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A YANG Data Model for RSVP-TE
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Abstract

This document defines a YANG data model for the configuration and management of RSVP (Resource Reservation Protocol) to establish Traffic-Engineered (TE) Label-Switched Paths (LSPs) for MPLS (Multi-Protocol Label Switching) and other technologies.

The model defines a generic RSVP-TE module for signaling LSPs that is technology agnostic. The generic RSVP-TE module is to be augmented by technology specific RSVP-TE modules that define technology specific data. This document defines the augmentation for RSVP-TE MPLS LSPs model.

This model covers data for the configuration, operational state, remote procedural calls, and event notifications.

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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 interfaces, such as CLI and programmatic APIs.

This document defines a generic YANG data model for configuring and managing RSVP-TE LSP(s) [RFC3209]. The RSVP-TE generic model augments the RSVP base and extended models defined in [I-D.ietf-teas-yang-rsvp], and adds TE extensions to the RSVP protocol [RFC2205] model configuration and state data. The technology specific RSVP-TE models augment the generic RSVP-TE model with additional technology specific parameters. For example, this document also defines the MPLS RSVP-TE model for configuring and managing MPLS RSVP TE LSP(s).

In addition to augmenting the RSVP YANG module, the modules defined in this document augment the TE Interfaces, Tunnels and LSP(s) YANG module defined in [I-D.ietf-teas-yang-te] to define additional parameters to enable signaling for RSVP-TE.

1.1. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in BCP 14, RFC 2119 [RFC2119].

1.2. Tree Diagram

A simplified graphical representation of the data model is presented in each section of the model. The following notations are used for the YANG model data tree representation.

```
<status> <flags> <name> <opts> <type>

 <status> is one of:
   +  for current
   x  for deprecated
   o  for obsolete

 <flags> is one of:
   rw  for read-write configuration data
   ro  for read-only non-configuration data
   -x  for execution rpcs
   -n  for notifications

 <name> is the name of the node

If the node is augmented into the tree from another module, its name
is printed as <prefix>:<name>

 <opts> is one of:
   ? for an optional leaf or node
   ! for a presence container
   * for a leaf-list or list
   Brackets [<keys>] for a list's keys
   Curly braces {<condition>} for optional feature that make node
conditional
   Colon : for marking case nodes
   Ellipses ("...") subtree contents not shown

   Parentheses enclose choice and case nodes, and case nodes are also
   marked with a colon (":").

 <type> is the name of the type for leafs and leaf-lists.
```

1.3. Prefixes in Data Node Names

In this document, names of data nodes and other data model objects are prefixed using the standard prefix associated with the corresponding YANG imported modules, as shown in Table 1.

Prefix	YANG module	Reference
yang	ietf-yang-types	[RFC6991]
inet	ietf-inet-types	[RFC6991]
te	ietf-te	this document
te-types	ietf-te-types	this document
te-mpls-types	ietf-te-mpls-types	this document
te-dev	ietf-te-device	this document
te-mpls	ietf-te-mpls	this document
te-sr-mpls	ietf-te-sr-mpls	this document

Table 1: Prefixes and corresponding YANG modules

2. Design Considerations

2.1. Module Hierarchy

The data pertaining to RSVP-TE in this document is divided into two modules: a technology agnostic RSVP-TE module that holds generic parameters for RSVP-TE applicable to all technologies, and a technology specific RSVP-TE module (e.g. for MPLS RSVP-TE) that holds parameters specific to the technology.

This document defines YANG data models for RSVP-TE, and RSVP-TE MPLS configuration, state, notification and RPCs. The relationship between the different modules is depicted in Figure 1.

```
     TE basic       +---------+        ^: import
     module         | ietf-te |        o: augment
                    +---------+
                       |   o
                       |   |
                       v   |
                    +--------------+
     RSVP-TE module | ietf-rsvp-te |o . . .
                    +--------------+         \
                       ^   |                  \
                       |   o               +--------------------+
                    +-----------+          | ietf-rsvp-otn-te  |
     RSVP module    | ietf-rsvp |          +--------------------+
                    +-----------+             RSVP-TE with OTN
                         o                    extensions
                         |                   (shown for illustration
     RSVP extended       |                    not in this document)
       module       +--------------------+
                    | ietf-rsvp-extended |
                    +--------------------+
```

Figure 1: Relationship of RSVP and RSVP-TE modules with other protocol modules

2.2. RSVP-TE Generic Model

The RSVP-TE generic module augments the RSVP base and extended YANG modules defined in [I-D.ietf-teas-yang-rsvp] as well as the TE tunnels and interfaces module [I-D.ietf-teas-yang-te] to cover parameters specific to the configuration and management of RSVP-TE interfaces, tunnels and LSP(s).

2.2.1. Tree Diagram

There are three types of configuration and state data nodes in this module:

