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A Yang Data Model for L1 Connectivity Service Model (L1CSM)

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Abstract

This document provides a YANG data model for Layer 1 Connectivity Service Model (L1CSM).

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1. Introduction

This document provides a YANG data model for L1VPN Connectivity Service Model (L1CSM). The intent of this document is to provide a transport service model exploiting Yang data model, which can be utilized by a client network controller to initiate a service request connectivity request as well as retrieving service states toward a transport network controller communicating with the client controller via a Netconf/Restconf interface.

[RFC4847] provides a framework and service level requirements for Layer 1 Virtual Private Networks (L1VPNs). It classifies service models as management-based service model, signaling-based service

model (Basic Mode) and signaling and routing service model (Enhanced Mode).

In the management-based service model, customer management systems and provider management systems communicate with each other. Customer management systems access provider management systems to request layer 1 connection setup/deletion between a pair of CEs. Customer management systems may obtain additional information, such as resource availability information and monitoring information, from provider management systems. There is no control message exchange between a CE and PE.

In the signaling-based service model (Basic Model), the CE-PE interface's functional repertoire is limited to path setup signaling only. In the Signaling and routing service model (Enhanced Mode), the CE-PE interface provides the signaling capabilities as in the Basic Mode, plus permits limited exchange of information between the control planes of the provider and the customer to help such functions as discovery of customer network routing information (i.e., reachability or TE information in remote customer sites), or parameters of the part of the provider's network dedicated to the customer.

The primary focus of this document is to describe L1CS YANG model required for the instantiation of point-to-point L1VPN service. A L1VPN is a service offered by a core layer 1 network to provide layer 1 connectivity between two or more customer sites where the customer has some control over the establishment and type of the connectivity.

1.1. Deployment Scenarios

Figure 1 depicts a deployment scenario of the L1VPN SDN control-based service model for an external customer instantiating L1 point-to-point connectivity to the provider.

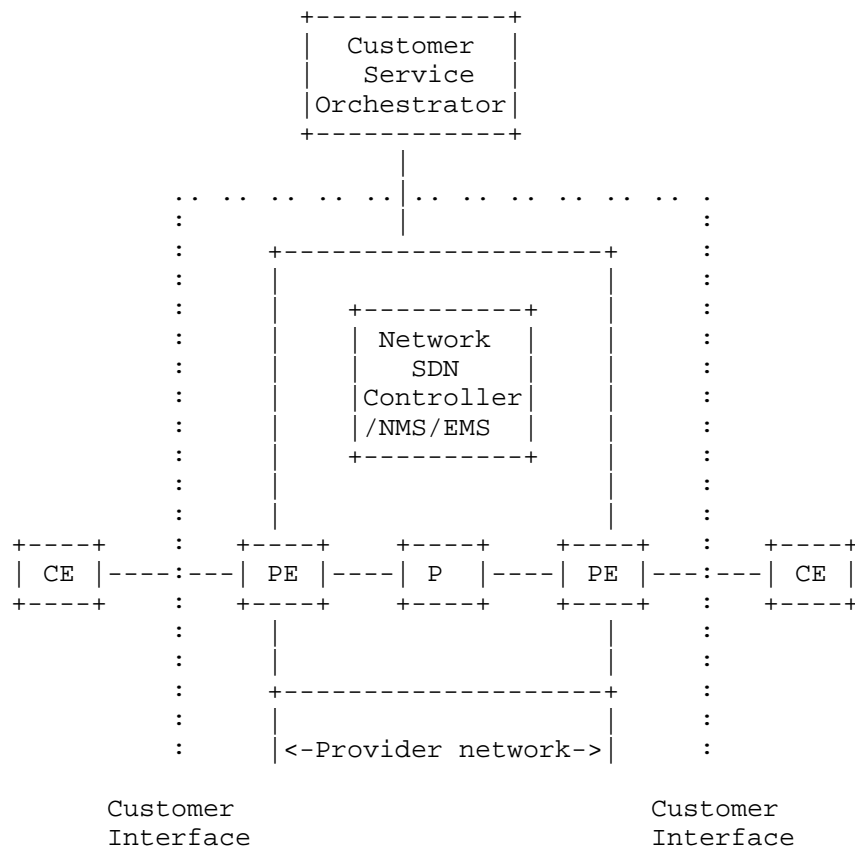


Figure 1: L1VPN SDN Controller/EMS/NMS-Based Service Model: External Customer

With this scenario, the customer service orchestrator interfaces with the network SDN controller of the provider using Customer Service Model as defined in [Service-Yang].

