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Data model for RIB I2RS protocol
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Abstract

Routing and routing functions in enterprise and carrier networks are typically performed by network devices (routers and switches) using a routing information base (RIB). Protocols and configuration collectively push data into RIB and the RIB manager installs state information into the hardware; for packet forwarding. This draft specifies a data model for the RIB in order to define and enable a standardized data model. Such a data model can be used to define an interface to the RIB by using an entity that may even be external to the network device. This interface can be used to support new use-cases being defined by the IETF I2RS WG.

This document introduces a yang data for I2RS RIB that aligns with the I2RS RIB use cases and I2RS RIB infomation model.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

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

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This Internet-Draft will expire on June 11, 2015.

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1. Introduction

The Interface to the Routing System (I2RS) provides read and write access to the information and state within the routing process that exists inside the routing elements via protocol message exchange between an I2RS Client and an I2RS Agent associated with the routing system. The [I-D.ietf-i2rs-architecture] describes the basic interaction procedures of this exchange activity. One of the important functions of this messages exchange is to get the I2RS client interact with one or more I2RS agents in order to collect information from the network routing systems.

Protocols and configuration collectively push data into RIB and the RIB manager installs state information into the hardware; for packet

forwarding. This draft specifies a standardized data model for the RIB. Such a data model can be used to define an interface to the RIB from an entity that may even be external to the network device. This interface can be used to support new use-cases being defined by the IETF I2RS WG.

2. Definitions and Acronyms

RIB: routing information base

Information Model: An abstract model of a conceptual domain, independent of a specific implementation or data representation

NETCONF:The Network Configuration Protocol as defined in [RFC6536]

RESTCONF: The REST-like protocol that provides a programmatic interface over HTTP for accesing the data defined in YANG, using datastores defined in NETCONF Protocol [I-D.ietf-netconf-restconf] as defined in RBNF: Routing Backus-Naur Form [RFC5511].

3. Yang Top-level description

3.1. Capabilities

RIB capability negotiation is very important because not all of the hardware will be able to support all kinds of nexthops and there should be a limitation on how many levels of lookup can be practically performed. Therefore, a RIB data-model MUST specify a way for an external entity to learn about the functional capabilities of a network device.

At the same time, nexthop chains can be used to specify multiple headers over a packet, before that particular packet is forwarded. Not every network device will be able to support all kinds of nexthop chains along with the arbitrary number of headers which are chained together. The RIB data-model SHOULD provide a way to expose the nexthop chaining capability supported by a given network device.

The high-level yang for the next-hop-capacity and the nexthop-tunnel-encap-capacity :

```
   +--rw nexthop-capacity
   |  +--rw support-tunnel?         boolean
   |  +--rw support-chains?         boolean
   |  +--rw support-list-of-list?   boolean
   |  +--rw support-replication?    boolean
   |  +--rw support-weighted?       boolean
   |  +--rw support-protection?     boolean
   |  +--rw lookup-limit?           uint8
   +--rw nexthop-tunnel-encap-capacity
   |  +--rw support-ipv4?    boolean
   |  +--rw support-ipv6?    boolean
   |  +--rw support-mpls?    boolean
   |  +--rw support-gre?     boolean
   |  +--rw support-vxlan?   boolean
   |  +--rw support-nvgre?   boolean
```

3.2. routing-instance-list

A routing instance, in the context of the RIB information model, is a collection of RIBs, interfaces, and routing protocol parameters. A routing instance creates a logical slice of the router and can allow multiple different logical slices; across a set of routers; to communicate with each other. And the routing protocol parameters control the information available in the RIBs.

A routing instance MUST contain the following mandatory fields.

o INSTANCE_NAME: A routing instance is identified by its defined name

o rib-list: This is the list of RIBs associated with this routing instance. Each routing instance can have multiple RIBs to represent routes of different types.A route is essentially a match condition and an action following that match. The match condition specifies the kind of route (IPv4, MPLS, etc.) and the set of fields to match on.

A routing instance MAY contain the following optional fields.

o interface-list: This represents the list of interfaces associated with a particular routing instance.

o router-id: The router-id field identifies the network device in various control plane interactions with other network devices.

Top level yang :

```
+--rw routing-instance-list* [instance-name]
      +--rw instance-name string
      +--rw interface-list* [name]
      |   +--rw name if:interface-ref
      +--rw-id?  Yang:dotted-quad
      +--rw rib-list* [rib-name]
           +--rw rib-name string
           +--rw rib-family  rib-family-def
           +--rw enable-ip-rpf-check? Boolean
           +--rw route-list* [route-index]
                +--rw route-index unit 64
                +--rw-type route-type-def
                +--rw (rib-route-type)?
                |  +--:(ipv4)
                |  +--:(ipv6)
                |  +--:(mpls-route)
                |  +--:(mac-route)
                |  +--:(interface-route)
            +--rw nexthop-list* [nexthop-list-index]
            +--ro route-state?  route-state-def
            +--ro route-installed-state?  route-installed-state-def
            +--ro route-reason ?  route-reason-def
            +--rw route-preference uint32
            +--rw local-only Boolean
            +--rw address-family-route-attributes
```

3.3. Route

A route is essentially a match condition and an action following that match. The match condition specifies the kind of route (IPv4, MPLS, MAC.Interface) and the set of fields to match on.Each route MUST have associated with an identified ROUTE_PREFERENCE attributes and preferably it can have one or more optional route attributes,such as the route-vendor-attributes.

Route must contains the following attributes: Installed (Indicates whether the route got installed in the FIB) ; Active (Indicates whether a route is fully resolved and is a candidate for selection) ; Reason - E.g. Not authorized

A nexthop represents an object value resulting from a route lookup. Nexthops can be Unicast, Tunnel nexthops , Replication lists, Weighted lists , Protection lists , Nexthop chains , Indirect nexthops, Special nexthops.

Top level yang :

```
+--rw route-list* [route-index]
   +--rw route-index                        uint64
   +--rw route-type                         route-type-def
   +--rw (rib-route-type)?
   |  +--:(ipv4)
   |  +--:(ipv6)
   |  +--:(mpls-route)
   |  +--:(mac-route)
   |  +--:(interface-route)
   +--rw nexthop-list* [nexthop-list-index]
   |  +--rw nexthop-list-index          uint32
   |  +--rw (nexthop-list-type)?
   |     +--:(special-nexthop)
   |     |  +--rw special-nexthop?            special-nexthop-def
   |     +--:(normal-nexthop)
   |        +--rw (nexthop-member-or-list-of-list)?
   |           +--:(one-nexthop-list-member)
   |           +--:(nexthop-list-of-list)
   +--ro route-state?                       route-state-def
   +--ro route-installed-state?             route-installed-state-def
   +--ro route-reason?                      route-reason-def
   +--rw route-preference                   uint32
   +--rw local-only                         boolean
   +--rw address-family-route-attributes
      +--rw (route-type)?
         +--:(ip-route-attributes)
         +--:(mpls-route-attributes)
         +--:(eThernet-route-attributes)
```

3.4. Notifications

Asynchronous notifications are sent by the RIB manager of a network device to an external entity when some event triggers on the network device. A RIB data-model MUST support sending 2 kind of asynchronous notifications.

1. Route change notification:

o Installed (Indicates whether the route got installed in the FIB) ;

o Active (Indicates whether a route is fully resolved and is a candidate for selection) ;

o Reason - E.g. Not authorized

2. Nexthop resolution status notification

Nexthops can be fully resolved nexthops or an unresolved nexthop.

A resolved nexthop has adequate level of information to send the outgoing packet towards the destination by forwarding it on an interface of a directly connected neighbor.

An unresolved nexthop is something that requires the RIB manager to determine the final resolved nexthop. For example, in a case when a nexthop could be an IP address. The RIB manager would resolve how to reach that IP address, e.g. by checking if that particular IP is address reachable by regular IP forwarding or by a MPLS tunnel or by both. If the RIB manager cannot resolve the nexthop, then the nexthop remains in an unresolved state and is NOT a suitable candidate for installation in the FIB.

Top level yang :

```
 notifications:
   +---n nexthop-resolution-status-change
   |  +--ro nexthop-chain-identifier
   |  |  +--ro (nexthop-identifier-type)?
   |  |     +--:(nexthop-name)
   |  |     |  +--ro nexthop-name    string
   |  |     +--:(nexthop-id)
   |  |        +--ro nexthop-id      uint32
   |  +--ro nexthop* [nexthop-index]
   |  |  +--ro nexthop-index                              uint32
   |  |  +--ro (next-hop-options)?
   |  |     +--:(nexthop-identifier-next-hop)
   |  |     +--:(egress-interface-next-hop)
   |  |     |  +--ro outgoing-interface                         string
   |  |     +--:(ipv4-address-next-hop)
   |  |     |  +--ro next-hop-ipv4-address                      inet:ipv4-address
   |  |     |  +--ro ipv4-rib-name?                             string
   |  |     +--:(ipv6-address-next-hop)
   |  |     |  +--ro next-hop-ipv6-address                      inet:ipv6-address
   |  |     |  +--ro ipv6-rib-name?                             string
   |  |     +--:(egress-interface-ipv4-next-hop)
   |  |     |  +--ro next-hop-egress-interface-ipv4-address
   |  |     |     +--ro outgoing-interface              string
   |  |     |     +--ro next-hop-egress-ipv4-address    inet:ipv4-address
   |  |     +--:(egress-interface-ipv6-next-hop)
   |  |     |  +--ro next-hop-egress-interface-ipv6-address
   |  |     |     +--ro outgoing-interface              string
   |  |     |     +--ro next-hop-egress-ipv6-address    inet:ipv4-address
   |  |     +--:(egress-interface-mac-next-hop)
   |  |     |  +--ro next-hop-egress-interface-mac-address
   |  |     |     +--ro outgoing-interface    string
   |  |     |     +--ro ieee-mac-address      uint32
   |  |     +--:(logical-tunnel-next-hop)
```

```
|  |     |  +--ro logical-tunnel
|  |     |     +--ro tunnel-type    tunnel-type-def
|  |     |     +--ro tunnel-name    string
|  |     +--:(tunnel-encap-next-hop)
|  |        +--ro tunnel-encap
|  |           +--ro (tunnel-type)?
|  |           |  +--:(ipv4)
|  |           |  +--:(ipv6)
|  |           |  +--:(mpls)
|  |           |  |  +--ro (mpls-action-type)?
|  |           |  +--:(gre)
|  |           |  +--:(nvgre)
|  |           |     +--ro (nvgre-type)?
|  |           |     +--ro virtual-subnet-id          uint32
|  |           |     +--ro flow-id?                   uint16
|  |           +--ro (nexthop-second-encap-or-not)?
|  |           |  +--:(nexthop-second-encap)
|  |           |     +--ro nexthop-second-encap
|  |           |        +--ro (nexthop-third-encap-or-not)?
|  |           |           +--:(nexthop-third-encap)
|  |           |              +--ro nexthop-third-encap
|  |           |                 +--ro (nexthop-forth-encap-or-not)?
|  |           |                    +--:(nexthop-forth-encap)
|  |           |                       +--ro nexthop-forth-encap
|  |           |                          +--ro (nexthop-fifth-encap-or-not)?
|  |           |                             +--:(nexthop-fifth-encap)
|  |           |                                +--ro nexthop-fifth-encap
|  |           +--ro outgoing-interface?         string
|  +--ro nexthop-state              nexthop-state-def

  +---n route-change
   +--ro instance-name           string
   +--ro rib-name                string
   +--ro rib-family              rib-family-def
   +--ro route-index             uint64
   +--ro route-type              route-type-def
   +--ro (rib-route-type)?
   |  +--:(ipv4)
   |  |  +--ro ipv4
   |  |     +--ro ipv4-route-type                  ip-route-type-def
   |  |     +--ro (ip-route-type)?
   |  |        +--:(destination-ipv4-address)
   |  |        |  +--ro destination-ipv4-prefix           inet:ipv4-prefix
   |  |        +--:(source-ipv4-address)
   |  |        |  +--ro source-ipv4-prefix               inet:ipv4-prefix
   |  |        +--:(destination-source-ipv4-address)
   |  |           +--ro destination-source-ipv4-address
   |  |              +--ro destination-ipv4-prefix    inet:ipv4-prefix
```

```
      |  |              +--ro source-ipv4-prefix        inet:ipv4-prefix
      |  +--:(ipv6)
      |  |  +--ro ipv6
      |  |     +--ro ipv6-route-type                  ip-route-type-def
      |  |     +--ro (ip-route-type)?
      |  |        +--:(destination-ipv6-address)
      |  |        |  +--ro destination-ipv6-prefix          inet:ipv6-prefix
      |  |        +--:(source-ipv6-address)
      |  |        |  +--ro source-ipv6-prefix               inet:ipv6-prefix
      |  |        +--:(destination-source-ipv6-address)
      |  |           +--ro destination-source-ipv6-address
      |  |              +--ro destination-ipv6-prefix   inet:ipv6-prefix
      |  |              +--ro source-ipv6-prefix        inet:ipv6-prefix
      |  +--:(mpls-route)
      |  |  +--ro mpls-label-in           uint32
      |  |  +--ro mpls-action             mpls-action-def
      |  |  +--ro mpls-label-out?         uint32
      |  +--:(mac-route)
      |  |  +--ro mac-address             uint32
      |  +--:(interface-route)
      |     +--ro interface-identifier     uint32
      +--ro route-installed-state    route-installed-state-def
      +--ro route-state              route-state-def
      +--ro route-reason             route-reason-def
```

3.5. NextHops

A nexthop represents an object resulting from a route lookup.

A nexthop can be Special nexthop or a normal nexthop.

1) special-next-hops -for performing some specific well-defined functions, for example, discard, discard with error, or receive.

Top level yang :

```
+--:(special-next-hops)
     +--rw special-nexthop?  special-next-hop-def
```

2) normal next-hops

Normal nexthops can be a nexthop list member which include only one nexthop or a list of list. One nexthop can be:

o IP address: A route lookup on this IP address is done to determine the egress interface.

o egress-interface - pointing to an interface .

o logical-tunnel- pointing to a tunnel .

o tunnel-encap is used to specify multiple headers over a packet, before a packet is forwarded. Using Nexthop chains can implement chained headers, e.g. MPLS label over a GRE header.

o Indirect nexthops - pointing to a nexthop identifier .

