduction

   This document defines a YANG [RFC7950] data model for describing the
   presentations of Segment Routing (SR) topology and Segment Routing
   (SR) traffic engineering (TE) topology.

1.1. Terminology

   The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
   "OPTIONAL" in this document are to be interpreted as described in BCP
   14, [RFC2119].

   The following terms are defined in [RFC7950] and are not redefined
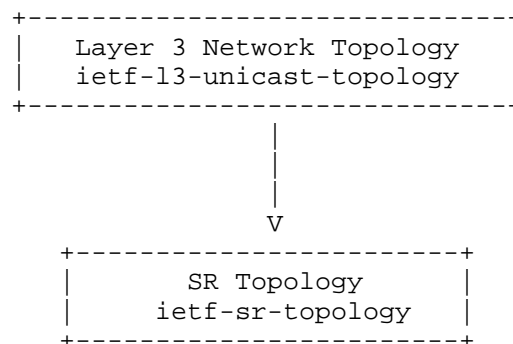   here:

   o augment

   o data model
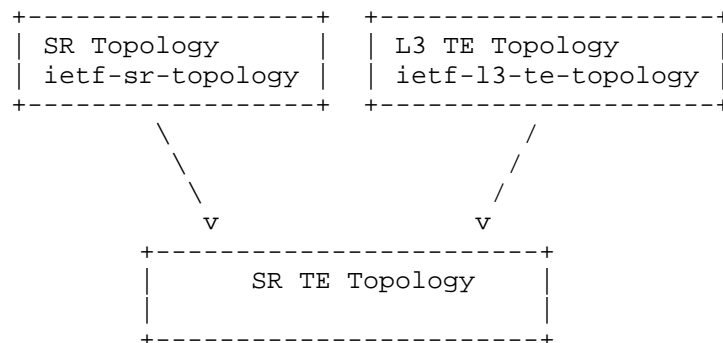
   o data node

2. Modeling Considerations

2.1. Segment Routing (SR) topology

   The Layer 3 network topology model is discussed in
   [I-D.ietf-i2rs-yang-l3-topology]. The Segment Routing (SR) topology
   model proposed in this document augments and uses the ietf-l3-
   unicast-igp-topology module defined in
   [I-D.ietf-i2rs-yang-l3-topology]. SR related attributes are covered
   in the ietf-sr-topology model.

```
             +-----------------------------+
             |    Layer 3 Network Topology  |
             |    ietf-l3-unicast-topology  |
             +-----------------------------+
                            |
                            |
                            |
                            V
              +-----------------------+
              |      SR Topology      |
              |     ietf-sr-topology  |
              +-----------------------+
```

2.2. Segment Routing (SR) TE topology

   When traffic engineering is enabled on an SR topology, there will be
   associations between objects in SR topologies and objects in TE
   topologies. An SR TE topology is both an SR topology and a layer 3
   TE topology. Multiple inheritance is used to achieve such relations.

```
      +------------------+  +--------------------+
      | SR Topology      |  | L3 TE Topology     |
      | ietf-sr-topology |  | ietf-l3-te-topology|
      +------------------+  +--------------------+
                 \                    /
                  \                  /
                   \                /
                    v            v
              +-----------------------+
              |      SR TE Topology   |
              |                       |
              +-----------------------+
```

Each type of topologies is indicated by "network-types" defined in
[I-D.ietf-i2rs-yang-network-topo]. For the three types of topologies
above, the data representations are:

L3 Topology:

/nd:networks/nd:network/nd:network-types/l3-unicast-topology

L3 TE Topology:

/nd:networks/nd:network/nd:network-types/l3-unicast-topology/l3-te

SR Topology:

/nd:networks/nd:network/nd:network-types/l3-unicast-topology/sr

SR TE Topology: (multiple inheritance)

/nd:networks/nd:network/nd:network-types/l3-unicast-topology/l3-te
/nd:networks/nd:network/nd:network-types/l3-unicast-topology/sr

2.3. Relations to ietf-segment-routing

[I-D.ietf-spring-sr-yang]defines ietf-segment-routing that is a model
intended to be used on network elements to configure or operate
segment routing; ietf-sr-topology defined in this document is
intended to be used on a controller for the network-wide operations
such as path computation.

