BESS Working Group
Internet Draft
Intended status: Standards Track
Expires: January 7, 2017

Y. Liu
Huawei Technologies
X. Liu
Ericsson
R. Kebler
Juniper Networks
M. Sivakumar
Cisco
F. Guo
Huawei Technologies

July 8, 2016

Yang Data Model for Multicast in MPLS/BGP IP VPNs
draft-liu-bess-mvpn-yang-01.txt

Status of this Memo

Copyright Notice

Abstract

This document defines a YANG data model that can be used to configure and manage multicast in MPLS/BGP IP VPNs.

Table of Contents

1. Introduction

YANG[RFC6020] is a data definition language that was introduced to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF[RFC6241]. YANG is proving relevant beyond its initial confines, as bindings to other interfaces(e.g. REST) and encoding other than XML (e.g. JSON) are being defined. Furthermore, YANG data models can be used as the basis of implementation for other interface, such as CLI and Programmatic APIs.

This document defines a YANG data model that can be used to configure and manage Multicast in MPLS/BGP IP VPN(MVPN). It includes Cisco systems' solution [RFC6037], BGP MVPN [RFC6513] [RFC6514] etc. Currently this model is incomplete, but it will support the core MVPN protocols, as well as many other features mentioned in separate MVPN RFCs. In addition, Non-core features described in MVPN standards other than mentioned above RFC in future version.

1.1. 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].

1.2. Terminology

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

This draft employs YANG tree diagrams, which are explained in [I-D.ietf-netmod-rfc6087bis].

2. Design of Data model

2.1. Scope of model

The model covers Rosen MVPN [RFC6037], BGP MVPN [RFC6513] [RFC6514]. The representation of some of extension features is not completely specified in this draft of the data model. This model is being circulated in its current form for early oversight and review of the basic hierarchy.

The operational state fields of this model are also incomplete, though the structure of what has been written may be taken as representative of the structure of the model when complete.

This model does not cover other MVPN related protocols such as MVPN Extranet [RFC7900] or MVPN MLDP In-band signaling [RFC7246] etc., these will be covered by future Internet Drafts.

2.2. Optional capabilities

This model is designed to represent the capabilities of MVPN devices with various specifications, including some with basic subsets of the MVPN protocols. The main design goals of this draft are that any major now-existing implementation may be said to support the basic model, and that the configuration of all implementations meeting the specification is easy to express through some combination of the features in the basic model and simple vendor augmentations.

On the other hand, operational state parameters are not so widely designated as features, as there are many cases where the defaulting of an operational state parameter would not cause any harm to the system, and it is much more likely that an implementation without native support for a piece of operational state would be able to

derive a suitable value for a state variable that is not natively supported.

For the same reason, wide constant ranges (for example, timer maximum and minimum) will be used in the model. It is expected that vendors will augment the model with any specific restrictions that might be required. Vendors may also extend the features list with proprietary extensions.

2.3. Position of address family in hierarchy

The current draft contains MVPN ipv4 and ipv6 as separate schema branches in the structure. The reason for this is to inherit l3vpn yang model structure and make it easier for implementations which may optionally choose to support specific address families. And the names of objects may be different between the ipv4 and ipv6 address families.

3. Module Structure

3.1. MVPN Configuration

The MVPN modules define the routing-instance-wide configuration options in a two-level hierarchy as listed below:

Instance level: MVPN configuration attributes for the entire routing instance, including route-target, I-PMSI tunnel and S-PMSI number, common timer etc.

PMSI tunnel level: MVPN configuration attributes applicable to the I-PMSI and per S-PMSI tunnel configuration attributes, including tunnel mode, tunnel specific parameters and threshold etc.

Where fields are not genuinely essential to protocol operation, they are marked as optional. Some fields will be essential but have a default specified, so that they need not be configured explicitly. The module structure also applies, where applicable, to the operational state as well.

Our current direction is to agree to a routing-instance-centric (VRF) model as opposed to protocol-centric mainly because it inherits l3vpn and it can as a part of l3vpn yang model. It fits well into the routing-instance model, and it is easier to map from the VRF-centric to the protocol-centric than the other way around due to forward references.

The IGMP and MLD model will augment "/rt:routing/rt:routing-instance/l3vpn:".

```
   augment /rt:routing/rt:routing-instance:
      +--rw l3vpn
         +--rw ipv4
         |  +--rw mvpn
         |     +--rw signaling-mode?        enumeration
         |     +--rw auto-discovery-mode?   enumeration
         |     +--rw config-type?           enumeration
         |     +--rw is-sender-site?        boolean
         |     +--rw rpt-spt-mode?          boolean
         |     +--rw mvpn-route-targets
         |     |  +--rw mvpn-route-target* [rt-type rt-value]
         |     |     +--rw rt-type     enumeration
         |     |     +--rw rt-value    string
         |     +--rw mvpn-ipmsi-tunnel
         |     |  +--rw tunnel-mode?                enumeration
         |     |  +--rw (ipmsi-type)?
         |     |     +--:(p2mp-te)
         |     |     |  +--rw te-p2mp-template?           string
         |     |     +--:(p2mp-mldp)
         |     |     +--:(pim-ssm)
         |     |     |  +--rw ssm-default-group-addr?     inet:ip-address
         |     |     +--:(pim-sm)
         |     |     |  +--rw sm-default-group-addr?      inet:ip-address
         |     |     +--:(bidir-pim)
         |     |     |  +--rw bidir-default-group-addr?   inet:ip-address
         |     |     +--:(pim-dm)
         |     |     |  +--rw dm-default-group-addr?      inet:ip-address
         |     |     +--:(ingress-replication)
         |     |     +--:(mp2mp-mldp)
         |     +--rw mvpn-spmsi-tunnels
         |        +--rw switch-delay-time?   uint8
         |        +--rw hold-down-time?      uint16
         |        +--rw tunnel-limit?        uint16
         |        +--rw mvpn-spmsi-tunnel* [tunnel-mode]
         |           +--rw tunnel-mode                    enumeration
         |           +--rw (spmsi-type)?
         |           |  +--:(p2mp-te)
         |           |  |  +--rw te-p2mp-template?             string
         |           |  +--:(p2mp-mldp)
         |           |  +--:(pim-ssm)
         |           |  |  +--rw ssm-group-pool-addr?          inet:ip-address
         |           |  |  +--rw ssm-group-pool-masklength?    uint8
         |           |  +--:(pim-sm)
         |           |  |  +--rw sm-group-pool-addr?           inet:ip-address
         |           |  |  +--rw sm-group-pool-masklength?     uint8
         |           |  +--:(bidir-pim)
         |           |  |  +--rw bidir-group-pool-addr?        inet:ip-address
         |           |  |  +--rw bidir-group-pool-masklength?  uint8
```

