A Yang model for I2RS service topology
draft-hares-i2rs-service-topo-dm-06.txt

Abstract

   This document defines I2RS protocol-independent service layer virtual
   topology data model. This data model utilizes the concepts in the
   generic I2RS topology model of virtual networks (node, links,
   termination points) and cross-layer topologies. This virtual service
   topology may be a composite layer created from the combination of
   protocol-dependent service layers. Protocol-dependent services
   layers include: L3VPN, L2VPN, EVPN, E-Tree, and others.

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1. Introduction

   Service topology in [I-D.ietf-i2rs-yang-network-topo] includes the a
   virtual topology for a service layer above the L1, L2, and L3 layers.
   This virtual topology has the generic topology elements of node,
   link, and terminating point. The virtual service topology is a
   network-wide topology stored on one routing system which an I2RS
   agent is connected to.

   The virtual service topology is a composite summary of the services
   available services gathered from the lower layer indications of
   L3VPN, L2VPN, and EVPN services, E-TREE services, Seamless MPLS
   topologies within an As and others. This is a "bottoms up" yang
   module providing composite protocol independent service topology
   based on these protocol services.

   This "bottoms-up" yang model does provide a mechanism to link this
   bottoms up model to a top-down service model. One example of a top-
   down service model for L3 VPNs is the L3 Service yang data model
   [I-D.ietf-l3sm-l3vpn-service-model]. Although the two models are
   linked, the top-down service model cannot be derived from the lower
   layers.

1.1. 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 RFC2119 [RFC2119].

1.2. Base Model: the Service-Topology Component

   The following diagram contains an informal graphical depiction of the
   main elements of the information model:

```
                +----------------+
                |    network     |
                |    topology    |<...
                +----------------+   :
                  *         *   :    :
                  |         |   :...:
                  |         |
             +--------+   +--------+
     ...>|   node  |<.......|link    |<...
      :     +--------+<.......+--------+    :
      :    :    *          : :  *   :    :
      :.....    |          : :  |   :...:
               |          : :  |
     .....>+--------+<........: :   |
      :    |   TP   |<..........:   |
      : ...>+--------+               |
      : :                           |
      : : ....................+---------+
     .......................|Direction|
                            +---------+
```
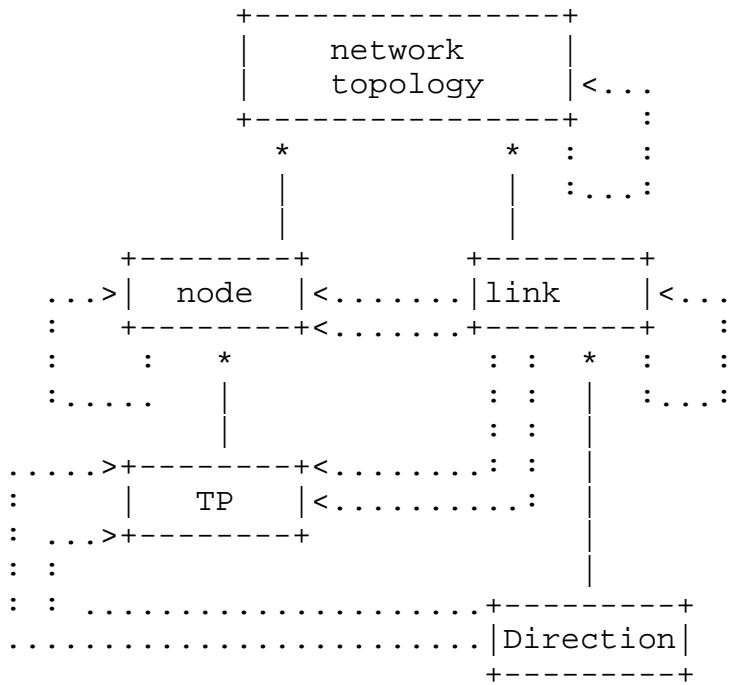
              Figure 1

   The link between the upper layer and the lower layer occurs by
   linking the bottoms up service network topologies to Top-down service
   topologies at certain service nodes to support transport of service
   across a virtual service link.

   An example of the top-down service topology link to the bottoms up
   composite service topology may help. Suppose a bottoms up topology
   contains a composite of 3 L3VPN network topologies, 2 L2VPN network
   topologies, and 2 EVPN network topologies. Each of these physical
   networks can support virtual networks on top of the physical network.
   The service network base bottoms up is formed topology map with all
   of these topologies.