SR topology model shares many modeling constructs defined in ietf-
segment-routing. The module ietf-sr-topology uses the types and
groupings defined in ietf-segment-routing.

2.4. Open Items

   a. Protection on link: The feature of link protection will be
       modeled in the next revision.

   b. Link bundle: The feature of link bundle will be modeled in the
       next revision.

3. Model Structure

   The model tree structure of the Segment Routing (SR) topology module
   is as shown below:

```
module: ietf-sr-topology
  augment /nw:networks/nw:network/nw:network-types
/l3t:l3-unicast-topology:
    +--rw sr!
  augment /nw:networks/nw:network/l3t:l3-topology-attributes:
    +--rw sr
       +--rw srgb* [lower-bound upper-bound]
          +--rw lower-bound    uint32
          +--rw upper-bound    uint32
  augment /nw:networks/nw:network/nw:node/l3t:l3-node-attributes:
    +--rw sr
       +--rw srgb* [lower-bound upper-bound]
       |  +--rw lower-bound    uint32
       |  +--rw upper-bound    uint32
       +--rw srlb* [lower-bound upper-bound]
       |  +--rw lower-bound    uint32
       |  +--rw upper-bound    uint32
       +--rw node-capabilities
       |  +--rw transport-planes* [transport-plane]
       |  |  +--rw transport-plane    identityref
       |  +--rw readable-label-stack-depth?   uint8
       +--ro information-source?         enumeration
       +--ro information-source-state
          +--ro credibility-preference?   uint16
  augment /nw:networks/nw:network/nw:node/l3t:l3-node-attributes
/l3t:prefix:
    +--rw sr!
       +--rw value-type?          enumeration
       +--rw start-sid            uint32
       +--rw range?               uint32
       +--rw algorithm?           identityref
       +--rw last-hop-behavior?   enumeration
 {sid-last-hop-behavior}?
       +--rw is-local?            boolean
  augment /nw:networks/nw:network/nw:node/nt:termination-point
/l3t:l3-termination-point-attributes:
  augment /nw:networks/nw:network/nt:link/l3t:l3-link-attributes:
    +--rw sr
       +--rw sid?                     uint32
       +--rw value-type?              enumeration
       +--rw is-local?                boolean
       +--ro is-part-of-set?          boolean
       +--ro is-on-lan?               boolean
       +--ro information-source?      enumeration
       +--ro information-source-state
          +--ro credibility-preference?   uint16
```