Top level yang :

```
+--:(normal-nexthop)
   +--rw (nexthop-member-or-list-of-list)?
      +--:(one-nexthop-list-member)
      |  +--rw nexthop-list-member-index    uint32
      |  +--rw (nexthop-chain-or-identifier)?
      |  |  +--:(nexthop-chain)
      |  |  |  +--rw nexthop-chain
      |  |  |     +--rw nexthop-chain-identifier
      |  |  |     |  +--rw (nexthop-identifier-type)?
      |  |  |     |     +--:(nexthop-name)
      |  |  |     |     |  +--rw nexthop-name    string
      |  |  |     |     +--:(nexthop-id)
      |  |  |     |        +--rw nexthop-id      uint32
      |  |  |     +--rw nexthop* [nexthop-index]
      |  |  |        +--rw nexthop-index                              uint32
      |  |  |        +--rw (next-hop-options)?
      |  |  |           +--:(nexthop-identifier-next-hop)
      |  |  |           +--:(egress-interface-next-hop)
      |  |  |           |  +--rw outgoing-interface
string
      |  |  |           +--:(ipv4-address-next-hop)
      |  |  |           |  +--rw next-hop-ipv4-address
inet:ipv4-address
      |  |  |           |  +--rw ipv4-rib-name?
string
      |  |  |           +--:(ipv6-address-next-hop)
      |  |  |           |  +--rw next-hop-ipv6-address
inet:ipv6-address
      |  |  |           |  +--rw ipv6-rib-name?
string
      |  |  |           +--:(egress-interface-ipv4-next-hop)
      |  |  |           |  +--rw next-hop-egress-interface-ipv4-address
      |  |  |           |     +--rw outgoing-interface             string
      |  |  |           |     +--rw next-hop-egress-ipv4-address    inet:ipv4-
address
      |  |  |           +--:(egress-interface-ipv6-next-hop)
      |  |  |           |  +--rw next-hop-egress-interface-ipv6-address
      |  |  |           |     +--rw outgoing-interface             string
```

```
      |  |  |           |     +--rw next-hop-egress-ipv6-address    inet:ipv4-
address
      |  |  |           +--:(egress-interface-mac-next-hop)
      |  |  |           |  +--rw next-hop-egress-interface-mac-address
      |  |  |           |     +--rw outgoing-interface    string
      |  |  |           |     +--rw ieee-mac-address      uint32
      |  |  |           +--:(logical-tunnel-next-hop)
```

```
      |  |  |           |  +--rw logical-tunnel
      |  |  |           |     +--rw tunnel-type    tunnel-type-def
      |  |  |           |     +--rw tunnel-name    string
      |  |  |           +--:(tunnel-encap-next-hop)
      |  |  |              +--rw tunnel-encap
      |  |  |                 +--rw (tunnel-type)?
      |  |  |                 |  +--:(ipv4)
      |  |  |                 |  +--:(ipv6)
      |  |  |                 |  +--:(mpls)
      |  |  |                 |  +--:(gre)
      |  |  |                 |  +--:(nvgre)
      |  |  |                 +--rw (nexthop-second-encap-or-not)?
      |  |  |                 |  +--:(nexthop-second-encap)
      |  |  |                 |     +--rw nexthop-second-encap
      |  |  |                 |        +--rw (nexthop-third-encap-or-not)?
      |  |  |                 |           +--:(nexthop-third-encap)
      |  |  |                 |                 +--rw (nexthop-forth-encap-or-
not)?
      |  |  |                 |                    +--:(nexthop-forth-encap)
      |  |  |                 |                       +--rw nexthop-forth-encap
      |  |  |                 |                          +--rw (nexthop-fifth-
encap-or-not)?
      |  |  |                 |                             +--:(nexthop-fifth-
encap)
      |  |  |                 |                                +--rw nexthop-
fifth-encap
      |  |  |                 +--rw outgoing-interface?         string
      |  |  +--:(nexthop-chain-identifier)
      |  +--rw nexthop-chain-identifier
      |  |  +--rw (nexthop-identifier-type)?
      |  |     +--:(nexthop-name)
      |  |     |  +--rw nexthop-name    string
      |  |     +--:(nexthop-id)
      |  |        +--rw nexthop-id      uint32
      |  +--ro nexthop-state               nexthop-state-def
      |  +--rw priority?                   enumeration
      |  +--rw weight?                     uint8
      +--:(nexthop-list-of-list)
         +--rw nexthop-list-member* [nexthop-list-member-index]
            +--rw nexthop-list-index?          uint32
            +--rw nexthop-list-member-index    uint32
            +--rw (nexthop-chain-or-identifier)?
            |  +--:(nexthop-chain)
             ...     same with above
```

4. Full Yang Top-level description

Below is the full RIB Yang top-level description for the

configuration portion of I2RS configuration model. Additional information on the structure of the information model is described in[I-D.ietf-i2rs-rib-info-model].

```
module: i2rs-rib
   +--rw nexthop-capacity
   |  +--rw support-tunnel?         boolean
   |  +--rw support-chains?         boolean
   |  +--rw support-list-of-list?   boolean
   |  +--rw support-replication?    boolean
   |  +--rw support-weighted?       boolean
   |  +--rw support-protection?     boolean
   |  +--rw lookup-limit?           uint8
   +--rw nexthop-tunnel-encap-capacity
   |  +--rw support-ipv4?    boolean
   |  +--rw support-ipv6?    boolean
   |  +--rw support-mpls?    boolean
   |  +--rw support-gre?     boolean
   |  +--rw support-vxlan?   boolean
   |  +--rw support-nvgre?   boolean
   +--rw routing-instance-list* [instance-name]
      +--rw instance-name     string
      +--rw interface-list* [name]
      |  +--rw name    if:interface-ref
      +--rw router-id?        yang:dotted-quad
      +--rw rib-list* [rib-name]
         +--rw rib-name               string
         +--rw rib-family             rib-family-def
         +--rw enable-ip-rpf-check?   boolean
         +--rw route-list* [route-index]
            +--rw route-index                        uint64
            +--rw route-type                         route-type-def
            +--rw (rib-route-type)?
            |  +--:(ipv4)
            |  |  +--rw ipv4
            |  |     +--rw ipv4-route-type                   ip-route-type-def
            |  |     +--rw (ip-route-type)?
            |  |        +--:(destination-ipv4-address)
            |  |        |  +--rw destination-ipv4-prefix           inet:ipv4-
prefix
            |  |        +--:(source-ipv4-address)
            |  |        |  +--rw source-ipv4-prefix               inet:ipv4-
prefix
            |  |        +--:(destination-source-ipv4-address)
            |  |           +--rw destination-source-ipv4-address
            |  |              +--rw destination-ipv4-prefix    inet:ipv4-prefix
            |  |              +--rw source-ipv4-prefix         inet:ipv4-prefix
            |  +--:(ipv6)
            |  |  +--rw ipv6
            |  |     +--rw ipv6-route-type                   ip-route-type-def
            |  |     +--rw (ip-route-type)?
            |  |        +--:(destination-ipv6-address)
```

```
            |  |        |  +--rw destination-ipv6-prefix            inet:ipv6-
prefix
            |  |        +--:(source-ipv6-address)
```

```
            |  |        |  +--rw source-ipv6-prefix                inet:ipv6-
prefix
            |  |        +--:(destination-source-ipv6-address)
            |  |           +--rw destination-source-ipv6-address
            |  |              +--rw destination-ipv6-prefix    inet:ipv6-prefix
            |  |              +--rw source-ipv6-prefix         inet:ipv6-prefix
            |  +--:(mpls-route)
            |  |  +--rw mpls-label-in                      uint32
            |  |  +--rw mpls-action                        mpls-action-def
            |  |  +--rw mpls-label-out?                    uint32
            |  +--:(mac-route)
            |  |  +--rw mac-address                        uint32
            |  +--:(interface-route)
            |     +--rw interface-identifier               uint32
           +--rw nexthop-list* [nexthop-list-index]
            |  +--rw nexthop-list-index           uint32
            |  +--rw (nexthop-list-type)?
            |     +--:(special-nexthop)
            |     |  +--rw special-nexthop?             special-nexthop-def
            |     +--:(normal-nexthop)
            |        +--rw (nexthop-member-or-list-of-list)?
            |           +--:(one-nexthop-list-member)
            |           |  +--rw nexthop-list-member-index    uint32
            |           |  +--rw (nexthop-chain-or-identifier)?
            |           |  |  +--:(nexthop-chain)
            |           |  |  |  +--rw nexthop-chain
            |           |  |  |     +--rw nexthop-chain-identifier
            |           |  |  |     |  +--rw (nexthop-identifier-type)?
            |           |  |  |     |     +--:(nexthop-name)
            |           |  |  |     |     |  +--rw nexthop-name    string
            |           |  |  |     |     +--:(nexthop-id)
            |           |  |  |     |        +--rw nexthop-id      uint32
            |           |  |  |     +--rw nexthop* [nexthop-index]
            |           |  |  |        +--rw nexthop-
index                            uint32
            |           |  |  |        +--rw (next-hop-options)?
            |           |  |  |           +--:(nexthop-identifier-next-hop)
            |           |  |  |           |  +--rw (nexthop-identifier-type)?
            |           |  |  |           |     +--:(nexthop-name)
            |           |  |  |           |     |  +--rw nexthop-
name                             string
            |           |  |  |           |     +--:(nexthop-id)
            |           |  |  |           |        +--rw nexthop-
id                               uint32
            |           |  |  |           +--:(egress-interface-next-hop)
            |           |  |  |           |  +--rw outgoing-
interface                          string
            |           |  |  |           +--:(ipv4-address-next-hop)
```

```
            |           |  |  |           |  +--rw next-hop-ipv4-
address                     inet:ipv4-address
            |           |  |  |           |  +--rw ipv4-rib-
name?                           string
            |           |  |  |           +--:(ipv6-address-next-hop)
            |           |  |  |           |  +--rw next-hop-ipv6-
address                     inet:ipv6-address
            |           |  |  |           |  +--rw ipv6-rib-
name?                           string
```

```
            |           |  |  |          +--:(egress-interface-ipv4-next-hop)
            |           |  |  |          |  +--rw next-hop-egress-interface-
ipv4-address
            |           |  |  |          |     +--rw outgoing-
interface              string
            |           |  |  |          |     +--rw next-hop-egress-ipv4-
address    inet:ipv4-address
            |           |  |  |          +--:(egress-interface-ipv6-next-hop)
            |           |  |  |          |  +--rw next-hop-egress-interface-
ipv6-address
            |           |  |  |          |     +--rw outgoing-
interface              string
            |           |  |  |          |     +--rw next-hop-egress-ipv6-
address    inet:ipv4-address
            |           |  |  |          +--:(egress-interface-mac-next-hop)
            |           |  |  |          |  +--rw next-hop-egress-interface-
mac-address
            |           |  |  |          |     +--rw outgoing-interface
string
            |           |  |  |          |     +--rw ieee-mac-address
uint32
            |           |  |  |          +--:(logical-tunnel-next-hop)
            |           |  |  |          |  +--rw logical-tunnel
            |           |  |  |          |     +--rw tunnel-type    tunnel-
type-def
            |           |  |  |          |     +--rw tunnel-name    string
            |           |  |  |          +--:(tunnel-encap-next-hop)
            |           |  |  |             +--rw tunnel-encap
            |           |  |  |                +--rw (tunnel-type)?
            |           |  |  |                |  +--:(ipv4)
            |           |  |  |                |  |  +--rw source-ipv4-
address         inet:ipv4-address
            |           |  |  |                |  |  +--rw destination-ipv4-
address    inet:ipv4-address
            |           |  |  |                |  |  +--rw
protocol                    uint8
            |           |  |  |                |  |  +--rw
ttl?                        uint8
            |           |  |  |                |  |  +--rw
dscp?                       uint8
            |           |  |  |                |  +--:(ipv6)
            |           |  |  |                |  |  +--rw source-ipv6-
address         inet:ipv6-address
            |           |  |  |                |  |  +--rw destination-ipv6-
address    inet:ipv6-address
            |           |  |  |                |  |  +--rw next-
header                 uint8
            |           |  |  |                |  |  +--rw traffic-
```

