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YANG Data Models for Network Resource Partitions (NRPs)
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Abstract

RFC 9543 describes a framework for Network Slices in networks built from IETF technologies. In this framework, the network resource partition (NRP) is introduced as a collection of network resources allocated from the underlay network to carry a specific set of Network Slice Service traffic and meet specific Service Level Objective (SLO) and Service Level Expectation (SLE) characteristics.

This document defines two YANG data models for Network Resource Partitions (NRPs): a network-level model for policy configuration by a Network Slice Controller, and a device-level model for configuration of individual network elements. These models enable automated provisioning of NRPs in IP/MPLS and Segment Routing (SR) networks, supporting scalable realization of RFC 9543 Network Slice Services.

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1. Introduction

[RFC9543] describes a framework for Network Slices in networks built from IETF technologies. As specified in Section 7.4 [RFC9543], an NRP is a collection of resources identified in the underlay network to support the RFC 9543 Network Slice Service to meet the slice Service Level Objectives (SLOs) and Service Level Expectations (SLEs) characteristics and network scalability. This document follows the Network Slice Service defined in [RFC9543], and all references to "Network Slice" refer to that same context.

Considering the NRPs realizations in IP/MPLS and Segment Routing (SR) networks, [I-D.ietf-teas-ns-ip-mpls] and [I-D.ietf-teas-nrp-scalability] describe NRP mechanisms of control plane, data plane, and management plane to provide specific forwarding treatment (scheduling, drop policy, resource usage) to the Slice Service packets associated with an NRP. Specifically, for instantiation of the device-specific and network wide NRPs, Section 3.5 of [I-D.ietf-teas-ns-ip-mpls] introduces the construct of NRP Policy.

Based on these descriptions of NRP, this document defines two YANG modules:

* ietf-nrp: A network-level model used by a Network Slice Controller (NSC) (defined in Section 6.3 [RFC9543]) to manage NRP instances for Network Slice Service realizations. This is a network configuration model according to the YANG model classification of [RFC8309].

* ietf-nrp-device: A device-level model used by a network controller to set NRP parameters on an individual device, including device-specific interface configurations. This is a device configuration model by the classification.

The NRPs models conform to the Network Management Datastore Architecture (NMDA) [RFC8342] and are designed to support both configuration and operational state retrieval.

2. Conventions and Definitions

The keywords "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 BCP14, [RFC2119], [RFC8174] when, and only when, they appear in all capitals, as shown here.

The following terms are defined in [RFC6241], [RFC7950], and [RFC8345] and are used in this specification:

* configuration data

* state data

* augment

* data model

* data node

* network topology

The terminology for describing YANG data models is found in [RFC7950]. The tree diagram used in this document follows the notation defined in [RFC8340].

Additionally, this document uses the following terms:

Network Resource Partition (NRP): A collection of network resources allocated from the underlay network to support one or more RFC 9543 Network Slice Services, meeting specific SLO/SLE requirements. Defined in Section 7.1 of [RFC9543].

NRP Policy: A configuration construct that specifies the rules for creating and maintaining an NRP, including resource allocation, selector identification, and topology association.

NRP Instance: The operational realization of an NRP Policy on network devices, representing the actual allocated resources and configured forwarding behaviors.

NRP Selector ID: A data plane identifier used by network devices to classify packets belonging to a specific NRP and apply the corresponding forwarding treatment.

PHB Profile: A named set of Per-Hop Behavior parameters that define the forwarding treatment (e.g., scheduling, drop policy) for packets associated with an NRP. Profiles are locally defined by the network operator.

NRP-Enabled Device: A network element that supports NRP data plane identification and resource partitioning mechanisms.

Network Slice Controller (NSC): A functional component responsible for translating Network Slice Service requests into network configuration, including NRP management. Defined in Section 6.3 of [RFC9543].

3. NRP Data Models

3.1. Models Usage

As defined in Section 7.1 [RFC9543], the Network Slice Controller (NSC) can determine which specific connectivity constructs from one or more slices could be grouped together upon Slice Service requests. This could be based on a specific set of SLOs and SLEs, or on any administrative or operational policy. The NSC can further map these connectivity constructs onto an NRP. It also constructs and distributes the network wide consistent NRP model to the relevant controllers, and in turn the controllers distribute the NRP device model to the NRP-enabled devices in the underlay network. Figure 1 shows the interfaces to which the two models are applied.

```
      +-------------------------------------------+
      | Customer higher-level operation system    |
      +-------------------------------------------+
                           A
                           | Network Slice Service Interface
                           V
      +-------------------------------------------+
      |    IETF Network Slice Controller (NSC)    |
      +-------------------------------------------+
                           A
                           | Network Configuration Interface
                           |  (e.g.,NRP Model)
                           V
      +-------------------------------------------+
      |           Network Controller(s)           |
      +-------------------------------------------+
                           A
                           | Device Configuration Interface
                           |  (e.g.,NRP Device Model)
                           V
    +-------------------------------------------------+
    |                 Underlay Network                |
    +-------------------------------------------------+
```

Figure 1

The general operations of NRPs are as follows:

* NRPs instantiation: Depending on the Slice Service types, network resources status, and also the operator’s policies, there can be at least two approaches. One method is to create an NRP instance before the network controller processes a Network Slice Service request. Another one is that the network controller may decide creating an NRP instance while implementing the Network Slice Service request.

* NRPs modification: When the capacity of an existing NPR link is close to maximum capacity, the bandwidth of the link could be increased. And when an NRP links or nodes resources are insufficient, new NRP links and nodes could be added.

* NRPs Deletion: If an NSC determines that no Slice Service is using an NRP, the NSC can delete the NRP instance. Another example is when it is necessary to merge NRPs.

* NRPs Monitoring: The NSC can use the NRPs model to track and monitor NRPs resource status and usage.

3.2. NRPs Instantiation

An NRP Policy is a configuration construct that specifies the rules for creating and maintaining a Network Resource Partition. It defines how network resources are allocated, how traffic is identified, which topology is used, and what forwarding treatment is applied. These rules apply to both device-level and network-level configurations.

An NRP Policy includes the following key components:

1. Topology customization rules: Determine the set of nodes, links, and network functions that belong to the NRP.

2. Data plane rules: Specify the NRP selector ID, QoS profiles, and bandwidth reservations for traffic identification and forwarding treatment.

3. Control plane rules: Define resource reservation, resource sharing, reservation preferences policy, etc.

NRP Policies support three resource partition modes:

a. Data Plane Partition: Physical network resources (e.g., bandwidth) are partitioned on network devices. Devices enable NRP data plane mechanisms to apply Per-Hop Behavior (PHB) to packets.

b. Control Plane Partition: Resource reservation state for each NRP is maintained in NRP-aware TE devices or network controllers, without physical resource isolation.

c. Hybrid Partition: Combines both data plane and control plane partitioning for full resource isolation and stateful management.

All modes require NRP topology specification. Modes (a) and (c) require NRP selector identification for packet classification. Modes (b) and (c) require distributed or centralized resource reservation management. When IGP routing is used with mode (c), NRP-aware IGP extensions may be employed for scalability.

For further implementation considerations, the concepts align with the NRP mechanisms described in [I-D.ietf-teas-ns-ip-mpls] and [I-D.ietf-teas-nrp-scalability].

The high-level model structure of NRP policy as modeled in this document is shown in Figure 2:

```
module: ietf-nrp
  augment /nw:networks:
    +--rw nrp-policies
       +--rw policy-profiles
       |  +--rw phb-profile-identifier* [id]
       |        ...
       +--rw nrp-policy* [name]
          +--rw name                     string
          +--rw nrp-id?                  uint32
          +--rw mode?                    identityref
          +--rw resource-reservation
          |     ...
          +--rw selector-id
          |     ...
          +--rw phb-profile?             leafref
          +--rw topology
                ...
```

Figure 2: NRP Policy subtree high-level structure

The "networks" container from the "ietf-network" module [RFC8345] provides a placeholder for an inventory of nodes in the network. This container is augmented to include a set of NRP policies.