   Suppose an L3SM has three VPN services topologies which support three
   services over 9 virtual topologies transiting the 2 of the L3VPN
   networks.

   o VPN-svc 1: supporting hub-spoke flow for Customer 1 with 2 Cloud
      identifiers (2 topologies) with connecting the customers access at
      3 sites

o VPN-svc 2: supporting hub-spoke flow disjoint for Customer 2 with
   2 Cloud identifiers (2 topologies) at 3 sites,

o VPN-svc 3: supporting any-to-any flow for Customer 3 with 1 Cloud
   Identifier (5 topologies) at 3 sites.

Let us examine how VPN-svc 1 links to the composite cloud. Let us
assume for simplicity of the example that the nodes providing the
L3VPN provider equipment (PE) and the customer equipment (CE) at all
sites are all unique. The diagram of how the top-down service
topology meets the bottom up service topology is shown in figure


```
   L3SM topologies
            Service-topology [VPN-ID:1]
                /              \
    cloud 1 topology 1        cloud 2 topology-1
      /     |     \            /     |     \
   Site-1A site-1B site1-C   site-1A Site-1B Site-1C
     |       |       |          |       |       |
 ====|=========|=======|=======|========|=====|====
     +-------+  |        \     /        /       |
 Bottoms-up |   |         \   /        /        |
 service    |   |          /\         /         |
 topology   |   |         /  \        |         |
 L3VPN-Service-topology 1  L3VPN-Service   Topology-2
       |   |        |       |       |         |
     node1 node2 node3   node4   node5     node6
       PE    PE    PE      PE      PE        PE
       |     |     |       |       |         |
       CE    CE    CE      CE      CE        CE
```
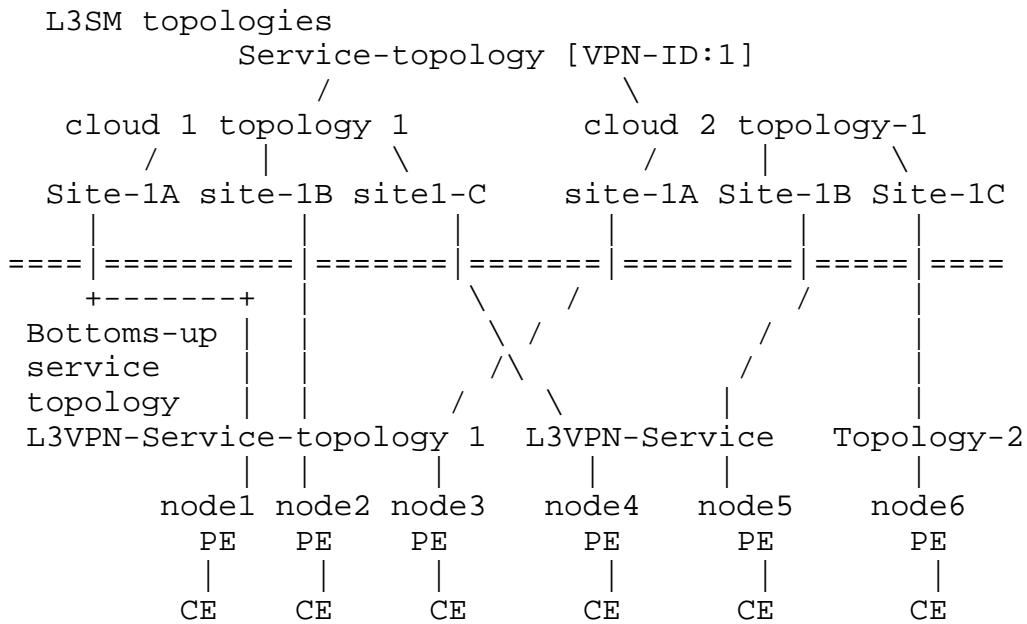
        Figure 2

These two layers of service topologies are by two different composite
models composite models and different supporting models as follows:

o Top-Down Provider Services with supporting L3SM model,

o Bottom-Up I2RS Composite Services with supporting model from
   L3VPN, L2VPN, EVPN (only L3VPN used). The links between
   topologies occur at specific nodes.

2. High level Yang architecture

   This section describes the Yang High level architecture.

