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Traffic Engineering and Service Mapping Yang Model

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Abstract

This document provides a YANG data model to map service model (e.g., L3SM) and Traffic Engineering model (e.g., TE Tunnel or ACTN VN model). This model is referred to as TE service Mapping Model. This model is applicable to the operation’s need for a seamless control and management of their VPN services with TE tunnel support.

Status of this Memo

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

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This Internet-Draft will expire on August 25, 2018.

Table of Contents

1. Introduction

Data models are a representation of objects that can be configured or monitored within a system. Within the IETF, YANG [RFC6020] is the language of choice for documenting data models, and YANG models have been produced to allow configuration or modeling of a variety of

network devices, protocol instances, and network services. YANG data models have been classified in [Netmod-Yang-Model-Classification] and [Service-YANG].

[RFC4110] provides a framework for Layer 3 Provider-Provisioned Virtual Private Networks (PPVPNs). [L3SM-YANG] provides a L3VPN service delivery YANG model for PE-based VPNs. The scope of this draft is limited to a set of domain under the same network operators to deliver services requiring TE tunnels.

[ACTN-VN-YANG] describes how customers or end to end orchestrators can request and/or instantiate a generic virtual network service. [ACTN-Applicability] describes a connection between IETF YANG model classifications to ACTN interfaces. In particular, it describes the customer service model can be mapped into the CMI (CNC-MDSC Interface) of the ACTN architecture.

The YANG model on the ACTN CMI is known as customer service model in [Service-YANG]. The YANG model developed in this document describes how operator's end to end orchestrator interacts with the MDSC so that the MDSC then can coordinate the control and management of L3VPN MPLS TE tunnels that traverse both IP/MPLS and Transport networks. In addition, the YANG model described in this document also supports the mapping with TE tunnels for other VPN models such as L1VPN and L2VPN, etc.

While IP/MPLS PNC is responsible for provisioning the VPN service on the PE nodes, the MDSC can coordinate how to map the VPN services with TE tunnels. This is consistent with the two of the core functions of the MDSC specified in [ACTN-Frame]:

- Customer mapping/translation function: This function is to map customer requests/commands into network provisioning requests that can be sent to the Physical Network Controller (PNC) according to business policies provisioned statically or dynamically. Specifically, it provides mapping and translation of a customer's service request into a set of parameters that are specific to a network type and technology such that network configuration process is made possible.

- Virtual service coordination function: This function translates customer service-related information into virtual network service operations in order to seamlessly operate virtual networks while meeting a customer's service requirements. In the context of ACTN, service/virtual service coordination includes a number of service orchestration functions such as multi-destination load balancing, guarantees of service

quality, bandwidth and throughput. It also includes notifications for service fault and performance degradation and so forth.

In some cases, under the confines of service policy, dynamic TE tunnel creation may need to be supported for the VPN service. This may occur when there are no suitable existing TE tunnels that can support VPN service requirements. Or the operator would like to dynamically create and bind tunnels to the VPN, which could not be shared for network slicing.

To summarize there are three mode of operations, but not limited to:

- New VN/Tunnel Binding - Customer could request an L3VPN service [L3SM-YANG] with a new VN/Tunnel not shared with other existing services. This is to meet VPN isolation requirement. Further the mapping yang model described in Section 5 of this document is used to set this mapping between the L3VPN service and the ACTN VN. Note that this could be done dynamically. The VN (and TE tunnels) could be bound to the L3VPN and not used for any other VPN.

- VN/Tunnel Selection - Customer could request an L3VPN service [L3SM-Yang], and with this model as input, the PNC configures the different network elements to deliver the service. Each network element would select a tunnel based on the configuration. With this mode, new tunnels (or VN) are not created for each VPN. Thus, the tunnels can be shared across multiple VPN. Further the mapping yang model described in Section 5 of this document is used to get the mapping between the L3VPN and the tunnels in use. No modification is allowed when an existing tunnel is selected.