| | +--:(pim-dm)

```
         |           |  |  +--rw dm-group-pool-addr?           inet:ip-address
         |           |  |  +--rw dm-group-pool-masklength?     uint8
         |           |  |  +--:(ingress-replication)
         |           |  |  +--:(mp2mp-mldp)
         |           |  +--rw switch-threshold?             uint32
         |           |  +--rw (address-mask-or-acl)?
         |           |     +--:(address-mask)
         |           |     |  +--rw ipv4-group-addr?              inet:ipv4-
address
         |           |     |  +--rw ipv4-group-masklength?        uint8
         |           |     |  +--rw ipv4-source-addr?             inet:ipv4-
address
         |           |     |  +--rw ipv4-source-masklength?       uint8
         |           |     +--:(acl)
         |           |        +--rw group-acl-ipv4?               string
         |        +--rw ipv6
         |           +--rw mvpn
         |              +--rw signaling-mode?        enumeration
         |              +--rw auto-discovery-mode?   enumeration
         |              +--rw config-type?           enumeration
         |              +--rw is-sender-site?        boolean
         |              +--rw rpt-spt-mode?          boolean
         |              +--rw mvpn-route-targets
         |              |  +--rw mvpn-route-target* [rt-type rt-value]
         |              |     +--rw rt-type     enumeration
         |              |     +--rw rt-value    string
         |              +--rw mvpn-ipmsi-tunnel
         |              |  +--rw tunnel-mode?               enumeration
         |              |  +--rw (ipmsi-type)?
         |              |     +--:(p2mp-te)
         |              |     |  +--rw te-p2mp-template?          string
         |              |     +--:(p2mp-mldp)
         |              |     +--:(pim-ssm)
         |              |     |  +--rw ssm-default-group-addr?    inet:ip-address
         |              |     +--:(pim-sm)
         |              |     |  +--rw sm-default-group-addr?     inet:ip-address
         |              |     +--:(bidir-pim)
         |              |     |  +--rw bidir-default-group-addr?  inet:ip-address
         |              |     +--:(pim-dm)
         |              |     |  +--rw dm-default-group-addr?     inet:ip-address
         |              |     +--:(ingress-replication)
         |              |     +--:(mp2mp-mldp)
         |              +--rw mvpn-spmsi-tunnels
         |                 +--rw switch-delay-time?   uint8
         |                 +--rw hold-down-time?      uint16
         |                 +--rw tunnel-limit?        uint16
         |                 +--rw mvpn-spmsi-tunnel* [tunnel-mode]
         |                    +--rw tunnel-mode                   enumeration
```

```
                    +--rw (spmsi-type)?
                    |  +--:(p2mp-te)
                    |  |  +--rw te-p2mp-template?              string
```

```
                    |  +--:(p2mp-mldp)
                    |  +--:(pim-ssm)
                    |  |  +--rw ssm-group-pool-addr?          inet:ip-address
                    |  |  +--rw ssm-group-pool-masklength?    uint8
                    |  +--:(pim-sm)
                    |  |  +--rw sm-group-pool-addr?           inet:ip-address
                    |  |  +--rw sm-group-pool-masklength?     uint8
                    |  +--:(bidir-pim)
                    |  |  +--rw bidir-group-pool-addr?        inet:ip-address
                    |  |  +--rw bidir-group-pool-masklength?  uint8
                    |  +--:(pim-dm)
                    |  |  +--rw dm-group-pool-addr?           inet:ip-address
                    |  |  +--rw dm-group-pool-masklength?     uint8
                    |  +--:(ingress-replication)
                    |  +--:(mp2mp-mldp)
                    +--rw switch-threshold?             uint32
                    +--rw (address-mask-or-acl)?
                       +--:(address-mask)
                       |  +--rw ipv6-group-addr?              inet:ipv6-
address
                       |  +--rw ipv6-groupmasklength?         uint8
                       |  +--rw ipv6-source-addr?             inet:ipv6-
address
                       |  +--rw ipv6-source-masklength?       uint8
                       +--:(acl)
                          +--rw group-acl-ipv6?                string
```

3.2. MVPN Operational State

The MVPN module contains operational state information also in a two-level hierarchy as mentioned earlier.

Instance level: MVPN operational state attributes for the entire routing instance, including route-target, I-PMSI tunnel and S-PMSI number, common timer etc.