4. YANG Module

```
   <CODE BEGINS> file "ietf-sr-topology@2017-10-30.yang"
   module ietf-sr-topology {
     yang-version 1.1;
     namespace "urn:ietf:params:xml:ns:yang:ietf-sr-topology";
     prefix "srt";

     import ietf-network {
       prefix "nw";
     }
     import ietf-network-topology {
       prefix "nt";
     }
     import ietf-l3-unicast-topology {
       prefix "l3t";
     }
     import ietf-segment-routing-common {
       prefix "sr-cmn";
     }

     organization "TBD";
     contact "TBD";
     description "L3 TE Topology model";

     revision 2017-10-30 {
       description "Initial revision";
       reference "TBD";
     }

     grouping sr-topology-type {
       description
         "Identifies the SR topology type.";
       container sr {
         presence "Indiates SR Topology";
         description
           "Its presence identifies the SR topology type.";
       }
     }

     augment "/nw:networks/nw:network/nw:network-types/"
       + "l3t:l3-unicast-topology" {
       description
         "Defines the SR topology type.";
       uses sr-topology-type;
     }
```

```
   augment "/nw:networks/nw:network/l3t:l3-topology-attributes" {
     when "../nw:network-types/l3t:l3-unicast-topology/sr" {
       description "Augment only for SR topology.";
     }
     description "Augment topology configuration";
     uses sr-topology-attributes;
   }

   augment "/nw:networks/nw:network/nw:node/l3t:l3-node-attributes" {
     when "../../nw:network-types/l3t:l3-unicast-topology/sr" {
       description "Augment only for SR topology.";
     }
     description "Augment node configuration.";
     uses sr-node-attributes;
   }

   augment "/nw:networks/nw:network/nw:node/l3t:l3-node-attributes"
     + "/l3t:prefix" {
     when "../../../nw:network-types/l3t:l3-unicast-topology/sr" {
       description "Augment only for SR topology.";
     }
     description "Augment node prefix.";
     uses sr-node-prefix-attributes;
   }

   augment "/nw:networks/nw:network/nw:node/nt:termination-point/"
     + "l3t:l3-termination-point-attributes" {
     when "../../../nw:network-types/l3t:l3-unicast-topology/"
       + "sr" {
       description "Augment only for SR topology.";
     }
     description "Augment termination point configuration";
     uses sr-tp-attributes;
   }

   augment "/nw:networks/nw:network/nt:link/l3t:l3-link-attributes" {
     when "../../nw:network-types/l3t:l3-unicast-topology/sr" {
       description "Augment only for SR topology.";
     }
     description "Augment link configuration.";
     uses sr-link-attributes;
   }

   grouping sr-topology-attributes {
     description "SR topology scope attributes.";
     container sr {
       description
         "Containing SR attributes.";
```

```
              uses sr-cmn:srgb-cfg;
          } // sr
        } // sr-topology-attributes

        grouping information-source-attributes {
          description
            "The attributes identifying source that has provided the
             related information, and the source credibility.";
          leaf information-source {
            type enumeration {
              enum "unknown" {
                description "The source is unknown.";
              }
              enum "locally-configured" {
                description "Configured entity.";
              }
              enum "ospfv2" {
                description "OSPFv2.";
              }
              enum "ospfv3" {
                description "OSPFv3.";
              }
              enum "isis" {
                description "ISIS.";
              }
              enum "system-processed" {
                description "System processed entity.";
              }
              enum "other" {
                description "Other source.";
              }
            }
            config false;
            description
              "Indicates the source of the information.";
          }
          container information-source-state {
            config false;
            description
              "The container contains state attributes related to
               the information source.";
            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.";
        }
      }
    } // information-source-attributes

    grouping sr-node-attributes {
      description "SR node scope attributes.";
      container sr {
        description
          "Containing SR attributes.";
        uses sr-cmn:srgb-cfg;
        uses sr-cmn:srlb-cfg;
        uses sr-cmn:node-capabilities;
        // Operational state data
        uses information-source-attributes;
      } // sr
    } // sr-node-attributes

    grouping sr-node-prefix-attributes {
      description "Containing SR attributes for a prefix.";
      container sr {
        presence "Presence indicates SR is enabled.";
        description
          "Containing SR attributes for a prefix.";
        uses sr-cmn:prefix-sid-attributes;
        uses sr-cmn:last-hop-behavior;
        leaf is-local {
          type boolean;
          description
            "'true' if the SID is local.";
        }
      } // sr
    } // sr-node-prefix-attributes

    grouping sr-tp-attributes {
      description "SR termination point scope attributes";
    } // sr-tp-attributes

    grouping sr-link-attributes {
      description "SR link scope attributes";
      container sr {
        description
          "Containing SR attributes.";
        leaf sid {
          type uint32;
          description
            "SID.";
        }
```

```
          uses sr-cmn:sid-value-type;
          leaf is-local {
            type boolean;
            description
              "'true' if the SID is local.";
          }
          leaf is-part-of-set {
            type boolean;
            config false;
            description
              "'true' if the SID is part of a set.";
          }
          leaf is-on-lan {
            type boolean;
            config false;
            description
              "'true' if on a lan.";
          }
          uses information-source-attributes;
        } // sr
      } // sr-link-attributes
    }
    <CODE ENDS>
```

5. IANA Considerations

    RFC Ed.: In this section, replace all occurrences of 'XXXX' with the
    actual RFC number (and remove this note).