Figure 2 depicts another deployment scenario for internal customer (e.g., higher-layer service management department(s)) interfacing the layer 1 transport network department. With this scenario, a multi-service backbone is characterized such that each service department of a provider (e.g., L2/3 services) that receives the same provider's L1VPN service provides a different kind of higher-layer service. The customer receiving the L1VPN service (i.e., each service department) can offer its own services, whose payloads can be any layer (e.g., ATM, IP, TDM). The layer 1 transport network and each service network belong to the same organization, but may be

managed separately. The Service SDN Controller is the control/management entity owned by higher-layer service department (e.g., L2/3 VPN) whereas the Network SDN Controller is the control/management entity responsible for Layer 1 connectivity service. The CE's in Figure 2 are L2/3 devices that interface with L1 PE devices.

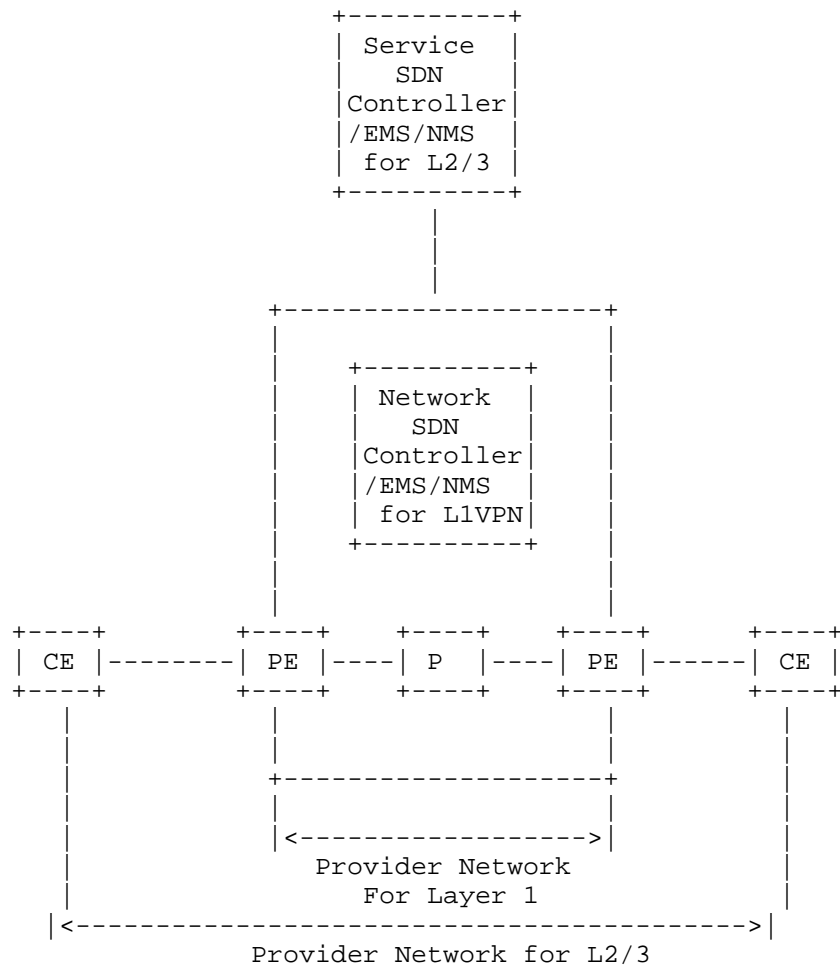


Figure 2: L1VPN SDN Controller/EMS/NMS-Based Service Model: Internal Customer

The benefit is that the same layer 1 transport network resources are shared by multiple services. A large capacity backbone network (data plane) can be built economically by having the resources shared by multiple services usually with flexibility to modify topologies, while separating the control functions for each service department. Thus, each customer can select a specific set of features that are needed to provide their own service [RFC4847].