PMSI tunnel level: MVPN PMSI tunnel operational state attributes applicable to the I-PMSI and per S-PMSI tunnel operational state attributes, including tunnel mode, tunnel role, tunnel specific parameters and referenced private source and group address etc.

```
augment /rt:routing-state/rt:routing-instance:
   +--ro l3vpn
      +--ro ipv4
      |  +--ro mvpn
      |     +--ro signaling-mode?                enumeration
      |     +--ro auto-discovery-mode?           enumeration
```

```
|     +--ro config-type?                    enumeration
|     +--ro is-sender-site?                 boolean
|     +--ro rpt-spt-mode?                   boolean
```

```
|     +--ro mvpn-route-targets
|     |  +--ro mvpn-route-target* [rt-type rt-value]
|     |     +--ro rt-type     enumeration
|     |     +--ro rt-value    string
|     +--ro mvpn-ipmsi-tunnel
|     |  +--ro tunnel-mode?                enumeration
|     |  +--ro (ipmsi-type)?
|     |     +--:(p2mp-te)
|     |     |  +--ro te-p2mp-template?           string
|     |     +--:(p2mp-mldp)
|     |     +--:(pim-ssm)
|     |     |  +--ro ssm-default-group-addr?     inet:ip-address
|     |     +--:(pim-sm)
|     |     |  +--ro sm-default-group-addr?      inet:ip-address
|     |     +--:(bidir-pim)
|     |     |  +--ro bidir-default-group-addr?   inet:ip-address
|     |     +--:(pim-dm)
|     |     |  +--ro dm-default-group-addr?      inet:ip-address
|     |     +--:(ingress-replication)
|     |     +--:(mp2mp-mldp)
|     +--ro mvpn-spmsi-tunnels
|     |  +--ro switch-delay-time?   uint8
|     |  +--ro hold-down-time?      uint16
|     |  +--ro tunnel-limit?        uint16
|     |  +--ro mvpn-spmsi-tunnel* [tunnel-mode]
|     |     +--ro tunnel-mode                    enumeration
|     |     +--ro (spmsi-type)?
|     |     |  +--:(p2mp-te)
|     |     |  |  +--ro te-p2mp-template?             string
|     |     |  +--:(p2mp-mldp)
|     |     |  +--:(pim-ssm)
|     |     |  |  +--ro ssm-group-pool-addr?          inet:ip-address
|     |     |  |  +--ro ssm-group-pool-masklength?    uint8
|     |     |  +--:(pim-sm)
|     |     |  |  +--ro sm-group-pool-addr?           inet:ip-address
|     |     |  |  +--ro sm-group-pool-masklength?     uint8
|     |     |  +--:(bidir-pim)
|     |     |  |  +--ro bidir-group-pool-addr?        inet:ip-address
|     |     |  |  +--ro bidir-group-pool-masklength?  uint8
|     |     |  +--:(pim-dm)
|     |     |  |  +--ro dm-group-pool-addr?           inet:ip-address
|     |     |  |  +--ro dm-group-pool-masklength?     uint8
|     |     |  +--:(ingress-replication)
|     |     |  +--:(mp2mp-mldp)
|     |     +--ro switch-threshold?              uint32
|     |     +--ro (address-mask-or-acl)?
|     |        +--:(address-mask)
|     |        |  +--ro ipv4-group-addr?             inet:ipv4-
```

```
address
         |     |        |  +--ro ipv4-group-masklength?         uint8
```

```
         |     |        |  +--ro ipv4-source-addr?             inet:ipv4-
address
         |     |        |  +--ro ipv4-source-masklength?       uint8
         |     |        +--:(acl)
         |     |           +--ro group-acl-ipv4?              string
         |     +--ro mvpn-ipmsi-tunnel-info
         |     |  +--ro tunnel-mode?             enumeration
         |     |  +--ro (pmsi-type)?
         |     |  |  +--:(p2mp-te)
         |     |  |  |  +--ro te-p2mp-id?             uint16
         |     |  |  |  +--ro te-tunnel-id?           uint16
         |     |  |  |  +--ro te-extend-tunnel-id?    uint16
         |     |  |  +--:(p2mp-mldp)
         |     |  |  |  +--ro mldp-root-addr?         inet:ip-address
         |     |  |  |  +--ro mldp-lsp-id?            string
         |     |  |  +--:(pim-ssm)
         |     |  |  |  +--ro ssm-group-addr?         inet:ip-address
         |     |  |  +--:(pim-sm)
         |     |  |  |  +--ro sm-group-addr?          inet:ip-address
         |     |  |  +--:(bidir-pim)
         |     |  |  |  +--ro bidir-group-addr?       inet:ip-address
         |     |  |  +--:(pim-dm)
         |     |  |  |  +--ro dm-group-addr?          inet:ip-address
         |     |  |  +--:(ingress-replication)
         |     |  |  +--:(mp2mp-mldp)
         |     |  +--ro tunnel-role?             enumeration
         |     |  +--ro mvpn-pmsi-sg-ref-ipv4s
         |     |     +--ro mvpn-pmsi-sg-ref-ipv4* [ipv4-source-address ipv4-
group-address]
         |     |        +--ro ipv4-source-address    inet:ipv4-address
         |     |        +--ro ipv4-group-address     inet:ipv4-address
         |     +--ro mvpn-spmsi-tunnel-ipv4-infos
         |        +--ro mvpn-spmsi-tunnel-ipv4-info* [tunnel-mode]
         |           +--ro tunnel-mode               enumeration
         |           +--ro (pmsi-type)?
         |           |  +--:(p2mp-te)
         |           |  |  +--ro te-p2mp-id?             uint16
         |           |  |  +--ro te-tunnel-id?           uint16
         |           |  |  +--ro te-extend-tunnel-id?    uint16
         |           |  +--:(p2mp-mldp)
         |           |  |  +--ro mldp-root-addr?         inet:ip-address
         |           |  |  +--ro mldp-lsp-id?            string
         |           |  +--:(pim-ssm)
         |           |  |  +--ro ssm-group-addr?         inet:ip-address
         |           |  +--:(pim-sm)
         |           |  |  +--ro sm-group-addr?          inet:ip-address
         |           |  +--:(bidir-pim)
         |           |  |  +--ro bidir-group-addr?       inet:ip-address
```

```
          |           |  +--:(pim-dm)
          |           |  |  +--ro dm-group-addr?           inet:ip-address
          |           |  +--:(ingress-replication)
```

```
         |           |  +--:(mp2mp-mldp)
         |           +--ro tunnel-role?              enumeration
         |           +--ro mvpn-pmsi-sg-ref-ipv4s
         |              +--ro mvpn-pmsi-sg-ref-ipv4* [ipv4-source-address ipv4-
group-address]
         |                 +--ro ipv4-source-address    inet:ipv4-address
         |                 +--ro ipv4-group-address     inet:ipv4-address
         +--ro ipv6
            +--ro mvpn
               +--ro signaling-mode?                 enumeration
               +--ro auto-discovery-mode?            enumeration
               +--ro config-type?                    enumeration
               +--ro is-sender-site?                 boolean
               +--ro rpt-spt-mode?                   boolean
               +--ro mvpn-route-targets
               |  +--ro mvpn-route-target* [rt-type rt-value]
               |     +--ro rt-type     enumeration
               |     +--ro rt-value    string
               +--ro mvpn-ipmsi-tunnel
               |  +--ro tunnel-mode?               enumeration
               |  +--ro (ipmsi-type)?
               |     +--:(p2mp-te)
               |     |  +--ro te-p2mp-template?          string
               |     +--:(p2mp-mldp)
               |     +--:(pim-ssm)
               |     |  +--ro ssm-default-group-addr?    inet:ip-address
               |     +--:(pim-sm)
               |     |  +--ro sm-default-group-addr?     inet:ip-address
               |     +--:(bidir-pim)
               |     |  +--ro bidir-default-group-addr?  inet:ip-address
               |     +--:(pim-dm)
               |     |  +--ro dm-default-group-addr?     inet:ip-address
               |     +--:(ingress-replication)
               |     +--:(mp2mp-mldp)
               +--ro mvpn-spmsi-tunnels
               |  +--ro switch-delay-time?   uint8
               |  +--ro hold-down-time?      uint16
               |  +--ro tunnel-limit?        uint16
               |  +--ro mvpn-spmsi-tunnel* [tunnel-mode]
               |     +--ro tunnel-mode                  enumeration
               |     +--ro (spmsi-type)?
               |     |  +--:(p2mp-te)
               |     |  |  +--ro te-p2mp-template?            string
               |     |  +--:(p2mp-mldp)
               |     |  +--:(pim-ssm)
               |     |  |  +--ro ssm-group-pool-addr?          inet:ip-address
               |     |  |  +--ro ssm-group-pool-masklength?    uint8
               |     |  +--:(pim-sm)
```

```
               |     |  |  +--ro sm-group-pool-addr?           inet:ip-address
               |     |  |  +--ro sm-group-pool-masklength?     uint8
```

```
               |     |  +--:(bidir-pim)
               |     |  |  +--ro bidir-group-pool-addr?         inet:ip-address
               |     |  |  +--ro bidir-group-pool-masklength?   uint8
               |     |  +--:(pim-dm)
               |     |  |  +--ro dm-group-pool-addr?            inet:ip-address
               |     |  |  +--ro dm-group-pool-masklength?      uint8
               |     |  +--:(ingress-replication)
               |     |  +--:(mp2mp-mldp)
               |     +--ro switch-threshold?              uint32
               |     +--ro (address-mask-or-acl)?
               |        +--:(address-mask)
               |        |  +--ro ipv6-group-addr?               inet:ipv6-
address
               |        |  +--ro ipv6-groupmasklength?         uint8
               |        |  +--ro ipv6-source-addr?              inet:ipv6-
address
               |        |  +--ro ipv6-source-masklength?       uint8
               |        +--:(acl)
               |           +--ro group-acl-ipv6?               string
               +--ro mvpn-ipmsi-tunnel-info
               |  +--ro tunnel-mode?              enumeration
               |  +--ro (pmsi-type)?
               |  |  +--:(p2mp-te)
               |  |  |  +--ro te-p2mp-id?              uint16
               |  |  |  +--ro te-tunnel-id?            uint16
               |  |  |  +--ro te-extend-tunnel-id?     uint16
               |  |  +--:(p2mp-mldp)
               |  |  |  +--ro mldp-root-addr?          inet:ip-address
               |  |  |  +--ro mldp-lsp-id?             string
               |  |  +--:(pim-ssm)
               |  |  |  +--ro ssm-group-addr?          inet:ip-address
               |  |  +--:(pim-sm)
               |  |  |  +--ro sm-group-addr?           inet:ip-address
               |  |  +--:(bidir-pim)
               |  |  |  +--ro bidir-group-addr?        inet:ip-address
               |  |  +--:(pim-dm)
               |  |  |  +--ro dm-group-addr?           inet:ip-address
               |  |  +--:(ingress-replication)
               |  |  +--:(mp2mp-mldp)
               |  +--ro tunnel-role?              enumeration
               |  +--ro mvpn-pmsi-sg-ref-ipv6s
               |     +--ro mvpn-pmsi-sg-ref-ipv6* [ipv6-source-address ipv6-
group-address]
               |        +--ro ipv6-source-address    inet:ipv6-address
               |        +--ro ipv6-group-address     inet:ipv6-address
               +--ro mvpn-spmsi-tunnel-ipv6-infos
                  +--ro mvpn-spmsi-tunnel-ipv6-info* [tunnel-mode]
                     +--ro tunnel-mode               enumeration
```

```
                    +--ro (pmsi-type)?
                    |  +--:(p2mp-te)
                    |  |  +--ro te-p2mp-id?              uint16
                    |  |  +--ro te-tunnel-id?            uint16
```

```
                     |  |  +--ro te-extend-tunnel-id?      uint16
                     |  +--:(p2mp-mldp)
                     |  |  +--ro mldp-root-addr?           inet:ip-address
                     |  |  +--ro mldp-lsp-id?              string
                     |  +--:(pim-ssm)
                     |  |  +--ro ssm-group-addr?           inet:ip-address
                     |  +--:(pim-sm)
                     |  |  +--ro sm-group-addr?            inet:ip-address
                     |  +--:(bidir-pim)
                     |  |  +--ro bidir-group-addr?         inet:ip-address
                     |  +--:(pim-dm)
                     |  |  +--ro dm-group-addr?            inet:ip-address
                     |  +--:(ingress-replication)
                     |  +--:(mp2mp-mldp)
                     +--ro tunnel-role?              enumeration
                     +--ro mvpn-pmsi-sg-ref-ipv6s
                        +--ro mvpn-pmsi-sg-ref-ipv6* [ipv6-source-address ipv6-
group-address]
                           +--ro ipv6-source-address    inet:ipv6-address
                           +--ro ipv6-group-address     inet:ipv6-address
```

