

**IETF Network Slice Service Mapping YANG Model  
draft-dhody-teas-ietf-network-slice-mapping-00**

Abstract

This document provides a YANG data model to map IETF network slice service to Traffic Engineering (TE) models (e.g., the Virtual Network (VN) model or the TE Tunnel etc). It also supports mapping to the VPN Network models and Network Resource Partition (NRP) models. These models are referred to as IETF network slice service mapping model and are applicable generically for the seamless control and management of the IETF network slice service with underlying TE/VPN support.

The models are principally used for monitoring and diagnostics of the management systems to show how the IETF network slice service requests are mapped onto underlying network resource and TE/VPN models.

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 <https://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 4 September 2022.

Copyright Notice

Copyright (c) 2022 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 (<https://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 Revised BSD License text as described in Section 4.e of the [Trust Legal Provisions](#) and are provided without warranty as described in the Revised BSD License.

Table of Contents

- [1.](#) Introduction . . . . . [2](#)
- [2.](#) Conventions . . . . . [3](#)
  - [2.1.](#) Tree Diagrams . . . . . [3](#)
  - [2.2.](#) Prefixes in Data Node Names . . . . . [4](#)
  - [2.3.](#) References in the Model . . . . . [4](#)
- [3.](#) Model Design . . . . . [5](#)
  - [3.1.](#) Open Questions . . . . . [6](#)
- [4.](#) Tree Structure . . . . . [6](#)
- [5.](#) YANG Model . . . . . [7](#)
- [6.](#) Security Considerations . . . . . [12](#)
- [7.](#) IANA Considerations . . . . . [12](#)
- [8.](#) References . . . . . [13](#)
  - [8.1.](#) Normative References . . . . . [13](#)
  - [8.2.](#) Informative References . . . . . [14](#)
- [Appendix A.](#) Acknowledgments . . . . . [15](#)
- [Appendix B.](#) Examples . . . . . [15](#)
- Authors' Addresses . . . . . [15](#)

**1. Introduction**

Data models are a representation of objects that can be configured or monitored within a system. Within the IETF, YANG [[RFC7950](#)] 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.

The YANG model discussed in this document augments the IETF Network Slice Service YANG model [[I-D.ietf-teas-ietf-network-slices](#)], which is used to operate IETF Network Slices during the IETF Network Slice instantiation. This provides a way to map IETF network slice service to Traffic Engineering (TE) models (e.g., the Virtual Network (VN) model or the TE Tunnel etc). Alternatively, it also supports mapping to the VPN Network models and Network Resource Partition (NRP) models.

The model supports:



- \* A mapping of the IETF Network Slice with the VPN network models - LxNM. This mapping can be populated at the time of IETF network service realization. This mapping information is internal and used for monitoring and diagnostics purpose such as telemetry, auto-scaling, closed-loop automation. Note that the LxNM may further map to other TE resources as specified in [[I-D.ietf-teas-te-service-mapping-yang](#)]. A mapping to the NRP can also be populated.
- \* A mapping of the IETF Network Slice with the underlying TE resources directly. The TE resources could be in a form of VN, set of TE tunnels, TE abstract topology etc. This mapping can be populated by the network at the time of realization of the IETF network slice service. It is also possible to configure the mapping provided one is aware of NRP/VN/tunnels. This mapping mode is used only when there is an awareness of VN or TE by the consumer of the model. Otherwise this mapping information is internal and used for monitoring and diagnostics purpose such as telemetry, auto-scaling, closed-loop automation.
- \* Possibility to request creation of a new VN/Tunnel to be binded to IETF network slice.
- \* Indication to share the VN/Tunnel sharing (with or without modification) for the IETF network slice.
- \* Support for configuration of underlying TE properties (as opposed to existing VN or tunnels).

Note: The RFC Editor will replace XXXX with the number assigned to the RFC once this draft becomes an RFC.

## **[2.](#) Conventions**

The key words "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](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

### **[2.1.](#) Tree Diagrams**

A simplified graphical representation of the data model is used in this document. The meaning of the symbols in these diagrams is defined in [[RFC8340](#)].