The "policy-profiles" container provides a list of PHB policy profile entries. Each of these entries can be referenced by one or more NRPs. A "phb-profile-identifier" entry can have a reference to a standard PHB profile available on the device or the network controller.

The "nrp-policies" container includes a list of NRP policies. Each "nrp-policy" entry is identified by a name and holds the set of attributes needed to instantiate an NRP.

The description of the "nrp-policies" data nodes are as follows, and the other key elements of each nrp-policy entry are discussed in the following sub-sections.

* "nrp-id": Is an identifier that is used to uniquely identify an NRP instance within an NSC network scope, which is created by the enforcement of the "nrp-policy".

* "mode": Refers to control plane partition, data plane partition, or hybrid partition.

3.2.1. Resource Reservation

The "resource-reservation" container specifies bidirectional bandwidth allocation for an NRP, expressed as either an absolute value or a percentage of link capacity. While currently limited to bandwidth, the container is designed to accommodate future extensions such as resource sharing or protection mechanisms described in [I-D.ietf-teas-ns-ip-mpls].

The bandwidth reservation specified at the policy level serves as a default for all links in the NRP topology. This can be overridden by link-specific configuration in the "nrp-topology" container Section 3.2.4.

```
+--rw resource-reservation
  +--rw (max-bw-type)?
     +--:(bw-value)
     |  +--rw maximum-bandwidth?           uint64
     +--:(bw-percentage)
        +--rw maximum-bandwidth-percent?   rt-types:percentage
```

Figure 3: NRP Resource Reservation YANG subtree structure

3.2.2. NRP Selector Identifier (NRP Selector ID)

The NRP selector ID defines data plane encapsulation types and values used to identify NRP-specific network resources. The configuration can be overridden by link-specific "selector-id" configuration in "nrp-topology" (Section 3.2.4).

Implementations MUST support at least one selector type in the NRP model of data plane partition or hybrid partition. Multiple selector types MAY be configured to support heterogeneous network environments. Selector ID values MUST be unique within the network scope where the NRP operates.

The following selector types are supported:

IPv4-derived: Uses destination IPv4 prefixes to identify NRP traffic. Suitable for networks where NRPs are aligned with IP addressing.

IPv6: Provides three sub-options:

- Dedicated: Uses a value in the IPv6 Hop-by-Hop extension header as specified in [I-D.ietf-6man-enhanced-vpn-vtn-id]

- SRv6-derived: Uses SRv6 SIDs where the SID structure encodes the NRP identifier, per [I-D.ietf-spring-sr-for-enhanced-vpn].

- IPv6-destination-derived: Uses destination IPv6 prefixes, similar to IPv4-derived.

MPLS: Supports two encoding mechanisms:

- In-Stack MPLS Network Action (MNA): Embeds the selector in the MPLS label stack using the format defined in [I-D.ietf-mpls-mna-nrp-selector]. Supports 13-bit (NRPS13) or 20-bit (NRPS20/ENRPS20) encodings.

- Post-Stack (PSD): Uses a dedicated post-stack label per [I-D.ietf-mpls-mna-psd-nrp-selector].

ACL-based: References standard ACLs to match NRP traffic. Provides flexibility for complex classification rules but may have higher processing overhead.

```
+--rw selector-id
|  +--rw ipv4-derived
|  |  +--rw destination-prefix*   inet:ipv4-prefix
|  +--rw ipv6
|  |  +--rw (selector-type)?
|  |     +--:(dedicated)
|  |     |  +--rw ipv6-hbh-eh?          uint32
|  |     +--:(srv6-derived)
|  |     |  +--rw srv6-sid*             srv6-types:srv6-sid
|  |     +--:(ipv6-destination-derived)
|  |        +--rw destination-prefix*   inet:ipv6-prefix
|  +--rw mpls
|  |  +--rw (mpls-encapsulation)?
|  |     +--:(mna-in-stack)
|  |     |  +--rw in-stack-identifier?     uint32
|  |     |  +--rw identifier-format?       enumeration
|  |     +--:(post-stack)
|  |        +--rw post-stack-identifier?   uint32
|  +--rw acl-ref*        acl-ref
```

Figure 4: NRP Selector ID YANG subtree structure

3.2.3. Per-Hop Behavior (PHB)

Per-Hop Behavior (PHB) defines the forwarding treatment for packets belonging to an NRP, including bandwidth control, congestion control, and scheduling priority (e.g., Section 3.4 [RFC3644]). The PHB profile and NRP selector are paired mechanisms: the selector classifies packets, and the referenced PHB profile applies the corresponding forwarding behavior. Profile contents are implementation-specific and may include standard IETF PHBs (e.g., "Assured Forwarding (AF)", "Expedited Forwarding (EF)") or customized local policies (e.g., "High", "Low", "Standard").

The phb-profile configured at the NRP policy level serves as the default for the entire NRP topology. This may be overridden by link-specific PHB configuration in the topology container Section 3.2.4.

```
+--rw phb-profile?            leafref
```

Figure 5: PHB YANG subtree structure

3.2.4. NRP Topology

"nrp-topology" defines a customized NRP topology used for an NRP.

When an NRP supports IGP routing, the topology of the NRP must be congruent with an IGP instance. The topology used for IGP route computation and forwarding can be derived using Multi-Topology Routing (MTR) [RFC4915], [RFC5120], and [I-D.ietf-lsr-isis-sr-vtn-mt] or Flex-algo [RFC9350].

Figure 6 shows an example of NRP-1 enabling "igp-congruent", which indicates that this NRP instance uses the same IGP topology with the specified "multi-topology-id" or "algo-id". NRP-1 has different link resource attributes from those of the IGP, but shares the same nodes and termination points (TPs) of the IGP topology.

```
                                 # O #### O #### O
                               #  #      #      #
                              O   #      #      #
                               #  #      #      #
                                # O #### O #### O
                                        NRP-1

                                         ||
                                         vv
                                   O-----O-----O
                                 / |     |     |
                                O  |     |     |
                                 \ |     |     |
                                   O-----O-----O
                               IGP Topology (MT or Flex-algo)
          Legend

          O     Virtual node
          ---   IGP links
          ###   Virtual links with a set of reserved resources
```

Figure 6: IGP Congruency Example

The "selection" container consists of a list of select subset of links of an underlay topology or a pre-built topology.

The "filter" container consists of a list of filters where each entry references a topology filter [I-D.ietf-teas-yang-topology-filter]. The topological elements that satisfy the membership criteria may override the default "resource-reservation" and "selector-id" specific nodes.

```
   +--rw topology
      +--rw igp-congruent!
      |  +--rw multi-topology-id?   uint32
      |  +--rw algo-id?             uint32
      |  +--rw sharing?             boolean
      +--rw (topology-type)?
         +--:(selection)
         |  +--rw select
         |     +--rw topology-group* [group-id]
         |        +--rw group-id                string
         |        +--rw network-ref?
         |        |       -> /nw:networks/network/network-id
         |        +--rw link* [link-ref]
         |        |     ...
         |        +--rw resource-reservation
         |        |     ...
         |        +--rw link-partition-type?    identityref
         |        +--rw phb-profile?            leafref
         +--:(filter)
            +--rw filters
               +--rw filter* [filter-ref]
                  +--rw filter-ref
                  |       topo-filter-ref
                  +--rw resource-reservation
                  |     ...
                  +--rw selector-id
                  |     ...
                  +--rw phb-profile?            leafref
```