4. MVPN YANG Modules

```
   module ietf-mvpn {
      namespace "urn:ietf:params:xml:ns:yang:ietf-mvpn";
      prefix mvpn;

      import ietf-inet-types {
        prefix inet;
      }

      import ietf-routing {
        prefix "rt";
      }

      organization
        "IETF BESS(BGP Enabled Services) Working Group";
      contact
        "liuyisong@huawei.com
         guofeng@huawei.com
         xliu@kuatrotech.com
         rkebler@juniper.net
         masivaku@cisco.com";
      description
        "This YANG module defines the generic configuration
         data for mvpn, which is common across all of the vendor
         implementations of the protocol. It is intended that the module
```

```
        will be extended by vendors to define vendor-specific
        mvpn configuration parameters.";
```

```
      revision 2016-07-08 {
        description
          "Initial revision.";
        reference
          "RFC XXXX: A YANG Data Model for MVPN";
      }

      grouping mvpn-instance-config {
        description "Mvpn basic configuration per instance.";

        leaf signaling-mode {
          type enumeration {
            enum invalid {
              value "0";
              description "invalid";
            }
            enum bgp {
              value "1";
              description "bgp";
            }
            enum pim {
              value "2";
              description "pim";
            }
          }
          default "invalid";
          description "Signaling mode.";
        }
        leaf auto-discovery-mode {
          type enumeration {
            enum none {
              value "0";
              description "none";
            }
            enum ad {
              value "1";
              description "auto-discovery";
            }
          }
          default "none";
          description "Auto discovery mode.";
        }
        leaf config-type {
          type enumeration {
            enum md {
              value "0";
              description "md";
```

```
            }
```

```
            enum ng {
              value "1";
              description "ng";
            }
          }
          default "md";
          description "Mvpn type, which can be md(rosen) mvpn or ng mvpn.";
        }
        leaf is-sender-site {
          type boolean;
          default "false";
          description "Configure the current PE as a sender PE.";
        }
        leaf rpt-spt-mode {
          type boolean;
          default "false";
          description "Rpt and spt mode in multicast private net.";
        }

      }

      grouping mvpn-vpn-targets {
        description "May be different from l3vpn unicast route-targets";
        container mvpn-route-targets{
          description "Multicast vpn route-targets";
          list mvpn-route-target {
            key "rt-type rt-value" ;
            description
              "List of multicast route-targets" ;
            leaf rt-type {
               type enumeration {
                 enum export-extcommunity {
                   value "0";
                   description "export-extcommunity";
                 }
                 enum import-extcommunity {
                   value "1";
                   description "import-extcommunity";
                 }
               }
               mandatory "true";
               description
                 "rt types are as follows:
                  export-extcommunity: specifies the value of
                  the extended community attribute of the
                  route from an outbound interface to the
                  destination vpn.
                  import-extcommunity: receives routes that
```

