

MPLS Working Group
Internet-Draft
Intended status: Standards Track
Expires: September 13, 2017

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A YANG Data Model for MPLS Base
draft-ietf-mpls-base-yang-04

Abstract

This document contains a specification of the the MPLS base YANG model. The MPLS base YANG module serves as a base framework for configuring and managing an MPLS switching subsystem. It is expected that other MPLS technology YANG models (e.g. MPLS LSP Static, LDP or RSVP-TE models) will augment the MPLS base YANG model.

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This Internet-Draft will expire on September 13, 2017.

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MPLS Base YANG Data Model

March 2017

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[1.](#) Introduction

A core routing data model is defined in [[RFC8022](#)], and it provides a basis for the development of data models for routing protocols. The MPLS base model augments this model with additional data specific to MPLS switching [[RFC3031](#)]. The interface data model is defined in [[RFC7223](#)] and is used for referencing interface from the MPLS base model.

The MPLS base YANG module augments the "routing" read-write (rw) and "routing-state" read-only (ro) branches of the ietf-routing module defined in [[RFC8022](#)]. The approach described in [[I-D.openconfig-netmod-opstate](#)] is adopted to represent data pertaining to configuration intended, applied state and derived state

data elements. Each container in the model holds a "config" and "state" sub-container. The "config" sub-container contains the intended configuration data, and the state sub-container contains both the applied configuration and any derived state, such as counters or statistical information.

This document defines the specification for the "ietf-mpls" YANG module that provides base components of the MPLS data model. It is expected that other MPLS YANG modules will augment the "ietf-mpls" base model to define data models for other MPLS technologies (e.g. MPLS LDP or MPLS RSVP-TE).

This document also defines a way to model MPLS labelled routes as an augmentation of the the routing RIB model defined in [[RFC8022](#)] for IP prefix routes that are MPLS labelled. Other MPLS non-IP prefix routes are also modelled by introducing a new "mpls" address-family RIB.

[1.1](#). Terminology

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 [BCP 14](#), [RFC 2119](#) [RFC2119](#)}}.

[1.1.1](#). Keywords

The following terms are defined in [[RFC6020](#)]:

- o augment,
- o configuration data,
- o data model,
- o data node,
- o feature,
- o mandatory node,
- o module,

- o schema tree,
- o state data,
- o RPC operation.

1.2. MPLS Base Tree Diagram

The MPLS base tree diagram is shown in Figure 1.

module: ietf-mpls

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```

augment /rt:routing:
  +--rw mpls
    +--rw config
      |  +--rw ttl-propagate?  boolean
    +--ro state
      |  +--ro ttl-propagate?  boolean
    +--rw label-blocks
      |  +--rw label-block* [index]
      |    +--rw index          -> ../config/index
      |    +--rw start-label?   -> ../config/start-label
      |    +--rw end-label?     -> ../config/end-label
      |    +--rw config
      |      |  +--rw index?          string
      |      |  +--rw start-label?    rt-types:mpls-label
      |      |  +--rw end-label?      rt-types:mpls-label
      |      |  +--rw block-allocation-mode? identityref
      |      +--ro state
      |        +--ro index?          string
      |        +--ro start-label?    rt-types:mpls-label
      |        +--ro end-label?      rt-types:mpls-label
      |        +--ro block-allocation-mode? identityref
      |        +--ro free-labels-count? uint32
      |        +--ro inuse-labels-count? uint32
    +--rw interface* [name]
      +--rw name          if:interface-ref
      +--rw config
        |  +--rw enabled?    boolean
        |  +--rw mtu?        uint32
      +--ro state
  
```

```

        +---ro enabled?    boolean
        +---ro mtu?       uint32
augment
  /rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route:
    +---ro local-label?  rt-types:mpls-label
augment
  /rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route/rt:next-hop/
  rt:next-hop-options/rt:simple-next-hop:
    +---ro remote-labels*  rt-types:mpls-label
augment
  /rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route/rt:next-hop/
  rt:next-hop-options/rt:next-hop-list/rt:next-hop-list/rt:next-hop:
    +---ro index?          string
    +---ro backup-index?   string
    +---ro loadshare?      uint16
    +---ro role?           nhlfe-role
    +---ro remote-labels*  rt-types:mpls-label
augment /rt:routing-state/rt:ribs/rt:rib/rt:active-route/rt:input:
  +---- index?            string

```

```

+---- backup-index?    string
+---- loadshare?      uint16
+---- role?           nhlfe-role
+---- remote-labels*  rt-types:mpls-label
augment
  /rt:routing-state/rt:ribs/rt:rib/rt:active-route/rt:output/rt:route:
+---- index?          string
+---- backup-index?   string
+---- loadshare?      uint16
+---- role?           nhlfe-role
+---- remote-labels*  rt-types:mpls-label

```

Figure 1: MPLS Base tree diagram

[1.3.](#) MPLS Base Module