Figure 7: NRP Topology YANG subtree structure

3.3. NRPs Monitoring

The NRP model can be used to monitor the operational status and resource usage of NRPs.

```
  augment /nw:networks/nw:network/nw:network-types:
    +--rw nrp!
  augment /nw:networks/nw:network/nw:node:
    +--rw (nrp-attachment-type)?
       +--:(single-nrp)
       |  +--ro nrp-node-attributes
       |     +--ro selector-id
       |        +--ro srv6?                 srv6-types:srv6-sid
       |        +--ro mpls-nrp-selector?   uint32
       +--:(multi-nrp)
          +--ro node-nrp-list
             +--ro nrp* [nrp-id]
```

```
                  +--ro nrp-id                 uint32
                  +--ro nrp-node-attributes
                     +--ro selector-id
                        +--ro srv6?                 srv6-types:srv6-sid
                        +--ro mpls-nrp-selector?   uint32
     augment /nw:networks/nw:network/nt:link:
       +--rw (nrp-attachment-type)?
          +--:(single-nrp)
          |  +--ro nrp-link-attributes
          |     +--ro link-partition-type?   identityref
          |     +--ro bandwidth-value?       uint64
          |     +--ro selector-id
          |     |  +--ro srv6?                 srv6-types:srv6-sid
          |     |  +--ro mpls-nrp-selector?   uint32
          |     +--ro statistics
          |        +--ro status
          |        |  +--ro admin-status
          |        |  |  +--ro status?        identityref
          |        |  |  +--ro last-change?   yang:date-and-time
          |        |  +--ro oper-status
          |        |     +--ro status?        identityref
          |        |     +--ro last-change?   yang:date-and-time
          |        +--ro one-way-available-bandwidth?   uint64
          |        +--ro one-way-utilized-bandwidth?    uint64
          |        +--ro one-way-min-delay?             uint32
          |        +--ro one-way-max-delay?             uint32
          |        +--ro one-way-delay-variation?       uint32
          |        +--ro one-way-packet-loss?           decimal64
          +--:(multi-nrp)
             +--ro link-nrp-list
                +--ro nrp* [nrp-id]
                   +--ro nrp-id                 uint32
                   +--ro nrp-link-attributes
                      +--ro link-partition-type?   identityref
                      +--ro bandwidth-value?       uint64
                      +--ro selector-id
                      |  +--ro srv6?                 srv6-types:srv6-sid
                      |  +--ro mpls-nrp-selector?   uint32
                      +--ro statistics
                         +--ro status
                         |  +--ro admin-status
                         |  |  +--ro status?        identityref
                         |  |  +--ro last-change?   yang:date-and-time
                         |  +--ro oper-status
                         |     +--ro status?        identityref
                         |     +--ro last-change?   yang:date-and-time
                         +--ro one-way-available-bandwidth?   uint64
                         +--ro one-way-utilized-bandwidth?    uint64
```

```
                  +--ro one-way-min-delay?            uint32
                  +--ro one-way-max-delay?            uint32
                  +--ro one-way-delay-variation?      uint32
                  +--ro one-way-packet-loss?          decimal64
```

Figure 8: NRPs Monitoring YANG subtree structure

3.4. NRPs Device Model Description

The device-specific NRPs model is defined in module "ietf-nrp-device" as shown in Section 5.

The NRP device YANG data model is only applicable to device configuration and includes attributes such as QoS policies, resource reservations, and NRP selector IDs. Specifically, it adds interface-specific attributes for cases where the QoS policies, NRP resources, and NRP selector IDs of an interface differ from the global NRP attributes of the device.

Figure 9 shows the tree diagram of the device NRPs YANG model defined in modules "ietf-nrp-device.yang".

```
module: ietf-nrp-device
  +--rw nrp-policies
     +--rw qos-profiles
     |  +--rw phb-profile-identifier* [id]
     |     +--rw id    string
     +--rw nrp-policy* [name]
        +--rw name                    string
        +--rw nrp-id?                 uint32
        +--rw resource-reservation
        |  +--rw (max-bw-type)?
        |        ...
        +--rw selector-id
        |  +--rw ipv4-derived
        |  |     ...
        |  +--rw ipv6
        |  |     ...
        |  +--rw mpls
        |  |     ...
        |  +--rw acl-ref*        acl-ref
        +--rw phb-profile?            leafref
        +--rw igp-congruent!
        |  +--rw multi-topology-id?   uint32
        |  +--rw algo-id?             uint32
        |  +--rw sharing?             boolean
        +--rw interfaces
           +--rw interface* [interface]
                 ...
```