carry the specified extended community

```
                attribute";
            }
            leaf rt-value {
              type string {
                length "3..21";
              }
              description
                "the available mvpn target formats are as
                 follows:
                 - 16-bit as number:32-bit user-defined
                 number, for example, 1:3. an as number
                 ranges from 0 to 65535, and a user-defined
                 number ranges from 0 to 4294967295. The as
                 number and user-defined number cannot be
                 both 0s. That is, a vpn target cannot be 0:0.
                 - 32-bit ip address:16-bit user-defined
                 number, for example, 192.168.122.15:1.
                 The ip address ranges from 0.0.0.0 to
                 255.255.255.255, and the user-defined
                 number ranges from 0 to 65535.";
            }
          }
        }
      }


    grouping mvpn-ipmsi-tunnel-config {
      description "Default mdt for rosen mvpn and I-PMSI for ng mvpn";

      container mvpn-ipmsi-tunnel {
        description "I-PMSI tunnel configuraton";
        leaf tunnel-mode {
          type enumeration {
            enum invalid {
              value "0";
              description "invalid";
            }
            enum p2mp-te {
              value "1";
              description "p2mp-te";
            }
            enum p2mp-mldp {
              value "2";
              description "p2mp-mldp";
            }
            enum pim-ssm {
              value "3";
```

```
                description "pim-ssm";
```

```
            }
            enum pim-sm {
              value "4";
              description "pim-sm";
            }
            enum bidir-pim {
              value "5";
              description "bidir-pim";
            }
            enum ingress-replication {
              value "6";
              description "ingress-replication";
            }
            enum mp2mp-mldp {
              value "7";
              description "mp2mp-mldp";
            }
            enum pim-dm {
              value "8";
              description "pim-dm";
            }
          }
          description "I-PMSI tunnel mode.";
        }
        choice ipmsi-type {
          description "I-PMSI tunnel parameter configuration";
          case p2mp-te {
            description "P2mp TE tunnel";
            leaf te-p2mp-template {
              type string {
                length "1..31";
              }
              description "P2mp te tunnel template";
            }
          }
          case p2mp-mldp {
            description "Mldp tunnel";
          }
          case pim-ssm {
            description "Pim ssm tunnel";
            leaf ssm-default-group-addr {
              type inet:ip-address;
              description "Default mdt or I-PMSI group address.";
            }
          }
          case pim-sm {
            description "Pim sm tunnel";
            leaf sm-default-group-addr {
```

```
                type inet:ip-address;
```

```
            description "Default mdt or I-PMSI group address.";
          }
        }
        case bidir-pim {
          description "Bidir pim tunnel";
          leaf bidir-default-group-addr {
            type inet:ip-address;
            description "Default mdt or I-PMSI group address.";
          }
        }
        case pim-dm {
          description "Pim dm tunnel";
          leaf dm-default-group-addr {
            type inet:ip-address;
            description "Default mdt or I-PMSI group address.";
          }
        }
        case ingress-replication {
          description "Ingress replication p2p tunnel";
        }
        case mp2mp-mldp {
          description "Mp2mp mldp tunnel";
        }
      }
    }
  }

  grouping mvpn-spmsi-tunnel-basic-config {
    description "S-PMSI tunnel basic configuration";
    leaf tunnel-mode {
      type enumeration {
        enum invalid {
          value "0";
          description "invalid";
        }
        enum p2mp-te {
          value "1";
          description "p2mp-te";
        }
        enum p2mp-mldp {
          value "2";
          description "p2mp-mldp";
        }
        enum pim-ssm {
          value "3";
          description "pim-ssm";
        }
        enum pim-sm {
```

```
            value "4";
```

```
            description "pim-sm";
          }
          enum bidir-pim {
            value "5";
            description "bidir-pim";
          }
          enum ingress-replication {
            value "6";
            description "ingress-replication";
          }
          enum mp2mp-mldp {
            value "7";
            description "mp2mp-mldp";
          }
          enum pim-dm {
            value "8";
            description "pim-dm";
          }
        }
        description "S-PMSI tunnel mode.";
      }
      choice spmsi-type {
        description "S-PMSI tunnel parameter configuration";
        case p2mp-te {
          description "P2mp te tunnel";
          leaf te-p2mp-template {
            type string {
              length "1..31";
            }
            description "P2mp te tunnel template";
          }
        }
        case p2mp-mldp {
          description "Mldp tunnel";
        }
        case pim-ssm {
          description "Pim ssm tunnel";
          leaf ssm-group-pool-addr {
            type inet:ip-address;
            description "Group pool address for data mdt or pim s-pmsi.";
          }
          leaf ssm-group-pool-masklength {
            type uint8 {
              range "8..128";
            }
            description "Group pool mask for data mdt or pim s-pmsi";
          }
        }
```

```
          case pim-sm {
```

```
            description "Pim sm tunnel";
            leaf sm-group-pool-addr {
              type inet:ip-address;
              description "Group pool address for data mdt or pim s-pmsi.";
            }
            leaf sm-group-pool-masklength {
              type uint8 {
                range "8..128";
              }
              description "Group pool mask for data mdt or pim s-pmsi";
            }
          }
          case bidir-pim {
            description "Bidir pim tunnel";
            leaf bidir-group-pool-addr {
              type inet:ip-address;
              description "Group pool address for data mdt or pim s-pmsi.";
            }
            leaf bidir-group-pool-masklength {
              type uint8 {
                range "8..128";
              }
              description "Group pool mask for data mdt or pim s-pmsi";
            }
          }
          case pim-dm {
            description "Pim dm tunnel";
            leaf dm-group-pool-addr {
              type inet:ip-address;
              description "Group pool address for data mdt or pim s-pmsi.";
            }
            leaf dm-group-pool-masklength {
              type uint8 {
                range "8..128";
              }
              description "Group pool mask for data mdt or pim s-pmsi";
            }
          }
          case ingress-replication {
            description "Ingress replication p2p tunnel";
          }
          case mp2mp-mldp {
            description "Mp2mp mldp tunnel";
          }
        }
        leaf switch-threshold {
          type uint32 {
            range "0..4194304";
```

```
          }
```

```
          default "0";
          description
            "Multicast packet rate threshold for
             triggering the switching from the
             I-PMSI to the S-PMSI. The value is
             an integer ranging from 0 to 4194304, in
             kbit/s. The default value is 0.";
        }
      }

      grouping mvpn-spmsi-tunnel-config-ipv4 {
        description "Data mdt for rosen mvpn and S-PMSI for ng mvpn";

        container mvpn-spmsi-tunnels {
          description "S-PMSI tunnel configuration";
          leaf switch-delay-time {
            type uint8 {