**2.2. Prefixes in Data Node Names**

In this document, names of data nodes and other data model objects are often used without a prefix, as long as it is clear from the context in which YANG module each name is defined. Otherwise, names are prefixed using the standard prefix associated with the corresponding YANG module, as shown in Table 1.

Prefix	YANG module	Reference
nw	ietf-network	[RFC8345]
tsmt	ietf-te-service-mapping-types	[I-D.ietf-teas-te-service-mapping-yang]
l3vpn-ntw	ietf-l3vpn-ntw	[RFC9182]
l2vpn-ntw	ietf-l2vpn-ntw	[I-D.ietf-opsawg-l2nm]
ietf-ns	ietf-network-slice	[I-D.ietf-teas-ietf-network-slice-nbi-yang]
nrp	ietf-nrp	[I-D.wd-teas-nrp-yang]

Table 1

**2.3. References in the Model**

Following additional documents are referenced in the model defined in this document -



Document	Reference
Realizing Network Slices in IP/MPLS Networks	<a href="#">[I-D.bestbar-teas-ns-packet]</a>

Table 2

### 3. Model Design

The YANG model specified in this document augments the IETF network slice service YANG model [\[I-D.ietf-teas-ietf-network-slice-nbi-yang\]](#).

Currently following mapping are supported:

- \* L3NM: The L3 network model (L3NM) describes a L3VPN Service in the Service Provider Network. It contains information of the Service Provider network and might include allocated resources. It can be used by network controllers to manage and control the L3VPN Service configuration in the Service Provider network. This model maps an IETF network slice to a L3VPN ID.
- \* L2NM: The L2 network model (L2NM) describes a L2VPN Service in the Service Provider Network. It contains information of the Service Provider network and might include allocated resources. It can be used by network controllers to manage and control the L2VPN Service configuration in the Service Provider network. This model maps an IETF network slice to a L2VPN ID.
- \* TE: The TE mapping is specified in [\[I-D.ietf-teas-te-service-mapping-yang\]](#). The mapping can be done to the following TE resources:
  - Virtual Networks (VN) [\[RFC8453\]](#)
  - TE-Tunnels
  - TE-Topology
- \* NRP: [\[I-D.ietf-teas-ietf-network-slices\]](#) defines IETF network slice services that provide connectivity coupled with network resources commitment between a number of endpoints over a shared network infrastructure and, for scalability concerns, defines NRP to host one or a group of network slice services according to characteristics including SLOs and SLEs. Along with mapping to VPN, this model maps an IETF network slice to a NRP ID.



### **3.1. Open Questions**

The following open questions needs to be addressed in a future revision:

- \* Is there a need/use-case to map IETF Network slice Connection Group and/or Connectivity Construct as well?
- \* Is there a need/use-case to map IETF Network slice to NRP directly?
- \* Is there a need/use-case to map IETF Network slice Endpoints?
- \* Is there a need to indicate "map-type" (new, share) for NRP and VPNS?

## **4. Tree Structure**



```
module: ietf-network-slice-mapping
```

```
augment /ietf-ns:network-slices/ietf-ns:network-slice:
```

```
  +--rw mapping!
    +--rw ns-mapping
      +--rw map-to?          identityref
      +--rw (map)?
        +--:(l3vpn)
          | +--rw l3vpn-id?    leafref
          | +--rw l3vpn-nrp-id?
          |           -> /nw:networks/network/nrp:nrp/nrp-id
        +--:(l2vpn)
          | +--rw l2vpn-id?    leafref
          | +--rw l2vpn-nrp-id?
          |           -> /nw:networks/network/nrp:nrp/nrp-id
        +--:(te)
          +--rw te-mapping
            +--rw map-type?          identityref
            +--rw te-policy
              | +--rw color?          uint32
              | +--rw protection-type? identityref
              | +--rw availability-type? identityref
            +--rw (te)?
              | +--:(vn)
              | | +--rw vn*
              | |           -> /vn:virtual-network/vn/vn-id
              | +--:(te-topo)
              | | +--rw vn-topology-id?
              | | |           te-types:te-topology-id
              | | +--rw abstract-node?
              | |           -> /nw:networks/network/node/node-id
              | +--:(te-tunnel)
              | +--rw te-tunnel*      te:tunnel-ref
              | +--rw sr-policy*
              |           [policy-color-ref policy-endpoint-ref]
              |           {sr-policy}?
              | +--rw policy-color-ref    leafref
              | +--rw policy-endpoint-ref leafref
            +--rw te-mapping-template-ref? leafref
              {template}?
```