2.1. Network level

   The service topology network level defines the following high-level
   yang architeture:

   module: i2rs-service-topologies
       augment /nw:network/nw:network-types:
         +--rw service-topologies-types
       augment /nw:network:
        +--rw service-topology-attributes
           +--rw name?   string
                   +--rw description? string
                   +--rw composite-flag* identity-ref
           +--rw tdsvc-supports-attributes*
                   [tdsvc-attr-name]
                   +--rw tdsvc-attr-name string
                      +--rw tdsvc-supports-attribute* identityref

   Note: Composite flags are bottoms-up flags

   Figure 3

   The service topology attributes for a network include the following

      name - name of the service topology,

      description - description of service topology

      composite-flags - bit mask with flags of service layer topologies
      network topology node available to create service topology from.
      These topologies include: L3VPN, L2VPN, and EVPN services, E-TREE
      services, Seamless MPLS topologies within an AS and others.

      tdsvc-supports-attributes - composite topology supports top-down
      services topology attributes

         tdsvc-supports-attr-name - name of top-down service attribute

         tdsvc-supports-attribute - identity ref of service attribute
         (e.g. L3SM service for any-to-any)

2.2. Node level

```
module: i2rs-service-topologies
....
   augment /nw:network/nw:node
     +--rw node-service-attributes
        +--rw c-svc-node-name?   inet:domain-name
        +--rw c-svc-node-flag*   identityref;
             +--rw tdsvc-node-supports-attributes*
                 [tdsvc-node-attr-name]
               +--rw tdsvc-node-attr-name string;
               +--rw tdsvc-node-supports-attribute identityref
            // Top down attributes supported
```

The additional fields in the service attributes are the following:

c-svc-node-name - name of network node,

c-svc-node-flag - composite service topology node flag. The
service node can be a member of one of the existing topology type
(L3VPN, L2VPN, EVPN, E-TREE, Seamless MPLS, MPLS-TE, MPLS node, or
I2RS created).

tdsvc-node-supports-attributes - node supports top-down services
topology attributes

   tdsvc-supports-node-attr-name - name of top-down service
   attribute

   tdsvc-supports-node-attribute - identity ref of service
   attribute (e.g. L3SM service for any-to-any)

2.3. Service Link and Termination point

```
        augment /nw:network/nt:link:
           +--rw service-link-attributes
              +--rw c-svc-link-name?      string
              +--rw c-svc-link-type identityref
              +--rw c-svc-link-metric?   uint32
                      +--rw tdsvc-link-supports-attr* [name]
                          +--rw tdsvc-link-attr-name string
                              +--rw tdsvc-link-attribute identityref
        augment /nw:network/nw:node/nt:termination-point:
           +--rw service-termination-point-attributes
                  +--rw svc-tp-name string
                      +--rw svc-tp-type identityref
                      +--rw tdsvc-tp-support-attributes
                          +--rw tdsvc-tp-attr-name
                              +--rw tdsvc-tp-support-attribute
```

   The augmentation to the service topology is the service link
   attributes which include:

      c-svc-link-name - name of the link,

      c-svc-link-type - the service link type supported by this logical
      link.

      metric - the metric of the service type. This metric allows the
      composite link to store a svc level metric. 0 = no servic metric.
      1-n values (1 best, n worse).

      svc-attributes - the composite attributes of link

      tdsvc-td-support-attributes - link support of Top-down attributes

         tdsvc-supports-node-attr-name - name of top-down service
         attribute

         tdsvc-supports-node-attribute - identity ref of service
         attribute (e.g. L3SM service for any-to-any)

   The augmentation to the termination point include the following

      svc-tp-name - name of termination point,

      tp-type - type of link (L3VPN, L2VPN, combined)

      tdsvc-tp-support-attributes - list of top-level domain-name
      attributes this links supports.