              range "3..60";
            }
            default "5";
            description
            "Delay for switching from the I-PMSI to
             the S-PMSI. The value is an integer
             ranging from 3 to 60, in seconds. ";
          }
          leaf hold-down-time {
            type uint16 {
              range "0..512";
            }
            default "60";
            description
              "Delay for switching back from the S-PMSI
               to the I-PMSI. The value is an integer
               ranging from 0 to 512, in seconds. ";
          }
          leaf tunnel-limit {
            type uint16 {
              range "1..1024";
            }
            description
              "Maximum number of s-pmsi tunnels allowed.";
          }

          list mvpn-spmsi-tunnel {
            key "tunnel-mode";
            description "S-PMSI tunnel parameter configuration";

            uses mvpn-spmsi-tunnel-basic-config;
```

```
            choice address-mask-or-acl {
              description "Type of define private net multicast address range";
              case address-mask {
                description "Use the type of address and mask";
                leaf ipv4-group-addr {
                  type inet:ipv4-address;
                  description
                    "Start and end ipv4 addresses of the group
                     address in private net. ";
                }
                leaf ipv4-group-masklength {
                  type uint8 {
                    range "4..32";
                  }
                  description
                    "Group mask length for ipv4 addresses in
                     the group address pool in private net.";
                }
                leaf ipv4-source-addr {
                  type inet:ipv4-address;
                  description
                    "Start and end ipv4 addresses of the source
                     address in private net.";
                }
                leaf ipv4-source-masklength {
                  type uint8 {
                    range "0..32";
                  }
                  description
                    "Source mask length for ipv4 addresses in
                     the group address pool in private net.";
                }
              }
              case acl {
                description "Use the type of acl";
                leaf group-acl-ipv4 {
                  type string {
                    length "1..32";
                  }
                  description
                    "Specify the (s, g) entry on which the
                     S-PMSI tunnel takes effect.
                     The value is an integer ranging from 3000
                     to 3999 or a string of 32 case-sensitive
                     characters. If no value is specified, the
                     switch-group address pool takes effect on
                     all (s, g).";
                }
```

```
            }
```

```
          }
        }
      }
    }

    grouping mvpn-spmsi-tunnel-config-ipv6 {
      description "Data mdt for rosen mvpn and S-PMSI for ng mvpn";

      container mvpn-spmsi-tunnels {
        description "S-PMSI tunnel configuration";
        leaf switch-delay-time {
          type uint8 {
            range "3..60";
          }
          default "5";
          description
          "Delay for switching from the I-PMSI to
           the S-PMSI. The value is an integer
           ranging from 3 to 60, in seconds. ";
        }
        leaf hold-down-time {
          type uint16 {
            range "0..512";
          }
          default "60";
          description
            "Delay for switching back from the S-PMSI
             to the I-PMSI. The value is an integer
             ranging from 0 to 512, in seconds. ";
        }
        leaf tunnel-limit {
          type uint16 {
            range "1..1024";
          }
          description
            "Maximum number of s-pmsi tunnels allowed.";
        }

        list mvpn-spmsi-tunnel {
          key "tunnel-mode";
          description "S-PMSI tunnel parameter configuration";

          uses mvpn-spmsi-tunnel-basic-config;

          choice address-mask-or-acl {
            description "Type of define private net multicast address range";
            case address-mask {
              description "Use the type of address and mask";
```

```
                leaf ipv6-group-addr {
```

```
                type inet:ipv6-address;
                description
                  "Start and end ipv6 addresses of the group
                   address in private net.";
              }
              leaf ipv6-groupmasklength {
                type uint8 {
                  range "8..128";
                }
                description
                  "Group mask length for ipv6 addresses in
                   the group address pool in private net.";
              }
              leaf ipv6-source-addr {
                type inet:ipv6-address;
                description
                  "Start and end ipv6 addresses of the source
                   address in private net.";
              }
              leaf ipv6-source-masklength {
                type uint8 {
                  range "0..128";
                }
                description
                  "Source mask length for ipv6 addresses in
                   the group address pool in private net.";
              }
            }
            case acl {
              description "Use the type of acl";
              leaf group-acl-ipv6 {
                type string {
                  length "1..32";
                }
                description
                  "Specify the (s, g) entry on which the
                   S-PMSI tunnel takes effect.
                   The value is an integer ranging from 3000
                   to 3999 or a string of 32 case-sensitive
                   characters. If no value is specified, the
                   switch-group address pool takes effect on
                   all (s, g).";
              }
            }
          }
        }
      }
    }
```

```
      grouping mvpn-pmsi-state {
        description "PMSI tunnel operational state information";
        leaf tunnel-mode {
          type enumeration {
            enum invalid {
              value "0";
              description "invalid";
            }
            enum p2mp-te {
              value "1";
              description "p2mp-te";
            }
            enum p2mp-mldp {
              value "2";
              description "p2mp-mldp";
            }
            enum pim-ssm {
              value "3";
              description "pim-ssm";
            }
            enum pim-sm {
              value "4";
              description "pim-sm";
            }
            enum bidir-pim {
              value "5";
              description "bidir-pim";
            }
            enum ingress-replication {
              value "6";
              description "ingress-replication";
            }
            enum mp2mp-mldp {
              value "7";
              description "mp2mp-mldp";
            }
            enum pim-dm {
              value "8";
              description "pim-dm";
            }
          }
          description "PMSI tunnel mode.";
        }
        choice pmsi-type {
          description "PMSI tunnel operational state information for each
type";
          case p2mp-te {
            description "P2mp te tunnel";
```

```
            leaf te-p2mp-id {
              type uint16 {
```

```
            range "0..65535";
          }
          default "0";
          description "P2mp id of the p2mp tunnel.";
        }
        leaf te-tunnel-id {
          type uint16 {
            range "1..65535";
          }
          description "Id of the p2mp tunnel.";
        }
        leaf te-extend-tunnel-id {
          type uint16 {
            range "1..65535";
          }
          description "P2mp extended tunnel interface id.";
