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YANG Data Model for SR and SR TE Topologies
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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

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[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:

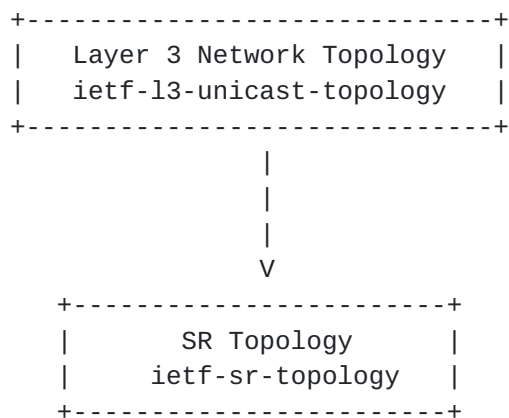
- o augment
- o data model

- o data node

2. Modeling Considerations

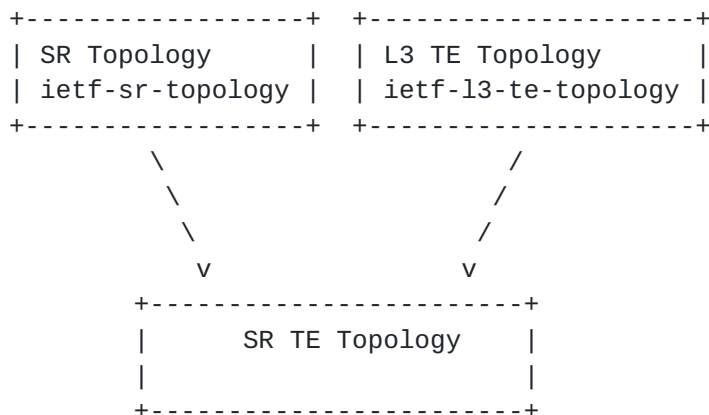
2.1. Segment Routing (SR) topology

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.



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.



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 "Indicates 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-10](#) (work in progress), January 2018.

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-20](#) (work in progress), December 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-16](#) (work in progress), December 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 Traffic Engineering (TE) Topologies", [draft-ietf-teas-yang-te-topo-13](#) (work in progress), October 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-08](#) (work in progress), December 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 cooresponding 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>
```

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