3. Yang Data Model

    <CODE BEGINS> file "ietf-i2rs-service-topology@2016-02-q0.yang"

```
 module ietf-i2rs-service-topology{
  namespace "urn:ietf:params:xml:ns:yang:ietf-i2rs-service-topology";
  prefix i2rs-st;

    import ietf-inet-types {
    prefix inet;
  }

   import ietf-network {
     prefix nw;
  }
   import ietf-network-topology {
     prefix "nt";
  }

   organization "IETF";
         contact
      "email: shares@ndzh.com;
       email: linda.dunbar@huawei.com;
         ";

   description
     "This module defines a model for the service topology.
          This service model imports
          - ietf-network and ietf-network-topology from
             draft-ietf-i2rs-yang-network-topo-02.txt,
          - ietf-routing from draft-ietf-netmod-routing-cfg,
          - ietf-l3vpn-svc from
             draft-ietf-l3sm-l3vpn-service-model.
                 (not defined yet )
          ";

   revision 2016-02-12 {
     description
       "Version 1 - initial version;
            Version 2 - yang format fixed
            Version 3 - errro in xml file
            version 4 - remove next-hops attribute.
            version 5- links to top-level attributes.
             version 6 - Remove extra parameters.";

     reference "draft-hares-i2rs-service-topo-dm-05.txt";
   }
```

```
        identity svc-topo-flag-identity {
          description "Base type for svc flags";
          }
        identity l3vpn-svc-topo {
          base svc-topo-flag-identity;
          description "L3VPN service type";
         }
        identity l2vpn-svc-topo {
          base svc-topo-flag-identity;
          description "L2VPN service type";
         }
         identity EVPN-svc-topo {
          base svc-topo-flag-identity;
          description "EVPN service type";
         }
          identity Seamless-MPLS-svc-topo {
          base svc-topo-flag-identity;
          description "Seamless MPLS service type";
         }
          identity Etree-svc-topo {
          base svc-topo-flag-identity;
          description "Seamless MPLS service type";
         }
          identity I2rs-svc-topo {
          base svc-topo-flag-identity;
          description "I2RS create service topo";
         }

        identity svc-tp-type {
          description "Base type for service
            termination-point type flags";
          }
        identity svc-tp-type-service {
          base svc-tp-type;
          description "service type";
         }
        identity svc-tp-type-ip {
          base svc-tp-type;
          description "service IP";
         }
        identity svc-tp-type-unnum {
                  base svc-tp-type;
          description "service unnumbered link";
         }


            identity svc-link-type {
             description "Base type for composite
```

```
                   service link attribute flags";
         }
             identity svc-link-ip-te {
               base svc-link-type;
               description "service link
               that support IP traffic engineering";
             }

             identity svc-link-ip-multicast {
               base svc-link-type;
               description "service link that
               supports IP multicast.";
             }

        identity tdsvc-support-identity {
      description "Base type for svc flags";
      }

             identity td-L3sm-hub-spoke {
                 base tdsvc-support-identity;
      description "Supports L3SM hub-spoke";
      }
         identity td-L3sm-hub-spoke-disjoint {
                 base tdsvc-support-identity;
      description "Supports L3SM hub-spoke disjoint";
      }

             identity td-L3sm-any-any {
                 base tdsvc-support-identity;
      description "Supports L3SM any-any";
      }


       grouping svc-combo-network-type {
         description "Identify the topology type to be
                 composite service topology.";
         container svc-combo-network {
           presence "indicates Service layer Network";
           description
           "The presence of the container node indicates
            Service layer which combines networks
                     L3VPN, L2VPN, and others";
                 }
       }


        grouping service-topology-attributes {
          leaf name {
```

```
                    type string;
              description "name of service
              topology";
                        }
              leaf description {
                      type string;
                      description "description
                      of service attribute";
                 }
                    leaf composite-flag {
                type identityref {
                   base svc-topo-flag-identity;
                        }
              description "other topologies
              this topology is configured to
               be a composite of
                  (L3VPN, L2VPN, I2RS only)";
              }

                    list tdsvc-supports-attributes {
                       key tdsvc-attr-name;
                       leaf tdsvc-attr-name {
                        type string;
                            description "top-down
                            service support attribute name";
                       }
                    leaf tdsvc-supports-attribute {
                  type identityref {
                   base tdsvc-support-identity;
                           }
                       description "top-down service
                      attribute this topology supports.";

                       }
                    description "supporting top-down
                service attributes. ";
                    }
                   description  "Group of attributes for
                  service topology";

          }


          grouping node-svc-attribute {
            leaf c-svc-node-name{
               type inet:domain-name;
               description "Domain name for node";
            }
```

```
         leaf c-svc-flag {
           type identityref {
             base svc-topo-flag-identity;
                   }
           description "virtual network
            node can be composite of the
            topologies list
            (L3VPN, L2VPN, I2RS only)";
         }

               list tdsvc-node-supports-attributes {
                   key tdsvc-node-attr-name;
                   leaf tdsvc-node-attr-name {
                        type string;