## 5. YANG Model



```
<CODE BEGINS> file "ietf-network-slice-mapping@2022-03-03.yang"
module ietf-network-slice-mapping {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-network-slice-mapping";
  prefix ietf-nsm;

  import ietf-network {
    prefix nw;
    reference
      "RFC 8345: A YANG Data Model for Network Topologies";
  }
  import ietf-network-slice {
    prefix ietf-ns;
    reference
      "I-D.ietf-teas-ietf-network-slice-nbi-yang: IETF Network Slice
      Service YANG Model";
  }
  import ietf-te-service-mapping-types {
    prefix tsmt;
    reference
      "I-D.ietf-teas-te-service-mapping-yang: Traffic Engineering
      (TE) and Service Mapping YANG Model";
  }
  import ietf-l3vpn-ntw {
    prefix l3vpn-ntw;
    reference
      "RFC9182: A YANG Network Data Model for Layer 3 VPNs";
  }
  import ietf-l2vpn-ntw {
    prefix l2vpn-ntw;
    reference
      "I-D.ietf-opsawg-l2nm: A Layer 2 VPN Network YANG Model";
  }
  import ietf-nrp {
    prefix nrp;
    reference
      "I-D.wd-teas-nrp-yang: A YANG Data Model for Network
      Resource Partition (NRP)";
  }

  organization
    "IETF Traffic Engineering Architecture and Signaling (TEAS)
    Working Group";
  contact
    "WG Web: <https://datatracker.ietf.org/wg/teas/about/>
    WG List: <mailto:teas@ietf.org>
    Editor: Dhruv Dhody <dhruv.ietf@gmail.com>
```



```
        Bo Wu <lane.wubo@huawei.com>;
description
  "This module contains a YANG module to map the IETF Network
  Slice with Traffic Engineering (TE) or VPN Network models.

  Copyright (c) 2022 IETF Trust and the persons identified as
  authors of the code. All rights reserved.

  Redistribution and use in source and binary forms, with or
  without modification, is permitted pursuant to, and subject to
  the license terms contained in, the Revised BSD License set
  forth in Section 4.c of the IETF Trust's Legal Provisions
  Relating to IETF Documents
  (https://trustee.ietf.org/license-info)."

  This version of this YANG module is part of RFC XXXX; see the
  RFC itself for full legal notices.";

revision 2022-03-03 {
  description
    "initial version.";
  reference
    "RFC XXXX: IETF Network Slice Service Mapping YANG Model";
}

identity map-to {
  description
    "Base identity from which specific map-to are derived.";
}

identity map-to-vpn {
  base map-to;
  description
    "Map to VPN";
}

identity map-to-l3vpn {
  base map-to-vpn;
  description
    "Map to L3VPN";
}

identity map-to-l2vpn {
  base map-to-vpn;
  description
    "Map to L2VPN";
}
```



```
identity map-to-l1vpn {
  base map-to-vpn;
  description
    "Map to L1VPN";
}

identity map-to-te {
  base map-to;
  description
    "Map to TE directly";
}

identity map-to-nrp {
  base map-to;
  description
    "Map to NRP";
}

grouping ns-mapping {
  description
    "Mapping between IETF network slice and Network
    Resource Partition (NRP)/VPN/TE";
  container ns-mapping {
    description
      "The container for the mapping";
    leaf map-to {
      type identityref {
        base map-to;
      }
      description
        "Mapping to NRP/VPN/TE";
    }
    choice map {
      description
        "Mapping to NRP/VPN/TE";
      case l3vpn {
        leaf l3vpn-id {
          type leafref {
            path "/l3vpn-ntw:l3vpn-ntw"
              + "/l3vpn-ntw:vpn-services"
              + "/l3vpn-ntw:vpn-service"
              + "/l3vpn-ntw:vpn-id";
          }
          description
            "A reference to VPN ID";
        }
        leaf l3vpn-nrp-id {
          type leafref {
```



```
        path "/nw:networks/nw:network"
          + "/nrp:nrp/nrp:nrp-id";
      }
      description
        "A reference to NRP ID";
      reference
        "I-D.bestbar-teas-ns-packet: Realizing
        Network Slices in IP/MPLS Networks";
    }
    description
      "Mapping to L3NM";
    reference
      "RFC9182: A YANG Network Data Model for
      Layer 3 VPNs";
  }
  case l2vpn {
    leaf l2vpn-id {
      type leafref {
        path "/l2vpn-ntw:l2vpn-ntw"
          + "/l2vpn-ntw:vpn-services"
          + "/l2vpn-ntw:vpn-service"
          + "/l2vpn-ntw:vpn-id";
      }
      description
        "A reference to VPN ID";
    }
    leaf l2vpn-nrp-id {
      type leafref {
        path "/nw:networks/nw:network"
          + "/nrp:nrp/nrp:nrp-id";
      }
      description
        "A reference to NRP ID";
      reference
        "I-D.bestbar-teas-ns-packet: Realizing
        Network Slices in IP/MPLS Networks";
    }
    description
      "Mapping to L2NM";
    reference
      "I-D.ietf-opsawg-l2nm: A Layer 2 VPN
      Network YANG Model";
  }
  case te {
    uses tsmt:te-mapping;
    description
      "Mapping to TE directly";
    reference
```



```

        "I-D.ietf-teas-te-service-mapping-yang:
        Traffic Engineering (TE) and Service
        Mapping YANG Model";
    }
}
}
}

augment "/ietf-ns:network-slices/ietf-ns:network-slice" {
  description
    "IETF Network Slice augmented to include the mapping
    information to the network slice realization";
  container mapping {
    presence "Indicates Mapping information";
    description
      "Container to augment IETF network slice to
      include NRP / VPN / TE mappings";
    uses ns-mapping;
  }
}
}
}