    This document registers the following namespace URIs in the IETF XML
    registry [RFC3688]:

    URI: urn:ietf:params:xml:ns:yang:ietf-sr-topology
    Registrant Contact: The IESG.
    XML: N/A, the requested URI is an XML namespace.

    URI: urn:ietf:params:xml:ns:yang:ietf-sr-topology-state
    Registrant Contact: The IESG.
    XML: N/A, the requested URI is an XML namespace.

    This document registers the following YANG modules in the YANG Module
    Names registry [RFC6020]:

```
       -------------------------------------------------------------------
       name:        ietf-sr-topology
       namespace:   urn:ietf:params:xml:ns:yang:ietf-sr-topology
       prefix:      srt
       reference:   RFC XXXX
       -------------------------------------------------------------------


       -------------------------------------------------------------------
       name:        ietf-sr-topology-state
       namespace:   urn:ietf:params:xml:ns:yang:ietf-sr-topology-state
       prefix:      srt-s
       reference:   RFC XXXX
       -------------------------------------------------------------------
```

6. Security Considerations

   The configuration, state, action and notification data defined in
   this document are designed to be accessed via the NETCONF protocol
   [RFC6241]. The data-model by itself does not create any security
   implications. The security considerations for the NETCONF protocol
   are applicable. The NETCONF protocol used for sending the data
   supports authentication and encryption.

7. References

7.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997, <https://www.rfc-
              editor.org/info/rfc2119>.

   [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed.,
              and A. Bierman, Ed., "Network Configuration Protocol
              (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011,
              <https://www.rfc-editor.org/info/rfc6241>.

   [RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language",
              RFC 7950, DOI 10.17487/RFC7950, August 2016,
              <https://www.rfc-editor.org/info/rfc7950>.

   [I-D.ietf-netmod-revised-datastores]
              Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K.,
              and R. Wilton, "Network Management Datastore
              Architecture", draft-ietf-netmod-revised-datastores-05
              (work in progress), October 2017.

7.2. Informative References

   [I-D.ietf-i2rs-yang-network-topo]
              Clemm, A., Medved, J., Varga, R., Bahadur, N.,
              Ananthakrishnan, H., and X. Liu, "A Data Model for Network
              Topologies", draft-ietf-i2rs-yang-network-topo-17 (work in
              progress), October 2017.

   [I-D.ietf-i2rs-yang-l3-topology]
              Clemm, A., Medved, J., Varga, R., Liu, X.,
              Ananthakrishnan, H., and N. Bahadur, "A YANG Data Model
              for Layer 3 Topologies", draft-ietf-i2rs-yang-
              l3-topology-12 (work in progress), October 2017.

   [I-D.ietf-teas-yang-te-topo]
              Liu, X., Bryskin, I., Beeram, V., Saad, T., Shah, H., and
              O. Dios, "YANG Data Model for TE Topologies", draft-ietf-
              teas-yang-te-topo-12 (work in progress), July 2017.

   [I-D.ietf-spring-sr-yang]
              Litkowski, S., Qu, Y., Sarkar, P., and J. Tantsura, "YANG
              Data Model for Segment Routing", draft-ietf-spring-sr-
              yang-07 (work in progress), July 2017.

Appendix A. Companion YANG Model for Non-NMDA Compliant Implementations

   The YANG module ietf-sr-topology defined in this document is designed
   to be used in conjunction with implementations that support the
   Network Management Datastore Architecture (NMDA) defined in
   [I-D.ietf-netmod-revised-datastores]. In order to allow
   implementations to use the model even in cases when NMDA is not
   supported, the following companion module, ietf-sr-topology-state, is
   defined as state model, which mirrors the module ietf-sr-topology
   defined earlier in this document. However, all data nodes in the
   companion module are non-configurable, to represent the applied
   configuration or the derived operational states.