                        description "name of top-down
                         service attribute ";
                   }
                   leaf tdsvc-node-supports-attribute {
               type identityref {
                base tdsvc-support-identity;
                       }
                     description "top-down service
                    attribute this topology supports.";

                   }
                   description "list of top-down service
                   attributes this node supports";
               }

             description
             "grouping of composite flag";
         }

         grouping service-link-attributes {
         leaf c-svc-link-name {
                  type string;
           description "name of
             service link";
                 }
         leaf c-svc-link-type {
           type identityref {
             base svc-link-type;
                   }
           description "other topologies
             this link is current a
                      composite of
             (L3VPN, L2VPN, I2RS only)";
         }
```

```
            leaf c-svc-link-metric {
              type uint32;
              description "link metric
                        for servicest to
                            allow TE loading at composite
                            service level";
            }
                    list tdsvc-link-supports-attributes {
                        key tdsvc-link-attr-name;
                        leaf tdsvc-link-attr-name {
                         type string;
                             description "top-down
                             service support attribute name";
                        }
                        leaf c-svc-link-td-support-attribute {
                  type identityref {
                   base tdsvc-support-identity;
                            }
                          description "top-down service
                         attribute this link supports.";
                        }
                      description "list of service level
                       link attributes";
                    }
                description "grouping of
                      service link attribute";
        }

      grouping service-termination-point-attributes {
          leaf svc-tp-name {
                  type string;
                  description "name of service
                   termination point";
                }
          leaf svc-tp-type {
              type identityref {
                base svc-topo-flag-identity;
                        }
            description "other topologies
              this link termination point is
              part of (L3VPN, L2VPN,
                    or I2RS only)";
                }
          list tdsvc-tp-support-attributes {
                  key tdsvc-tp-attr-name;
                  leaf tdsvc-tp-attr-name {
                   type string;
                        description "top-down
```

```
                        service support attribute name";
                  }
                leaf tdsvc-tp-support-attribute {
             type identityref {
              base tdsvc-support-identity;
                     }
                    description "top-down service
                  attribute this link supports.";
                }
               description "list of service level
                 link attributes";
             }
           description "grouping of
               service link attribute";

       }


         augment "/nw:networks/nw:network/nw:network-types" {
       uses svc-combo-network-type;
             description
             "augment the network-tpyes with
             the service-topology-types grouping";
             }

             augment "/nw:networks/nw:network" {
         when "nw:network-types/svc-combo-network" {
           description
             "Augmentation parameters apply only for
                       service network with bottoms up topology";
          }
          description
            "Augment with combo service
                  topology attributes";
          uses service-topology-attributes;
        }

     augment "/nw:networks/nw:network/nw:node"{
           when "nw:network-types/svc-combo-network" {
           description
             "Augmentation parameters apply only for
                       service network with bottoms up topology";
          }
          uses node-svc-attribute;
             description
            "augment the node with the node-svc-attribute";
          }
```

```
        augment "/nw:networks/nw:network/nt:link" {
          when "nw:network-types/svc-combo-network" {
        description
          "Augmentation parameters apply only for
                     service network with bottoms up topology";
        }
              uses service-link-attributes;
              description
              "augment the link with
              service-link-attributes";
        }
    augment "/nw:networks/nw:network/nw:node/nt:termination-point"{
           when "nw:network-types/svc-combo-network" {
        description
          "Augmentation parameters apply only for
                     service network with bottoms up topology";
         }
              uses service-termination-point-attributes;
              description
              "augment the termination-point with
              service-termination-point-attributes";
        }

   } // module i2rs-service-topology
   } // module i2rs-service-topology

   <CODE ENDS>
```

4. IANA Considerations

   TBD

5. Security Considerations

   TBD

6. References

6.1. Normative References

   [I-D.ietf-i2rs-yang-network-topo]
           Clemm, A., Medved, J., Varga, R., Tkacik, T., Bahadur, N.,
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   [RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
               Requirement Levels", BCP 14, RFC 2119,
               DOI 10.17487/RFC2119, March 1997,
               <http://www.rfc-editor.org/info/rfc2119>.

6.2. Informative References

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               Bryskin, I., Guo, A., Ananthakrishnan, H., Bahadur, N.,
               and V. Beeram, "A YANG Data Model for Layer 3 Topologies",
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               December 2015.

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               2015.

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