Figure 9: NRPs Device YANG subtree high-level structure

4. NRPs YANG Module

The "ietf-nrp" module uses types defined in [RFC8345], [RFC8294],[RFC8776], [RFC9911], [RFC8519], [I-D.ietf-spring-srv6-yang], and [I-D.ietf-teas-yang-topology-filter].

```
<CODE BEGINS> file "ietf-nrp@2026-01-22.yang"
module ietf-nrp {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-nrp";
  prefix nrp;

  import ietf-network {
    prefix nw;
    reference
      "RFC 8345: A YANG Data Model for Network Topologies,
                 Section 6.1";
```

```
     }
     import ietf-network-topology {
       prefix nt;
       reference
         "RFC 8345: A YANG Data Model for Network Topologies,
                    Section 6.2";
     }
     import ietf-routing-types {
       prefix rt-types;
       reference
         "RFC 8294: Common YANG Data Types for the Routing Area";
     }
     import ietf-vpn-common {
       prefix vpn-common;
       reference
         "RFC 9181: A Common YANG Data Model for Layer 2 and Layer 3
                    VPNs";
     }
     import ietf-te-packet-types {
       prefix te-packet-types;
       reference
         "RFC 8776: Traffic Engineering Common YANG Types";
     }
     import ietf-inet-types {
       prefix inet;
       reference
         "RFC 9911: Common YANG Data Types";
     }
     import ietf-access-control-list {
       prefix acl;
       reference
         "RFC 8519: YANG Data Model for Network Access Control Lists
                    (ACLs)";
     }
     import ietf-srv6-types {
       prefix srv6-types;
       reference
         "draft-ietf-spring-srv6-yang: YANG Data Model for SRv6 Base
          and Static";
     }
     import ietf-topology-filter {
       prefix topo-filt;
       reference
         "draft-ietf-teas-yang-topology-filter: YANG Data Model
          for Topology Filter";
     }

     organization
```

```
       "IETF Traffic Engineering Architecture and Signaling (TEAS)
        Working Group";
     contact
       "WG Web:   <https://datatracker.ietf.org/wg/teas/>
        WG List:  <mailto:teas@ietf.org>

        Editor:   Bo Wu
               <mailto:lana.wubo@huawei.com>
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        Editor:   Tarek Saad
                  <mailto:tsaad.net@gmail.com>

        Editor:   Shaofu Peng
                  <mailto:peng.shaofu@zte.com.cn>";
     description
       "This YANG module defines a data model for
        Network Resource Partitions (NRPs) management.

        Copyright (c) 2026 IETF Trust and the persons identified as
        authors of the code.  All rights reserved.

        Redistribution and use in source and binary forms, with or
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           (https://trustee.ietf.org/license-info).

        This version of this YANG module is part of RFC XXXX
        (https://www.rfc-editor.org/info/rfcXXXX); see the RFC itself
        for full legal notices.";

     revision 2026-01-22 {
       description
         "Initial revision.";
       reference
         "RFC XXXX: YANG Data Models for Network Resource
                    Partitions (NRPs)";
     }

     /*
      * I D E N T I T I E S
      */
```

```
     identity nrp-partition-mode {
       description
         "Base identity for NRP partition type.";
     }

     identity control-plane-partition {
       base nrp-partition-mode;
       description
         "NRP control plane partition.";
     }

     identity data-plane-partition {
       base nrp-partition-mode;
       description
         "NRP data plane partition.";
     }

     identity hybrid-plane-partition {
       base nrp-partition-mode;
       description
         "Both control and data planes partitions of NRP.";
     }

     identity nrp-link-partition-type {
       description
         "Base identity for NRP interface partition type.";
     }

     identity virtual-interface {
       base nrp-link-partition-type;
       description
         "Identity for NRP virtual interface or sub-interface partition,
          e.g., FlexE.";
     }

     identity queue-partition {
       base nrp-link-partition-type;
       description
         "Identity for NRP queue partition type.";
     }

     /*
      * T Y P E D E F S
      */

     typedef acl-ref {
       type leafref {
         path "/acl:acls/acl:acl/acl:name";
```

```
       }
       description
         "Used to reference an ACL.";
     }

     typedef topo-filter-ref {
       type leafref {
         path "/nw:networks/topo-filt:topology-filters/"
            + "topo-filt:topology-filter/topo-filt:name";
       }
       description
         "This type is used to reference a Topology Filter.";
       reference
         "draft-ietf-teas-yang-topology-filter: YANG Data Model
          for Topology Filter";
     }

     /*
      * Grouping - NRP Resource Reservation
      */

     grouping resource-reservation {
       description
         "Grouping for NRP resource reservation.";
       container resource-reservation {
         description
           "Container for NRP resource reservation.";
         choice max-bw-type {
           description
             "Choice of maximum bandwidth specification.";
           case bw-value {
             leaf maximum-bandwidth {
               type uint64;
               units "bits/second";
               description
                 "The maximum bandwidth allocated to an NRP
                  - specified as absolute value.";
             }
           }
           case bw-percentage {
             leaf maximum-bandwidth-percent {
               type rt-types:percentage;
               description
                 "The maximum bandwidth allocated to an NRP
                  - specified as percentage of link
                  capacity.";
             }
           }
```

```
        }
      }
    }

    /*
     * Grouping - NRP Selector Identifier Configuration
     */

    grouping selector-id {
      description
        "Grouping for NRP selector identifier (NRP Selector ID)
         configuration.";
      container selector-id {
        description
          "Container for NRP selector ID.";
        container ipv4-derived {
          description
            "Container for IPv4 NRP selector ID.";
          leaf-list destination-prefix {
            type inet:ipv4-prefix;
            description
              "Any prefix from the specified set of IPv4
               destination prefixes can be the selector ID.";
          }
        }
        container ipv6 {
          description
            "Container for IPv6 NRP selector ID.";
          choice selector-type {
            description
              "Choices for IPv6 selector ID type.";
            case dedicated {
              leaf ipv6-hbh-eh {
                type uint32;
                description
                  "The selector ID carried in Hop-by-Hop option of
                   IPv6 extension header.";
                reference
                  "draft-ietf-6man-enhanced-vpn-vtn-id: Carrying
                   Network Resource (NRP) related Information in IPv6
                   Extension Header";
              }
            }
            case srv6-derived {
              leaf-list srv6-sid {
                type srv6-types:srv6-sid;
                description
                  "Any SID from the specified set of SRv6 SID can
```

```
                    be the NRP selector ID.";
                 reference
                   "draft-ietf-spring-sr-for-enhanced-vpn: Segment
                    Routing based Network Resource Partition (NRP) for
                    Enhanced VPN";
               }
             }
             case ipv6-destination-derived {
               leaf-list destination-prefix {
                 type inet:ipv6-prefix;
                 description
                   "Any prefix from the specified set of IPv6
                    destination prefixes can be the NRP selector ID.";
               }
             }
           }
         }
         container mpls {
           description
             "Container for MPLS NRP selector ID. Supports both
              In-Stack (MNA) and Post-Stack (PSD) encoding mechanisms.";
           choice mpls-encapsulation {
             description
               "Selects the MPLS NRP Selector encoding mechanism.";
             case mna-in-stack {
               description
                 "In-Stack NRP Selector action.
                  Refers to draft-ietf-mpls-mna-nrp-selector.";
               leaf in-stack-identifier {
                 type uint32;
                 must
                   "(../identifier-format='nrps13' and . <= 8191) or
                    (../identifier-format='nrps20' and . <= 1048575) or
                    (../identifier-format='enrps20' and . <= 1048575)" {
                   error-message
                     "NRP Selector value exceeds format range";
                 }
                 description
                   "The NRP Selector value. The valid range depends on the
                    encoding format (13-bit or 20-bit) selected.";
               }
               leaf identifier-format {
                 type enumeration {
                   enum nrps13 {
                     description
                       "13-bit NRP Selector (NRPS13).
                        Value range: 0-8191.";
                   }
```

```
                   enum nrps20 {
                     description
                       "20-bit NRP Selector (NRPS20).
                        Value range: 0-1048575.";
                   }
                   enum enrps20 {
                     description
                       "20-bit Extended NRP Selector (ENRPS20) compatible
                        with Entropy Label. Value range: 0-1048575.";
                   }
                 }
                 description
                   "Specifies the encoding format for the In-Stack
                    NRP Selector.";
               }
             }
             case post-stack {
               description
                 "Post-Stack NRP Selector (PS-NRP).
                  Refers to draft-ietf-mpls-mna-psd-nrp-selector.";
               leaf post-stack-identifier {
                 type uint32 {
                   range "0..4294967295"; // 2^32 - 1
                 }
                 description
                   "The 32-bit Post-Stack NRP Selector.";
               }
             }
           }
         }
         leaf-list acl-ref {
           type acl-ref;
           description
             "NRP selection is done based on the specified list of
              ACLs.";
           reference
             "RFC 8519: YANG Data Model for Network Access Control Lists
                        (ACLs)";
         }
       }
     }

     /*
      * Grouping - NRP QoS Per-Hop Behavior (PHB) profiles
      */

     grouping qos-profiles {
       description
```

```
        "Grouping for NRP QoS profiles.";
      container qos-profiles {
        description
          "Container for profiles.";
        list phb-profile-identifier {
          key "id";
          description
            "List of PHB profiles.";
          leaf id {
            type string;
            description
              "Uniquely identifies the PHB.
               The profile only has significance within the service
               provider's administrative domain";
          }
        }
      }
    }

    /*
     * Grouping - NRP QoS Per-Hop Behavior (PHB) profile
     */

    grouping qos-phb-profile {
      description
        "Grouping for NRP QoS Per-Hop Behavior (PHB) profile.";
      leaf phb-profile {
        type leafref {
          path "/nw:networks/nrp:nrp-policies/"
             + "nrp:qos-profiles/nrp:phb-profile-identifier/nrp:id";
        }
        description
          "PHB profile identifier, specifying the forwarding treatment
           of packets belonging to a specific NRP selector ID, such as
           bandwidth control, congestion control
           (e.g., Section 3.4 of [RFC3644]).
           The PHB may be standard PHB, such as Assured Forwarding (AF),