1.2. Terminology

Refer to [RFC4847] and [RFC5253] for the key terms used in this document.

The following terms are defined in [RFC6241] and are not redefined here:

- o client
- o configuration data
- o server
- o state data

The following terms are defined in [RFC6020] and are not redefined here:

- o augment
- o data model
- o data node

The terminology for describing YANG data models is found in [RFC6020].

1.3. Tree diagram

A simplified graphical representation of the data model is presented in Section x.

The meaning of the symbols in these diagrams is as follows:

- o Brackets "[" and "]" enclose list keys.

- o Curly braces "{" and "}" contain names of optional features that make the corresponding node conditional.
- o Abbreviations before data node names: "rw" means configuration (read-write), and "ro" state data (read-only).
- o Symbols after data node names: "?" means an optional node and "*" denotes a "list" or "leaf-list".
- o Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- o Ellipsis ("...") stands for contents of subtrees that are not shown.

2. Definitions

TDB

3. L1SM YANG Model (Tree Structure)

```

module: ietf-llcsm
  +--rw llcs
    +--rw access
      |   +--rw uni-list* [UNI-ID]
      |   |   +--rw UNI-ID          string
      |   |   +--rw protocol?       identityref
      |   |   +--rw coding?         identityref
      |   |   +--rw optical_interface? identityref
      |   +--rw service
      |   |   +--rw service-list* [subscriber-llvc-id]
      |   |   |   +--rw subscriber-llvc-id    string
      |   |   |   +--rw service-config
      |   |   |   |   +--rw subscriber-llvc-id?    string
      |   |   |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   |   |   +--rw client-protocol?    identityref
      |   |   |   |   +--rw time-start?         yang:date-and-time
      |   |   |   |   +--rw time-interval?      int64
      |   |   |   |   +--rw CoS_Name?           string
      |   |   |   |
      |   |   |   +--rw subscriber-llvc-id?    string
      |   |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   |   +--rw client-protocol?    identityref
      |   |   |   +--rw time-start?         yang:date-and-time
      |   |   |   +--rw time-interval?      int64
      |   |   |   +--rw CoS_Name?           string
      |   |   |
      |   |   +--rw subscriber-llvc-id?    string
      |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   +--rw client-protocol?    identityref
      |   |   +--rw time-start?         yang:date-and-time
      |   |   +--rw time-interval?      int64
      |   |   +--rw CoS_Name?           string
      |   |
      |   +--rw service-list* [subscriber-llvc-id]
      |   |   +--rw subscriber-llvc-id    string
      |   |   +--rw service-config
      |   |   |   +--rw subscriber-llvc-id?    string
      |   |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   |   +--rw client-protocol?    identityref
      |   |   |   +--rw time-start?         yang:date-and-time
      |   |   |   +--rw time-interval?      int64
      |   |   |   +--rw CoS_Name?           string
      |   |   |
      |   |   +--rw subscriber-llvc-id?    string
      |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   +--rw client-protocol?    identityref
      |   |   +--rw time-start?         yang:date-and-time
      |   |   +--rw time-interval?      int64
      |   |   +--rw CoS_Name?           string
      |   |
      |   +--rw subscriber-llvc-id?    string
      |   +--rw subscriber-llvc-ep-ingress? ->
      |   +--rw subscriber-llvc-ep-egress? ->
      |   +--rw client-protocol?    identityref
      |   +--rw time-start?         yang:date-and-time
      |   +--rw time-interval?      int64
      |   +--rw CoS_Name?           string
      |
      +--rw service-list* [subscriber-llvc-id]
      |   +--rw subscriber-llvc-id    string
      |   +--rw service-config
      |   |   +--rw subscriber-llvc-id?    string
      |   |   +--rw subscriber-llvc-ep-ingress? ->
      |   |   +--rw subscriber-llvc-ep-egress? ->
      |   |   +--rw client-protocol?    identityref
      |   |   +--rw time-start?         yang:date-and-time
      |   |   +--rw time-interval?      int64
      |   |   +--rw CoS_Name?           string
      |   |
      |   +--rw subscriber-llvc-id?    string
      |   +--rw subscriber-llvc-ep-ingress? ->
      |   +--rw subscriber-llvc-ep-egress? ->
      |   +--rw client-protocol?    identityref
      |   +--rw time-start?         yang:date-and-time
      |   +--rw time-interval?      int64
      |   +--rw CoS_Name?           string
      |
      +--rw subscriber-llvc-id?    string
      +--rw subscriber-llvc-ep-ingress? ->
      +--rw subscriber-llvc-ep-egress? ->
      +--rw client-protocol?    identityref
      +--rw time-start?         yang:date-and-time
      +--rw time-interval?      int64
      +--rw CoS_Name?           string