- VN/Tunnel Modify - This mode allows the modification of the properties of the existing VN/tunnel (e.g., bandwidth) when VN/Tunnel Selection Mode is applied.

Other mode of operations could be easily added to the current model in the future.

[Editor’s note - A future version of the document can be updated to add more modes or policy.]

The YANG model described in this document provides an ACTN TE-service mapping model that enables a seamless service mapping across L1/2/3 VPN, ACTN VN and TE-tunnel models at the controllers.

2. L3VPN Architecture in ACTN context

Figure 1 shows the architectural context of this document.

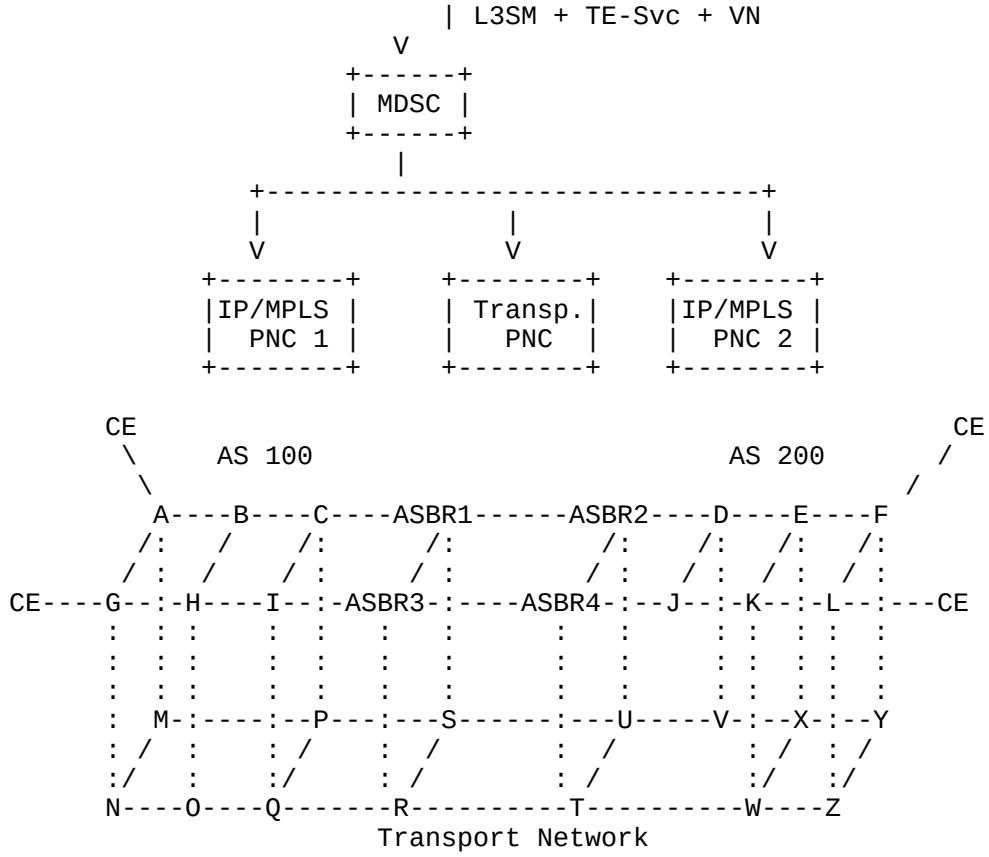


Figure 1: L3VPN Architecture from the IP+Optical Network Perspective

There are three main entities in the architecture.

. MDSC: This entity is responsible for coordinating a L3VPN service request (expressed in L3SM) with the IP PNC and the Transport PNC.

One of the key responsibilities of the MDSC for TE services is to coordinate with both the IP PNC and the Transport PNC for the mapping of L3VPN Service Model and ACTN VN model. With the VN/TE-tunnel binding case, the MDSC will need to coordinate with the Transport PNC to dynamically create the TE-tunnel(s) in the Transport network as needed. These tunnels are added as links in the IP Layer topology. The MDSC coordinates with IP PNC to create the TE-tunnel(s) in the IP layer, as part of the ACTN VN creation.