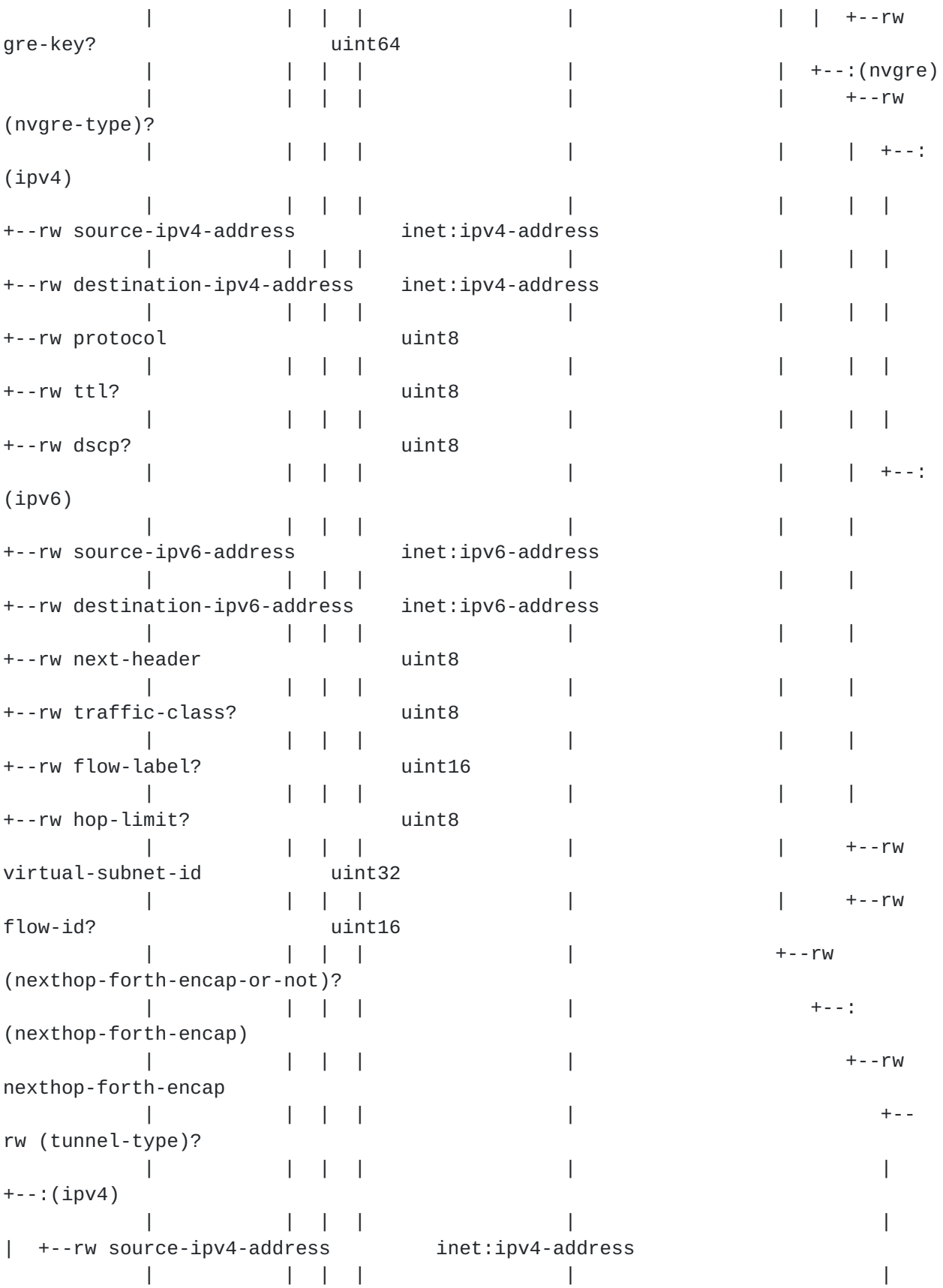
```
class?              uint8
           |           |  |  |                |  |  +--rw flow-
label?                 uint16
           |           |  |  |                |  |  +--rw hop-
limit?                  uint8
           |           |  |  |                |  +--:(mpls)
           |           |  |  |                |  |  +--rw (mpls-action-type)?
           |           |  |  |                |  |     +--:(mpls-push)
           |           |  |  |                |  |     |  +--rw mpls-
push                   boolean
           |           |  |  |                |  |     |  +--rw mpls-
label                  uint32
           |           |  |  |                |  |     |  +--rw s-
bit?                     boolean
           |           |  |  |                |  |     |  +--rw tos-
value?                  uint8
           |           |  |  |                |  |     |  +--rw ttl-
value?                  uint8
           |           |  |  |                |  |     +--:(mpls-pop)
           |           |  |  |                |  |        +--rw mpls-
pop                    boolean
           |           |  |  |                |  |        +--rw ttl-
action?                 uint8
           |           |  |  |                |  +--:(gre)
           |           |  |  |                |  |  +--rw gre-ip-
destination          inet:ipv4-address
           |           |  |  |                |  |  +--rw gre-protocol-
type           inet:ipv4-address
           |           |  |  |                |  |  +--rw gre-
key?                    uint64
           |           |  |  |                |  +--:(nvgre)
```

```
            |           |  |  |                |     +--rw (nvgre-type)?
            |           |  |  |                |     |  +--:(ipv4)
            |           |  |  |                |     |  |  +--rw source-ipv4-
address         inet:ipv4-address
            |           |  |  |                |     |  |  +--rw destination-
ipv4-address    inet:ipv4-address
            |           |  |  |                |     |  |  +--rw
protocol                    uint8
            |           |  |  |                |     |  |  +--rw
ttl?                        uint8
            |           |  |  |                |     |  |  +--rw
dscp?                       uint8
            |           |  |  |                |     |  +--:(ipv6)
            |           |  |  |                |     |     +--rw source-ipv6-
address         inet:ipv6-address
            |           |  |  |                |     |     +--rw destination-
ipv6-address    inet:ipv6-address
            |           |  |  |                |     |     +--rw next-
header                uint8
            |           |  |  |                |     |     +--rw traffic-
class?              uint8
            |           |  |  |                |     |     +--rw flow-
label?                uint16
            |           |  |  |                |     |     +--rw hop-
limit?                 uint8
            |           |  |  |                |     +--rw virtual-subnet-
id           uint32
            |           |  |  |                |     +--rw flow-
id?                   uint16
            |           |  |  |               +--rw (nexthop-second-encap-or-
not)?
            |           |  |  |                |  +--:(nexthop-second-encap)
            |           |  |  |                |     +--rw nexthop-second-encap
            |           |  |  |                |        +--rw (tunnel-type)?
            |           |  |  |                |        |  +--:(ipv4)
            |           |  |  |                |        |  |  +--rw source-
ipv4-address         inet:ipv4-address
            |           |  |  |                |        |  |  +--rw
destination-ipv4-address    inet:ipv4-address
            |           |  |  |                |        |  |  +--rw
protocol                    uint8
            |           |  |  |                |        |  |  +--rw
ttl?                        uint8
            |           |  |  |                |        |  |  +--rw
dscp?                       uint8
            |           |  |  |                |        |  +--:(ipv6)
            |           |  |  |                |        |  |  +--rw source-
ipv6-address         inet:ipv6-address
```

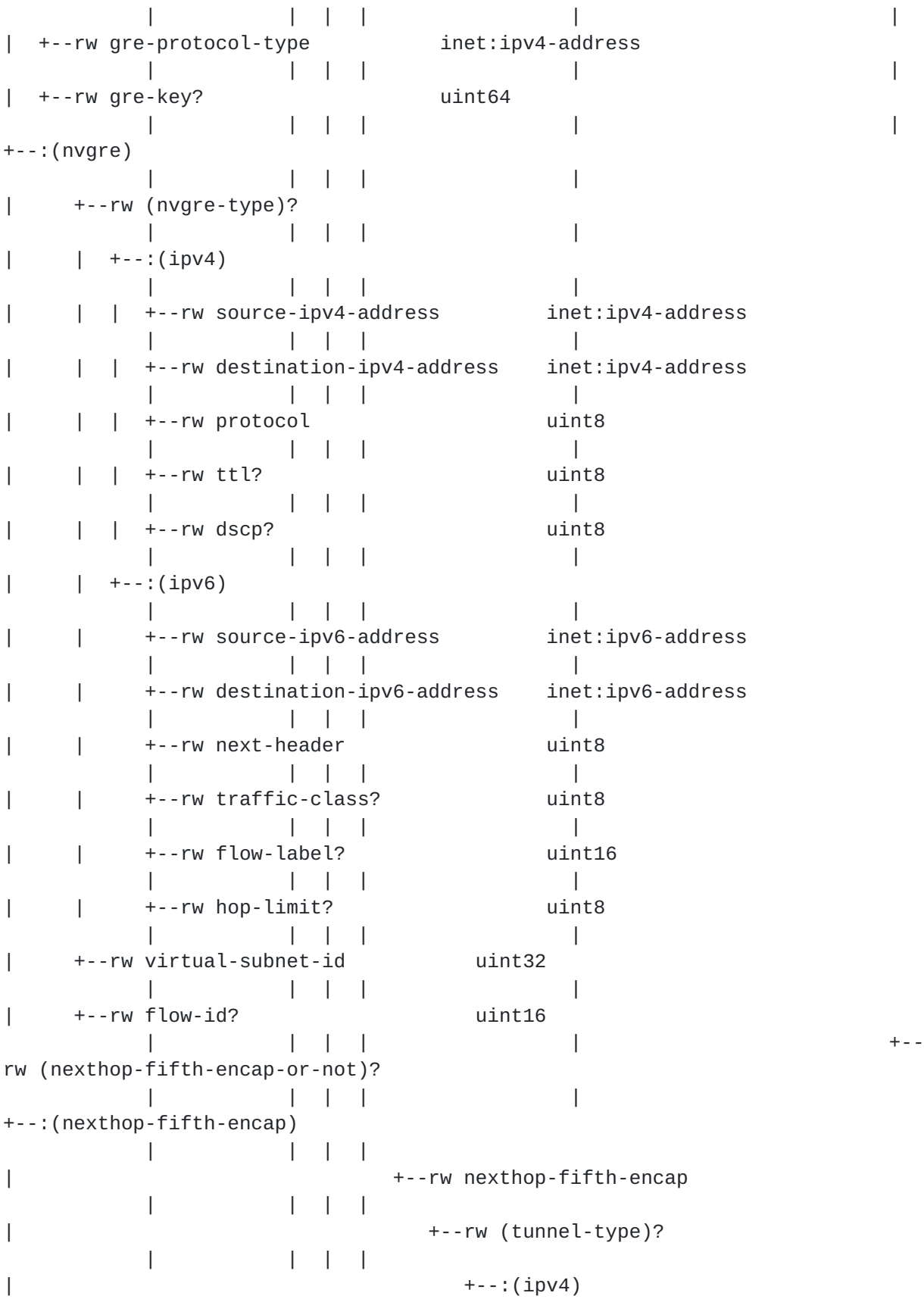
```
            |           |  |  |                 |        |  |  +--rw
destination-ipv6-address    inet:ipv6-address
            |           |  |  |                 |        |  |  +--rw next-
header                  uint8
            |           |  |  |                 |        |  |  +--rw traffic-
class?              uint8
            |           |  |  |                 |        |  |  +--rw flow-
label?                  uint16
            |           |  |  |                 |        |  |  +--rw hop-
limit?                   uint8
            |           |  |  |                 |        |  +--:(mpls)
            |           |  |  |                 |        |  |  +--rw (mpls-
action-type)?
            |           |  |  |                 |        |  |     +--:(mpls-
push)
            |           |  |  |                 |        |  |     |  +--rw mpls-
push                    boolean
            |           |  |  |                 |        |  |     |  +--rw mpls-
label                   uint32
            |           |  |  |                 |        |  |     |  +--rw s-
bit?                      boolean
            |           |  |  |                 |        |  |     |  +--rw tos-
value?                   uint8
            |           |  |  |                 |        |  |     |  +--rw ttl-
value?                   uint8
            |           |  |  |                 |        |  |     +--:(mpls-pop)
            |           |  |  |                 |        |  |        +--rw mpls-
pop                     boolean
            |           |  |  |                 |        |  |        +--rw ttl-
action?                  uint8
            |           |  |  |                 |        |  +--:(gre)
            |           |  |  |                 |        |  |  +--rw gre-ip-
destination          inet:ipv4-address
            |           |  |  |                 |        |  |  +--rw gre-
protocol-type           inet:ipv4-address
            |           |  |  |                 |        |  |  +--rw gre-
key?                    uint64
```

```
            |           |  |  |                 |        |  +--:(nvgre)
            |           |  |  |                 |        |     +--rw (nvgre-
type)?
            |           |  |  |                 |        |     |  +--:(ipv4)
            |           |  |  |                 |        |     |  |  +--rw
source-ipv4-address         inet:ipv4-address
            |           |  |  |                 |        |     |  |  +--rw
destination-ipv4-address    inet:ipv4-address
            |           |  |  |                 |        |     |  |  +--rw
protocol                    uint8
            |           |  |  |                 |        |     |  |  +--rw
ttl?                        uint8
            |           |  |  |                 |        |     |  |  +--rw
dscp?                       uint8
            |           |  |  |                 |        |     |  +--:(ipv6)
            |           |  |  |                 |        |     |     +--rw
source-ipv6-address         inet:ipv6-address
            |           |  |  |                 |        |     |     +--rw
destination-ipv6-address    inet:ipv6-address
            |           |  |  |                 |        |     |     +--rw next-
header                 uint8
            |           |  |  |                 |        |     |     +--rw
traffic-class?              uint8
            |           |  |  |                 |        |     |     +--rw flow-
label?                 uint16
            |           |  |  |                 |        |     |     +--rw hop-
limit?                  uint8
            |           |  |  |                 |        |     +--rw virtual-
subnet-id           uint32
            |           |  |  |                 |        |     +--rw flow-
id?                    uint16
            |           |  |  |                 |        +--rw (nexthop-third-
encap-or-not)?
            |           |  |  |                 |           +--:(nexthop-third-
encap)
            |           |  |  |                 |              +--rw nexthop-
third-encap
            |           |  |  |                 |                 +--rw (tunnel-
type)?
            |           |  |  |                 |                    |  +--:(ipv4)
            |           |  |  |                 |                    |  |  +--rw
source-ipv4-address         inet:ipv4-address
            |           |  |  |                 |                    |  |  +--rw
destination-ipv4-address    inet:ipv4-address
            |           |  |  |                 |                    |  |  +--rw
protocol                    uint8
            |           |  |  |                 |                    |  |  +--rw
ttl?                        uint8
```

```
            |           |  |  |                 |                 |  |  +--rw
dscp?                        uint8
            |           |  |  |                 |                 |  +--:(ipv6)
            |           |  |  |                 |                 |  |  +--rw
source-ipv6-address          inet:ipv6-address
            |           |  |  |                 |                 |  |  +--rw
destination-ipv6-address     inet:ipv6-address
            |           |  |  |                 |                 |  |  +--rw
next-header                  uint8
            |           |  |  |                 |                 |  |  +--rw
traffic-class?               uint8
            |           |  |  |                 |                 |  |  +--rw
flow-label?                  uint16
            |           |  |  |                 |                 |  |  +--rw
hop-limit?                   uint8
            |           |  |  |                 |                 |  +--:(mpls)
            |           |  |  |                 |                 |  |  +--rw
(mpls-action-type)?
            |           |  |  |                 |                 |  |     +--:
(mpls-push)
            |           |  |  |                 |                 |  |     |
+--rw mpls-push                    boolean
            |           |  |  |                 |                 |  |     |
+--rw mpls-label                   uint32
            |           |  |  |                 |                 |  |     |
+--rw s-bit?                       boolean
            |           |  |  |                 |                 |  |     |
+--rw tos-value?                   uint8
            |           |  |  |                 |                 |  |     |
+--rw ttl-value?                   uint8
            |           |  |  |                 |                 |  |     +--:
(mpls-pop)
            |           |  |  |                 |                 |  |
+--rw mpls-pop                     boolean
            |           |  |  |                 |                 |  |
+--rw ttl-action?                  uint8
            |           |  |  |                 |                 |  +--:(gre)
            |           |  |  |                 |                 |  |  +--rw
gre-ip-destination           inet:ipv4-address
            |           |  |  |                 |                 |  |  +--rw
gre-protocol-type            inet:ipv4-address
```