```

<CODE ENDS>

**6. Security Considerations**

TBD

**7. IANA Considerations**

IANA is requested to make the following allocation for the URIs in the "ns" subregistry within the "IETF XML Registry" [[RFC3688](#)]:

```

-----
URI: urn:ietf:params:xml:ns:yang:ietf-network-slice-mapping
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.
-----

```

IANA is requested to make the following allocation for the YANG module in the "YANG Module Names" registry [[RFC6020](#)]:

```

-----
name:          ietf-network-slice-mapping
namespace:    urn:ietf:params:xml:ns:yang:ietf-network-slice-mapping
prefix:       ietf-nsm
reference:    RFC XXXX
-----

```



## 8. References

### 8.1. 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>>.
- [RFC3688] Mealling, M., "The IETF XML Registry", [BCP 81](#), [RFC 3688](#), DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", [RFC 6020](#), DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.
- [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>>.
- [RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", [BCP 215](#), [RFC 8340](#), DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.
- [RFC8345] Clemm, A., Medved, J., Varga, R., Bahadur, N., Ananthakrishnan, H., and X. Liu, "A YANG Data Model for Network Topologies", [RFC 8345](#), DOI 10.17487/RFC8345, March 2018, <<https://www.rfc-editor.org/info/rfc8345>>.
- [RFC9182] Barguil, S., Gonzalez de Dios, O., Ed., Boucadair, M., Ed., Munoz, L., and A. Aguado, "A YANG Network Data Model for Layer 3 VPNs", [RFC 9182](#), DOI 10.17487/RFC9182, February 2022, <<https://www.rfc-editor.org/info/rfc9182>>.
- [I-D.ietf-teas-ietf-network-slice-nbi-yang]  
Wu, B., Dhody, D., Rokui, R., Saad, T., and L. Han, "IETF Network Slice Service YANG Model", Work in Progress, Internet-Draft, [draft-ietf-teas-ietf-network-slice-nbi-yang-00](#), 29 September 2021, <<https://www.ietf.org/archive/id/draft-ietf-teas-ietf-network-slice-nbi-yang-00.txt>>.
- [I-D.ietf-teas-te-service-mapping-yang]  
Lee, Y., Dhody, D., Fioccola, G., Wu, Q., Ceccarelli, D., and J. Tantsura, "Traffic Engineering (TE) and Service Mapping YANG Model", Work in Progress, Internet-Draft,