   The companion module, ietf-sr-topology-state, is redundant and SHOULD
   NOT be supported by implementations that support NMDA.

   As the structure of the companion module mirrors that of the
   coorespinding NMDA model, the YANG tree of the companion module is
   not depicted separately.

A.1. SR Topology State Module

   <CODE BEGINS> file "ietf-sr-topology-state@2017-10-30.yang"
   module ietf-sr-topology-state {
     yang-version 1.1;
     namespace "urn:ietf:params:xml:ns:yang:ietf-sr-topology-state";
     prefix "srt-s";

     import ietf-sr-topology {
       prefix "srt";
     }
     import ietf-network-state {
       prefix "nw-s";
     }
     import ietf-network-topology-state {
       prefix "nt-s";
     }
     import ietf-l3-unicast-topology-state {
       prefix "l3t-s";
     }
     import ietf-segment-routing-common {
       prefix "sr-cmn";
     }

     organization "TBD";
     contact "TBD";
     description "L3 TE Topology model";

```
      revision 2017-10-30 {
        description "Initial revision";
        reference "TBD";
      }

      augment "/nw-s:networks/nw-s:network/nw-s:network-types/"
        + "l3t-s:l3-unicast-topology" {
        description
          "Defines the SR topology type.";
        uses srt:sr-topology-type;
      }

      augment "/nw-s:networks/nw-s:network/"
        + "l3t-s:l3-topology-attributes" {
        when "../nw-s:network-types/l3t-s:l3-unicast-topology/sr" {
          description "Augment only for SR topology.";
        }
        description "Augment topology configuration";
        uses srt:sr-topology-attributes;
      }

      augment "/nw-s:networks/nw-s:network/nw-s:node/"
        + "l3t-s:l3-node-attributes" {
        when "../../nw-s:network-types/l3t-s:l3-unicast-topology/sr" {
          description "Augment only for SR topology.";
        }
        description "Augment node configuration.";
        uses srt:sr-node-attributes;
      }

      augment "/nw-s:networks/nw-s:network/nw-s:node/"
        + "l3t-s:l3-node-attributes/l3t-s:prefix" {
        when "../../../nw-s:network-types/l3t-s:l3-unicast-topology/sr" {
          description "Augment only for SR topology.";
        }
        description "Augment node prefix.";
        uses srt:sr-node-prefix-attributes;
      }

      augment "/nw-s:networks/nw-s:network/nw-s:node/"
        + "nt-s:termination-point/"
        + "l3t-s:l3-termination-point-attributes" {
        when "../../../nw-s:network-types/l3t-s:l3-unicast-topology/"
          + "sr" {
          description "Augment only for SR topology.";
        }
        description "Augment termination point configuration";
        uses srt:sr-tp-attributes;
```

```
      }

      augment "/nw-s:networks/nw-s:network/nt-s:link/"
        + "l3t-s:l3-link-attributes" {
        when "../../nw-s:network-types/l3t-s:l3-unicast-topology/sr" {
          description "Augment only for SR topology.";
        }
        description "Augment link configuration.";
        uses srt:sr-link-attributes;
      }

      grouping sr-topology-attributes {
        description "SR topology scope attributes.";
        container sr {
          description
            "Containing SR attributes.";
          uses sr-cmn:srgb-cfg;
        } // sr
      } // sr-topology-attributes
    }
    <CODE ENDS>
```

Authors' Addresses

   Xufeng Liu
   Jabil
   8281 Greensboro Drive, Suite 200
   McLean VA 22102
   USA

   EMail: Xufeng_Liu@jabil.com

   Igor Bryskin
   Huawei Technologies

   EMail: Igor.Bryskin@huawei.com

   Vishnu Pavan Beeram
   Juniper Networks

   EMail: vbeeram@juniper.net

Tarek Saad
Cisco Systems Inc

EMail: tsaad@cisco.com

Himanshu Shah
Ciena

EMail: hshah@ciena.com

Stephane Litkowski
Orange Business Service

EMail: stephane.litkowski@orange.com