+--rw gre-key? uint64
+--:(nvgre)
+--rw (nvgre-type)?
+--: (ipv4)
+--rw source-ipv4-address inet:ipv4-address
+--rw destination-ipv4-address inet:ipv4-address
+--rw protocol uint8
+--rw ttl? uint8
+--rw dscp? uint8
+--: (ipv6)
+--rw source-ipv6-address inet:ipv6-address
+--rw destination-ipv6-address inet:ipv6-address
+--rw next-header uint8
+--rw traffic-class? uint8
+--rw flow-label? uint16
+--rw hop-limit? uint8
+--rw virtual-subnet-id uint32
+--rw flow-id? uint16
+--rw (nexthop-forth-encap-or-not)?
+--: (nexthop-forth-encap)
+--rw nexthop-forth-encap
+-- rw (tunnel-type)?
+--:(ipv4)
+--rw source-ipv4-address inet:ipv4-address

```
|  +--rw destination-ipv4-address    inet:ipv4-address
           |           |  |  |                |                          |
|  +--rw protocol                    uint8
           |           |  |  |                |                          |
|  +--rw ttl?                        uint8
           |           |  |  |                |                          |
|  +--rw dscp?                       uint8
           |           |  |  |                |                          |
+--:(ipv6)
           |           |  |  |                |                          |
|  +--rw source-ipv6-address         inet:ipv6-address
           |           |  |  |                |                          |
|  +--rw destination-ipv6-address    inet:ipv6-address
           |           |  |  |                |                          |
|  +--rw next-header                 uint8
           |           |  |  |                |                          |
|  +--rw traffic-class?              uint8
           |           |  |  |                |                          |
|  +--rw flow-label?                 uint16
           |           |  |  |                |                          |
|  +--rw hop-limit?                  uint8
           |           |  |  |                |                          |
+--:(mpls)
           |           |  |  |                |                          |
|  +--rw (mpls-action-type)?
           |           |  |  |                |                          |
|     +--:(mpls-push)
           |           |  |  |                |                          |
|     |  +--rw mpls-push                 boolean
           |           |  |  |                |                          |
|     |  +--rw mpls-label                uint32
           |           |  |  |                |                          |
|     |  +--rw s-bit?                    boolean
           |           |  |  |                |                          |
|     |  +--rw tos-value?                uint8
           |           |  |  |                |                          |
|     |  +--rw ttl-value?                uint8
           |           |  |  |                |                          |
|     +--:(mpls-pop)
           |           |  |  |                |                          |
|        +--rw mpls-pop                  boolean
           |           |  |  |                |                          |
|        +--rw ttl-action?               uint8
           |           |  |  |                |                          |
+--:(gre)
           |           |  |  |                |                          |
|  +--rw gre-ip-destination          inet:ipv4-address
```