. IP/MPLS PNC: This entity is responsible for device configuration to create PE-PE L3VPN tunnels for the VPN customer and for the configuration of the L3VPN VRF on the PE nodes. Each network element would select a tunnel based on the configuration.

. Transport PNC: This entity is responsible for device configuration for TE tunnels in the transport networks.

High-Level Control Flows

1. Customer asks for a L3VPN between CE1 and CE2 with TE constraints using L3SM model. The customer can provide tunnel creation policy where it allows dynamic VN/TE tunnel creation or not. Under this policy, dynamic VN/TE tunnels can be created when there are no proper VN/TE-tunnels that can support L3VPN tunnels or when there is a strict isolation requirement for the VPN service, e.g., no sharing with other tunnels is allowed.

2. The MDSC determines if it needs to create a new VN, and if that is the case, ACTN VN YANG [ACTN-VN-YANG] is used to configure a new VN based on this VPN and map the VPN service to ACTN VN. In case an existing tunnel is to be used, each device will select which tunnel to use and populates this mapping information.

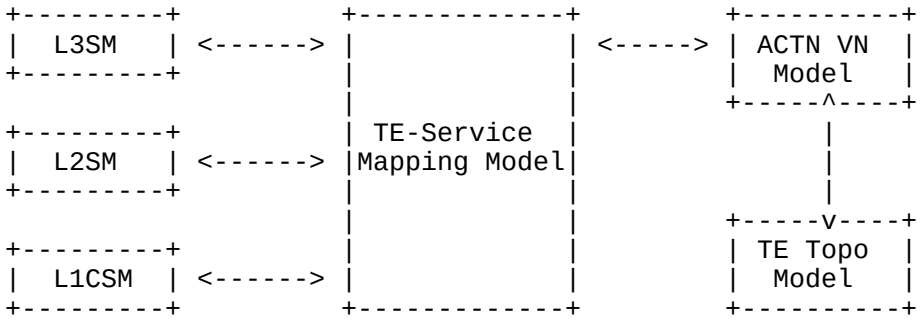
3. The MDSC interacts with both the IP/MPLS PNC and the Transport PNC to create a PE-PE tunnel in the IP network mapped to a TE tunnel in the transport network by providing the inter-layer access points and tunnel requirements. The specific service information are passed to the IP/MPLS PNC for the actual VPN configuration and activation.

    a. The Transport PNC creates the corresponding TE tunnel matching with the access point and egress point.
    b. The IP/MPLS PNC maps the VPN ID with the corresponding TE tunnel ID to bind these two IDs.

4. The IP/MPLS PNC creates/updates a VRF instance for this VPN customer. This is not in the scope of this document..

3. TE-Service Mapping Model

The role of TE-service Mapping model is to create a binding relationship across L3SM, L2SM [L2SM-YANG] and L1CSM [L1CSM-YANG] and ACTN VN Model. The ACTN VN YANG model is a generic virtual network service model that allows customers (internal or external) to create a VN that meets the customer's service objective with various constraints via TE-topology model [TE-topo]. The TE-service mapping model is needed to bind LxVPN specific service model with TE-specific parameters. This binding will facilitate a seamless service operation with underlay-TE network visibility. The TE-service model developed in this document can also be extended to support other services beyond L3SM, L2SM and L1CSM.



. . .