           Expedited Forwarding (EF), or a customized local policy,
           such as 'High', 'Low', 'Standard'.";
      }
    }

    /*
     * Grouping - NRP IGP congruent
     */

    grouping igp-congruent {
      description
```

```
         "Grouping for NRP IGP congruent attributes.";
       container igp-congruent {
         presence "Indicates NRP IGP congruency.";
         description
           "The presence of the container node describes NRP IGP
            congruent, which indicates that the NRP instance uses the
            same IGP topology with the specified 'multi-topology-id'
            and 'algo-id'. That is, the nodes and termination point of
            the NRP topology and the IGP topology are the same, while
            the link attributes of the NRP are different from those of
            the IGP.";
         leaf multi-topology-id {
           type uint32;
           description
             "Indicates the MT-id of the NRP IGP instance.";
           reference
             "RFC 5120:  M-ISIS: Multi Topology (MT) Routing in
              Intermediate System to Intermediate Systems (IS-ISs)
              RFC 4915:  Multi-Topology (MT) Routing in OSPF";
         }
         leaf algo-id {
           type uint32;
           description
             "Indicates the algo-id of the NRP IGP instance.";
           reference
             "RFC 9350: IGP Flexible Algorithm";
         }
         leaf sharing {
           type boolean;
           description
             "'true' if the NRP IGP instance can be shared with
              other NRPs;
              'false' if the NRP IGP instance is dedicated
              to this NRP.";
         }
       }
     }

     /*
      * Grouping - NRP Topology Filter
      */

     grouping topology-filter {
       description
         "Grouping for NRP filter topology.";
       container filters {
         description
           "Container for filters.";
```

```
         list filter {
           key "filter-ref";
           description
             "List of filters.";
           leaf filter-ref {
             type topo-filter-ref;
             description
               "Reference to a specific topology filter from the
                list of global topology filters.";
           }
           uses resource-reservation;
           uses selector-id;
           uses qos-phb-profile;
         }
       }
     }

     /*
      * Grouping - NRP Select Topology
      */

     grouping select-topology {
       description
         "NRP topology specified by selection.";
       container select {
         description
           "The container of NRP select topology.";
         list topology-group {
           key "group-id";
           description
             "List of groups for NRP topology elements (node or links)
              that share common attributes.";
           leaf group-id {
             type string;
             description
               "The NRP topology group identifier.";
           }
           /*The base topology reference. All links in
           the list below must belong to this specific
           network.*/
           uses nw:network-ref;
           list link {
             key "link-ref";
             description
               "A list of links with common attributes that are
                part of the referenced network";
             leaf link-ref {
               type leafref {
```

```
                path "/nw:networks/nw:network"
                   + "[nw:network-id=current()/../../nrp:network-ref]"
                   + "/nt:link/nt:link-id";
              }
              description
                "A reference to a link in the base topology specified
                 by the 'network-ref' sibling node.";
            }
          }
          uses resource-reservation;
          leaf link-partition-type {
            type identityref {
              base nrp-link-partition-type;
            }
            description
              "Indicates the resource reservation type of an NRP link.";
          }
          uses qos-phb-profile;
        }
      }
    }

    /*
     * Grouping - NRP Policy
     */

    grouping nrp-pol {
      description
        "Grouping for NRP policies.";
      container nrp-policies {
        description
          "Container for nrp policies.";
        uses qos-profiles;
        list nrp-policy {
          key "name";
          unique "nrp-id";
          description
            "List of NRP policies.";
          leaf name {
            type string;
            description
              "A string that uniquely identifies the NRP policy.";
          }
          leaf nrp-id {
            type uint32;
            description
              "A 32-bit ID that uniquely identifies the NRP
               created by the enforcement of this NRP policy.";
```

```
           }
           leaf mode {
             type identityref {
               base nrp-partition-mode;
             }
             description
               "Indicates the resource partition mode of the NRP, such
                as control plane partition, data plane partition,
                or hybrid partition.";
           }
           uses resource-reservation;
           uses selector-id;
           uses qos-phb-profile;
           container topology {
             description
               "Container for NRP topology.";
             uses igp-congruent;
             choice topology-type {
               description
                 "Choice of NRP topology type.";
               case selection {
                 uses select-topology;
               }
               case filter {
                 uses topology-filter;
               }
             }
           }
         }
       }
     }

     /*
      * Grouping - NRP Selector ID State
      */

     grouping selector-id-state {
       description
         "The grouping of NRP selector ID state.";
       container selector-id {
         config false;
         description
           "The container of NRP selector ID.";
         leaf srv6 {
           type srv6-types:srv6-sid;
           description
             "SRv6 SID value.";
         }
```

```
         leaf mpls-nrp-selector {
           type uint32;
           description
             "MPLS NRP selector value.";
         }
       }
     }

     // nrp-link-statistics

     grouping statistics-per-link {
       description
         "Statistics attributes per NRP link.";
       container statistics {
         config false;
         description
           "Statistics for NRP link.";
         uses vpn-common:service-status;
         uses nrp-bandwidth-metrics;
         uses te-packet-types:one-way-performance-metrics-packet;
       }
     }

     /*
      * Grouping - NRP node attributes
      */

     grouping node-nrp-attributes {
       description
         "NRP node scope attributes.";
       container nrp-node-attributes {
         config false;
         description
           "Containing NRP attributes.";
         uses selector-id-state;
       }
     }

     /*
      * Grouping - NRP Link Attributes
      */

     grouping link-nrp-attributes {
       description
         "NRP link scope attributes.";
       container nrp-link-attributes {
         config false;
         description
```

```
           "Contains NRP link attributes.";
         leaf link-partition-type {
           type identityref {
             base nrp-link-partition-type;
           }
           description
             "Indicates the resource partition type of an NRP link.";
         }
         leaf bandwidth-value {
           type uint64;
           units "bits/second";
           description
             "Bandwidth allocation for the NRP as absolute value.";
         }
         uses selector-id-state;
         uses statistics-per-link;
       }
     }

     /*
      * Grouping - NRP Bandwidth Metrics
      */

     grouping nrp-bandwidth-metrics {
       description
         "Grouping for NRP bandwidth metrics.";
       leaf one-way-available-bandwidth {
         type uint64;
         units "bits/second";
         description
           "Available bandwidth that is defined to be NRP link
            bandwidth minus bandwidth utilization.";
       }
       leaf one-way-utilized-bandwidth {
         type uint64;
         units "bits/second";
         description
           "Bandwidth utilization that represents the actual
            utilization of the link (i.e., as measured in the router).";
       }
     }

     /*
      * Grouping - NRPs Node Attributes
      */

     grouping node-nrp-list-attributes {
       description
```

```
         "Grouping for NRPs nodes attributes.";
       container node-nrp-list {
         config false;
         description
           "Containing NRPs attributes.";
         list nrp {
           key "nrp-id";
           description
             "List of NRPs.";
           leaf nrp-id {
             type uint32;
             description
               "NRP identifier";
           }
           uses node-nrp-attributes;
         }
       }
     }

     /*
      * Grouping - NRPs Link Attributes
      */

     grouping link-nrp-list-attributes {
       description
         "Grouping for NRPs link attributes.";
       container link-nrp-list {
         config false;
         description
           "Contains NRPs link attributes.";
         list nrp {
           key "nrp-id";
           description
             "List of NRPs.";
           leaf nrp-id {
             type uint32;
             description
               "NRP identifier";
           }
           uses link-nrp-attributes;
         }
       }
     }

     // nrp-network-type

     grouping nrp-network-type {
       description
```

```
         "Identifies the network type to be NRP.";
       container nrp {
         presence "Indicates NRP network topology.";
         description
           "The presence of the container node indicates NRP network.";
       }
     }

     /*
      * Augment - Network Resource Partition Policies.
      */

     augment "/nw:networks" {
       description
         "Augments networks with NRP policies.";
       uses nrp-pol;
     }

     /*
      * Augment - NRP type.
      */

     augment "/nw:networks/nw:network/nw:network-types" {
       description
         "Indicates the network type of NRP";
       uses nrp-network-type;
     }

     /*
      * Augment - NRP node operational status.
      */

     augment "/nw:networks/nw:network/nw:node" {
       description
         "Augments node with NRP state attributes.";
       choice nrp-attachment-type {
         description
           "Determines how NRP information is attached to node:
            single-nrp for NRP-specific topology, multi-nrp for
            native topology with multiple NRPs.";
         case single-nrp {
           when '../nw:network-types/nrp:nrp' {
             description
               "Condition: only applies to NRP network topologies.";
           }
           uses node-nrp-attributes;
         }
         case multi-nrp {
```

```
           description
             "Native topology with NRPs node operational status.";
           uses node-nrp-list-attributes;
         }
       }
     }

     /*
      * Augment - NRP link operational status.
      */

     augment "/nw:networks/nw:network/nt:link" {
       description
         "Augments link with NRP state attributes.";
       choice nrp-attachment-type {
         description
           "Determines how NRP information is attached to link:
            single-nrp for NRP-specific topology, multi-nrp for
            native topology with multiple NRPs.";
         case single-nrp {
           when '../nw:network-types/nrp:nrp' {
             description
               "Condition: only applies to NRP network topology.";
           }
           uses link-nrp-attributes;
         }
         case multi-nrp {
           /*Native topology with NRPs link operational status.*/
           description
             "Native topology with NRPs link operational status.";
           uses link-nrp-list-attributes;
         }
       }
     }
   }
   <CODE ENDS>
```