+--rw gre-protocol-type inet:ipv4-address
+--rw gre-key? uint64
+--:(nvgre)
+--rw (nvgre-type)?
+--:(ipv4)
+--rw source-ipv4-address inet:ipv4-address
+--rw destination-ipv4-address inet:ipv4-address
+--rw protocol uint8
+--rw ttl? uint8
+--rw dscp? uint8
+--:(ipv6)
+--rw source-ipv6-address inet:ipv6-address
+--rw destination-ipv6-address inet:ipv6-address
+--rw next-header uint8
+--rw traffic-class? uint8
+--rw flow-label? uint16
+--rw hop-limit? uint8
+--rw virtual-subnet-id uint32
+--rw flow-id? uint16
+--rw (nexthop-fifth-encap-or-not)?
+--:(nexthop-fifth-encap)
+--rw nexthop-fifth-encap
+--rw (tunnel-type)?
+--:(ipv4)

```
            |           |  |  |
|                                   |  +--rw source-ipv4-address
inet:ipv4-address
            |           |  |  |
|                                   |  +--rw destination-ipv4-address
inet:ipv4-address
            |           |  |  |
|                                   |  +--rw protocol
uint8
            |           |  |  |
|                                   |  +--rw ttl?
uint8
            |           |  |  |
|                                   |  +--rw dscp?
uint8
            |           |  |  |
|                                   +--:(ipv6)
            |           |  |  |
|                                   |  +--rw source-ipv6-address
inet:ipv6-address
            |           |  |  |
|                                   |  +--rw destination-ipv6-address
inet:ipv6-address
            |           |  |  |
|                                   |  +--rw next-header
uint8
            |           |  |  |
|                                   |  +--rw traffic-class?
uint8
            |           |  |  |
|                                   |  +--rw flow-label?
uint16
            |           |  |  |
|                                   |  +--rw hop-limit?
uint8
            |           |  |  |
|                                   +--:(mpls)
            |           |  |  |
|                                   |  +--rw (mpls-action-type)?
            |           |  |  |
|                                   |     +--:(mpls-push)
            |           |  |  |
|                                   |     |  +--rw mpls-
push                  boolean
            |           |  |  |
|                                   |     |  +--rw mpls-
label                 uint32
            |           |  |  |
|                                   |     |  +--rw s-
bit?                    boolean
            |           |  |  |
```

```
|                                       |     |  +--rw tos-
value?                  uint8
            |           |  |  |
|                                       |     |  +--rw ttl-
value?                  uint8
            |           |  |  |
|                                       |     +--:(mpls-pop)
            |           |  |  |
|                                       |        +--rw mpls-
pop                    boolean
            |           |  |  |
|                                       |        +--rw ttl-
action?                 uint8
            |           |  |  |
|                                    +--:(gre)
```

```
            |           |  |  |
|                                    |  +--rw gre-ip-destination
inet:ipv4-address
            |           |  |  |
|                                    |  +--rw gre-protocol-type
inet:ipv4-address
            |           |  |  |
|                                    |  +--rw gre-key?
uint64
            |           |  |  |
|                                    +--:(nvgre)
            |           |  |  |
|                                       +--rw (nvgre-type)?
            |           |  |  |
|                                       |  +--:(ipv4)
            |           |  |  |
|                                       |  |  +--rw source-ipv4-
address         inet:ipv4-address
            |           |  |  |
|                                       |  |  +--rw destination-ipv4-
address    inet:ipv4-address
            |           |  |  |
|                                       |  |  +--rw
protocol                    uint8
            |           |  |  |
|                                       |  |  +--rw
ttl?                        uint8
            |           |  |  |
|                                       |  |  +--rw
dscp?                       uint8
            |           |  |  |
|                                       |  +--:(ipv6)
            |           |  |  |
|                                       |     +--rw source-ipv6-
address         inet:ipv6-address
            |           |  |  |
|                                       |     +--rw destination-ipv6-
address    inet:ipv6-address
            |           |  |  |
|                                       |     +--rw next-
header                 uint8
            |           |  |  |
|                                       |     +--rw traffic-
class?              uint8
            |           |  |  |
|                                       |     +--rw flow-
label?                 uint16
            |           |  |  |
```

```
|                                       |     +--rw hop-
limit?                  uint8
            |           |  |  |
|                                       +--rw virtual-subnet-id
uint32
            |           |  |  |
|                                       +--rw flow-id?
uint16
            |           |  |  |                +--rw outgoing-
interface?         string
            |           |  |  +--:(nexthop-chain-identifier)
            |           |  |     +--rw (nexthop-identifier-type)?
            |           |  |        +--:(nexthop-name)
            |           |  |        |  +--rw nexthop-name                string
            |           |  |        +--:(nexthop-id)
            |           |  |           +--rw nexthop-id                   uint32
            |           |  +--ro nexthop-state               nexthop-state-def
            |           |  +--rw priority?                   enumeration
            |           |  +--rw weight?                     uint8
            |           +--:(nexthop-list-of-list)
            |              +--rw nexthop-list-member* [nexthop-list-member-
index]
            |                 +--rw nexthop-list-index?          uint32
            |                 +--rw nexthop-list-member-index    uint32
            |                 +--rw (nexthop-chain-or-identifier)?
            |                 |  +--:(nexthop-chain)
            |                 |  |  +--rw nexthop-chain
            |                 |  |     +--rw nexthop-chain-identifier
            |                 |  |     |  +--rw (nexthop-identifier-type)?
            |                 |  |     |     +--:(nexthop-name)
            |                 |  |     |     |  +--rw nexthop-name    string
            |                 |  |     |     +--:(nexthop-id)
            |                 |  |     |        +--rw nexthop-id      uint32
            |                 |  |     +--rw nexthop* [nexthop-index]
            |                 |  |        +--rw nexthop-
index                            uint32
            |                 |  |        +--rw (next-hop-options)?
            |                 |  |           +--:(nexthop-identifier-next-hop)
            |                 |  |           |  +--rw (nexthop-identifier-type)?
```

```
            |                 |  |          |     +--:(nexthop-name)
            |                 |  |          |     |  +--rw nexthop-
name                             string
            |                 |  |          |     +--:(nexthop-id)
            |                 |  |          |        +--rw nexthop-
id                               uint32
            |                 |  |          +--:(egress-interface-next-hop)
            |                 |  |          |  +--rw outgoing-
interface                        string
            |                 |  |          +--:(ipv4-address-next-hop)
            |                 |  |          |  +--rw next-hop-ipv4-
address                   inet:ipv4-address
            |                 |  |          |  +--rw ipv4-rib-
name?                            string
            |                 |  |          +--:(ipv6-address-next-hop)
            |                 |  |          |  +--rw next-hop-ipv6-
address                   inet:ipv6-address
            |                 |  |          |  +--rw ipv6-rib-
name?                            string
            |                 |  |          +--:(egress-interface-ipv4-next-
hop)
            |                 |  |          |  +--rw next-hop-egress-interface-
ipv4-address
            |                 |  |          |     +--rw outgoing-
interface             string
            |                 |  |          |     +--rw next-hop-egress-ipv4-
address    inet:ipv4-address
            |                 |  |          +--:(egress-interface-ipv6-next-
hop)
            |                 |  |          |  +--rw next-hop-egress-interface-
ipv6-address
            |                 |  |          |     +--rw outgoing-
interface             string
            |                 |  |          |     +--rw next-hop-egress-ipv6-
address    inet:ipv4-address
            |                 |  |          +--:(egress-interface-mac-next-hop)
            |                 |  |          |  +--rw next-hop-egress-interface-
mac-address
            |                 |  |          |     +--rw outgoing-interface
string
            |                 |  |          |     +--rw ieee-mac-address
uint32
            |                 |  |          +--:(logical-tunnel-next-hop)
            |                 |  |          |  +--rw logical-tunnel
            |                 |  |          |     +--rw tunnel-type    tunnel-
type-def
            |                 |  |          |     +--rw tunnel-name    string
            |                 |  |          +--:(tunnel-encap-next-hop)
```

```
            |                 |  |              +--rw tunnel-encap
            |                 |  |                 +--rw (tunnel-type)?
            |                 |  |                 |  +--:(ipv4)
            |                 |  |                 |  |  +--rw source-ipv4-
address         inet:ipv4-address
            |                 |  |                 |  |  +--rw destination-ipv4-
address    inet:ipv4-address
            |                 |  |                 |  |  +--rw
protocol                    uint8
            |                 |  |                 |  |  +--rw
ttl?                        uint8
            |                 |  |                 |  |  +--rw
dscp?                       uint8
            |                 |  |                 |  +--:(ipv6)
            |                 |  |                 |  |  +--rw source-ipv6-
address         inet:ipv6-address
            |                 |  |                 |  |  +--rw destination-ipv6-
address    inet:ipv6-address
            |                 |  |                 |  |  +--rw next-
header                  uint8
            |                 |  |                 |  |  +--rw traffic-
class?              uint8
            |                 |  |                 |  |  +--rw flow-
label?                  uint16
            |                 |  |                 |  |  +--rw hop-
limit?                   uint8
            |                 |  |                 |  +--:(mpls)
            |                 |  |                 |  |  +--rw (mpls-action-
type)?
            |                 |  |                 |  |     +--:(mpls-push)
            |                 |  |                 |  |     |  +--rw mpls-
push                    boolean
```

```
           |                |  |                |  |     |  +--rw mpls-
label                  uint32
           |                |  |                |  |     |  +--rw s-
bit?                     boolean
           |                |  |                |  |     |  +--rw tos-
value?                  uint8
           |                |  |                |  |     |  +--rw ttl-
value?                  uint8
           |                |  |                |  |     +--:(mpls-pop)
           |                |  |                |  |        +--rw mpls-
pop                    boolean
           |                |  |                |  |        +--rw ttl-
action?                 uint8
           |                |  |                |  +--:(gre)
           |                |  |                |  |  +--rw gre-ip-
destination          inet:ipv4-address
           |                |  |                |  |  +--rw gre-protocol-
type           inet:ipv4-address
           |                |  |                |  |  +--rw gre-
key?                    uint64
           |                |  |                |  +--:(nvgre)
           |                |  |                |     +--rw (nvgre-type)?
           |                |  |                |     |  +--:(ipv4)
           |                |  |                |     |  |  +--rw source-
ipv4-address         inet:ipv4-address
           |                |  |                |     |  |  +--rw
destination-ipv4-address    inet:ipv4-address
           |                  |  |                |     |  |  +--rw
protocol                    uint8
           |                  |  |                |     |  |  +--rw
ttl?                        uint8
           |                  |  |                |     |  |  +--rw
dscp?                       uint8
           |                  |  |                |     |  +--:(ipv6)
           |                  |  |                |     |     +--rw source-
ipv6-address         inet:ipv6-address
           |                |  |                |     |     +--rw
destination-ipv6-address    inet:ipv6-address
           |                  |  |                |     |     +--rw next-
header                  uint8
           |                |  |                |     |     +--rw traffic-
class?               uint8
           |                |  |                |     |     +--rw flow-
label?                  uint16
           |                |  |                |     |     +--rw hop-
limit?                  uint8
           |                |  |                |     +--rw virtual-subnet-
id           uint32
```

```
            |                 |  |                |     +--rw flow-
id?                    uint16
            |                 |  |                +--rw (nexthop-second-encap-
or-not)?
            |                 |  |                |  +--:(nexthop-second-encap)
            |                 |  |                |     +--rw nexthop-second-
encap
            |                 |  |                |        +--rw (tunnel-type)?
            |                 |  |                |        |  +--:(ipv4)
            |                 |  |                |        |  |  +--rw source-
ipv4-address         inet:ipv4-address
            |                 |  |                |        |  |  +--rw
destination-ipv4-address    inet:ipv4-address
            |                 |  |                |        |  |  +--rw
protocol                    uint8
            |                 |  |                |        |  |  +--rw
ttl?                        uint8
            |                 |  |                |        |  |  +--rw
dscp?                       uint8
            |                 |  |                |        |  +--:(ipv6)
            |                 |  |                |        |  |  +--rw source-
ipv6-address         inet:ipv6-address
            |                 |  |                |        |  |  +--rw
destination-ipv6-address    inet:ipv6-address
            |                 |  |                |        |  |  +--rw next-
header                  uint8
            |                 |  |                |        |  |  +--rw traffic-
class?              uint8
            |                 |  |                |        |  |  +--rw flow-
label?                  uint16
            |                 |  |                |        |  |  +--rw hop-
limit?                   uint8
            |                 |  |                |        |  +--:(mpls)
            |                 |  |                |        |  |  +--rw (mpls-
action-type)?
            |                 |  |                |        |  |     +--:(mpls-
push)
```

```
            |                 |  |                |        |  |     |  +--rw
mpls-push                   boolean
            |                 |  |                |        |  |     |  +--rw
mpls-label                  uint32
            |                 |  |                |        |  |     |  +--rw s-
bit?                      boolean
            |                 |  |                |        |  |     |  +--rw
tos-value?                  uint8
            |                 |  |                |        |  |     |  +--rw
ttl-value?                  uint8
            |                 |  |                |        |  |     +--:(mpls-
pop)
            |                 |  |                |        |  |        +--rw
mpls-pop                    boolean
            |                 |  |                |        |  |        +--rw
ttl-action?                 uint8
            |                 |  |                |        |  +--:(gre)
            |                 |  |                |        |  |  +--rw gre-ip-
destination          inet:ipv4-address
            |                 |  |                |        |  |  +--rw gre-
protocol-type           inet:ipv4-address
            |                 |  |                |        |  |  +--rw gre-
key?                    uint64
            |                 |  |                |        |  +--:(nvgre)
            |                 |  |                |        |     +--rw (nvgre-
type)?
            |                 |  |                |        |     |  +--:(ipv4)
            |                 |  |                |        |     |  |  +--rw
source-ipv4-address         inet:ipv4-address
            |                 |  |                |        |     |  |  +--rw
destination-ipv4-address    inet:ipv4-address
            |                 |  |                |        |     |  |  +--rw
protocol                    uint8
            |                 |  |                |        |     |  |  +--rw
ttl?                        uint8
            |                 |  |                |        |     |  |  +--rw
dscp?                       uint8
            |                 |  |                |        |     |  +--:(ipv6)
            |                 |  |                |        |     |     +--rw
source-ipv6-address         inet:ipv6-address
            |                 |  |                |        |     |     +--rw
destination-ipv6-address    inet:ipv6-address
            |                 |  |                |        |     |     +--rw
next-header                 uint8
            |                 |  |                |        |     |     +--rw
traffic-class?              uint8
            |                 |  |                |        |     |     +--rw
flow-label?                 uint16
```

```
            |                 |  |                |        |     |     +--rw
hop-limit?                  uint8
            |                 |  |                |        |     +--rw virtual-
subnet-id           uint32
            |                 |  |                |        |     +--rw flow-
id?                    uint16
            |                 |  |                |        +--rw (nexthop-
third-encap-or-not)?
            |                 |  |                |           +--:(nexthop-
third-encap)
            |                 |  |                |              +--rw nexthop-
third-encap
            |                 |  |                |                 +--rw
(tunnel-type)?
            |                 |  |                |                    |  +--:
(ipv4)
            |                 |  |                |                    |  |  +--
rw source-ipv4-address         inet:ipv4-address
            |                 |  |                |                    |  |  +--
rw destination-ipv4-address    inet:ipv4-address
            |                 |  |                |                    |  |  +--
rw protocol                    uint8
            |                 |  |                |                    |  |  +--
rw ttl?                        uint8
            |                 |  |                |                    |  |  +--
rw dscp?                       uint8
            |                 |  |                |                    |  +--:
(ipv6)
            |                 |  |                |                    |  |  +--
rw source-ipv6-address         inet:ipv6-address
            |                 |  |                |                    |  |  +--
rw destination-ipv6-address    inet:ipv6-address
            |                 |  |                |                    |  |  +--
rw next-header                 uint8
            |                 |  |                |                    |  |  +--
rw traffic-class?              uint8
            |                 |  |                |                    |  |  +--
rw flow-label?                 uint16
            |                 |  |                |                    |  |  +--
rw hop-limit?                  uint8
            |                 |  |                |                    |  +--:
(mpls)
            |                 |  |                |                    |  |  +--
rw (mpls-action-type)?
```

```
           |                |  |                |                |  |
+--:(mpls-push)
           |                |  |                |                |  |
|  +--rw mpls-push                  boolean
           |                |  |                |                |  |
|  +--rw mpls-label                 uint32
           |                |  |                |                |  |
|  +--rw s-bit?                     boolean
           |                |  |                |                |  |
|  +--rw tos-value?                 uint8
           |                |  |                |                |  |
|  +--rw ttl-value?                 uint8
           |                |  |                |                |  |
+--:(mpls-pop)
           |                |  |                |                |
|       +--rw mpls-pop                  boolean
           |                |  |                |                |
|       +--rw ttl-action?               uint8
           |                |  |                |                |  +--:
(gre)
           |                |  |                |                |  |  +--
rw gre-ip-destination         inet:ipv4-address
           |                |  |                |                |  |  +--
rw gre-protocol-type          inet:ipv4-address
           |                |  |                |                |  |  +--
rw gre-key?                   uint64
           |                |  |                |                |  +--:
(nvgre)
           |                |  |                |                |     +--
rw (nvgre-type)?
           |                |  |                |                |     |
+--:(ipv4)
           |                |  |                |                |     |
|  +--rw source-ipv4-address        inet:ipv4-address
           |                |  |                |                |     |
|  +--rw destination-ipv4-address   inet:ipv4-address
           |                |  |                |                |     |
|  +--rw protocol                   uint8
           |                |  |                |                |     |
|  +--rw ttl?                       uint8
           |                |  |                |                |     |
|  +--rw dscp?                      uint8
           |                |  |                |                |     |
+--:(ipv6)
           |                |  |                |                |
|     +--rw source-ipv6-address        inet:ipv6-address
           |                |  |                |                |
|     +--rw destination-ipv6-address   inet:ipv6-address
```

```
            |                 |  |                |                 |
|     +--rw next-header                 uint8
            |                 |  |                |                 |
|     +--rw traffic-class?              uint8
            |                 |  |                |                 |
|     +--rw flow-label?                 uint16
            |                 |  |                |                 |
|     +--rw hop-limit?                  uint8
            |                 |  |                |                 |     +--
rw virtual-subnet-id           uint32
            |                 |  |                |                 |     +--
rw flow-id?                    uint16
            |                 |  |                |                 +--rw
(nexthop-forth-encap-or-not)?
            |                 |  |                |                    +--:
(nexthop-forth-encap)
            |                 |  |                |                       +--
rw nexthop-forth-encap
            |                 |  |                |
+--rw (tunnel-type)?
            |                 |  |                |
|  +--:(ipv4)
            |                 |  |                |
|  |  +--rw source-ipv4-address         inet:ipv4-address
            |                 |  |                |
|  |  +--rw destination-ipv4-address    inet:ipv4-address
            |                 |  |                |
|  |  +--rw protocol                    uint8
            |                 |  |                |
|  |  +--rw ttl?                        uint8
            |                 |  |                |
|  |  +--rw dscp?                       uint8
            |                 |  |                |
|  +--:(ipv6)
            |                 |  |                |
|  |  +--rw source-ipv6-address         inet:ipv6-address
            |                 |  |                |
|  |  +--rw destination-ipv6-address    inet:ipv6-address
            |                 |  |                |
|  |  +--rw next-header                 uint8
            |                 |  |                |
|  |  +--rw traffic-class?              uint8
            |                 |  |                |
|  |  +--rw flow-label?                 uint16
            |                 |  |                |
|  |  +--rw hop-limit?                  uint8
            |                 |  |                |
|  +--:(mpls)
```

```
            |                 |  |                |
|  |  +--rw (mpls-action-type)?
            |                 |  |                |
|  |     +--:(mpls-push)
            |                 |  |                |
|  |     |  +--rw mpls-push                  boolean
            |                 |  |                |
|  |     |  +--rw mpls-label                 uint32
            |                 |  |                |
|  |     |  +--rw s-bit?                     boolean
            |                 |  |                |
|  |     |  +--rw tos-value?                 uint8
            |                 |  |                |
|  |     |  +--rw ttl-value?                 uint8
            |                 |  |                |
|  |     +--:(mpls-pop)
            |                 |  |                |
|  |        +--rw mpls-pop                     boolean
            |                 |  |                |
|  |        +--rw ttl-action?                  uint8
            |                 |  |                |
|  +--:(gre)
            |                 |  |                |
|  |  +--rw gre-ip-destination          inet:ipv4-address
            |                 |  |                |
|  |  +--rw gre-protocol-type           inet:ipv4-address
            |                 |  |                |
|  |  +--rw gre-key?                    uint64
            |                 |  |                |
|  +--:(nvgre)
            |                 |  |                |
|     +--rw (nvgre-type)?
            |                 |  |                |
|     |  +--:(ipv4)
            |                 |  |                |
|     |  |  +--rw source-ipv4-address         inet:ipv4-address
            |                 |  |                |
|     |  |  +--rw destination-ipv4-address    inet:ipv4-address
            |                 |  |                |
|     |  |  +--rw protocol                    uint8
            |                 |  |                |
|     |  |  +--rw ttl?                        uint8
            |                 |  |                |
|     |  |  +--rw dscp?                       uint8
            |                 |  |                |
|     |  +--:(ipv6)
            |                 |  |                |
|     |     +--rw source-ipv6-address         inet:ipv6-address
```

```
            |                 |  |                 |
|     |     +--rw destination-ipv6-address    inet:ipv6-address
            |                 |  |                 |
|     |     +--rw next-header                 uint8
            |                 |  |                 |
|     |     +--rw traffic-class?              uint8
            |                 |  |                 |
|     |     +--rw flow-label?                 uint16
            |                 |  |                 |
|     |     +--rw hop-limit?                  uint8
            |                 |  |                 |
|     +--rw virtual-subnet-id           uint32
            |                 |  |                 |
|     +--rw flow-id?                    uint16