o those augmenting or extending the base RSVP module

o those augmenting or extending the base TE module

o those that are specific to the RSVP-TE module

Below is a YANG tree representation for data items defined in the RSVP-TE generic module:

```
module: ietf-rsvp-te
  augment
```

```
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:globals:
  +--rw global-soft-preemption!
     +--rw soft-preemption-timeout?   uint16
augment
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:interfaces:
  +--rw rsvp-te-interface-attributes
     +--ro state
augment
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:interfaces/rsvp:interface:
  +--rw rsvp-te-interface-attributes
     +--ro state
augment
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:globals/rsvp:sessions/rsvp:session/rsvp:state/
rsvp:psbs/rsvp:psb:
  +--ro tspec-average-rate?   rt-types:bandwidth-ieee-float32
  +--ro tspec-size?           rt-types:bandwidth-ieee-float32
  +--ro tspec-peak-rate?      rt-types:bandwidth-ieee-float32
  +--ro min-policed-unit?     uint32
  +--ro max-packet-size?      uint32
augment
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:globals/rsvp:sessions/rsvp:session/rsvp:state/
rsvp:rsbs/rsvp:rsb:
  +--ro fspec-average-rate?   rt-types:bandwidth-ieee-float32
  +--ro fspec-size?           rt-types:bandwidth-ieee-float32
  +--ro fspec-peak-rate?      rt-types:bandwidth-ieee-float32
  +--ro min-policed-unit?     uint32
  +--ro max-packet-size?      uint32
augment
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/
rsvp:rsvp/rsvp:neighbors:
augment /te:te/te:tunnels/te:tunnel:
  +--rw lsp-signaled-name?           string
  +--rw local-recording-desired?     boolean
  +--rw se-style-desired?            boolean
  +--rw path-reevaluation-request?   boolean
  +--rw soft-preemption-desired?     boolean
  +--rw lsp-rerouting?               enumeration
  +--rw lsp-integrity-required?      boolean
  +--rw lsp-contiguous?              boolean
  +--rw lsp-stitching-desired?       boolean
  +--rw lsp-preplanned?              boolean
  +--rw lsp-oob-mapping?             boolean
  +--rw retry-timer?                 uint16
```

```
   augment /te:te/te:tunnels/te:tunnel/te:state:
     +--ro lsp-signaled-name?           string
     +--ro local-recording-desired?     boolean
     +--ro se-style-desired?            boolean
     +--ro path-reevaluation-request?   boolean
     +--ro soft-preemption-desired?     boolean
     +--ro lsp-rerouting?               enumeration
     +--ro lsp-integrity-required?      boolean
     +--ro lsp-contiguous?              boolean
     +--ro lsp-stitching-desired?       boolean
     +--ro lsp-preplanned?              boolean
     +--ro lsp-oob-mapping?             boolean
     +--ro retry-timer?                 uint16
   augment /te:te/te:lsps-state/te:lsp:
     +--ro associated-rsvp-session?            ->
     /rt:routing/control-plane-protocols/control-plane-protocol/
     rsvp:rsvp/globals/sessions/session/local-index
     +--ro lsp-signaled-name?                  string
     +--ro local-recording-desired?            boolean
     +--ro se-style-desired?                   boolean
     +--ro path-reevaluation-request?          boolean
     +--ro soft-preemption-desired?            boolean
     +--ro lsp-rerouting?                      enumeration
     +--ro lsp-integrity-required?             boolean
     +--ro lsp-contiguous?                     boolean
     +--ro lsp-stitching-desired?              boolean
     +--ro lsp-preplanned?                     boolean
     +--ro lsp-oob-mapping?                    boolean
     +--ro explicit-route-objects
     |  +--ro incoming-explicit-route-hop* [index]
     |  |  +--ro index    -> ../state/index
     |  |  +--ro state
     |  |     +--ro index?            uint32
     |  |     +--ro (type)?
     |  |        +--:(numbered)
     |  |        |  +--ro numbered-hop
     |  |        |     +--ro address?     te-types:te-tp-id
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        |     +--ro direction?   te-link-direction
     |  |        +--:(as-number)
     |  |        |  +--ro as-number-hop
     |  |        |     +--ro as-number?   binary
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        +--:(unnumbered)
     |  |        |  +--ro unnumbered-hop
     |  |        |     +--ro node-id?      te-types:te-node-id
     |  |        |     +--ro link-tp-id?   te-types:te-tp-id
     |  |        |     +--ro hop-type?     te-hop-type
```

```
     |  |        |     +--ro direction?    te-link-direction
     |  |        +--:(label)
     |  |           +--ro label-hop
     |  |              +--ro te-label
     |  |                 +--ro (technology)?
     |  |                 |  +--:(generic)
     |  |                 |     +--ro generic?
     rt-types:generalized-label
     |  |                 +--ro direction?   te-label-direction
     |  +--ro outgoing-explicit-route-hop* [index]
     |     +--ro index    -> ../state/index
     |     +--ro state
     |        +--ro index?            uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro numbered-hop
     |           |     +--ro address?     te-types:te-tp-id
     |           |     +--ro hop-type?    te-hop-type
     |           |     +--ro direction?   te-link-direction
     |           +--:(as-number)
     |           |  +--ro as-number-hop
     |           |     +--ro as-number?   binary
     |           |     +--ro hop-type?    te-hop-type
     |           +--:(unnumbered)
     |           |  +--ro unnumbered-hop
     |           |     +--ro node-id?      te-types:te-node-id
     |           |     +--ro link-tp-id?   te-types:te-tp-id
     |           |     +--ro hop-type?     te-hop-type
     |           |     +--ro direction?    te-link-direction
     |           +--:(label)
     |              +--ro label-hop
     |                 +--ro te-label
     |                    +--ro (technology)?
     |                    |  +--:(generic)
     |                    |     +--ro generic?
     rt-types:generalized-label
     |                    +--ro direction?   te-label-direction
     +--ro incoming-record-route-subobjects
     |  +--ro incoming-record-route-subobject* [index]
     |     +--ro index    -> ../state/index
     |     +--ro state
     |        +--ro index?         uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro address?       te-types:te-tp-id
     |           |  +--ro ip-flags?      binary
     |           +--:(unnumbered)
     |           |  +--ro node-id?       te-types:te-node-id
```

```
     |           |  +--ro link-tp-id?    te-types:te-tp-id
     |           +--:(label)
     |              +--ro value?         rt-types:generalized-label
     |              +--ro label-flags?   binary
     +--ro outgoing-record-route-subobjects
        +--ro outgoing-record-route-subobject* [index]
           +--ro index    -> ../state/index
           +--ro state
              +--ro index?         uint32
              +--ro (type)?
                 +--:(numbered)
                 |  +--ro address?       te-types:te-tp-id
                 |  +--ro ip-flags?      binary
                 +--:(unnumbered)
                 |  +--ro node-id?       te-types:te-node-id
                 |  +--ro link-tp-id?    te-types:te-tp-id
                 +--:(label)
                    +--ro value?         rt-types:generalized-label
                    +--ro label-flags?   binary
   augment
   /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/te:p2p-primary-path/
   te:state/te:lsps/te:lsp:
     +--ro associated-rsvp-session?            ->
     /rt:routing/control-plane-protocols/control-plane-protocol/
     rsvp:rsvp/globals/sessions/session/local-index
     +--ro lsp-signaled-name?                  string
     +--ro local-recording-desired?            boolean
     +--ro se-style-desired?                   boolean
     +--ro path-reevaluation-request?          boolean
     +--ro soft-preemption-desired?            boolean
     +--ro lsp-rerouting?                      enumeration
     +--ro lsp-integrity-required?             boolean
     +--ro lsp-contiguous?                     boolean
     +--ro lsp-stitching-desired?              boolean
     +--ro lsp-preplanned?                     boolean
     +--ro lsp-oob-mapping?                    boolean
     +--ro explicit-route-objects
     |  +--ro incoming-explicit-route-hop* [index]
     |  |  +--ro index    -> ../state/index
     |  |  +--ro state