5. NRPs Device YANG Module

The NRP YANG module for devices ("ietf-nrp-device") reuses the qos policy, "resource-reservation", "selector-id" grouping defined in Section 4,and adds interface-specific NRP attributes.

The device NRPs YANG module also imports the following module(s): ietf-interfaces defined in [RFC8343].

```
<CODE BEGINS> file "ietf-nrp-device@2025-03-02.yang"
module ietf-nrp-device {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-nrp-device";
  prefix nrp-dev;

  /* Import IETF interface module */

  import ietf-interfaces {
    prefix if;
    reference
      "RFC8343: A YANG Data Model for Interface Management";
  }

  /* Import NRPs module */

  import ietf-nrp {
    prefix nrp;
    reference
      "RFCXXXX: YANG Data Models for Network Resource
                Partitions (NRPs)";
  }

  organization
    "IETF Traffic Engineering Architecture and Signaling (TEAS)
     Working Group";
  contact
    "WG Web:   <https://datatracker.ietf.org/wg/teas/>
     WG List:  <mailto:teas@ietf.org>

     Editor:   Bo Wu
               <mailto:lana.wubo@huawei.com>

     Editor:   Dhruv Dhody
               <mailto:dhruv.ietf@gmail.com>

     Editor:   Vishnu Pavan Beeram
               <mailto:vbeeram@juniper.net>

     Editor:   Tarek Saad
               <mailto:tsaad.net@gmail.com>

     Editor:   Shaofu Peng
               <mailto:peng.shaofu@zte.com.cn>";
  description
    "This YANG module defines a data model for Network Resource
     Partitions (NRPs) device configurations and states. The model
     fully conforms to the Network Management Datastore
```

```
        Architecture (NMDA).

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        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
        (https://www.rfc-editor.org/info/rfcXXXX); see the RFC itself
        for full legal notices.";

     // RFC Ed.: replace XXXX with actual RFC number and
     // remove this note.
     // RFC Ed.: update the date below with the date of RFC
     // publication and remove this note.

     revision 2025-03-02 {
       description
         "Initial revision.";
       reference
         "RFCXXXX: YANG Data Models for Network Resource
                   Partitions (NRPs)";
     }

     /*
      * Grouping - NRP QoS Per-Hop Behavior (PHB) profile
      */

     grouping qos-phb-profile {
       description
         "Grouping for NRP QoS Per-Hop Behavior (PHB) profile.";
       leaf phb-profile {
         type leafref {
           path
             "/nrp-policies/qos-profiles/phb-profile-identifier/id";
         }
         description
           "PHB profile identifier, specifying the forwarding treatment
            of packets belonging to a specific NRP selector identifier,
            such as bandwidth control, congestion control
            (e.g., Section 3.4 of [RFC3644]).
            The PHB may be standard PHB, such as Assured
            Forwarding (AF), Expedited Forwarding (EF), or
```

```
            a customized local policy, such as 'High', 'Low',
            'Standard'.";
       }
     }

     /* NRP device configuraiton */

     container nrp-policies {
       description
         "Container for nrp policies.";
       uses nrp:qos-profiles;
       list nrp-policy {
         key "name";
         unique "nrp-id";
         description
           "List of NRP policies.";
         leaf name {
           type string;
           description
             "A string that uniquely identifies the NRP policy.";
         }
         leaf nrp-id {
           type uint32;
           description
             "A 32-bit ID that uniquely identifies the NRP
              created by the enforcement of this NRP policy.";
         }
         uses nrp:resource-reservation;
         uses nrp:selector-id;
         uses qos-phb-profile;
         uses nrp:igp-congruent;
         /* NRP Interface Configuration Data */
         container interfaces {
           description
             "NRP interfaces global configuration.";
           list interface {
             key "interface";
             description
               "The list of interfaces enabled for NRP.";
             leaf interface {
               type if:interface-ref;
               description
                 "NRP interface name.";
             }
             uses nrp:resource-reservation;
             uses nrp:selector-id;
             uses qos-phb-profile;
           }
```

```
          }
        }
      }
    }
    <CODE ENDS>
```

6. Scalability Considerations

[I-D.ietf-teas-nrp-scalability] analyzes the scalability considerations of the control plane and data plane in the NRPs deployment. This section complements some scalability considerations with the model and the possible implications on deployment or implementation.

As discussed in Section 2 of [I-D.ietf-teas-nrp-scalability], the number of Network Resource Partitions (NRPs) required depends on the deployment scenario: multi-service networks typically need around ten NRPs, whereas industrial-vertical and cloud-network expansions can require hundreds to thousands of NRPs to support correspondingly large numbers of Network Slices. Compared to a single NRP, all these numbers of NRPs pose challenges for management and operations, including NRP planning, provisioning, monitoring, and Network Slice Service provisioning and assurance based on NRPs. Section 3 of [I-D.ietf-teas-ns-ip-mpls] describes the detailed realization process of multiple NRPs.

For better scalability, the NRP YANG model design considers the following aspects:

* Planning: A reusable "qos-profile" groups Service-Level Objectives (SLOs) once and applies them to any NRP, guaranteeing consistent QoS policy across the domain while eliminating per-NRP duplication. "filter/selection" enables multiple NRPs to share a common topology, confining per-NRP state to the differences rather than replicating the entire topology. Network operators should create new NRPs only when strict resource isolation is required, ensuring that network-wide resources remain efficiently utilized.

* Provisioning: The network controller, not the Network Slice Controller (NSC), is responsible for the actual resource allocation of NRPs on devices. It assigns NRPs to the relevant interfaces, reserve the bandwidth, and set data-plane selector IDs. NSC conveys the intent through the NRP network model, specifically via the "nrp-policy", and the network controller then realize the requested allocation. And for data-plane selector IDs, Section 5.2 of [I-D.ietf-teas-nrp-scalability] recommends selecting a data-plane mechanism that minimizes per-NRP configuration. A dedicated IPv6 selector identifier is one example that achieves this objective.

* Monitoring: The model supports two complementary monitoring approaches:

  Per-NRP view: Operational state scoped to a single "nrp-id", letting the controller present the logical network dedicated to that NRP.

  Network-wide view: An extension of the RFC 8345 topology model that exposes the mapping between the underlay network and all associated NRPs, including per-node and per-link NRP status.

7. Security Considerations

The YANG models defined in this document are designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF access control model [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG model that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations.

nrp-policies: Unauthorized creation or modification of NRP policies can allocate excessive network resources (bandwidth, buffers, forwarding entries), causing denial of service to other services. Implementations MUST enforce resource limits and validate quota constraints before applying NRP configurations. NETCONF access control SHOULD restrict NRP policy creation to authorized network-admin roles only.

selector-id and phb-profile: Misconfiguration of NRP selector IDs or PHB profiles may cause traffic to be forwarded on the wrong NRP, violating isolation guarantees and SLOs. Implementations MUST validate selector ID uniqueness within the network scope and prevent overlapping PHB configurations that could create ambiguous forwarding rules.

topology: Modification of NRP topology (links, nodes, filters) could reroute traffic through unintended paths, bypassing security policies or causing congestion. Operators MUST apply access controls to topology modifications and audit all changes. The model's operational state SHOULD be monitored to detect unauthorized topology alterations.

The entries in the nodes above include the whole network configurations corresponding with the NRP, and indirectly create or modify the PE or P device configurations. Unexpected changes to these entries could lead to service disruption and/or network misbehavior.

Sensitive Data Exposure: Operational state data (e.g., utilized bandwidth, delay statistics) may reveal sensitive information about network load and customer traffic patterns. Access to operational state SHOULD be restricted using NACM rules, limiting visibility to authorized monitoring systems.

8. IANA Considerations

This document registers a URI in the IETF XML registry [RFC3688]. Following the format in [RFC3688], the following registration is requested to be made:

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

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

This document requests to register a YANG module in the YANG Module Names registry [RFC7950].

```
Name: ietf-nrp
Namespace: urn:ietf:params:xml:ns:yang:ietf-nrp
Maintained by IANA: N
Prefix: nrp
Reference: RFC XXXX

Name: ietf-nrp-device
Namespace: urn:ietf:params:xml:ns:yang:ietf-nrp-device
Maintained by IANA: N
Prefix: nrp-dev
Reference: RFC XXXX
```

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10. Contributor

The following individuals, authors of [I-D.bestbar-teas-yang-nrp-policy] and [I-D.wd-teas-nrp-yang], contributed to this consolidated document:

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Appendix A. Open issues

All issues identified during Working Group review have been resolved. This section is intentionally left blank for the final publication.