            |                 |  |                 |
+--rw (nexthop-fifth-encap-or-not)?
            |                 |  |
|                           +--:(nexthop-fifth-encap)
            |                 |  |
|                              +--rw nexthop-fifth-encap
            |                 |  |
|                                 +--rw (tunnel-type)?
            |                 |  |
|                                    +--:(ipv4)
            |                 |  |
|                                    |  +--rw source-ipv4-address
inet:ipv4-address
            |                 |  |
|                                    |  +--rw destination-ipv4-address
inet:ipv4-address
            |                 |  |
|                                    |  +--rw protocol
uint8
            |                 |  |
|                                    |  +--rw ttl?
uint8
            |                 |  |
|                                    |  +--rw dscp?
uint8
            |                 |  |
|                                    +--:(ipv6)
            |                 |  |
|                                    |  +--rw source-ipv6-address
inet:ipv6-address
            |                 |  |
|                                    |  +--rw destination-ipv6-address
inet:ipv6-address
            |                 |  |
|                                    |  +--rw next-header
uint8
            |                 |  |
```

```
|                                       |  +--rw traffic-class?
uint8
           |                 |  |
|                                       |  +--rw flow-label?
uint16
           |                 |  |
|                                       |  +--rw hop-limit?
uint8
```

```
|                |  |
|                                +--:(mpls)
|                |  |
|                                |  +--rw (mpls-action-type)?
|                |  |
|                                |     +--:(mpls-push)
|                |  |
|                                |     |  +--rw mpls-
push                  boolean
|                |  |
|                                |     |  +--rw mpls-
label                 uint32
|                |  |
|                                |     |  +--rw s-
bit?                    boolean
|                |  |
|                                |     |  +--rw tos-
value?                 uint8
|                |  |
|                                |     |  +--rw ttl-
value?                 uint8
|                |  |
|                                |     +--:(mpls-pop)
|                |  |
|                                |        +--rw mpls-
pop                   boolean
|                |  |
|                                |        +--rw ttl-
action?                uint8
|                |  |
|                                +--:(gre)
|                |  |
|                                |  +--rw gre-ip-destination
inet:ipv4-address
|                |  |
|                                |  +--rw gre-protocol-type
inet:ipv4-address
|                |  |
|                                |  +--rw gre-key?
uint64
|                |  |
|                                +--:(nvgre)
|                |  |
|                                   +--rw (nvgre-type)?
|                |  |
|                                   |  +--:(ipv4)
|                |  |
|                                   |  |  +--rw source-ipv4-
```

```
address         inet:ipv4-address
            |                 |  |
|                                    |  |  +--rw destination-ipv4-
address    inet:ipv4-address
            |                 |  |
|                                    |  |  +--rw
protocol                   uint8
            |                 |  |
|                                    |  |  +--rw
ttl?                       uint8
            |                 |  |
|                                    |  |  +--rw
dscp?                      uint8
            |                 |  |
|                                    |  +--:(ipv6)
            |                 |  |
|                                    |     +--rw source-ipv6-
address         inet:ipv6-address
            |                 |  |
|                                    |     +--rw destination-ipv6-
address    inet:ipv6-address
            |                 |  |
|                                    |     +--rw next-
header                 uint8
            |                 |  |
|                                    |     +--rw traffic-
class?              uint8
            |                 |  |
|                                    |     +--rw flow-
label?                 uint16
            |                 |  |
|                                    |     +--rw hop-
limit?                  uint8
            |                 |  |
|                                    +--rw virtual-subnet-id
uint32
            |                 |  |
|                                    +--rw flow-id?
uint16
            |                 |  |                 +--rw outgoing-
interface?         string
            |                 |  +--:(nexthop-chain-identifier)
            |                 |     +--rw (nexthop-identifier-type)?
            |                 |        +--:(nexthop-name)
            |                 |        |  +--rw nexthop-name
string
            |                 |        +--:(nexthop-id)
            |                 |           +--rw nexthop-id
uint32
            |                +--ro nexthop-state               nexthop-state-
def
```

```
|                +--rw priority?                    enumeration
|                +--rw weight?                      uint8
+--ro route-state?                        route-state-def
+--ro route-installed-state?              route-installed-state-def
+--ro route-reason?                       route-reason-def
+--rw route-preference                    uint32
+--rw local-only                          boolean
+--rw address-family-route-attributes
```

```
              +--rw (route-type)?
                 +--:(ip-route-attributes)
                 +--:(mpls-route-attributes)
                 +--:(eThernet-route-attributes)
notifications:
   +---n nexthop-resolution-status-change
   |  +--ro nexthop-chain-identifier
   |  |  +--ro (nexthop-identifier-type)?
   |  |     +--:(nexthop-name)
   |  |     |  +--ro nexthop-name    string
   |  |     +--:(nexthop-id)
   |  |        +--ro nexthop-id      uint32
   |  +--ro nexthop* [nexthop-index]
   |  |  +--ro nexthop-index                              uint32
   |  |  +--ro (next-hop-options)?
   |  |     +--:(nexthop-identifier-next-hop)
   |  |     |  +--ro (nexthop-identifier-type)?
   |  |     |     +--:(nexthop-name)
   |  |     |     |  +--ro nexthop-name                           string
   |  |     |     +--:(nexthop-id)
   |  |     |        +--ro nexthop-id                             uint32
   |  |     +--:(egress-interface-next-hop)
   |  |     |  +--ro outgoing-interface                       string
   |  |     +--:(ipv4-address-next-hop)
   |  |     |  +--ro next-hop-ipv4-address                    inet:ipv4-address
   |  |     |  +--ro ipv4-rib-name?                           string
   |  |     +--:(ipv6-address-next-hop)
   |  |     |  +--ro next-hop-ipv6-address                    inet:ipv6-address
   |  |     |  +--ro ipv6-rib-name?                           string
   |  |     +--:(egress-interface-ipv4-next-hop)
   |  |     |  +--ro next-hop-egress-interface-ipv4-address
   |  |     |     +--ro outgoing-interface              string
   |  |     |     +--ro next-hop-egress-ipv4-address    inet:ipv4-address
   |  |     +--:(egress-interface-ipv6-next-hop)
   |  |     |  +--ro next-hop-egress-interface-ipv6-address
   |  |     |     +--ro outgoing-interface              string
   |  |     |     +--ro next-hop-egress-ipv6-address    inet:ipv4-address
   |  |     +--:(egress-interface-mac-next-hop)
   |  |     |  +--ro next-hop-egress-interface-mac-address
   |  |     |     +--ro outgoing-interface    string
   |  |     |     +--ro ieee-mac-address      uint32
   |  |     +--:(logical-tunnel-next-hop)
   |  |     |  +--ro logical-tunnel
   |  |     |     +--ro tunnel-type    tunnel-type-def
   |  |     |     +--ro tunnel-name    string
   |  |     +--:(tunnel-encap-next-hop)
   |  |        +--ro tunnel-encap
   |  |           +--ro (tunnel-type)?
```

```
   |  |          |  +--:(ipv4)
   |  |          |  |  +--ro source-ipv4-address         inet:ipv4-address
   |  |          |  |  +--ro destination-ipv4-address    inet:ipv4-address
   |  |          |  |  +--ro protocol                    uint8
   |  |          |  |  +--ro ttl?                        uint8
   |  |          |  |  +--ro dscp?                       uint8
   |  |          |  +--:(ipv6)
   |  |          |  |  +--ro source-ipv6-address         inet:ipv6-address
   |  |          |  |  +--ro destination-ipv6-address    inet:ipv6-address
   |  |          |  |  +--ro next-header                 uint8
   |  |          |  |  +--ro traffic-class?              uint8
   |  |          |  |  +--ro flow-label?                 uint16
   |  |          |  |  +--ro hop-limit?                  uint8
   |  |          |  +--:(mpls)
   |  |          |  |  +--ro (mpls-action-type)?
   |  |          |  |     +--:(mpls-push)
   |  |          |  |     |  +--ro mpls-push                   boolean
   |  |          |  |     |  +--ro mpls-label                  uint32
   |  |          |  |     |  +--ro s-bit?                      boolean
   |  |          |  |     |  +--ro tos-value?                  uint8
   |  |          |  |     |  +--ro ttl-value?                  uint8
   |  |          |  |     +--:(mpls-pop)
   |  |          |  |        +--ro mpls-pop                   boolean
   |  |          |  |        +--ro ttl-action?                uint8
   |  |          |  +--:(gre)
   |  |          |  |  +--ro gre-ip-destination          inet:ipv4-address
   |  |          |  |  +--ro gre-protocol-type           inet:ipv4-address
   |  |          |  |  +--ro gre-key?                    uint64
   |  |          |  +--:(nvgre)
   |  |          |     +--ro (nvgre-type)?
   |  |          |     |  +--:(ipv4)
   |  |          |     |  |  +--ro source-ipv4-address         inet:ipv4-
address
   |  |          |     |  |  +--ro destination-ipv4-address    inet:ipv4-
address
   |  |          |     |  |  +--ro protocol                    uint8
   |  |          |     |  |  +--ro ttl?                        uint8
   |  |          |     |  |  +--ro dscp?                       uint8
   |  |          |     |  +--:(ipv6)
   |  |          |     |     +--ro source-ipv6-address         inet:ipv6-
address
   |  |          |     |     +--ro destination-ipv6-address    inet:ipv6-
address
   |  |          |     |     +--ro next-header                 uint8
   |  |          |     |     +--ro traffic-class?              uint8
   |  |          |     |     +--ro flow-label?                 uint16
   |  |          |     |     +--ro hop-limit?                  uint8
   |  |          |     +--ro virtual-subnet-id           uint32
```

```
|  |           |     +--ro flow-id?                    uint16
|  |           +--ro (nexthop-second-encap-or-not)?
|  |           |  +--:(nexthop-second-encap)
|  |           |     +--ro nexthop-second-encap
```

```
   |  |          |       +--ro (tunnel-type)?
   |  |          |       |  +--:(ipv4)
   |  |          |       |  |  +--ro source-ipv4-address         inet:ipv4-
address
   |  |          |       |  |  +--ro destination-ipv4-address    inet:ipv4-
address
   |  |          |       |  |  +--ro protocol                    uint8
   |  |          |       |  |  +--ro ttl?                        uint8
   |  |          |       |  |  +--ro dscp?                       uint8
   |  |          |       |  +--:(ipv6)
   |  |          |       |  |  +--ro source-ipv6-address         inet:ipv6-
address
   |  |          |       |  |  +--ro destination-ipv6-address    inet:ipv6-
address
   |  |          |       |  |  +--ro next-header                 uint8
   |  |          |       |  |  +--ro traffic-class?              uint8
   |  |          |       |  |  +--ro flow-label?                 uint16
   |  |          |       |  |  +--ro hop-limit?                  uint8
   |  |          |       |  +--:(mpls)
   |  |          |       |  |  +--ro (mpls-action-type)?
   |  |          |       |  |     +--:(mpls-push)
   |  |          |       |  |     |  +--ro mpls-push                   boolean
   |  |          |       |  |     |  +--ro mpls-label                  uint32
   |  |          |       |  |     |  +--ro s-bit?                      boolean
   |  |          |       |  |     |  +--ro tos-value?                  uint8
   |  |          |       |  |     |  +--ro ttl-value?                  uint8
   |  |          |       |  |     +--:(mpls-pop)
   |  |          |       |  |        +--ro mpls-pop                   boolean
   |  |          |       |  |        +--ro ttl-action?                uint8
   |  |          |       |  +--:(gre)
   |  |          |       |  |  +--ro gre-ip-destination          inet:ipv4-
address
   |  |          |       |  |  +--ro gre-protocol-type           inet:ipv4-
address
   |  |          |       |  |  +--ro gre-key?                    uint64
   |  |          |       |  +--:(nvgre)
   |  |          |       |     +--ro (nvgre-type)?
   |  |          |       |     |  +--:(ipv4)
   |  |          |       |     |  |  +--ro source-ipv4-address
inet:ipv4-address
   |  |          |       |     |  |  +--ro destination-ipv4-address
inet:ipv4-address
   |  |          |       |     |  |  +--ro protocol                  uint8
   |  |          |       |     |  |  +--ro ttl?                      uint8
   |  |          |       |     |  |  +--ro dscp?                     uint8
   |  |          |       |     |  +--:(ipv6)
   |  |          |       |     |     +--ro source-ipv6-address
inet:ipv6-address
```

```
   |  |           |        |     |     +--ro destination-ipv6-address
inet:ipv6-address
   |  |           |        |     |     +--ro next-header                uint8
   |  |           |        |     |     +--ro traffic-class?             uint8
   |  |           |        |     |     +--ro flow-label?                uint16
   |  |           |        |     |     +--ro hop-limit?                 uint8
   |  |           |        |     |    +--ro virtual-subnet-id          uint32
   |  |           |        |     |    +--ro flow-id?                   uint16
   |  |           |        |    +--ro (nexthop-third-encap-or-not)?
   |  |           |        |       +--:(nexthop-third-encap)
```

```
   |  |          |              +--ro nexthop-third-encap
   |  |          |                 +--ro (tunnel-type)?
   |  |          |                 |  +--:(ipv4)
   |  |          |                 |  |  +--ro source-ipv4-address
inet:ipv4-address
   |  |          |                 |  |  +--ro destination-ipv4-address
inet:ipv4-address
   |  |          |                 |  |  +--ro protocol
uint8
   |  |          |                 |  |  +--ro ttl?
uint8
   |  |          |                 |  |  +--ro dscp?
uint8
   |  |          |                 |  +--:(ipv6)
   |  |          |                 |  |  +--ro source-ipv6-address
inet:ipv6-address
   |  |          |                 |  |  +--ro destination-ipv6-address
inet:ipv6-address
   |  |          |                 |  |  +--ro next-header
uint8
   |  |          |                 |  |  +--ro traffic-class?
uint8
   |  |          |                 |  |  +--ro flow-label?
uint16
   |  |          |                 |  |  +--ro hop-limit?
uint8
   |  |          |                 |  +--:(mpls)
   |  |          |                 |  |  +--ro (mpls-action-type)?
   |  |          |                 |  |     +--:(mpls-push)
   |  |          |                 |  |     |  +--ro mpls-
push                  boolean
   |  |          |                 |  |     |  +--ro mpls-
label                 uint32
   |  |          |                 |  |     |  +--ro s-
bit?                     boolean
   |  |          |                 |  |     |  +--ro tos-
value?                uint8
   |  |          |                 |  |     |  +--ro ttl-
value?                uint8
   |  |          |                 |  |     +--:(mpls-pop)
   |  |          |                 |  |        +--ro mpls-
pop                   boolean
   |  |          |                 |  |        +--ro ttl-
action?               uint8
   |  |          |                 |  +--:(gre)
   |  |          |                 |  |  +--ro gre-ip-destination
inet:ipv4-address
   |  |          |                 |  |  +--ro gre-protocol-type
```

```
inet:ipv4-address
   |  |           |                 |  |  +--ro gre-key?
uint64
   |  |           |                 |  +--:(nvgre)
   |  |           |                 |     +--ro (nvgre-type)?
   |  |           |                 |     |  +--:(ipv4)
   |  |           |                 |     |  |  +--ro source-ipv4-
address         inet:ipv4-address
   |  |           |                 |     |  |  +--ro destination-ipv4-
address    inet:ipv4-address
   |  |           |                 |     |  |  +--ro
protocol                     uint8
   |  |           |                 |     |  |  +--ro
ttl?                         uint8
   |  |           |                 |     |  |  +--ro
dscp?                        uint8
   |  |           |                 |     |  +--:(ipv6)
   |  |           |                 |     |     +--ro source-ipv6-
address         inet:ipv6-address
   |  |           |                 |     |     +--ro destination-ipv6-
address    inet:ipv6-address
   |  |           |                 |     |     +--ro next-
header                  uint8
   |  |           |                 |     |     +--ro traffic-
class?              uint8
   |  |           |                 |     |     +--ro flow-
label?                  uint16
   |  |           |                 |     |     +--ro hop-
limit?                   uint8
   |  |           |                 |     +--ro virtual-subnet-id
uint32
   |  |           |                 |     +--ro flow-id?
uint16
   |  |           |                 +--ro (nexthop-forth-encap-or-not)?
```

```
   |  |           |                    +--:(nexthop-forth-encap)
   |  |           |                       +--ro nexthop-forth-encap
   |  |           |                          +--ro (tunnel-type)?
   |  |           |                          |  +--:(ipv4)
   |  |           |                          |  |  +--ro source-ipv4-
address         inet:ipv4-address
   |  |           |                          |  |  +--ro destination-ipv4-
address    inet:ipv4-address
   |  |           |                          |  |  +--ro
protocol                    uint8
   |  |           |                          |  |  +--ro
ttl?                        uint8
   |  |           |                          |  |  +--ro
dscp?                       uint8
   |  |           |                          |  +--:(ipv6)
   |  |           |                          |  |  +--ro source-ipv6-
address         inet:ipv6-address
   |  |           |                          |  |  +--ro destination-ipv6-
address    inet:ipv6-address
   |  |           |                          |  |  +--ro next-
header                 uint8
   |  |           |                          |  |  +--ro traffic-
class?              uint8
   |  |           |                          |  |  +--ro flow-
label?                 uint16
   |  |           |                          |  |  +--ro hop-
limit?                  uint8
   |  |           |                          |  +--:(mpls)
   |  |           |                          |  |  +--ro (mpls-action-type)?
   |  |           |                          |  |     +--:(mpls-push)
   |  |           |                          |  |     |  +--ro mpls-
push                   boolean
   |  |           |                          |  |     |  +--ro mpls-
label                  uint32
   |  |           |                          |  |     |  +--ro s-
bit?                     boolean
   |  |           |                          |  |     |  +--ro tos-
value?                  uint8
   |  |           |                          |  |     |  +--ro ttl-
value?                  uint8
   |  |           |                          |  |     +--:(mpls-pop)
   |  |           |                          |  |        +--ro mpls-
pop                    boolean
   |  |           |                          |  |        +--ro ttl-
action?                 uint8
   |  |           |                          |  +--:(gre)
   |  |           |                          |  |  +--ro gre-ip-
destination          inet:ipv4-address
```

```
   |  |           |                          |  |  +--ro gre-protocol-
type           inet:ipv4-address
   |  |           |                          |  |  +--ro gre-
key?                    uint64
   |  |           |                          |  +--:(nvgre)
   |  |           |                          |     +--ro (nvgre-type)?
   |  |           |                          |     |  +--:(ipv4)
   |  |           |                          |     |  |  +--ro source-ipv4-
address         inet:ipv4-address
   |  |           |                          |     |  |  +--ro destination-ipv4-
address    inet:ipv4-address
   |  |           |                          |     |  |  +--ro
protocol                    uint8
   |  |           |                          |     |  |  +--ro
ttl?                        uint8
   |  |           |                          |     |  |  +--ro
dscp?                       uint8
   |  |           |                          |     |  +--:(ipv6)
   |  |           |                          |     |     +--ro source-ipv6-
address         inet:ipv6-address
   |  |           |                          |     |     +--ro destination-ipv6-
address    inet:ipv6-address
   |  |           |                          |     |     +--ro next-
header                 uint8
   |  |           |                          |     |     +--ro traffic-
class?              uint8
   |  |           |                          |     |     +--ro flow-
label?                 uint16
   |  |           |                          |     |     +--ro hop-
limit?                  uint8
   |  |           |                          |     +--ro virtual-subnet-
id           uint32
   |  |           |                          |     +--ro flow-
id?                    uint16
```

```
   |  |          |                          +--ro (nexthop-fifth-encap-or-not)?
   |  |          |                             +--:(nexthop-fifth-encap)
   |  |          |                                +--ro nexthop-fifth-encap
   |  |          |                                   +--ro (tunnel-type)?
   |  |          |                                      +--:(ipv4)
   |  |          |                                      |  +--ro source-ipv4-
address         inet:ipv4-address
   |  |          |                                      |  +--ro destination-
ipv4-address    inet:ipv4-address
   |  |          |                                      |  +--ro
protocol                   uint8
   |  |          |                                      |  +--ro
ttl?                       uint8
   |  |          |                                      |  +--ro
dscp?                      uint8
   |  |          |                                      +--:(ipv6)
   |  |          |                                      |  +--ro source-ipv6-
address         inet:ipv6-address
   |  |          |                                      |  +--ro destination-
ipv6-address    inet:ipv6-address
   |  |          |                                      |  +--ro next-
header                 uint8
   |  |          |                                      |  +--ro traffic-
class?               uint8
   |  |          |                                      |  +--ro flow-
label?                 uint16
   |  |          |                                      |  +--ro hop-
limit?                  uint8
   |  |          |                                      +--:(mpls)
   |  |          |                                      |  +--ro (mpls-action-
type)?
   |  |          |                                      |     +--:(mpls-push)
   |  |          |                                      |     |  +--ro mpls-
push                   boolean
   |  |          |                                      |     |  +--ro mpls-
label                  uint32
   |  |          |                                      |     |  +--ro s-
bit?                     boolean
   |  |          |                                      |     |  +--ro tos-
value?                  uint8
   |  |          |                                      |     |  +--ro ttl-
value?                  uint8
   |  |          |                                      |     +--:(mpls-pop)
   |  |          |                                      |        +--ro mpls-
pop                    boolean
   |  |          |                                      |        +--ro ttl-
action?                 uint8
   |  |          |                                      +--:(gre)
```

```
   |  |           |                                        |  +--ro gre-ip-
destination          inet:ipv4-address
   |  |           |                                        |  +--ro gre-protocol-
type           inet:ipv4-address
   |  |           |                                        |  +--ro gre-
key?                    uint64
   |  |           |                                        +--:(nvgre)
   |  |           |                                           +--ro (nvgre-type)?
   |  |           |                                           |  +--:(ipv4)
   |  |           |                                           |  |  +--ro source-
ipv4-address         inet:ipv4-address
   |  |           |                                           |  |  +--ro
destination-ipv4-address    inet:ipv4-address
   |  |           |                                           |  |  +--ro
protocol                    uint8
   |  |           |                                           |  |  +--ro
ttl?                        uint8
   |  |           |                                           |  |  +--ro
dscp?                       uint8
   |  |           |                                           |  +--:(ipv6)
   |  |           |                                           |     +--ro source-
ipv6-address         inet:ipv6-address
   |  |           |                                           |     +--ro
destination-ipv6-address    inet:ipv6-address
   |  |           |                                           |     +--ro next-
header                 uint8
   |  |           |                                           |     +--ro traffic-
class?              uint8
   |  |           |                                           |     +--ro flow-
label?                 uint16
   |  |           |                                           |     +--ro hop-
limit?                  uint8
   |  |           |                                           +--ro virtual-
subnet-id           uint32
```

```
   |  |          |                                          +--ro flow-
id?                    uint16
   |  |          +--ro outgoing-interface?         string
   |  +--ro nexthop-state               nexthop-state-def
   +---n route-change
      +--ro instance-name           string
      +--ro rib-name                string
      +--ro rib-family              rib-family-def
      +--ro route-index             uint64
      +--ro route-type              route-type-def
      +--ro (rib-route-type)?
      |  +--:(ipv4)
      |  |  +--ro ipv4
      |  |     +--ro ipv4-route-type                   ip-route-type-def
      |  |     +--ro (ip-route-type)?
      |  |        +--:(destination-ipv4-address)
      |  |        |  +--ro destination-ipv4-prefix           inet:ipv4-prefix
      |  |        +--:(source-ipv4-address)
      |  |        |  +--ro source-ipv4-prefix                inet:ipv4-prefix
      |  |        +--:(destination-source-ipv4-address)
      |  |           +--ro destination-source-ipv4-address
      |  |              +--ro destination-ipv4-prefix    inet:ipv4-prefix
      |  |              +--ro source-ipv4-prefix         inet:ipv4-prefix
      |  +--:(ipv6)
      |  |  +--ro ipv6
      |  |     +--ro ipv6-route-type                   ip-route-type-def
      |  |     +--ro (ip-route-type)?
      |  |        +--:(destination-ipv6-address)
      |  |        |  +--ro destination-ipv6-prefix           inet:ipv6-prefix
      |  |        +--:(source-ipv6-address)
      |  |        |  +--ro source-ipv6-prefix                inet:ipv6-prefix
      |  |        +--:(destination-source-ipv6-address)
      |  |           +--ro destination-source-ipv6-address
      |  |              +--ro destination-ipv6-prefix    inet:ipv6-prefix
      |  |              +--ro source-ipv6-prefix         inet:ipv6-prefix
      |  +--:(mpls-route)
      |  |  +--ro mpls-label-in           uint32
      |  |  +--ro mpls-action             mpls-action-def
      |  |  +--ro mpls-label-out?         uint32
      |  +--:(mac-route)
      |  |  +--ro mac-address             uint32
      |  +--:(interface-route)
      |     +--ro interface-identifier     uint32
      +--ro route-installed-state    route-installed-state-def
      +--ro route-state              route-state-def
      +--ro route-reason             route-reason-def
```