     |  |     +--ro index?            uint32
     |  |     +--ro (type)?
     |  |        +--:(numbered)
     |  |        |  +--ro numbered-hop
     |  |        |     +--ro address?     te-types:te-tp-id
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        |     +--ro direction?   te-link-direction
     |  |        +--:(as-number)
```

```
     |  |        |  +--ro as-number-hop
     |  |        |     +--ro as-number?   binary
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        +--:(unnumbered)
     |  |        |  +--ro unnumbered-hop
     |  |        |     +--ro node-id?      te-types:te-node-id
     |  |        |     +--ro link-tp-id?   te-types:te-tp-id
     |  |        |     +--ro hop-type?     te-hop-type
     |  |        |     +--ro direction?    te-link-direction
     |  |        +--:(label)
     |  |           +--ro label-hop
     |  |              +--ro te-label
     |  |                 +--ro (technology)?
     |  |                 |  +--:(generic)
     |  |                 |     +--ro generic?
     rt-types:generalized-label
     |  |                 +--ro direction?   te-label-direction
     |  +--ro outgoing-explicit-route-hop* [index]
     |     +--ro index    -> ../state/index
     |     +--ro state
     |        +--ro index?            uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro numbered-hop
     |           |     +--ro address?     te-types:te-tp-id
     |           |     +--ro hop-type?    te-hop-type
     |           |     +--ro direction?   te-link-direction
     |           +--:(as-number)
     |           |  +--ro as-number-hop
     |           |     +--ro as-number?   binary
     |           |     +--ro hop-type?    te-hop-type
     |           +--:(unnumbered)
     |           |  +--ro unnumbered-hop
     |           |     +--ro node-id?      te-types:te-node-id
     |           |     +--ro link-tp-id?   te-types:te-tp-id
     |           |     +--ro hop-type?     te-hop-type
     |           |     +--ro direction?    te-link-direction
     |           +--:(label)
     |              +--ro label-hop
     |                 +--ro te-label
     |                    +--ro (technology)?
     |                    |  +--:(generic)
     |                    |     +--ro generic?
     rt-types:generalized-label
     |                    +--ro direction?   te-label-direction
     +--ro incoming-record-route-subobjects
     |  +--ro incoming-record-route-subobject* [index]
     |     +--ro index    -> ../state/index
```

```
     |     +--ro state
     |        +--ro index?         uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro address?       te-types:te-tp-id
     |           |  +--ro ip-flags?      binary
     |           +--:(unnumbered)
     |           |  +--ro node-id?       te-types:te-node-id
     |           |  +--ro link-tp-id?    te-types:te-tp-id
     |           +--:(label)
     |              +--ro value?         rt-types:generalized-label
     |              +--ro label-flags?   binary
     +--ro outgoing-record-route-subobjects
        +--ro outgoing-record-route-subobject* [index]
           +--ro index    -> ../state/index
           +--ro state
              +--ro index?         uint32
              +--ro (type)?
                 +--:(numbered)
                 |  +--ro address?       te-types:te-tp-id
                 |  +--ro ip-flags?      binary
                 +--:(unnumbered)
                 |  +--ro node-id?       te-types:te-node-id
                 |  +--ro link-tp-id?    te-types:te-tp-id
                 +--:(label)
                    +--ro value?         rt-types:generalized-label
                    +--ro label-flags?   binary
   augment
   /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
   te:p2p-secondary-path/te:state/te:lsps/te:lsp:
     +--ro associated-rsvp-session?            ->
     /rt:routing/control-plane-protocols/control-plane-protocol/
     rsvp:rsvp/globals/sessions/session/local-index
     +--ro lsp-signaled-name?                  string
     +--ro local-recording-desired?            boolean
     +--ro se-style-desired?                   boolean
     +--ro path-reevaluation-request?          boolean
     +--ro soft-preemption-desired?            boolean
     +--ro lsp-rerouting?                      enumeration
     +--ro lsp-integrity-required?             boolean
     +--ro lsp-contiguous?                     boolean
     +--ro lsp-stitching-desired?              boolean
     +--ro lsp-preplanned?                     boolean
     +--ro lsp-oob-mapping?                    boolean
     +--ro explicit-route-objects
     |  +--ro incoming-explicit-route-hop* [index]
     |  |  +--ro index    -> ../state/index
     |  |  +--ro state
```

```
     |  |     +--ro index?            uint32
     |  |     +--ro (type)?
     |  |        +--:(numbered)
     |  |        |  +--ro numbered-hop
     |  |        |     +--ro address?     te-types:te-tp-id
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        |     +--ro direction?   te-link-direction
     |  |        +--:(as-number)
     |  |        |  +--ro as-number-hop
     |  |        |     +--ro as-number?   binary
     |  |        |     +--ro hop-type?    te-hop-type
     |  |        +--:(unnumbered)
     |  |        |  +--ro unnumbered-hop
     |  |        |     +--ro node-id?      te-types:te-node-id
     |  |        |     +--ro link-tp-id?   te-types:te-tp-id
     |  |        |     +--ro hop-type?     te-hop-type
     |  |        |     +--ro direction?    te-link-direction
     |  |        +--:(label)
     |  |           +--ro label-hop
     |  |              +--ro te-label
     |  |                 +--ro (technology)?
     |  |                 |  +--:(generic)
     |  |                 |     +--ro generic?
     rt-types:generalized-label
     |  |                 +--ro direction?   te-label-direction
     |  +--ro outgoing-explicit-route-hop* [index]
     |     +--ro index    -> ../state/index
     |     +--ro state
     |        +--ro index?            uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro numbered-hop
     |           |     +--ro address?     te-types:te-tp-id
     |           |     +--ro hop-type?    te-hop-type
     |           |     +--ro direction?   te-link-direction
     |           +--:(as-number)
     |           |  +--ro as-number-hop
     |           |     +--ro as-number?   binary
     |           |     +--ro hop-type?    te-hop-type
     |           +--:(unnumbered)
     |           |  +--ro unnumbered-hop
     |           |     +--ro node-id?      te-types:te-node-id
     |           |     +--ro link-tp-id?   te-types:te-tp-id
     |           |     +--ro hop-type?     te-hop-type
     |           |     +--ro direction?    te-link-direction
     |           +--:(label)
     |              +--ro label-hop
     |                 +--ro te-label
```

```
     |                    +--ro (technology)?
     |                    |  +--:(generic)
     |                    |     +--ro generic?
     rt-types:generalized-label
     |                    +--ro direction?   te-label-direction
     +--ro incoming-record-route-subobjects
     |  +--ro incoming-record-route-subobject* [index]
     |     +--ro index    -> ../state/index
     |     +--ro state
     |        +--ro index?         uint32
     |        +--ro (type)?
     |           +--:(numbered)
     |           |  +--ro address?       te-types:te-tp-id
     |           |  +--ro ip-flags?      binary
     |           +--:(unnumbered)
     |           |  +--ro node-id?       te-types:te-node-id
     |           |  +--ro link-tp-id?    te-types:te-tp-id
     |           +--:(label)
     |              +--ro value?         rt-types:generalized-label
     |              +--ro label-flags?   binary
     +--ro outgoing-record-route-subobjects
        +--ro outgoing-record-route-subobject* [index]
           +--ro index    -> ../state/index
           +--ro state
              +--ro index?         uint32
              +--ro (type)?
                 +--:(numbered)
                 |  +--ro address?       te-types:te-tp-id
                 |  +--ro ip-flags?      binary
                 +--:(unnumbered)
                 |  +--ro node-id?       te-types:te-node-id
                 |  +--ro link-tp-id?    te-types:te-tp-id
                 +--:(label)
                    +--ro value?         rt-types:generalized-label
                    +--ro label-flags?   binary
   augment /te:te/te-dev:interfaces/te-dev:interface:
```