Appendix B. An Example

This section contains an example of an instance data tree in JSON encoding [RFC7951].

```
                +------------+                   +------------+
                |     D1     |                   |     D2     |
               /-\          /-\                 /-\          /-\
               | | 1-0-1    | |---------------->| | 2-1-1    | |
               | |    1-2-1 | |<----------------| |    2-0-1 | |
               \-/  1-3-1   \-/                 \-/  2-3-1   \-/
                |   /----\   |                   |   /----\   |
                +---|    |---+                   +---|    |---+
                    \----/                           \----/
                     |  |                             |  |
                     |  |                             |  |
                     |  |                             |  |
                     |  |       +------------+        |  |
                     |  |       |     D3     |        |  |
                     |  |      /-\          /-\       |  |
                     |  +----->| | 3-1-1    | |-------+  |
                     +---------| |    3-2-1 | |<---------+
                               \-/          \-/
                                |            |
                                +------------+
```

Figure 10: An NRP Instance Example

The following example configures a hybrid NRP (NRP1) with SRv6 selector and Flex-Algo based topology.

```
============== NOTE: '\' line wrapping per RFC 8792 ===============
{
  "ietf-network:networks": {
    "ietf-nrp:nrp-policies": {
      "qos-profiles": {
        "phb-profile-identifier": [
          {
            "id": "High-Priority-Profile"
          }
        ]
      },
      "nrp-policy": [
        {
          "name": "NRP1-SRv6-FlexAlgo",
          "nrp-id": "example:nrp-example1",
          "mode": "ietf-nrp:hybrid-plane-partition",
          "resource-reservation": {
            "maximum-bandwidth": "10000000000"
          },
          "selector-id": {
            "ipv6": {
              "srv6-derived": {
                "srv6-sid": [
                  "2001:db8:100::"
                ]
              }
            }
          },
          "phb-profile:" "High-Priority-Profile",
          "topology": {
            "igp-congruent": {
              "algo-id": "128",
              "sharing": false
            },
           ]
           }
          }
        }
      ]
    }
  }
}
```

Figure 11: Instance data tree

Another example of an NRP that supports the control plane partition mode is shown in the following figure.

```
{
  "ietf-network:networks": {
    "ietf-nrp:nrp-policies": {
      "nrp-policy": [
        {
          "name": "NRP2-CONTROL-PLANE",
          "nrp-id": "example:nrp-example2",
          "mode": "control-plane-partition",
          "resource-reservation": {
            "bw-value": "10000"
          },
          "phb-profile:": "EF",
          "topology": {
            "filters": {
              "filter": [
                {
                  "filter-ref": "te-topology-filter1"
                }
              ]
            }
          }
        }
      ]
    }
  }
}
```


The following example configures a router with two NRP instances using IPv6 Hop-by-Hop extension header options for traffic identification. NRP-100 uses selector ID 100 for high-priority service traffic, while NRP-200 uses selector ID 200 for standard services.


```
{
  "ietf-interfaces:interfaces": {
    "interface": [
      {
        "name": "GigabitEthernet0/0/0/0",
        "type": "iana-if-type:ethernetCsmacd",
        "enabled": true
      },
      {
        "name": "GigabitEthernet0/0/0/1",
        "type": "iana-if-type:ethernetCsmacd",
        "enabled": true
      },
      {
        "name": "GigabitEthernet0/0/0/2",
```

```
            "type": "iana-if-type:ethernetCsmacd",
            "enabled": true
          }
        ]
      },
      "ietf-nrp-device:nrp-policies": {
        "qos-profiles": {
          "phb-profile-identifier": [
            {
              "id": "High-Priority-PHB"
            },
            {
              "id": "Standard-PHB"
            }
          ]
        },
        "nrp-policy": [
          {
            "name": "NRP-Premium-Service",
            "nrp-id": 100,
            "mode": "ietf-nrp:hybrid-plane-partition",
            "resource-reservation": {
              "maximum-bandwidth-percent": 20
            },
            "selector-id": {
              "ipv6": {
                "ipv6-hbh-eh": 100
              }
            },
            "phb-profile": "High-Priority-PHB",
            "igp-congruent": {
              "algo-id": 128,
              "sharing": false
            },
            "interfaces": {
              "interface": [
                {
                  "interface": "GigabitEthernet0/0/0/0",
                  "resource-reservation": {
                    "maximum-bandwidth-percent": 40
                  },
                  "selector-id": {
                    "ipv6": {
                      "ipv6-hbh-eh": 101
                    }
                  },
                  "phb-profile": "High-Priority-PHB"
                },
```

```
              {
                "interface": "GigabitEthernet0/0/0/1",
                "resource-reservation": {
                  "maximum-bandwidth-percent": 30
                },
                "selector-id": {
                  "ipv6": {
                    "ipv6-hbh-eh": 102
                  }
                },
                "phb-profile": "High-Priority-PHB"
              }
            ]
          }
        },
        {
          "name": "NRP-Standard-Service",
          "nrp-id": 200,
          "mode": "ietf-nrp:data-plane-partition",
          "resource-reservation": {
            "maximum-bandwidth-percent": 50
          },
          "selector-id": {
            "ipv6": {
              "ipv6-hbh-eh": 200
            }
          },
          "phb-profile": "Standard-PHB",
          "interfaces": {
            "interface": [
              {
                "interface": "GigabitEthernet0/0/0/2",
                "resource-reservation": {
                  "maximum-bandwidth-percent": 50
                },
                "selector-id": {
                  "ipv6": {
                    "ipv6-hbh-eh": 201
                  }
                },
                "phb-profile": "Standard-PHB"
              }
            ]
          }
        }
      ]
    }
  }
```