5. RIB Yang description

```
//<code begins> file "i2rs isis@2014-08-31.yang"


module i2rs-rib  {

  namespace "urn:huawei:params:xml:ns:yang:rt:i2rs:rib";
    // replace with iana namespace when assigned
    prefix "i2rs-rib";

  import ietf-inet-types {
    prefix inet;
    //rfc6991
  }

  import ietf-interfaces {
    prefix "if";
  }

  import ietf-routing {
    prefix "rt";
  }

  organization
    "Huawei technologies co., ltd. ";
  contact
     "email: wanglixing@huawei.com
      email: shares@ndzh.com";

    description
      "
        terms and acronyms

        isis (isis):intermediate system to intermediate system

        ip (ip): internet protocol

        ipv4 (ipv4):internet protocol version 4

        ipv6 (ipv6): internet protocol version 6

        metric(metric): multi exit discriminator

        igp (igp): interior gateway protocol

        mtu (mtu) maximum transmission uint
       ";
```

```
  revision "2014-08-22" {
    description "initial revision";
    reference "draft-ietf-i2rs-rib-info-model-03";
  }


  container nexthop-capacity{
    leaf support-tunnel{
      type boolean;
    }
    leaf support-chains{
      type boolean;
    }
    leaf support-list-of-list{
      type boolean;
    }
    leaf support-replication{
      type boolean;
    }
    leaf support-weighted{
      type boolean;
    }
    leaf support-protection{
      type boolean;
    }
    leaf lookup-limit{
      type uint8;
    }
  }


  container nexthop-tunnel-encap-capacity{
    leaf support-ipv4{
      type boolean;
    }
    leaf support-ipv6{
      type boolean;
    }
    leaf support-mpls{
      type boolean;
    }
    leaf support-gre{
      type boolean;
    }
    leaf support-vxlan{
      type boolean;
    }
    leaf support-nvgre{
```

```
      type boolean;
    }
  }

  list routing-instance-list{
    description
      "configuration of a 'i2rs' pseudo-protocol instance
        consists of a list of routes.";
    key "instance-name";
    leaf instance-name {
      description
        "A routing instance is identified by its name,
        INSTANCE_name.  This MUST be unique across all routing instances
        in a given network device.";
      type string ;
      mandatory true;
    }
    list interface-list {
      description
        "This represents the list of interfaces associated
        with this routing instance.  The interface list helps constrain
        the boundaries of packet forwarding.  Packets coming on these
        interfaces are directly associated with the given routing
        instance.  The interface list contains a list of identifiers, with
        each identifier uniquely identifying an interface.";
      key "name";
      leaf name {
        type if:interface-ref;
         description
         "A reference to The name of a configured network layer  interface.";
      }
    }
    uses rt:router-id ;
    list rib-list {
      description
        "This is the list of RIBs associated with this routing
        instance.  Each routing instance can have multiple RIBs to
        represent routes of different types.";
      key "rib-name";
      leaf rib-name {
        description
         "A reference to The name of a rib.";
       type string;
        mandatory true;
      }
      leaf rib-family {
        type rib-family-def;
        mandatory true;
```

```
      }
      leaf enable-ip-rpf-check {
        description
          "Each RIB can be optionally associated with a ENABLE_IP_RPF_CHECK
           attribute that enables Reverse path forwarding (RPF) checks on all IP
           routes in that RIB.  Reverse path forwarding (RPF) check is used to
           prevent spoofing and limit malicious traffic.";
        type boolean;
      }
      list route-list{
        key "route-index";
        uses route;
      }
    }
  }


  grouping route-prefix{
    description
      "The common attributes usesd for all routes";
    leaf route-index {
      type uint64 ;
      mandatory true;
    }
    leaf route-type {
      type route-type-def ;
      mandatory true;
    }

    choice rib-route-type {
      case ipv4 {
        description
          "Match on destination IP address in the IPv4 header";
        container ipv4{
          leaf ipv4-route-type {
            type ip-route-type-def ;
            mandatory true;
          }
          choice ip-route-type {

            case destination-ipv4-address {
              leaf destination-ipv4-prefix {
                type inet:ipv4-prefix;
                mandatory true;
              }
            }
            case source-ipv4-address {
              leaf source-ipv4-prefix {
```

```
              type inet:ipv4-prefix;
              mandatory true;
            }
          }
          case destination-source-ipv4-address {
            container destination-source-ipv4-address {
              leaf destination-ipv4-prefix {
                type inet:ipv4-prefix;
                mandatory true;
              }
              leaf source-ipv4-prefix {
                type inet:ipv4-prefix;
                mandatory true;
              }
            }
          }
        }
      }
      case ipv6 {
        description
          "Match on destination IP address in the IPv6 header";
        container ipv6{
          leaf ipv6-route-type {
            type ip-route-type-def ;
            mandatory true;
          }
          choice ip-route-type {
            case destination-ipv6-address {
              leaf destination-ipv6-prefix {
                type inet:ipv6-prefix;
                mandatory true;
              }
            }
            case source-ipv6-address {
              leaf source-ipv6-prefix {
                type inet:ipv6-prefix;
                mandatory true;
              }
            }
            case destination-source-ipv6-address {
              container destination-source-ipv6-address {
                leaf destination-ipv6-prefix {
                  type inet:ipv6-prefix;
                  mandatory true;
                }
                leaf source-ipv6-prefix {
                  type inet:ipv6-prefix;
```

```
                mandatory true;
              }
            }
          }
        }
      }
    }
    case mpls-route {
      description
        "Match on a MPLS label at the top of the MPLS label stack";
      leaf mpls-label-in {
        type uint32 ;
        mandatory true;
      }
      leaf mpls-action {
        type mpls-action-def ;
        mandatory true;
      }
      leaf mpls-label-out {
        type uint32 ;
      }
    }

    case mac-route {
      description
        "Match on MAC destination addresses in the ethernet header";
      leaf mac-address {
        type uint32 ;
        mandatory true;
      }
    }
    case interface-route {
      description
        "Match on incoming interface of the packet";
      leaf interface-identifier {
        type uint32 ;
        mandatory true;
      }
    }
  }
}

grouping route
{
  description
    "The common attributes usesd for all routes";
  uses route-prefix;
  list nexthop-list{
```

```
      description
        "One can create a replication list for replication traffic to multiple
        destinations.  The destinations, in turn, could be complex nexthops
        in themselves - at a level supported by the network device.  Point to
        multipoint and broadcast are examples that involve replication";
      key "nexthop-list-index";
      uses nexthop-list;
    }
    leaf route-state {
      type route-state-def ;
      config false;
    }
    leaf route-installed-state {
      type route-installed-state-def ;
      config false;
    }
    leaf route-reason {
      type route-reason-def ;
      config false;
    }
    uses route-attributes;
    uses route-vendor-attributes;
  }

  grouping nexthop-list{
    leaf nexthop-list-index{
      type uint32;
    }
    choice nexthop-list-type{
      case special-nexthop {
        leaf special-nexthop{
          type special-nexthop-def;
        }
      }
      case normal-nexthop {
        choice nexthop-member-or-list-of-list{
          case one-nexthop-list-member {
            uses nexthop-list-member;
          }
          case nexthop-list-of-list {
            list nexthop-list-member{
              key "nexthop-list-member-index";
              leaf nexthop-list-index{
                description
                  "Lists of lists is a complex construct.  One example of usage
of such
                  a construct is to replicate traffic to multiple destinations,
with
```