```

<CODE BEGINS>file "ietf-mpls@2017-03-11.yang"
module ietf-mpls {

  namespace "urn:ietf:params:xml:ns:yang:ietf-mpls";

```

```
prefix "mpls";

import ietf-routing {
  prefix "rt";
}

import ietf-interfaces {
  prefix "if";
}

import ietf-routing-types {
  prefix "rt-types";
}

organization "IETF MPLS Working Group";

contact
  "WG Web: <http://tools.ietf.org/wg/mpls/>

  WG List: <mailto:mpls@ietf.org>

  WG Chair: Loa Andersson
            <mailto:loa@pi.nu>

  WG Chair: Ross Callon
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```

```
description
```

```
"This YANG module defines the essential components for the
management of the MPLS subsystem.";
```

```
revision "2017-03-11" {
```

```
  description
```

```
    "Latest revision:
```

```
      - Addressed MPLS-RT review comments";
```

```
  reference "RFC 3031: A YANG Data Model for base MPLS";
```

```
}
```

```
/* Identities */
```

```
identity mpls {
  base rt:address-family;
  description
    "This identity represents the MPLS address family.";
}

identity label-block-alloc-mode {
  description
```

```

    "Base identity label-block allocation mode";
}

identity label-block-alloc-mode-manager {
    base label-block-alloc-mode;
    description
        "Label block allocation on reserved block
        is managed by label manager";
}

identity label-block-alloc-mode-application {
    base label-block-alloc-mode;
    description
        "Label block allocation on reserved block
        is managed by application";
}

typedef nhlfe-role {
    type enumeration {
        enum PRIMARY {
            description
                "Next-hop acts as primary traffic carrying";
        }
        enum BACKUP {
            description
                "Next-hop acts as backup";
        }
        enum PRIMARY_AND_BACKUP {
            description
                "Next-hop acts as primary and backup simultaneously";
        }
    }
    description "The next-hop role";
}

grouping nhlfe-simple-contents {
    description
        "MPLS simple NHLFE contents";
    leaf-list remote-labels {
        type rt-types:mpls-label;
    }
}

```

```

description "The MPLS label stack";

```



```

    }
}

grouping nhlfe-contents {
    description
        "MPLS NHLFE contents";
    leaf index {
        type string;
        description
            "A user-specified identifier utilised to uniquely
            reference the next-hop entry in the next-hop list.
            The value of this index has no semantic meaning
            other than for referencing the entry.";
    }

    leaf backup-index {
        type string;
        description
            "A user-specified identifier utilised to uniquely
            reference the backup next-hop entry in the NHLFE list.
            The value of this index has no semantic meaning
            other than for referencing the entry.";
    }

    leaf loadshare {
        type uint16;
        description
            "This value is used to compute a loadshare to perform un-equal
            load balancing when multiple outgoing next-hop(s) are
            specified. A share is computed as a ratio of this number to the
            total under all next-hops(s).";
    }

    leaf role {
        type nhlfe-role;
        description "NHLFE role";
    }
    uses nhlfe-simple-contents;
}

grouping interface-mpls_config {
    description "MPLS interface contents grouping";
    leaf enabled {
        type boolean;
        description
            "'true' if mpls encapsulation is enabled on the
            interface. 'false' if mpls encapsulation is enabled