Appendix C. NRPs YANG Module Tree

Figure 12 shows the full tree diagram of the NRPs YANG model defined in module "ietf-nrp.yang".

```
module: ietf-nrp

  augment /nw:networks:
    +--rw nrp-policies
       +--rw qos-profiles
       |  +--rw phb-profile-identifier* [id]
       |     +--rw id    string
       +--rw nrp-policy* [name]
          +--rw name                     string
          +--rw nrp-id?                  uint32
          +--rw mode?                    identityref
          +--rw resource-reservation
          |  +--rw (max-bw-type)?
          |     +--:(bw-value)
          |     |  +--rw maximum-bandwidth?           uint64
          |     +--:(bw-percentage)
          |        +--rw maximum-bandwidth-percent?
          |                rt-types:percentage
          +--rw selector-id
          |  +--rw ipv4-derived
          |  |  +--rw destination-prefix*   inet:ipv4-prefix
          |  +--rw ipv6
          |  |  +--rw (selector-type)?
          |  |     +--:(dedicated)
          |  |     |  +--rw ipv6-hbh-eh?          uint32
          |  |     +--:(srv6-derived)
          |  |     |  +--rw srv6-sid*             srv6-types:srv6-sid
          |  |     +--:(ipv6-destination-derived)
          |  |        +--rw destination-prefix*   inet:ipv6-prefix
          |  +--rw mpls
          |  |  +--rw (mpls-encapsulation)?
          |  |     +--:(mna-in-stack)
          |  |     |  +--rw in-stack-identifier?     uint32
          |  |     |  +--rw identifier-format?       enumeration
          |  |     +--:(post-stack)
          |  |        +--rw post-stack-identifier?   uint32
          |  +--rw acl-ref*        acl-ref
          +--rw phb-profile?             leafref
          +--rw topology
             +--rw igp-congruent!
             |  +--rw multi-topology-id?   uint32
             |  +--rw algo-id?             uint32
             |  +--rw sharing?             boolean
```

```
                +--rw (topology-type)?
                   +--:(selection)
                   |  +--rw select
                   |     +--rw topology-group* [group-id]
                   |        +--rw group-id                string
                   |        +--rw network-ref?
                   |        |       -> /nw:networks/network/network-id
                   |        +--rw link* [link-ref]
                   |        |  +--rw link-ref    leafref
                   |        +--rw resource-reservation
                   |        |  +--rw (max-bw-type)?
                   |        |     +--:(bw-value)
                   |        |     |  +--rw maximum-bandwidth?
                   |        |     |          uint64
                   |        |     +--:(bw-percentage)
                   |        |        +--rw maximum-bandwidth-percent?
                   |        |                rt-types:percentage
                   |        +--rw link-partition-type?    identityref
                   |        +--rw phb-profile?            leafref
                   +--:(filter)
                      +--rw filters
                         +--rw filter* [filter-ref]
                            +--rw filter-ref
                            |       topo-filter-ref
                            +--rw resource-reservation
                            |  +--rw (max-bw-type)?
                            |     +--:(bw-value)
                            |     |  +--rw maximum-bandwidth?
                            |     |          uint64
                            |     +--:(bw-percentage)
                            |        +--rw maximum-bandwidth-percent?
                            |                rt-types:percentage
                            +--rw selector-id
                            |  +--rw ipv4-derived
                            |  |  +--rw destination-prefix*
                            |  |          inet:ipv4-prefix
                            |  +--rw ipv6
                            |  |  +--rw (selector-type)?
                            |  |     +--:(dedicated)
                            |  |     |  +--rw ipv6-hbh-eh?
                            |  |     |          uint32
                            |  |     +--:(srv6-derived)
                            |  |     |  +--rw srv6-sid*
                            |  |     |          srv6-types:srv6-sid
                            |  |     +--:(ipv6-destination-derived)
                            |  |        +--rw destination-prefix*
                            |  |                inet:ipv6-prefix
                            |  +--rw mpls
```

```
                            |  |  +--rw (mpls-encapsulation)?
                            |  |     +--:(mna-in-stack)
                            |  |     |  +--rw in-stack-identifier?
                            |  |     |  |       uint32
                            |  |     |  +--rw identifier-format?
                            |  |     |          enumeration
                            |  |     +--:(post-stack)
                            |  |        +--rw post-stack-identifier?
                            |  |                uint32
                            |  +--rw acl-ref*        acl-ref
                            +--rw phb-profile?            leafref
     augment /nw:networks/nw:network/nw:network-types:
       +--rw nrp!
     augment /nw:networks/nw:network/nw:node:
       +--rw (nrp-attachment-type)?
          +--:(single-nrp)
          |  +--ro nrp-node-attributes
          |     +--ro selector-id
          |        +--ro srv6?                srv6-types:srv6-sid
          |        +--ro mpls-nrp-selector?   uint32
          +--:(multi-nrp)
             +--ro node-nrp-list
                +--ro nrp* [nrp-id]
                   +--ro nrp-id                 uint32
                   +--ro nrp-node-attributes
                      +--ro selector-id
                         +--ro srv6?                srv6-types:srv6-sid
                         +--ro mpls-nrp-selector?   uint32
     augment /nw:networks/nw:network/nt:link:
       +--rw (nrp-attachment-type)?
          +--:(single-nrp)
          |  +--ro nrp-link-attributes
          |     +--ro link-partition-type?   identityref
          |     +--ro bandwidth-value?       uint64
          |     +--ro selector-id
          |     |  +--ro srv6?                srv6-types:srv6-sid
          |     |  +--ro mpls-nrp-selector?   uint32
          |     +--ro statistics
          |        +--ro status
          |        |  +--ro admin-status
          |        |  |  +--ro status?        identityref
          |        |  |  +--ro last-change?   yang:date-and-time
          |        |  +--ro oper-status
          |        |     +--ro status?        identityref
          |        |     +--ro last-change?   yang:date-and-time
          |        +--ro one-way-available-bandwidth?   uint64
          |        +--ro one-way-utilized-bandwidth?    uint64
          |        +--ro one-way-min-delay?             uint32
```

```
          |        +--ro one-way-max-delay?            uint32
          |        +--ro one-way-delay-variation?      uint32
          |        +--ro one-way-packet-loss?          decimal64
          +--:(multi-nrp)
             +--ro link-nrp-list
                +--ro nrp* [nrp-id]
                   +--ro nrp-id                  uint32
                   +--ro nrp-link-attributes
                      +--ro link-partition-type?   identityref
                      +--ro bandwidth-value?       uint64
                      +--ro selector-id
                      |  +--ro srv6?                 srv6-types:srv6-sid
                      |  +--ro mpls-nrp-selector?   uint32
                      +--ro statistics
                         +--ro status
                         |  +--ro admin-status
                         |  |  +--ro status?        identityref
                         |  |  +--ro last-change?   yang:date-and-time
                         |  +--ro oper-status
                         |     +--ro status?        identityref
                         |     +--ro last-change?   yang:date-and-time
                         +--ro one-way-available-bandwidth?   uint64
                         +--ro one-way-utilized-bandwidth?    uint64
                         +--ro one-way-min-delay?             uint32
                         +--ro one-way-max-delay?             uint32
                         +--ro one-way-delay-variation?       uint32
                         +--ro one-way-packet-loss?           decimal64
```

Figure 12

Appendix D. NRPs Device YANG Module Tree

Figure 13 shows the full tree diagram of the NRPs device YANG model defined in module "ietf-nrp-device.yang".

```
   module: ietf-nrp-device
     +--rw nrp-policies
        +--rw qos-profiles
        |  +--rw phb-profile-identifier* [id]
        |     +--rw id    string
        +--rw nrp-policy* [name]
           +--rw name                     string
           +--rw nrp-id?                  uint32
           +--rw resource-reservation
           |  +--rw (max-bw-type)?
           |     +--:(bw-value)
           |     |  +--rw maximum-bandwidth?           uint64
           |     +--:(bw-percentage)
```

```
           |        +--rw maximum-bandwidth-percent?
           |                rt-types:percentage
           +--rw selector-id
           |  +--rw ipv4-derived
           |  |  +--rw destination-prefix*   inet:ipv4-prefix
           |  +--rw ipv6
           |  |  +--rw (selector-type)?
           |  |     +--:(dedicated)
           |  |     |  +--rw ipv6-hbh-eh?          uint32
           |  |     +--:(srv6-derived)
           |  |     |  +--rw srv6-sid*             srv6-types:srv6-sid
           |  |     +--:(ipv6-destination-derived)
           |  |        +--rw destination-prefix*   inet:ipv6-prefix
           |  +--rw mpls
           |  |  +--rw (mpls-encapsulation)?
           |  |     +--:(mna-in-stack)
           |  |     |  +--rw in-stack-identifier?     uint32
           |  |     |  +--rw identifier-format?       enumeration
           |  |     +--:(post-stack)
           |  |        +--rw post-stack-identifier?   uint32
           |  +--rw acl-ref*        acl-ref
           +--rw phb-profile?           leafref
           +--rw igp-congruent!
           |  +--rw multi-topology-id?   uint32
           |  +--rw algo-id?             uint32
           |  +--rw sharing?             boolean
           +--rw interfaces
              +--rw interface* [interface]
                 +--rw interface               if:interface-ref
                 +--rw resource-reservation
                 |  +--rw (max-bw-type)?
                 |     +--:(bw-value)
                 |     |  +--rw maximum-bandwidth?           uint64
                 |     +--:(bw-percentage)
                 |        +--rw maximum-bandwidth-percent?
                 |                rt-types:percentage
                 +--rw selector-id
                 |  +--rw ipv4-derived
                 |  |  +--rw destination-prefix*   inet:ipv4-prefix
                 |  +--rw ipv6
                 |  |  +--rw (selector-type)?
                 |  |     +--:(dedicated)
                 |  |     |  +--rw ipv6-hbh-eh?          uint32
                 |  |     +--:(srv6-derived)
                 |  |     |  +--rw srv6-sid*
                 |  |     |          srv6-types:srv6-sid
                 |  |     +--:(ipv6-destination-derived)
                 |  |        +--rw destination-prefix*
```

```
                 |  |                inet:ipv6-prefix
                 |  +--rw mpls
                 |  |  +--rw (mpls-encapsulation)?
                 |  |     +--:(mna-in-stack)
                 |  |     |  +--rw in-stack-identifier?     uint32
                 |  |     |  +--rw identifier-format?       enumeration
                 |  |     +--:(post-stack)
                 |  |        +--rw post-stack-identifier?   uint32
                 |  +--rw acl-ref*        acl-ref
                 +--rw phb-profile?            leafref
```

Figure 13

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