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.

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering 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/.

Internet-Drafts are draft documents valid for a maximum of six months 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 August 15, 2016.

Copyright Notice

Copyright (c) 2016 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust’s Legal Provisions Relating to IETF Documents (http://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of
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     |<...|    network     |
+----------------+    |    topology     |<...|    topology     |
|           *    |<...|    * : :        |<...|    * : :        |
|           :    |<...|    : : :        |<...|    : : :        |
|           : :   |<...|    : : :        |<...|    : : :        |
|           : : : |<...|    : : :        |<...|    : : :        |
|           : :   |<...|    : : :        |<...|    : : :        |
+--------+<.......|link   |<...|+--------+
|  node  |<.......|       |<...|+--------+
|......|<.......|       |<...|......|
|       |<.......|       |<...|       |
|       |<.......|       |<...|       |
|       |      |<.......|<......|       |
|       |      |        |<......|       |
|       |      |        |       |       |
|       |      |        |       |       |
|       |      |        |       |        |
+---------+<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.

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

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

- Top-Down Provider Services with supporting L3SM model,
- 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 architecture:

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
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 service 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 - erro 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";
  }

Hares & Dunbar           Expires August 15, 2016                [Page 8]
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)";
}

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";
    }
}

description "supporting top-down service attributes. ";
}

description "Group of attributes for service topology";
}
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 services 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 Link Attribute";
        }
    }
    description "grouping of
    service link attribute";
}
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-types 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]
Topologies", draft-ietf-i2rs-yang-network-topo-02 (work in
progress), December 2015.
6.2. Informative References

[I-D.ietf-i2rs-yang-l3-topology]

[I-D.ietf-l3sm-l3vpn-service-model]

Authors’ Addresses

Susan Hares
Huawei
7453 Hickory Hill
Saline, MI 48176
USA
Email: shares@ndzh.com

Linda Dunbar
Huawei
USA
Email: linda.dunbar@huawei.com