[draft-ietf-teas-te-service-mapping-yang-09](https://www.ietf.org/archive/id/draft-ietf-teas-te-service-mapping-yang-09), 24 October 2021, <<https://www.ietf.org/archive/id/draft-ietf-teas-te-service-mapping-yang-09.txt>>.

[I-D.ietf-opsawg-l2nm]

Barguil, S., Dios, O. G. D., Boucadair, M., and L. A. Munoz, "A Layer 2 VPN Network YANG Model", Work in Progress, Internet-Draft, [draft-ietf-opsawg-l2nm-12](https://www.ietf.org/archive/id/draft-ietf-opsawg-l2nm-12), 22 November 2021, <<https://www.ietf.org/archive/id/draft-ietf-opsawg-l2nm-12.txt>>.

[I-D.wd-teas-nrp-yang]

Wu, B., Dhody, D., and Y. Cheng, "A YANG Data Model for Network Resource Partition (NRP)", Work in Progress, Internet-Draft, [draft-wd-teas-nrp-yang-00](https://www.ietf.org/archive/id/draft-wd-teas-nrp-yang-00), 30 January 2022, <<https://www.ietf.org/archive/id/draft-wd-teas-nrp-yang-00.txt>>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in [RFC 2119](https://www.rfc-editor.org/info/rfc2119) Key Words", [BCP 14](https://www.rfc-editor.org/info/bcp-14), [RFC 8174](https://www.rfc-editor.org/info/rfc8174), DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.

## 8.2. Informative References

[RFC8453] Ceccarelli, D., Ed. and Y. Lee, Ed., "Framework for Abstraction and Control of TE Networks (ACTN)", [RFC 8453](https://www.rfc-editor.org/info/rfc8453), DOI 10.17487/RFC8453, August 2018, <<https://www.rfc-editor.org/info/rfc8453>>.

[I-D.ietf-teas-ietf-network-slices]

Farrel, A., Gray, E., Drake, J., Rokui, R., Homma, S., Makhijani, K., Contreras, L. M., and J. Tantsura, "Framework for IETF Network Slices", Work in Progress, Internet-Draft, [draft-ietf-teas-ietf-network-slices-05](https://www.ietf.org/archive/id/draft-ietf-teas-ietf-network-slices-05), 25 October 2021, <<https://www.ietf.org/archive/id/draft-ietf-teas-ietf-network-slices-05.txt>>.

[I-D.bestbar-teas-ns-packet]

Saad, T., Beeram, V. P., Dong, J., Wen, B., Ceccarelli, D., Halpern, J., Peng, S., Chen, R., Liu, X., Contreras, L. M., Rokui, R., and L. Jalil, "Realizing Network Slices in IP/MPLS Networks", Work in Progress, Internet-Draft, [draft-bestbar-teas-ns-packet-08](https://www.ietf.org/archive/id/draft-bestbar-teas-ns-packet-08), 2 February 2022, <<https://www.ietf.org/archive/id/draft-bestbar-teas-ns-packet-08.txt>>.



**[Appendix A](#). Acknowledgments**

Thanks to Jie Dong for the initial discussion behind this document.

**[Appendix B](#). Examples**

TO be added in future revisions.

Authors' Addresses

Dhruv Dhody  
Huawei Technologies  
Divyashree Techno Park, Whitefield  
Bangalore 560066  
India  
Email: dhruv.ietf@gmail.com

Bo Wu  
Huawei Technologies  
101 Software Avenue, Yuhua District  
Nanjing  
210012  
China  
Email: lana.wubo@huawei.com