        }
      }
      case p2mp-mldp {
        description "P2mp mldp tunnel";
        leaf mldp-root-addr {
          type inet:ip-address;
          description "Ip address of the root of a p2mp ldp lsp.";
        }
        leaf mldp-lsp-id {
          type string {
            length "1..256";
          }
          description "P2mp ldp lsp id.";
        }
      }
      case pim-ssm {
        description "Pim ssm tunnel";
        leaf ssm-group-addr {
          type inet:ip-address;
          description "Group address for pim ssm";
        }
      }
      case pim-sm {
        description "Pim sm tunnel";
        leaf sm-group-addr {
          type inet:ip-address;
          description "Group address for pim sm";
        }
      }
      case bidir-pim {
        description "Bidir pim tunnel";
        leaf bidir-group-addr {
```

```
            type inet:ip-address;
```

```
            description "Group address for bidir-pim";
          }
        }
        case pim-dm {
          description "Pim dm tunnel";
          leaf dm-group-addr {
            type inet:ip-address;
            description "Group address for pim-dm";
          }
        }
        case ingress-replication {
          description "Ingress replication p2p tunnel";
        }
        case mp2mp-mldp {
          description "mp2mp mldp tunnel";
        }
      }
      leaf tunnel-role {
        type enumeration {
          enum none {
            value "0";
            description "none";
          }
          enum root {
            value "1";
            description "root";
          }
          enum leaf {
            value "2";
            description "leaf";
          }
          enum root-and-leaf {
            value "3";
            description "root-and-leaf";
          }
        }
        description "Role of a tunnel node.";
      }
    }

    grouping mvpn-pmsi-entry-ipv4 {
      description "Multicast entries in ipv4 mvpn referenced the pmsi
tunnel";
      container mvpn-pmsi-sg-ref-ipv4s {
        description "Multicast entries in ipv4 mvpn referenced the pmsi
tunnel";
        list mvpn-pmsi-sg-ref-ipv4 {
          key "ipv4-source-address ipv4-group-address";
```

```
            description "Ipv4 source and group address";
            leaf ipv4-source-address {
              type inet:ipv4-address;
```

```
            description "Source address in I-PMSI or S-PMSI for ipv4.";
          }
          leaf ipv4-group-address {
            type inet:ipv4-address;
            description "Group address in I-PMSI or S-PMSI for ipv4.";
          }
        }
      }
    }


    grouping mvpn-pmsi-entry-ipv6 {
      description "Multicast entries in ipv6 mvpn referenced the pmsi
tunnel";
      container mvpn-pmsi-sg-ref-ipv6s {
        description "Multicast entries in ipv6 mvpn referenced the pmsi
tunnel";
        list mvpn-pmsi-sg-ref-ipv6 {
          key "ipv6-source-address ipv6-group-address";
          description "Ipv6 source and group address";
          leaf ipv6-source-address {
            type inet:ipv6-address;
            description "Source address in I-PMSI or S-PMSI for ipv6.";
          }
          leaf ipv6-group-address {
            type inet:ipv6-address;
            description "Group address in I-PMSI or S-PMSI for ipv6.";
          }
        }
      }
    }

    grouping mvpn-ipmsi-tunnel-state-ipv4 {
      description "Default mdt or I-PMSI operational state information";
      container mvpn-ipmsi-tunnel-info {
        description "Default mdt or I-PMSI operational state information";
        uses mvpn-pmsi-state;
        uses mvpn-pmsi-entry-ipv4;
      }
    }

    grouping mvpn-ipmsi-tunnel-state-ipv6 {
      description "Default mdt or I-PMSI operational state information";
      container mvpn-ipmsi-tunnel-info {
        description "Default mdt or I-PMSI operational state information";
        uses mvpn-pmsi-state;
        uses mvpn-pmsi-entry-ipv6;
      }
```

```
      }

      grouping mvpn-spmsi-tunnel-state-ipv4 {
```

```
        description "Data mdt or S-PMSI operational state information";
        container mvpn-spmsi-tunnel-ipv4-infos {
          description "Data mdt or S-PMSI operational state information";
          list mvpn-spmsi-tunnel-ipv4-info {
            key "tunnel-mode";
            description "Data mdt or S-PMSI operational state information";
            uses mvpn-pmsi-state;
            uses mvpn-pmsi-entry-ipv4;
          }
        }
      }

      grouping mvpn-spmsi-tunnel-state-ipv6 {
        description "Data mdt or S-PMSI operational state information";
        container mvpn-spmsi-tunnel-ipv6-infos {
          description "Data mdt or S-PMSI operational state information";
          list mvpn-spmsi-tunnel-ipv6-info {
            key "tunnel-mode";
            description "Data mdt or S-PMSI operational state information";
            uses mvpn-pmsi-state;
            uses mvpn-pmsi-entry-ipv6;
          }
        }
      }

      grouping l3vpn-mvrf-params-config {
        description "Specify multicast vrf parameters";
        container ipv4 {
          description "Specify multicast ipv4 vrf parameters";
            container mvpn {
              description "Specify multicast ipv4 vrf parameters";
              uses mvpn-instance-config;
              uses mvpn-vpn-targets;
              uses mvpn-ipmsi-tunnel-config;
              uses mvpn-spmsi-tunnel-config-ipv4;
            }
          }
        container ipv6 {
          description "Ipv6 address family specific multicast vrf parameters";
            container mvpn {
              description "Ipv6 address family specific multicast vrf
parameters";
              uses mvpn-instance-config;
              uses mvpn-vpn-targets;
              uses mvpn-ipmsi-tunnel-config;
              uses mvpn-spmsi-tunnel-config-ipv6;
           }
        }
```

```
      }
```

```
      augment "/rt:routing/rt:routing-instance" {
        description "Augment routing instance container for per multicast VRF
config";
        container l3vpn {
          when "../type='rt:vrf-routing-instance'" {
            description "This container is only valid for multicast vrf routing
instance";
          }
          description "Configuration of multicast vpn specific parameters";

          uses l3vpn-mvrf-params-config;
        }
      }


      grouping l3vpn-mvrf-params-state {
        description "Multicast vrf operational state information";
        container ipv4 {
          description "Multicast ipv4 vrf operational state information";
            container mvpn {
              description "Multicast ipv4 vrf operational state information";
              uses mvpn-instance-config;
              uses mvpn-vpn-targets;
              uses mvpn-ipmsi-tunnel-config;
              uses mvpn-spmsi-tunnel-config-ipv4;
              uses mvpn-ipmsi-tunnel-state-ipv4;
              uses mvpn-spmsi-tunnel-state-ipv4;
            }
          }
        container ipv6 {
          description "Ipv6 address family multicast vrf operational state
information";
            container mvpn {
              description "Ipv6 address family multicast vrf operational state
information";
              uses mvpn-instance-config;
              uses mvpn-vpn-targets;
              uses mvpn-ipmsi-tunnel-config;
              uses mvpn-spmsi-tunnel-config-ipv6;
              uses mvpn-ipmsi-tunnel-state-ipv6;
              uses mvpn-spmsi-tunnel-state-ipv6;
           }
        }
      }


      augment "/rt:routing-state/rt:routing-instance" {
```

```
        description "Augment routing instance container for per multicast VRF
config";
        container l3vpn {
          when "../type='rt:vrf-routing-instance'" {
            description "This container is only valid for multicast vrf routing
instance";
          }
```

```
          description "Operational state of multicast vpn specific parameters";

          uses l3vpn-mvrf-params-state;
        }
      }
    }
```