Figure 2: RSVP-TE model Tree diagram

2.2.2. YANG Module

```
   <CODE BEGINS> file "ietf-rsvp-te@2018-02-19.yang"
   module ietf-rsvp-te {

     namespace "urn:ietf:params:xml:ns:yang:ietf-rsvp-te";

     prefix "rsvp-te";
```

```
     import ietf-rsvp {
       prefix rsvp;
     }

     import ietf-routing {
       prefix "rt";
     }

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

     import ietf-te {
       prefix te;
     }

     import ietf-te-device {
       prefix te-dev;
     }

     /* Import TE generic types */
     import ietf-te-types {
       prefix te-types;
     }

     organization
       "IETF Traffic Engineering Architecture and Signaling (TEAS)
        Working Group";

     contact
       "WG Web:   <http://tools.ietf.org/wg/teas/>
        WG List:  <mailto:teas@ietf.org>

        WG Chair: Lou Berger
                  <mailto:lberger@labn.net>

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

        Editor:   Vishnu Pavan Beeram
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        Editor:   Tarek Saad
                  <mailto:tsaad@cisco.com>

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                  <mailto:rgandhi@cisco.com>
```

```
        Editor:   Himanshu Shah
                  <mailto:hshah@ciena.com>

        Editor:   Xufeng Liu
                  <mailto:xliu@kuatrotech.com>

        Editor:   Xia Chen
                  <mailto:jescia.chenxia@huawei.com>

        Editor:   Raqib Jones
                  <mailto:raqib@Brocade.com>

        Editor:   Bin Wen
                  <mailto:Bin_Wen@cable.comcast.com>";

     description
       "This module contains the RSVP-TE YANG generic data model.";

     revision "2018-02-19" {
       description "Latest revision to RSVP-TE generic YANG module";
       reference "RFC2205, RFC3209, etc.";
     }


     /**
      * RSVP-TE LSPs groupings.
      */

     grouping lsp-record-route-information_state {
       description "recorded route information grouping";
       container incoming-record-route-subobjects {
         description "RSVP recorded route object incoming information";
         list incoming-record-route-subobject {
           when "../../te:origin-type != 'ingress'" {
             description "Applicable on non-ingress LSPs only";
           }
           key "index";
           description
             "List of RSVP Path record-route objects";
           leaf index {
             type leafref {
               path "../state/index";
             }
             description "RRO subobject index";
           }
           container state {
             config false;
             description
```

```
                "State parameters for the record route hop";
              uses te-types:record-route-subobject_state;
            }
          }
        }
        container outgoing-record-route-subobjects {
          description "RSVP recorded route object outgoing information";
          list outgoing-record-route-subobject {
            when "../../te:origin-type != 'egress'" {
              description "Applicable on non-egress LSPs only";
            }
            key "index";
            description
              "List of RSVP Resv record-route objects";
            leaf index {
              type leafref {
                path "../state/index";
              }
              description "RRO subobject index";
            }
            container state {
              config false;
              description
                "State parameters for the record route hop";
              uses te-types:record-route-subobject_state;
            }
          }
        }
      }

      grouping lsp-explicit-route-information_state {
        description "RSVP-TE LSP explicit-route information";
        container explicit-route-objects {
          description "Explicit route object information";
          list incoming-explicit-route-hop {
            when "../../te:origin-type != 'ingress'" {
              description "Applicable on non-ingress LSPs only";
            }
            key "index";
            description
              "List of incoming RSVP Path explicit-route objects";
            leaf index {
              type leafref {
                path "../state/index";
              }
              description "ERO subobject index";
            }
            container state {
```

```
            config false;
            description
              "State parameters for the explicit route hop";
            uses te-types:explicit-route-hop;
          }
        }
        list outgoing-explicit-route-hop {
          when "../../te:origin-type != 'egress'" {
            description "Applicable on non-egress LSPs only";
          }
          key "index";
          description
            "List of outgoing RSVP Path explicit-route objects";
          leaf index {
            type leafref {
              path "../state/index";
            }
            description "ERO subobject index";
          }
          container state {
            config false;
            description
              "State parameters for the explicit route hop";
            uses te-types:explicit-route-hop;
          }
        }
      }
    }

    grouping lsp-attributes-flags_config {
      description
        "Configuration parameters relating to RSVP-TE LSP
        attribute flags";
      leaf lsp-rerouting {
        type enumeration {
          enum end-to-end-routing {
            description
              "End-to-end routing desired";
            reference "RFC4920, RFC5420";
          }
          enum boundary-rerouting {
            description
              "Boundary rerouting desired";
            reference "RFC4920, RFC5420";
          }
          enum segment-based-rerouting {
            description
              "Segment-based rerouting desired";
```

```
              reference "RFC4920, RFC5420";
            }
          }
          description "LSP rerouting types";
        }
        leaf lsp-integrity-required {
          type boolean;
          description "LSP integrity desired";
          reference "RFC4875";
        }
        leaf lsp-contiguous {
          type boolean;
          description "Contiguous LSP";
          reference "RFC5151";
        }
        leaf lsp-stitching-desired {
          type boolean;
          description "Stitched LSP";
          reference "RFC5150";
        }
        leaf lsp-preplanned {
          type boolean;
          description "Preplanned LSP";
          reference "RFC6001";
        }
        leaf lsp-oob-mapping {
          type boolean;
          description
            "Mapping is done out-of-band";
          reference "RFC6511";
        }
      }

      grouping lsp-session-attributes-obj-flags_config {
        description
          "Configuration parameters relating to RSVP-TE LSP
          session attribute flags";
        reference
          "RFC4859: Registry for RSVP-TE Session Flags";
        leaf local-recording-desired {
          type boolean;
          description "Path recording is desired.";
          reference "RFC3209";
        }
        leaf se-style-desired {
          type boolean;
          description "SE Style desired";
          reference "RFC3209";
```

```
      }
      leaf path-reevaluation-request {
        type boolean;
        description "Path re-evaluation request";
        reference "RFC4736";
      }
      leaf soft-preemption-desired {
        type boolean;
        description "Soft-preemption is desired";
        reference "RFC5712";
      }
    }

    grouping lsp-properties_config {
      description
        "Configuration parameters relating to RSVP-TE LSP
        session attribute flags";
      leaf lsp-signaled-name {
        type string;
        description
          "Sets the session name to use in the session
          attribute object.";
      }
      uses lsp-session-attributes-obj-flags_config;
      uses lsp-attributes-flags_config;
    }

    grouping tunnel-properties_config {
      description "RSVP-TE Tunnel properties grouping";
      leaf retry-timer {
        type uint16 {
          range 1..600;
        }
        units seconds;
        description
          "sets the time between attempts to establish the
           LSP";
      }
    }

    /*** End of RSVP-TE LSP groupings ***/

    /**
     * RSVP-TE generic global properties.
     */

    grouping global-soft-preemption_config {
      description
```

```
        "Configuration for global RSVP-TE soft preemption";
      leaf soft-preemption-timeout {
        type uint16 {
          range 0..300;