```

+--rw performance-metric? identityref

4. L1SM YANG Code

The YANG code is as follows:

<CODE BEGINS> file "ietf-l1csm@2017-10-27.yang"

```
module ietf-l1csm {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-l1csm";
  prefix "l1csm";

  import ietf-yang-types {
    prefix "yang";
  }

  organization
    "Internet Engineering Task Force (IETF) CCAMP WG";

  contact
    "Editor: G. Fioccola (giuseppe.fioccola@telecomitalia.it)
     Editor: K. Lee (kwangkoog.lee@kt.com)
     Editor: Y. Lee (leeyoung@huawei.com)
     Editor: D. Dhody (dhruv.ietf@gmail.com)
     Editor: O. Gonzalez de-Dios (oscar.gonzalezdedios@telefonica.com)
     Editor: D. Ceccarelli (daniele.ceccarelli@ericsson.com)";

  description
    "this module describes Layer 1 connectivity service model for
     subscriber Layer 1 Connectivity Services and Attributes";

  revision 2017-10-27 {
    description
      "Initial revision.";
    reference "to add the draft name";
  }

  identity protocol-type {
    description
```



```
                                "base identity from which client protocol
type is derived.";
    }

    identity aGigE {
        base protocol-type;
        description
            "GigE protocol type";
    }

    identity a10GigE_WAN {
        base protocol-type;
        description
            "10GigE-WAN protocol type";
    }

    identity a10GigE_LAN {
        base protocol-type;
        description
            "10GigE-LAN protocol type";
    }

    identity a40GigE {
        base protocol-type;
        description
            "40GigE protocol type";
    }

    identity a100GigE {
        base protocol-type;
        description
            "100GigE protocol type";
    }

    identity FC-100 {
        base protocol-type;
        description
            "Fiber Channel - 100 protocol type";
    }

    identity FC-200 {
        base protocol-type;
        description
            "Fiber Channel - 200 protocol type";
    }
}
```

```
identity FC-400 {
    base protocol-type;
    description
        "Fiber Channel - 400 protocol type";
}

identity FC-800 {
    base protocol-type;
    description
        "Fiber Channel - 800 protocol type";
}

identity FC-1200 {
    base protocol-type;
    description
        "Fiber Channel - 1200 protocol type";
}

identity FC-1600 {
    base protocol-type;
    description
        "Fiber Channel - 1600 protocol type";
}

identity FC-3200 {
    base protocol-type;
    description
        "Fiber Channel - 3200 protocol type";
}

identity STM-1 {
    base protocol-type;
    description
        "SDH STM-1 protocol type";
}

identity STM-4 {
    base protocol-type;
    description
        "SDH STM-4 protocol type";
}

identity STM-16 {
    base protocol-type;
```

```
        description
            "SDH STM-16 protocol type";
    }

    identity STM-64 {
        base protocol-type;
        description
            "SDH STM-64 protocol type";
    }

    identity STM-256 {
        base protocol-type;
        description
            "SDH STM-256 protocol type";
    }

    identity OC-3 {
        base protocol-type;
        description
            "SONET OC-3 protocol type";
    }

    identity OC-12 {
        base protocol-type;
        description
            "SONET OC-12 protocol type";
    }

    identity OC-48 {
        base protocol-type;
        description
            "SONET OC-48 protocol type";
    }

    identity OC-192 {
        base protocol-type;
        description
            "SONET OC-192 protocol type";
    }

    identity OC-768 {
        base protocol-type;
        description
            "SONET OC-768 protocol type";
    }
}
```

```
        identity coding-func {
            description
                "base identity from which coding func is
derived.";
        }

        identity a1000X-PCS-36 {
            base coding-func;
            description
                "PCS clause 36 coding function that
corresponds to 1000BASE-X";
        }

        identity a10GW-PCS-49-WIS-50 {
            base coding-func;
            description
                "PCS clause 49 and WIS clause 50 coding func
that corresponds to 10GBASE-W (WAN PHY)";
        }

        identity a10GR-PCS-49 {
            base coding-func;
            description
                "PCS clause 49 coding function that
corresponds to 10GBASE-R (LAN PHY)";
        }

        identity a40GR-PCS-82 {
            base coding-func;
            description
                "PCS clause 82 coding function that
corresponds to 40GBASE-R";
        }

        identity a100GR-PCS-82 {
            base coding-func;
            description