5. Security Considerations

The data model defined does not introduce any security implications. This draft does not change any underlying security issues inherent in [I-D.ietf-netmod-routing-cfg].

6. IANA Considerations

TBD

7. References

7.1. Normative References

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

[RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, October 2010

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, June 2011

[I-D.ietf-netmod-rfc6087bis] Bierman, A., "Guidelines for Authors and Reviewers of YANG Data Model Documents", draft-ietf-netmod-rfc6087bis-05 (work in progress), October 2015.

7.2. Informative References

[RFC6037] Rosen, E., Cai, Y., and IJ. Wijnands, "Cisco Systems' Solution for Multicast in BGP/MPLS IP VPNs", RFC 6037, October 2010.

[RFC6513] Rosen, E. and R. Aggarwal, "Multicast in MPLS/BGP IP VPNs", RFC 6513, February 2012.

[RFC6514] Aggarwal, R., Rosen, E., Morin, T., and Y. Rekhter, "BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs", RFC 6514, February 2012.

8. Acknowledgments

The authors would like to thank Liu Xufeng, Guo Feng, Robert Kebler, Anish Peter, Mahesh Sivakumar, and Stig Venaas for their valuable contributions.

Authors' Addresses

Yisong Liu
Huawei Technologies
Huawei Bld., No.156 Beiqing Rd.
Beijing 100095
China

Email: liuyisong@huawei.com

Xufeng Liu
Ericsson
1595 Spring Hill Road, Suite 500
Vienna VA 22182
USA

Email: xliu@kuatrotech.com

Robert Kebler
Juniper Networks

Email: rkebler@juniper.net

Mahesh Sivakumar
Cisco Systems, Inc
510 McCarthy Blvd
Milpitas, California 95035
United States

Email: masivaku@cisco.com

Feng Guo
Huawei Technologies
Huawei Bld., No.156 Beiqing Rd.
Beijing 100095
China

Email: guofeng@huawei.com