high availability. In other words, for each destination you have a primary and backup nexthop (replication list) to ensure there is no

```
                  traffic drop in case of a failure.  So the outer list is a
protection
                  list and the inner lists are replication lists of primary/
backup";
                type uint32;
              }
              uses nexthop-list-member;

            }
          }
        }
      }
    }
  }

  grouping nexthop-chain{
    container nexthop-chain-identifier {
      uses nexthop-identifier;
    }
    list nexthop{
      key "nexthop-index";
      uses nexthop;
    }
  }

  grouping nexthop-list-member{
    leaf nexthop-list-member-index {
      type uint32 ;
      mandatory true;
    }
    choice nexthop-chain-or-identifier{
      case nexthop-chain {
        container nexthop-chain {
          description
            "only one nexthop.";
          uses nexthop-chain;
        }
      }
      case nexthop-chain-identifier {
        description
          "A nexthop chain identifier.";
        uses nexthop-identifier;
      }
    }
    leaf nexthop-state {
      description
       "Nexthop resolution status (resolved/unresolved) notification.";
      type nexthop-state-def;
```

```
      mandatory true;
      config false;
```

```
    }
    uses rt:next-hop-classifiers;
  }

  grouping  nexthop-identifier{
    choice nexthop-identifier-type{
      case nexthop-name {
        leaf nexthop-name{
          type string;
          mandatory true;
        }
      }
      case nexthop-id {
        leaf nexthop-id{
          type uint32;
          mandatory true;
        }
      }
    }

  }

  grouping  route-vendor-attributes{

  }


  grouping  logical-tunnel{

    leaf tunnel-type {
      type tunnel-type-def ;
      mandatory true;
    }
    leaf tunnel-name {
      type string ;
      mandatory true;
    }
  }


  grouping  ipv4-header{

    leaf source-ipv4-address {
      type inet:ipv4-address;
      mandatory true;
    }
    leaf destination-ipv4-address {
      type inet:ipv4-address;
```

```
      mandatory true;
    }
    leaf protocol {
      type uint8;
      mandatory true;
    }
    leaf ttl {
      type uint8;
    }
    leaf dscp {
      type uint8;
    }
  }


  grouping  ipv6-header{

    leaf source-ipv6-address {
      type inet:ipv6-address;
      mandatory true;
    }
    leaf destination-ipv6-address {
      type inet:ipv6-address;
      mandatory true;
    }
    leaf next-header {
      type uint8;
      mandatory true;
    }
    leaf traffic-class {
      type uint8;
    }
    leaf flow-label {
      type uint16;
    }
    leaf hop-limit {
      type uint8;
    }
  }



  grouping  nvgre-header{
    choice nvgre-type {
      description
        "vxlan-header.";
      case ipv4 {
        uses ipv4-header;
```

```
      }
      case ipv6 {
        uses ipv6-header;
      }
    }
    leaf virtual-subnet-id {
      type uint32;
      mandatory true;
    }
    leaf flow-id {
      type uint16;
    }
  }

  grouping  vxlan-header{
    choice vxlan-type {
      description
        "vxlan-header.";
      case ipv4 {
        uses ipv4-header;
      }
      case ipv6 {
        uses ipv6-header;
      }
    }
    leaf vxlan-identifier {
      type uint32;
    }
  }

  grouping  gre-header{

    leaf gre-ip-destination {
      type inet:ipv4-address;
      mandatory true;
    }
    leaf gre-protocol-type {
      type inet:ipv4-address;
      mandatory true;
    }
    leaf gre-key {
      type uint64;
    }
  }


  grouping  mpls-header{
```

```
    choice mpls-action-type {
      description
        "mpls-header.";
      case mpls-push {
        leaf mpls-push {
          type boolean;
          mandatory true;
        }
        leaf mpls-label {
          type uint32;
          mandatory true;
        }
        leaf s-bit {
          type boolean;
        }
        leaf tos-value {
          type uint8;
        }
        leaf ttl-value {
          type uint8;
        }
          }
      case mpls-pop {
        leaf mpls-pop {
          type boolean;
          mandatory true;
        }
        leaf ttl-action {
          type uint8;
        }
      }
    }

  }

  grouping  tunnel-encap{

    choice tunnel-type {
      description
        "options for next-hops.";
      case ipv4 {
        uses ipv4-header;
      }
      case ipv6 {
        uses ipv6-header;
      }
      case mpls {
        uses mpls-header;
```

```
      }
      case gre {
        uses gre-header;
      }
      case nvgre {
        uses nvgre-header;
      }
    }
  }



  grouping nexthop {
    description
      "One Nexthop content for routes.";
    leaf nexthop-index {
      type uint32;
      mandatory true;
    }
    choice next-hop-options {
       case nexthop-identifier-next-hop{
         uses nexthop-identifier;
       }
       case egress-interface-next-hop {
           description
             "simple next-hop is specified as an outgoing interface,
              next-hop address or both.
              address-family-specific modules are expected to provide
              'next-hop-address' leaf via augmentation.";
           leaf outgoing-interface {
             type string;
             mandatory true;
             description
               "name of The outgoing interface.";
           }
      }
      case ipv4-address-next-hop {

        leaf next-hop-ipv4-address {
          type inet:ipv4-address;
          mandatory true;
          description
            "Ipv4 address of The next-hop.";
        }
        leaf ipv4-rib-name {
          type string;
          description
```

```
            "A nexthop pointing to a rib indicates that The route
            lookup needs to continue in The specified rib.  This is a way to
            perform chained lookups.";
        }
      }
      case ipv6-address-next-hop {
        leaf next-hop-ipv6-address {
          type inet:ipv6-address;
          mandatory true;
          description
            "Ipv6 address of The next-hop.";
        }
        leaf ipv6-rib-name {
          type string;
          description
            "A nexthop pointing to a rib indicates that The route
            lookup needs to continue in The specified rib.  This is a way to
            perform chained lookups.";
        }
      }
      case egress-interface-ipv4-next-hop {
        container next-hop-egress-interface-ipv4-address{
          leaf outgoing-interface {
            type string;
            mandatory true;
            description    "name of The outgoing interface.";
          }
          leaf next-hop-egress-ipv4-address {
            type inet:ipv4-address;
            mandatory true;
            description
              "Ipv4 address of The next-hop.";
          }
          description
            "egress-interface and ip address: This can be usesd in cases e.g.
            where The ip address is a link-local address..";
        }
      }
      case egress-interface-ipv6-next-hop {
        container next-hop-egress-interface-ipv6-address{
          leaf outgoing-interface {
            type string;
            mandatory true;
            description    "name of The outgoing interface.";
          }
          leaf next-hop-egress-ipv6-address {
            type inet:ipv4-address;
            mandatory true;
```

```
            description
              "Ipv4 address of The next-hop.";
            }
            description
              "egress-interface and ip address: This can be usesd in cases e.g.
              where The ip address is a link-local address..";

        }
      }

      case egress-interface-mac-next-hop {
        container next-hop-egress-interface-mac-address{
          leaf outgoing-interface {
            type string;
            mandatory true;
            description    "name of The outgoing interface.";
          }
          leaf ieee-mac-address {
            type uint32;
            mandatory true;
            description    "name of The mac-address.";
          }
          description
            "egress-interface and ip address: This can be usesd in cases e.g.
            where The ip address is a link-local address..";
        }
      }
      case logical-tunnel-next-hop {
        container logical-tunnel {
          uses logical-tunnel;
          description
            "This can be a mpls lsp or a gre tunnel (or oThers
              as defined in This document), that is represented by a unique
              identifier (e.g. name).";
        }
      }
      case tunnel-encap-next-hop {
        container tunnel-encap {
          uses tunnel-encap;
          choice nexthop-second-encap-or-not{
            case nexthop-second-encap{
              container nexthop-second-encap{
                description
                  "the two encapsulating nexthop.One example is a Pseudowire -
which is MPLS over
                   some transport (MPLS or GRE for instance).  Another example
is VxLAN
                   over IP.  ";
```

```
            uses tunnel-encap;
            choice nexthop-third-encap-or-not{
```

```
                  case nexthop-third-encap {
                    container nexthop-third-encap{
                      description
                        "the three encapsulating nexthop.One exampl is Option A
-L3VPN OVER MPLS tunnel and MPLS over TE tunnel";
                      uses tunnel-encap;
                      choice nexthop-forth-encap-or-not{
                        case nexthop-forth-encap {
                          container nexthop-forth-encap{
                            description
                              "the four encapsulating nexthop.One exampl is
Option C - which L3VPN OVER BGP-LSP and over MPLS tunnel
                               , and MPLS over TE tunnel.";
                            uses tunnel-encap;
                            choice nexthop-fifth-encap-or-not{
                              case nexthop-fifth-encap {
                                container nexthop-fifth-encap{
                                  description
                                    "the five encapsulating nexthop.One exampl
is Option C - which L3VPN OVER BGP-LSP and over MPLS tunnel
                                   , and MPLS over TE tunnel, the innest TE tunnel
is FRR";
                                  uses tunnel-encap;
                                }
                              }
                            }
                          }
                        }
                      }
                    }
                  }
                }
              }
            }
          }
          leaf outgoing-interface {
            type string;
          }
          description
            "This can be an encap representing an ip tunnel or
             mpls tunnel or oThers as defined in This document.  an optional
             egress interface can be specified to indicate which interface to
             send The packet out on.  The egress interface is usesful when The
             network device contains eThernet interfaces and one needs to
             perform address resolution for The ip packet.";
        }
      }
    }
```

```
  }

  grouping  route-attributes{
```

```
    leaf route-preference {
      description
        "ROUTE_PREFERENCE: This is a numerical value that allows for
        comparing routes from different protocols.  Static configuration
        is also considered a protocol for the purpose of this field.  It
        is also known as administrative-distance.  The lower the value,
        the higher the preference.";
        type uint32 ;
      mandatory true;
    }
    leaf local-only {
      type boolean ;
      mandatory true;
    }
    container address-family-route-attributes{
      choice route-type {
        case ip-route-attributes {
        }
        case mpls-route-attributes {
        }
        case eThernet-route-attributes {
        }
      }
    }
  }



  typedef mpls-action-def {
    type enumeration {
      enum "push";
      enum "pop";
      enum "swap";

    }
  }

  typedef special-nextho-def {
    type enumeration {
      enum "discard";
      enum "discard-with-error";
      enum "receive";
      enum "cos-value";
    }
  }
  typedef ip-route-type-def {
    type enumeration {
      enum "src";
```

```
      enum "dest";
      enum "dest-src";
    }
  }
  typedef rib-family-def {
    type enumeration {
      enum "ipv4-rib-family";
      enum "ipv6-rib-family";
      enum "mpls-rib-family";
      enum "ieee-mac-rib-family";
    }
  }


  typedef route-type-def {
    type enumeration {
      enum "ipv4";
      enum "ipv6";
      enum "mpls";
      enum "ieee-mac";
      enum "interface";
    }
  }


  typedef tunnel-type-def {
    type enumeration {
      enum "ipv4";
      enum "ipv6";
      enum "mpls";
      enum "gre";
      enum "vxlan";
      enum "nvgre";
    }
  }

  typedef special-nexthop-def {
    type enumeration {
      enum "discard";
      enum "discard-with-error";
      enum "receive";
      enum "cos-value";
    }
  }
  typedef route-state-def {
    type enumeration {
      enum "active";
      enum "inactive";
```

```
    }
  }

  typedef nexthop-state-def {
    type enumeration {
      enum "resolved";
      enum "unresolved";
    }
  }
  typedef route-installed-state-def {
    type enumeration {
      enum "Installed";
      enum "uninstalled";
    }
  }

  typedef route-reason-def {
    type enumeration {
      enum "low preference";
      enum "unresolved nexthop";
      enum "higher metric";
    }
  }




  notification nexthop-resolution-status-change {

    description
        "Nexthop resolution status (resolved/unresolved) notification.";
    uses nexthop-chain;
    leaf nexthop-state {
      description
       "Nexthop resolution status (resolved/unresolved) notification.";
      type nexthop-state-def;
      mandatory true;
    }
  }

  notification route-change {
    description
        "Route change notification.";
    leaf instance-name {
      description
        "A routing instance is identified by its name,
        INSTANCE_name.  This MUST be unique across all routing instances
```

```
        in a given network device.";
      type string ;
      mandatory true;
    }
    leaf rib-name {
      description
       "A reference to The name of a rib.";
      type string;
      mandatory true;
    }
    leaf rib-family {
      type rib-family-def;
      mandatory true;
    }
    uses route-prefix;
    leaf route-installed-state {
      description
       "Indicates whether the route got installed in the FIB.";
      type route-installed-state-def;
      mandatory true;
    }
    leaf route-state {
      description
       "Indicates whether a route is fully resolved and
        is a candidate for selection.";
      type route-state-def;
      mandatory true;
    }
    leaf route-reason {
      description
       "Need to be added.";
      type route-reason-def;
      mandatory true;
    }
  }
}
//   </code ends>
```

6. IANA Considerations

This draft includes no request to IANA.

7. Security Considerations

This document introduces no new security threat and SHOULD follow the security requirements as stated in [I-D.ietf-i2rs-architecture].

8. References

8.1. Informative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC5511] Farrel, A., "Routing Backus-Naur Form (RBNF): A Syntax Used to Form Encoding Rules in Various Routing Protocol Specifications", RFC 5511, April 2009.

8.2. Normative References

[I-D.ietf-i2rs-architecture] Atlas, A., Halpern, J., Hares, S., Ward, D., and T. Nadeau, "An Architecture for the Interface to the Routing System", draft-ietf-i2rs-architecture-06 (work in progress), December 2014.

[I-D.ietf-i2rs-rib-info-model] Bahadur, N., Folkes, R., Kini, S., and J. Medved, "Routing Information Base Info Model", draft-ietf-i2rs-rib-info-model-04 (work in progress), December 2014.

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