```

```
        on the interface.";
    }
    leaf mtu {
        type uint32;
        description
            "MPLS Maximum Transmission Unit (MTU)";
    }
}

grouping interfaces-mpls {
    description "List of MPLS interfaces";
    list interface {
        key "name";
        description "List of MPLS interfaces";
        leaf name {
            type if:interface-ref;
            description
                "The name of a configured MPLS interface";
        }
        container config {
            description "Holds intended configuration";
            uses interface-mpls_config;
        }
        container state {
            config false;
            description "Holds inuse configuration";
            uses interface-mpls_config;
        }
    }
}

grouping label-block_config {
    description "Label-block configuration items";
    leaf index {
        type string;
        description
            "A user-specified identifier utilised to uniquely
            reference the next-hop entry in the next-hop list.
            The value of this index has no semantic meaning
            other than for referencing the entry.";
    }
    leaf start-label {
        type rt-types:mpls-label;
        description "Label-block start";
    }
    leaf end-label {
```

```
type rt-types:mpls-label;  
description "Label-block end";
```

```
    }  
    leaf block-allocation-mode {  
      type identityref {  
        base label-block-alloc-mode;  
      }  
      description "Label-block allocation mode";  
    }  
  }  
}  
  
grouping label-block_state {  
  description "Label-block state items";  
  leaf free-labels-count {  
    when  
      "../block-allocation-mode = 'label-block-alloc-mode-manager'";  
    type uint32;  
    description "Label-block free labels count";  
  }  
  leaf inuse-labels-count {  
    when  
      "../block-allocation-mode = 'label-block-alloc-mode-manager'";  
    type uint32;  
    description "Label-block inuse labels count";  
  }  
}  
  
grouping globals_config {  
  description "MPLS global configuration leafs grouping";  
  leaf ttl-propagate {  
    type boolean;  
    default 'true';  
    description "Propagate TTL between IP and MPLS";  
  }  
}  
  
grouping globals {  
  description "MPLS global configuration grouping";  
  container config {  
    description "Holds intended configuration";  
    uses globals_config;  
  }  
}
```

```

    }
    container state {
        config false;
        description "Holds inuse configuration";
        uses globals_config;
    }
}
grouping label-blocks {
    description "Label-block allocation grouping";

```

```

container label-blocks {
    description "Label-block allocation container";
    list label-block {
        must "start-label >= end-label" {
            error-message "start-label can not be less than end-label";
        }
        key index;
        unique "start-label end-label";
        leaf index {
            type leafref {
                path "../config/index";
            }
            description "Label-block index";
        }
        leaf start-label {
            type leafref {
                path "../config/start-label";
            }
            description
                "Label-block start label reference";
        }
        leaf end-label {
            type leafref {
                path "../config/end-label";
            }
            description
                "Label-block end label reference";
        }
    }
    description "List of MPLS label-blocks";
    container config {
        description "Holds intended configuration";
        uses label-block_config;
    }
}

```

```

    }
    container state {
        config false;
        description "Holds inuse configuration";
        uses label-block_config;
        uses label-block_state;
    }
}
}
}

augment "/rt:routing" {
    description "MPLS augmentation.";
    container mpls {
        description
            "MPLS container, to be used as an augmentation target node

```

```

        other MPLS sub-features config, e.g. MPLS static LSP, MPLS
        LDP LSPs, and Traffic Engineering MPLS LSP Tunnels, etc.";
        uses globals;
        uses label-blocks;
        uses interfaces-mpls;
    }
}

/* State data */
augment "/rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route" {
    description
        "This leaf augments an IPv4 unicast route.";
    leaf local-label {
        type rt-types:mpls-label;
        description
            "MPLS local label.";
    }
}

augment "/rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route/"
    + "rt:next-hop/rt:next-hop-options/rt:simple-next-hop" {
    description
        "Augment 'simple-next-hop' case in IPv4 unicast routes.";
    uses nhlfe-simple-contents;
}

```

```

augment "/rt:routing-state/rt:ribs/rt:rib/rt:routes/rt:route/"
  + "rt:next-hop/rt:next-hop-options/rt:next-hop-list/"
  + "rt:next-hop-list/rt:next-hop" {
  description
    "This leaf augments the 'next-hop-list' case of IPv4 unicast
    routes.";
  uses nhlfe-contents;
}

augment
  "/rt:routing-state/rt:ribs/rt:rib/rt:active-route/rt:input" {
  description
    "This augment adds the input parameter of the 'active-route'
    action.";
  uses nhlfe-contents;
}

augment "/rt:routing-state/rt:ribs/rt:rib/rt:active-route/"
  + "rt:output/rt:route" {
  description
    "This augment adds the destination prefix to the reply of the
    'active-route' action.";
}

```

```

  uses nhlfe-contents;
}
}
<CODE ENDS>

```

Figure 2: MPLS base YANG module

2. IANA Considerations

This document registers the following URIs in the IETF XML registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registration is requested to be made.

URI: urn:ietf:params:xml:ns:yang:ietf-mpls XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the YANG Module Names registry [[RFC6020](#)].

name: ietf-mpls namespace: urn:ietf:params:xml:ns:yang:ietf-mpls
prefix: ietf-mpls reference: [RFC3031](#)

3. Security Considerations

The YANG module defined in this document is designed to be accessed via the NETCONF protocol [[RFC6241](#)]. The lowest NETCONF layer is the secure transport layer and the mandatory-to-implement secure transport is SSH [[RFC6242](#)]. The NETCONF access control model [[RFC6536](#)] provides means to restrict access for particular NETCONF users to a pre-configured subset of all available NETCONF protocol operations and content.

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

4. References

4.1. Normative References

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[4.2.](#) Informative References

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