        }
        default 0;
        description
          "Timeout value for soft preemption to revert
          to hard preemption";
      }
    }

    grouping global-soft-preemption {
      description
        "Top level group for RSVP-TE soft-preemption";
      container global-soft-preemption {
        presence "Enables soft preemption on a node.";
        description
          "Top level container for RSVP-TE soft-preemption";
        uses global-soft-preemption_config;
      }
    }
    /*** End of RSVP-TE generic global properties. ***/

    /**
     * RSVP-TE interface generic groupings.
     */

    grouping rsvp-te-interface-attributes {
      description
        "Top level grouping for RSVP-TE interface properties.";
      container rsvp-te-interface-attributes {
        description
          "Top level container for RSVP-TE interface
          properties";
        container state {
          config false;
          description
            "State information associated with RSVP-TE
            bandwidth";
        }
      }
    }
    /*** End of RSVP-TE generic groupings ***/


    /* RSVP-TE global properties */
    augment "/rt:routing/rt:control-plane-protocols/"
```

```
     + "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals" {
       description
         "RSVP-TE augmentation to RSVP globals";
         uses global-soft-preemption;
     }

     /* Linkage to the base RSVP all links */
     augment "/rt:routing/rt:control-plane-protocols/"
     + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces" {
       description
         "RSVP-TE generic data augmentation pertaining to interfaces";
       uses rsvp-te-interface-attributes;
     }

     /* Linkage to per RSVP interface */
     augment "/rt:routing/rt:control-plane-protocols/"
       + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
       "rsvp:interface" {
       description
         "RSVP-TE generic data augmentation pertaining to specific
          interface";
       uses rsvp-te-interface-attributes;
     }

     /* add augmentation for sessions and neighbors */
     augment "/rt:routing/rt:control-plane-protocols/"
     + "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/"
     + "rsvp:sessions/rsvp:session/rsvp:state/rsvp:psbs/rsvp:psb" {
       description
         "RSVP-TE generic data augmentation pertaining to session";
       /* To be added */
       leaf tspec-average-rate {
         type rt-types:bandwidth-ieee-float32;
         units "Bytes per second";
         description "Tspec Token Bucket Average Rate";
         reference "RFC2210: RSVP with INTSERV";
       }
       leaf tspec-size {
         type rt-types:bandwidth-ieee-float32;
         units "Bytes per second";
         description "Tspec Token Bucket Burst Rate";
         reference "RFC2210";
       }
       leaf tspec-peak-rate {
         type rt-types:bandwidth-ieee-float32;
         units "Bytes per second";
         description "Tspec Token Bucket Peak Data Rate";
         reference "RFC2210";
```

```
      }
      leaf min-policed-unit {
        type uint32;
        description "Tspec Minimum Policed Unit";
        reference "RFC2210";
      }
      leaf max-packet-size {
        type uint32;
        description "Tspec Maximum Packet Size";
        reference "RFC2210";
      }
    }
    augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/"
    + "rsvp:sessions/rsvp:session/rsvp:state/rsvp:rsbs/rsvp:rsb" {
      description
        "RSVP-TE generic data augmentation pertaining to session";
      leaf fspec-average-rate {
        type rt-types:bandwidth-ieee-float32;
        units "Bytes per second";
        description "Fspec Token Bucket Average Rate";
        reference "RFC2210";
      }
      leaf fspec-size {
        type rt-types:bandwidth-ieee-float32;
        units "Bytes per second";
        description "Fspec Token Bucket Burst Rate";
        reference "RFC2210";
      }
      leaf fspec-peak-rate {
        type rt-types:bandwidth-ieee-float32;
        units "Bytes per second";
        description "Fspec Token Bucket Peak Data Rate";
        reference "RFC2210";
      }
      leaf min-policed-unit {
        type uint32;
        description "Fspec Minimum Policed Unit";
        reference "RFC2210";
      }
      leaf max-packet-size {
        type uint32;
        description "Fspec Maximum Packet Size";
        reference "RFC2210";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols/"
```

```
     + "rt:control-plane-protocol/rsvp:rsvp/rsvp:neighbors" {
       description
         "RSVP-TE generic data augmentation pertaining to neighbors";
       /* To be added */
     }

     /**
      * RSVP-TE generic augmentations of generic TE model.
      */

     /* TE tunnel augmentation */
     augment "/te:te/te:tunnels/te:tunnel" {
       when "/te:te/te:tunnels/te:tunnel" +
         "/te:p2p-primary-paths/te:p2p-primary-path" +
         "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
         description
         "When the path signaling protocol is RSVP-TE ";
       }
       description
         "RSVP-TE generic data augmentation pertaining to TE tunnels";
       uses lsp-properties_config;
       uses tunnel-properties_config;
     }

     augment "/te:te/te:tunnels/te:tunnel/te:state" {
       when "/te:te/te:tunnels/te:tunnel" +
         "/te:p2p-primary-paths/te:p2p-primary-path" +
         "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
         description
         "When the path signaling protocol is RSVP-TE ";
       }
       description
         "RSVP-TE generic data augmentation pertaining to TE tunnels";
       uses lsp-properties_config;
       uses tunnel-properties_config;
     }

     /* TE LSP augmentation */
     grouping rsvp-te-lsp-properties {
       description "RSVP-TE LSP properties grouping";
       leaf associated-rsvp-session {
         type leafref {
           path "/rt:routing/rt:control-plane-protocols/"
              + "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/"
              + "rsvp:sessions/rsvp:session/rsvp:local-index";
         }
         description
           "If the signalling protocol specified for this path is
```

```
          RSVP-TE, this leaf provides a reference to the associated
          session within the RSVP-TE protocol sessions list, such
          that details of the signaling can be retrieved.";
      }

      uses lsp-properties_config;
      uses lsp-explicit-route-information_state;
      uses lsp-record-route-information_state;
    }

    augment "/te:te/te:lsps-state/te:lsp" {
      when "/te:te/te:lsps-state/te:lsp" +
        "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
        description
        "When the signaling protocol is RSVP-TE ";
      }
      description
        "RSVP-TE generic data augmentation pertaining to specific TE
         LSP";
      uses rsvp-te-lsp-properties;
    }

    augment "/te:te/te:tunnels/te:tunnel/te:p2p-primary-paths" +
            "/te:p2p-primary-path/te:state/te:lsps/te:lsp" {
      when "/te:te/te:tunnels/te:tunnel/te:p2p-primary-paths" +
            "/te:p2p-primary-path/te:state/te:lsps/te:lsp" +
            "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
          description
          "When the signaling protocol is RSVP-TE ";
      }
      description
        "RSVP-TE generic data augmentation pertaining to specific TE
         LSP";
      uses rsvp-te-lsp-properties;
    }

    augment "/te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths" +
      "/te:p2p-secondary-path/te:state/te:lsps/te:lsp" {
      when "/te:te/te:tunnels/te:tunnel/te:p2p-primary-paths" +
            "/te:p2p-primary-path/te:state/te:lsps/te:lsp" +
            "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
          description
          "When the signaling protocol is RSVP-TE ";
      }
      description
        "RSVP-TE generic data augmentation pertaining to specific TE
         LSP";
      uses rsvp-te-lsp-properties;
```

```
    }

    /* TE interface augmentation */
    augment "/te:te/te-dev:interfaces/te-dev:interface" {
      description
        "RSVP-TE generic data augmentation pertaining to specific TE
         interface";
    }
  }
  <CODE ENDS>
```

Figure 3: RSVP TE generic YANG module

2.3. RSVP-TE MPLS Model

The MPLS RSVP-TE YANG module augments the RSVP-TE generic module with parameters to configure and manage signaling of MPLS RSVP-TE LSPs. RSVP-TE YANG modules for other dataplane technologies (e.g. OTN or WDM) are outside the scope of this document and are defined in other documents.