                "PCS clause 82 coding function that
corresponds to 100GBASE-R";
        }

        /* coding func needs to expand for Fiber Channel, SONET, SDH */

        identity optical-interface-func {
```

```
        description
            "base identity from which optical-interface-
function is derived.";
    }

    identity SX-PMD-clause-38 {
        base optical-interface-func;
        description
            "SX-PMD-clause-38 Optical Interface function
for 1000BASE-X PCS-36";
    }

    identity LX-PMD-clause-38 {
        base optical-interface-func;
        description
            "LX-PMD-clause-38 Optical Interface function
for 1000BASE-X PCS-36";
    }

    identity LX10-PMD-clause-59 {
        base optical-interface-func;
        description
            "LX10-PMD-clause-59 Optical Interface
function for 1000BASE-X PCS-36";
    }

    identity BX10-PMD-clause-59 {
        base optical-interface-func;
        description
            "BX10-PMD-clause-59 Optical Interface
function for 1000BASE-X PCS-36";
    }

    identity LW-PMD-clause-52 {
        base optical-interface-func;
        description
            "LW-PMD-clause-52 Optical Interface function
for 10GBASE-W PCS-49-WIS-50";
    }

    identity EW-PMD-clause-52 {
        base optical-interface-func;
        description
            "EW-PMD-clause-52 Optical Interface function
for 10GBASE-W PCS-49-WIS-50";
    }
```

```
    }

    identity LR-PMD-clause-52 {
        base optical-interface-func;
        description
            "LR-PMD-clause-52 Optical Interface function
for 10GBASE-R PCS-49";
    }

    identity ER-PMD-clause-52 {
        base optical-interface-func;
        description
            "ER-PMD-clause-52 Optical Interface function
for 10GBASE-R PCS-49";
    }

    identity LR4-PMD-clause-87 {
        base optical-interface-func;
        description
            "LR4-PMD-clause-87 Optical Interface function
for 40GBASE-R PCS-82";
    }

    identity ER4-PMD-clause-87 {
        base optical-interface-func;
        description
            "ER4-PMD-clause-87 Optical Interface function
for 40GBASE-R PCS-82";
    }

    identity FR-PMD-clause-89 {
        base optical-interface-func;
        description
            "FR-PMD-clause-89 Optical Interface function
for 40GBASE-R PCS-82";
    }

    identity LR4-PMD-clause-88 {
        base optical-interface-func;
        description
            "LR4-PMD-clause-88 Optical Interface function
for 100GBASE-R PCS-82";
    }

    identity ER4-PMD-clause-88 {
```

```
        base optical-interface-func;
        description
            "ER4-PMD-clause-88 Optical Interface function
for 100GBASE-R PCS-82";
    }

/* optical interface func needs to expand for Fiber Channel, SONET
and SDH */

    identity performance-metriclist {
        description "list of performance metric";
    }

    identity One-way-Delay {
        base performance-metriclist;
        description "One-way-Delay";
    }

    identity One-way-Errored-Second {
        base performance-metriclist;
        description "One-way-Errored-Second";
    }

    identity One-way-Severely-Errored-Second {
        base performance-metriclist;
        description "One-way-Severely-Errored-Second";
    }

    identity One-way-Unavailable-Second {
        base performance-metriclist;
        description "One-way-Unavailable-Second";
    }

    identity One-way-Availability {
        base performance-metriclist;
        description "One-way-Availability";
    }

    grouping protocol-coding-optical_interface {
        description
            "describes <p,c,o>";
        leaf protocol {
            type identityref {
```

```

        base protocol-type;
    }
    description "Physical layer L1VC client
protocol service attribute";
}

    leaf coding {
        type identityref {
            base coding-func;
        }
        description "coding function";
    }

    leaf optical_interface {
        type identityref {
            base optical-interface-func;
        }
        description "optical-interface-function";
    }
}

grouping uni-attributes {
    description
        "uni-service-attributes";

    leaf UNI-ID {
        type string;
        description "the UNI id of UNI
Service Attributes";
    }

    uses protocol-coding-optical_interface;
}

grouping subscriber-llvc-sls-service-attribute {
    description
        "The value of the Subscriber L1VC SLS
(Service Level Specification) Service Attribute expressed in a 4-tuple of the
form.";

    leaf time-start {
        type yang:date-and-time;
        description "a time that represent
the date and time for the start of the SLS";
    }
}