4. YANG Data Tree

```
module: ietf-te-service-mapping
    +--rw te-service-mapping
       +--rw service-mapping
       |  +--rw mapping-list* [map-id]
       |     +--rw map-id         uint32
       |     +--rw map-type?      map-type
       |     +--rw (service)?
       |     |  +--:(l3vpn)
```

```
       |     |  |  +--rw l3vpn-ref?     -> /l3:l3vpn-svc/vpn-services/vpn-
service/vpn-id
       |     |  +--:(l2vpn)
       |     |  |  +--rw l2vpn-ref?     -> /l2:l2vpn-svc/vpn-services/vpn-
service/vpn-id
       |     |  +--:(l1vpn)
       |     |     +--rw l1vpn-ref?     -> /l1:l1cs/service/service-
list/subscriber-l1vc-id
       |     +--rw actn-vn-ref?   -> /vn:actn/vn/vn-list/vn-id
       +--rw site-mapping
          +--rw mapping-list* [map-id]
             +--rw map-id         uint32
             +--rw (service)?
             |  +--:(l3vpn)
             |  |  +--rw l3vpn-ref?     -> /l3:l3vpn-svc/sites/site/site-id
             |  +--:(l2vpn)
             |  |  +--rw l2vpn-ref?     -> /l2:l2vpn-svc/sites/site/site-id
             |  +--:(l1vpn)
             |     +--rw l1vpn-ref?     -> /l1:l1cs/access/uni-list/UNI-ID
                +--rw actn-ap-ref?   -> /vn:actn/ap/access-point-list/access-
   point-id
```

5. Yang Data Model

The YANG code is as follows:

<CODE BEGINS> file "ietf-te-service-mapping@2018-02-24.yang"

```
module ietf-te-service-mapping {

       namespace "urn:ietf:params:xml:ns:yang:ietf-te-service-mapping";

       prefix "tm";

       import ietf-l3vpn-svc {
           prefix "l3";
       }

       import ietf-l2vpn-svc {
           prefix "l2";
       }

       import ietf-l1csm {
           prefix "l1";
```

```
    }

    import ietf-actn-vn {
        prefix "vn";
    }

    organization
        "IETF Traffic Engineering Architecture and Signaling (TEAS)
        Working Group";

    contact
        "Editor: Young Lee <leeyoung@huawei.com>
                 Dhruv Dhody <dhruv.ietf@gmail.com>";
    description
        "This module contains a YANG module for the mapping of
        service (e.g. L3VPN) to the TE tunnels or ACTN VN.";

    revision 2018-02-24 {
        description
            "initial version.";
        reference
            "TBD";
    }

    /*
     * Identities
     */
    identity service-type {
        description
            "Base identity from which specific service types are
            derived.";
    }

    identity l3vpn-service {
        base service-type;
        description
            "L3VPN service type.";
    }

    identity l2vpn-service {
        base service-type;
        description
            "L2VPN service type.";
    }
```

```
       identity l1vpn-service {
           base service-type;
           description
               "L1VPN connectivity service type.";
       }
       /*
        * Enum
        */
       typedef map-type {
           type enumeration {
               enum "new" {
                   description
                       "The new VN/tunnels are binded to the service. Customer
could request a VN with a new VN/Tunnel not shared with other existing
services. This is to meet VPN isolation requirement. ";
               }
               enum "select" {
                   description
                       "The VPN service selects an existing tunnel with no
modification";
               }
               enum "modify" {
                   description
                       "The VPN service selects an existing tunnel and allows
to modify the properties of the tunnel (e.g., b/w) ";
                  }
           }
           description
               "The map-type";
       }

       /*
        * Groupings
        */
       grouping service-ref{
           description
               "The reference to the service.";
            choice service {
               description
                   "The service";
               case l3vpn {
                   leaf l3vpn-ref {
                       type leafref {
                           path "/l3:l3vpn-svc/l3:vpn-services/"
                           + "l3:vpn-service/l3:vpn-id";
```

```
                        }
                        description
                            "The reference to L3VPN Service Yang Model";
                    }
                }
                case l2vpn {
                    leaf l2vpn-ref {
                        type leafref {
                            path "/l2:l2vpn-svc/l2:vpn-services/"
                            + "l2:vpn-service/l2:vpn-id";
                        }
                        description
                            "The reference to L2VPN Service Yang Model";
                    }

                }
                case l1vpn {
                    leaf l1vpn-ref {
                        type leafref {
                            path "/l1:l1cs/l1:service/"
                            + "l1:service-list/l1:subscriber-l1vc-id";
                        }
                        description
                            "The reference to L1VPN Service Yang Model";
                    }

                }
            }
        }

        grouping site-ref {
            description
                "The reference to the site.";
             choice service {
                description
                    "The service choice";
                case l3vpn {