2.3.1. Tree Diagram

The following are possible types of configuration and state data nodes in this module:

o those augmenting or extending the generic RSVP-TE module

o those augmenting or extending the TE module

o those that are specific to the RSVP-TE MPLS module

Below is a YANG tree representation for data items defined in the RSVP-TE MPLS module:

```
module: ietf-rsvp-te-mpls
  augment /rt:routing/rt:control-plane-protocols/
  rt:control-plane-protocol/rsvp:rsvp:
    +--rw fast-reroute-local-revertive
       +--rw rsvp-frr-local-revert-delay?   uint32
  augment /rt:routing/rt:control-plane-protocols/
  rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces:
  augment /rt:routing/rt:control-plane-protocols/
  rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/rsvp:interface:
  augment /rt:routing/rt:control-plane-protocols/
  rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/
  rsvp:sessions/rsvp:session/rsvp:state:
  augment /rt:routing/rt:control-plane-protocols/
```

```
     rt:control-plane-protocol/rsvp:rsvp/rsvp:neighbors:
     augment /te:te/te:tunnels/te:tunnel:
       +--rw local-protection-desired?       empty
       +--rw bandwidth-protection-desired?   empty
       +--rw node-protection-desired?        empty
       +--rw non-php-desired?                empty
       +--rw entropy-label-cap?              empty
       +--rw oam-mep-entities-desired?       empty
       +--rw oam-mip-entities-desired?       empty
     augment /te:te/te:lsps-state/te:lsp:
       +--ro state
       |  +--ro local-protection-desired?       empty
       |  +--ro bandwidth-protection-desired?   empty
       |  +--ro node-protection-desired?        empty
       |  +--ro non-php-desired?                empty
       |  +--ro entropy-label-cap?              empty
       |  +--ro oam-mep-entities-desired?       empty
       |  +--ro oam-mip-entities-desired?       empty
       +--ro backup-info
          +--ro state
             +--ro backup-tunnel-name?         string
             +--ro backup-frr-on?              uint8
             +--ro backup-protected-lsp-num?   uint32
     augment /te:te/te:tunnels/te:tunnel/te:p2p-primary-paths/
     te:p2p-primary-path/te:state/te:lsps/te:lsp:
       +--ro state
       |  +--ro local-protection-desired?       empty
       |  +--ro bandwidth-protection-desired?   empty
       |  +--ro node-protection-desired?        empty
       |  +--ro non-php-desired?                empty
       |  +--ro entropy-label-cap?              empty
       |  +--ro oam-mep-entities-desired?       empty
       |  +--ro oam-mip-entities-desired?       empty
       +--ro backup-info
          +--ro state
             +--ro backup-tunnel-name?         string
             +--ro backup-frr-on?              uint8
             +--ro backup-protected-lsp-num?   uint32
     augment /te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths/
     te:p2p-secondary-path/te:state/te:lsps/te:lsp:
       +--ro state
       |  +--ro local-protection-desired?       empty
       |  +--ro bandwidth-protection-desired?   empty
       |  +--ro node-protection-desired?        empty
       |  +--ro non-php-desired?                empty
       |  +--ro entropy-label-cap?              empty
       |  +--ro oam-mep-entities-desired?       empty
       |  +--ro oam-mip-entities-desired?       empty
```

```
       +--ro backup-info
          +--ro state
             +--ro backup-tunnel-name?         string
             +--ro backup-frr-on?              uint8
             +--ro backup-protected-lsp-num?   uint32
     augment /te:te/te-dev:interfaces/te-dev:interface:
       +--rw bandwidth-mpls-reservable
          +--rw (bandwidth-value)?
          |  +--:(absolute)
          |  |  +--rw absolute-value?   uint32
          |  +--:(percentage)
          |     +--rw percent-value?    uint32
          +--rw (bc-model-type)?
             +--:(bc-model-rdm)
             |  +--rw bc-model-rdm
             |     +--rw bandwidth-mpls-constraints
             |        +--rw maximum-reservable?   uint32
             |        +--rw bc-value*             uint32
             +--:(bc-model-mam)
             |  +--rw bc-model-mam
             |     +--rw bandwidth-mpls-constraints
             |        +--rw maximum-reservable?   uint32
             |        +--rw bc-value*             uint32
             +--:(bc-model-mar)
                +--rw bc-model-mar
                   +--rw bandwidth-mpls-constraints
                      +--rw maximum-reservable?   uint32
                      +--rw bc-value*             uint32
     augment /te:te/te-dev:interfaces/te-dev:interface:
       +--rw rsvp-te-frr-backups
          +--rw (type)?
             +--:(static-tunnel)
             |  +--rw static-backups
             |     +--rw static-backup* [backup-tunnel-name]
             |        +--rw backup-tunnel-name ->
             /te:te/tunnels/tunnel/name
             +--:(auto-tunnel)
                +--rw auto-tunnel-backups
                   +--rw auto-backup-protection?         identityref
                   +--rw auto-backup-path-computation?   identityref
```

Figure 4: RSVP-TE MPLS Tree diagram

2.3.2. YANG Module

```
<CODE BEGINS> file "ietf-rsvp-te-mpls@2018-02-19.yang"
module ietf-rsvp-te-mpls {
```

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

     prefix "rsvp-te-mpls";

     import ietf-rsvp {
       prefix "rsvp";
     }

     import ietf-routing {
       prefix "rt";
     }

     import ietf-te-mpls-types {
       prefix "te-mpls-types";
     }

     import ietf-te-types {
       prefix "te-types";
     }

     import ietf-te {
       prefix "te";
     }

     import ietf-te-device {
       prefix "te-dev";
     }

     organization
       "IETF Traffic Engineering Architecture and Signaling (TEAS)
        Working Group";

     contact
       "WG Web:   <http://tools.ietf.org/wg/teas/>
        WG List:  <mailto:teas@ietf.org>

        WG Chair: Lou Berger
                  <mailto:lberger@labn.net>

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        Editor:   Vishnu Pavan Beeram
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        Editor:   Raqib Jones
                  <mailto:raqib@Brocade.com>