```



```

    }

    leaf time-interval {
        type int64;
        units seconds;
        description "a time interval
(e.g., 1 month) that is used in conjunction with time-start to specify a
contiguous sequence of time intervals T for determining when performance
objectives are met.";
    }

    leaf CoS_Name {
        type string;
        description "a Class of Service
Name used by the Subscriber L1VC End Point Class of Service Identifier Service
Attribute.";
    }

    leaf performance-metric {
        type identityref {
            base performance-metriclist;
        }
        description "list of performance
metric";
    }
}

grouping subscriber-l1vc-service-attributes {
    description
        "subscriber layer 1 connection service
service level";

    leaf subscriber-l1vc-id {
        type string;
        description "subscriber L1VC identifier";
    }

    leaf subscriber-l1vc-ep-ingress {
        type leafref {
            path "/l1cs/access/uni-list/UNI-ID";
        }
        description "this is one end of subscriber L1VC end
point ID value = UNI-1";
    }
}

```

```
        leaf subscriber-llvc-ep-egress {
            type leafref {
                path "/llcs/access/uni-list/UNI-ID";
            }
            description "this is the other end of subscriber
L1VC end point ID value = UNI-2";
        }

        leaf client-protocol {
            type identityref {
                base protocol-type;
            }
            description "One of Ethernet, Fiber Channel, SONET,
SDH";
        }

        uses subscriber-llvc-sls-service-attribute;
    }

    grouping subscriber-attributes {
        description
            "subscriber attributes";

        uses subscriber-llvc-service-attributes;
    }

    container llcs {
        description
            "serves as a top-level container for a list of layer 1
connection services (llcs)";

        container access {
            description "UNI configurations";

            list uni-list {
                key "UNI-ID";
                description "uni identifier";
                uses uni-attributes {
```

```

        description "UNI attributes
information";
    }
}

container service {
    description "L1VC service";
    list service-list {
        key "subscriber-llvc-id";
        description
            "an unique identifier of a service";

        leaf subscriber-llvc-id {
            type string;
            description "a unique service identifier for
L1VC.";
        }
        container service-config {
            description "service-config container";

            uses subscriber-attributes;

        } //end of service-config
    } //end of service list
} //end of service container

} //service top container
}

```

<CODE ENDS>

5. Security Considerations

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.

6. IANA Considerations

TDB

7. Acknowledgments

The authors would like to thank Italo Busi for his helpful comments and valuable contributions.

8. References

8.1. Normative References

8.2. Informative References

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[RFC5253] T. Takeda, "Applicability Statement for Layer 1 Virtual Private Network (L1VPN) Basic Mode", RFC 5253, July 2008.

[Service-Yang] Q. Wu, et al, "Service Models Explained", draft-wu-opsawg-service-model-explained, Work in progress.

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