                    leaf l3vpn-ref{
                        type leafref {
                            path "/l3:l3vpn-svc/l3:sites/l3:site/"
                            + "l3:site-id";
                        }
                        description
                            "The reference to L3VPN Service Yang Model";
                    }
```

```
                }
                case l2vpn {
                    leaf l2vpn-ref{
                        type leafref {
                            path "/l2:l2vpn-svc/l2:sites/l2:site/"
                            + "l2:site-id";
                        }
                        description
                            "The reference to L2VPN Service Yang Model";
                    }

                }
                case l1vpn {
                    leaf l1vpn-ref{
                        type leafref {
                            path "/l1:l1cs/l1:access/l1:uni-list/"
                            + "l1:UNI-ID";
                        }
                        description
                            "The reference to L1VPN Connectivity Service Yang
Model";
                    }

                }

             }
        }

        grouping actn-vn-ref {
            description
                "The reference to ACTN VN.";
            leaf actn-vn-ref {
                 type leafref {
                     path "/vn:actn/vn:vn/vn:vn-list/vn:vn-id";
                 }
                 description
                     "The reference to ACTN VN";
            }
        }

        grouping actn-ap-ref {
            description
                "The reference to ACTN endpoints (AP).";
            leaf actn-ap-ref {
                 type leafref {
```

```
                    path "/vn:actn/vn:ap/vn:access-point-list"
                           + "/vn:access-point-id";
                    }
                    description
                        "The reference to ACTN AP";
            }
        }

        grouping service-mapping {
            description
                "Mapping between Services and TE";
            container service-mapping {
                description
                    "Mapping between Services and TE";

                list mapping-list {
                    key "map-id";
                    description
                        "Mapping identified via a map-id";
                    leaf map-id {
                        type uint32;
                        description
                            "a unique mapping identifier";
                    }
                    leaf map-type {
                        type map-type;
                        description
                            "Tunnel Bind or Tunnel Selection";
                    }
                    uses service-ref;

                    uses actn-vn-ref ;
                }
            }
        }
        grouping site-mapping {
            description
                "Mapping between VPN access site and ACTN AP";
            container site-mapping {
                description
                    "Mapping between VPN access site and ACTN AP";
                list mapping-list {
                    key "map-id";
                    description
                        "Mapping identified via a map-id";
```

```
                    leaf map-id {
                        type uint32;
                        description
                            "a unique mapping identifier";
                    }
                    uses site-ref;

                    uses actn-ap-ref ;
                }

            }
        }

        /*
         * Configuration data nodes
         */
        container te-service-mapping {
            description
                "Mapping between Services and TE";

            uses service-mapping;

            uses site-mapping;
        }


    }
```

<CODE ENDS>

6. Security

The configuration, state, and action data defined in this document are designed to be accessed via a management protocol with a secure transport layer, such as NETCONF [RFC6241]. The NETCONF access control model [RFC6536] provides the means to restrict access for particular NETCONF users to a preconfigured subset of all available NETCONF protocol operations and content.

A number of configuration data nodes defined in this document are writable/deletable (i.e., "config true") These data nodes may be considered sensitive or vulnerable in some network environments.

7. IANA Considerations

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

```
---------------------------------------------------------------------
URI: urn:ietf:params:xml:ns:yang:ietf-te-service-mapping
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 [RFC7950]:

```
---------------------------------------------------------------------
name:         ietf-te-service-mapping
namespace:    urn:ietf:params:xml:ns:yang:ietf-te-service-mapping
reference:    RFC XXXX (TDB)
---------------------------------------------------------------------
```

8. Acknowledgements

We thank Diego Caviglia and Igor Bryskin for useful discussions and motivation for this work.

9. References

9.1. Informative References

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10. Contributors

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