        Editor:   Bin Wen
                  <mailto:Bin_Wen@cable.comcast.com>";

     description
       "Latest update to MPLS RSVP-TE YANG data model.";

     revision "2018-02-19" {
       description "Update to MPLS RSVP-TE YANG initial revision.";
       reference "RFC3209, RFC6511, RFC6790, RFC7260, RFC4859, RFC4090";
     }

     /* RSVP-TE MPLS LSPs groupings */
     grouping lsp-attributes-flags-mpls_config {
       description
         "Configuration parameters relating to RSVP-TE MPLS LSP
         attribute flags";
       leaf non-php-desired {
         type empty;
         description
           "Non-PHP is desired";
         reference "RFC6511";
       }
       leaf entropy-label-cap {
         type empty;
         description "Entropy label capability";
         reference "RFC6790";
       }
       leaf oam-mep-entities-desired {
         type empty;
         description "OAM MEP entities desired";
         reference "RFC7260";
       }
       leaf oam-mip-entities-desired {
```

```
          type empty;
          description "OAM MIP entities desired";
          reference "RFC7260";
        }
      }

      grouping lsp-session-attributes-obj-flags-mpls_config {
        description
          "Configuration parameters relating to RSVP-TE MPLS LSP
           session attribute flags";
        reference
          "RFC4859: Registry for RSVP-TE Session Flags";
        leaf local-protection-desired {
          type empty;
          description "Fastreroute local protection is desired.";
          reference
            "RFC4859: Registry for RSVP-TE Session Flags";
        }
        leaf bandwidth-protection-desired {
          type empty;
          description
            "Request FRR bandwidth protection on LSRs if
            present.";
          reference "RFC4090";
        }
        leaf node-protection-desired {
          type empty;
          description
            "Request FRR node protection on LSRs if
            present.";
          reference "RFC4090";
        }
      }

      grouping tunnel-properties-mpls_config {
        description
          "Top level grouping for LSP properties.";
        uses lsp-session-attributes-obj-flags-mpls_config;
        uses lsp-attributes-flags-mpls_config;
      }

      grouping lsp-properties-mpls {
        description
          "Top level grouping for LSP properties.";
        container state {
          config false;
          description
            "Configuration applied parameters and state";
```

```
        uses lsp-session-attributes-obj-flags-mpls_config;
        uses lsp-attributes-flags-mpls_config;
      }
    }
    /* End of RSVP-TE MPLS LSPs groupings */

    /* MPLS RSVP-TE interface groupings */
    grouping rsvp-te-interface_state {
      description
        "The RSVP-TE interface state grouping";
      leaf over-subscribed-bandwidth {
        type uint32;
        description
          "The amount of over-subscribed bandwidth on
          the interface";
      }
    }

    grouping rsvp-te-interface-softpreemption_state {
      description
        "The RSVP-TE interface preeemptions state grouping";
      container interface-softpreemption-state {
        description
          "The RSVP-TE interface preeemptions state grouping";
        leaf soft-preempted-bandwidth {
          type uint32;
          description
            "The amount of soft-preempted bandwidth on
            this interface";
        }
        list lsps {
          key
            "source destination tunnel-id lsp-id "+
            "extended-tunnel-id";
          description
            "List of LSPs that are soft-preempted";
          leaf source {
            type leafref {
              path "/te:te/te:lsps-state/te:lsp/"+
                   "te:source";
            }
            description
              "Tunnel sender address extracted from
              SENDER_TEMPLATE  object";
            reference "RFC3209";
          }
          leaf destination {
            type leafref {
```

```
                path "/te:te/te:lsps-state/te:lsp/"+
                     "te:destination";
              }
              description
                "Tunnel endpoint address extracted from
                SESSION object";
              reference "RFC3209";
            }
            leaf tunnel-id {
              type leafref {
                path "/te:te/te:lsps-state/te:lsp/"+
                  "te:tunnel-id";
              }
              description
                "Tunnel identifier used in the SESSION
                that remains constant over the life
                of the tunnel.";
              reference "RFC3209";
            }
            leaf lsp-id {
              type leafref {
                path "/te:te/te:lsps-state/te:lsp/"+
                     "te:lsp-id";
              }
              description
                "Identifier used in the SENDER_TEMPLATE
                and the FILTER_SPEC that can be changed
                to allow a sender to share resources with
                itself.";
              reference "RFC3209";
            }
            leaf extended-tunnel-id {
              type leafref {
                path "/te:te/te:lsps-state/te:lsp/"+
                  "te:extended-tunnel-id";
              }
              description
                "Extended Tunnel ID of the LSP.";
              reference "RFC3209";
            }
            leaf type {
              type leafref {
                path "/te:te/te:lsps-state/te:lsp/"+
                  "te:type";
              }
              description "LSP type P2P or P2MP";
            }
          }
```

```
      }
    }

    grouping bandwidth-mpls-constraints {
      description "Bandwidth constraints.";
      container bandwidth-mpls-constraints {
        description
          "Holds the bandwidth constraints properties";
        leaf maximum-reservable {
          type uint32 {
            range "0..4294967295";
          }
          description
            "The maximum reservable bandwidth on the
            interface";
        }
        leaf-list bc-value {
          type uint32 {
            range "0..4294967295";
          }
          max-elements 8;
          description
            "The bandwidth constraint type";
        }
      }
    }

    grouping bandwidth-constraint-values {
      description
        "Packet bandwidth contraints values";
      choice value-type {
        description
          "Value representation";
        case percentages {
          container perc-values {
            uses bandwidth-mpls-constraints;
            description
              "Percentage values";
          }
        }
        case absolutes {
          container abs-values {
            uses bandwidth-mpls-constraints;
            description
              "Absolute values";
          }
        }
      }
```

```
     }

     grouping bandwidth-mpls-reservable_config {
       description
         "Interface bandwidth reservable configuration grouping";
       choice bandwidth-value {
         description "Reservable bandwidth configuration choice";
         case absolute {
           leaf absolute-value {
             type uint32;
             description "Absolute value of the bandwidth";
           }
         }
         case percentage {
           leaf percent-value {
             type uint32 {
               range "0..4294967295";
             }
             description "Percentage reservable bandwidth";
           }
           description
             "The maximum reservable bandwidth on the
             interface";
         }
       }
       choice bc-model-type {
         description
           "Reservable bandwidth percentage capacity
           values.";
         case bc-model-rdm {
           container bc-model-rdm {
             description
               "Russian Doll Model Bandwidth Constraints.";
             uses bandwidth-mpls-constraints;
           }
         }
         case bc-model-mam {
           container bc-model-mam {
             uses bandwidth-mpls-constraints;
             description
               "Maximum Allocation Model Bandwidth
               Constraints.";
           }
         }
         case bc-model-mar {
           container bc-model-mar {
             uses bandwidth-mpls-constraints;
             description
```

```
                "Maximum Allocation with Reservation Model
                Bandwidth Constraints.";
            }
          }
        }
      }

      grouping bandwidth-mpls-reservable {
        description
          "Packet reservable bandwidth";
        container bandwidth-mpls-reservable {
          description
            "Interface bandwidth reservable container";
          uses bandwidth-mpls-reservable_config;
        }
      }
      /* End of RSVP-TE interface groupings */

      /* RSVP-TE FRR groupings */
      grouping rsvp-te-frr-auto-tunnel-backup_config {
        description
          "Auto-tunnel backup configuration grouping";
        leaf auto-backup-protection {
          type identityref {
            base te-mpls-types:backup-protection-type;
          }
          default
            te-mpls-types:backup-protection-node-link;
          description
            "Describes whether the backup should offer
            protection against link, node, or either";
        }
        leaf auto-backup-path-computation {
          type identityref {
            base
              te-types:path-computation-srlg-type;
          }
          description
            "FRR backup computation type";
        }
      }

      grouping rsvp-te-frr-backups_config {
        description
          "Top level container for RSVP-TE FRR backup parameters";
        choice type {
          description
            "FRR backup tunnel type";
```

```
        case static-tunnel {
          container static-backups {
            description "List of static backups";
            list static-backup {
              key "backup-tunnel-name";
              description
                "List of static backup tunnels that
                protect the RSVP-TE interface.";
              leaf backup-tunnel-name {
                type leafref {
                  path "/te:te/te:tunnels/te:tunnel/te:name";
                }
                description "FRR Backup tunnel name";
              }
            }
          }
        }
        case auto-tunnel {
          container auto-tunnel-backups {
            description "Auto-tunnel choice";
            uses rsvp-te-frr-auto-tunnel-backup_config;
          }
        }
      }
    }

    grouping rsvp-te-frr-backups {
        description
          "RSVP-TE facility backup grouping";
      container rsvp-te-frr-backups {
        description
          "RSVP-TE facility backup properties";
        uses rsvp-te-frr-backups_config;
      }
    }

    grouping lsp-backup-info_state {
      description "LSP backup information grouping";
      leaf backup-tunnel-name {
        type string;
        description
          "If an LSP has an FRR backup LSP that can protect it,
          this field identifies the tunnel name of the backup LSP.
          Otherwise, this field is empty.";
      }
      leaf backup-frr-on {
        type uint8;
        description
```

```
            "Whether currently this backup is carrying traffic";
        }
        leaf backup-protected-lsp-num {
          type uint32;
          description
            "Number of LSPs protected by this backup";
        }
      }

      grouping lsp-backup-info {
        description "Backup/bypass LSP related information";
        container backup-info {
          description
            "backup information";
          container state {
            config false;
            description
              "Configuration applied parameters and state";
            uses lsp-backup-info_state;
          }
        }
      }

      grouping fast-reroute-local-revertive_config {
        description "RSVP-TE FRR local revertive grouping";
        leaf rsvp-frr-local-revert-delay {
          type uint32;
          description
            "Time to wait after primary link is restored
            before node attempts local revertive
            procedures.";
        }
      }

      /*** End of RSVP-TE FRR backup information ***/

      grouping fast-reroute-local-revertive {
        description
          "Top level grouping for globals properties";
        container fast-reroute-local-revertive {
          description "RSVP-TE FRR local revertive container";
          uses fast-reroute-local-revertive_config;
        }
      }

      /* RSVP-TE global properties */
      augment "/rt:routing/rt:control-plane-protocols/"
      + "rt:control-plane-protocol/rsvp:rsvp" {
```

```
      description
        "RSVP-TE augmentation to RSVP globals";
      uses fast-reroute-local-revertive;
    }

    /* Linkage to the base RSVP all interfaces */
    augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces" {
      description
        "Augmentations for RSVP-TE MPLS all interfaces properties";
      /* To be added */
    }

    /* Linkage to per RSVP interface */
    augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
    "rsvp:interface" {
      description
        "Augmentations for RSVP-TE MPLS per interface properties";
      /* To be added */
    }

    /* add augmentation for sessions neighbors */
    augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/"
    + "rsvp:sessions/rsvp:session/rsvp:state" {
      description
        "Augmentations for RSVP-TE MPLS sessions";
      /* To be added */
    }

    augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:neighbors" {
      description
        "Augmentations for RSVP-TE MPLS neighbors properties";
      /* To be added */
    }

    /**
     * Augmentation to TE generic module
     */
    augment "/te:te/te:tunnels/te:tunnel" {
      description
        "Augmentations for RSVP-TE MPLS TE tunnel properties";
      uses tunnel-properties-mpls_config;
    }

    augment "/te:te/te:lsps-state/te:lsp" {
```

```
        when "/te:te/te:lsps-state/te:lsp" +
        "/te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
          description
          "When the signaling protocol is RSVP-TE ";
        }
        description
          "RSVP-TE MPLS LSP state properties";
        uses lsp-properties-mpls;
        uses lsp-backup-info;
      }

      augment "/te:te/te:tunnels/te:tunnel/te:p2p-primary-paths" +
        "/te:p2p-primary-path/te:state/te:lsps/te:lsp" {
        when "/te:te/te:tunnels/te:tunnel" +
          "/te:p2p-secondary-paths/te:p2p-secondary-path/" +
          "te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
          description
          "When the signaling protocol is RSVP-TE ";
        }
        description
          "RSVP-TE MPLS LSP state properties";
        uses lsp-properties-mpls;
        uses lsp-backup-info;
      }

      augment "/te:te/te:tunnels/te:tunnel/te:p2p-secondary-paths" +
        "/te:p2p-secondary-path/te:state/te:lsps/te:lsp" {
        when "/te:te/te:tunnels/te:tunnel" +
          "/te:p2p-secondary-paths/te:p2p-secondary-path/" +
          "te:path-setup-protocol = 'te-types:path-setup-rsvp'" {
          description
          "When the signaling protocol is RSVP-TE ";
        }
        description
          "RSVP-TE MPLS LSP state properties";
        uses lsp-properties-mpls;
        uses lsp-backup-info;
      }

      augment "/te:te/te-dev:interfaces/te-dev:interface" {
        description
          "RSVP reservable bandwidth configuration properties";
        uses bandwidth-mpls-reservable;
      }

      augment "/te:te/te-dev:interfaces/te-dev:interface" {
        description
          "RSVP reservable bandwidth configuration properties";
```

```
      uses rsvp-te-frr-backups;
    }
  }
  <CODE ENDS>
```

Figure 5: RSVP TE MPLS YANG module

Figure 5 shows the YANG tree representation of the RSVP TE MPLS module that augments RSVP-TE module as well as RSVP and TE YANG modules.

3. 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-rsvp-te XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-rsvp-te-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-rsvp namespace: urn:ietf:params:xml:ns:yang:ietf-rsvp-te prefix: ietf-rsvp reference: RFC3209

name: ietf-rsvp-te namespace: urn:ietf:params:xml:ns:yang:ietf-rsvp-te-mpls prefix: ietf-rsvp-te reference: RFC3209

4. Security Considerations

The YANG module defined in this memo 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.

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