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A YANG Data Model for RSVP-TE Protocol
draft-ietf-teas-yang-rsvp-te-09

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 are technology agnostic. The generic RSVP-TE module is to be augmented by technology specific RSVP-TE modules that define technology specific data. This document also 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 [RFC7950] is a data modeling language that was introduced to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [RFC6241]. YANG has proved relevant beyond its initial confines, as bindings to other interfaces (e.g. RESTCONF [RFC8040]) 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

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

The terminology for describing YANG data models is found in [RFC7950].

1.2. 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	[I-D.ietf-teas-yang-te]
rsvp	ietf-rsvp	[I-D.ietf-teas-yang-rsvp]
te-dev	ietf-te-device	[I-D.ietf-teas-yang-te]
te-types	ietf-te-types	[I-D.ietf-teas-yang-te-types]
te-mpls-types	ietf-te-mpls-types	[I-D.ietf-teas-yang-te-types]
rsvp-te	ietf-rsvp-te	this document
rsvp-te-mpls	ietf-rsvp-te-mpls	this document

Table 1: Prefixes and corresponding YANG modules

2. Model Overview

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

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

There are three types of configuration and state data nodes in module(s) defined in this document:

- o those augmenting or extending the base RSVP module that is defined in [I-D.ietf-teas-yang-rsvp]
- o those augmenting or extending the base TE module defined in [I-D.ietf-teas-yang-te]
- o those that are specific to the RSVP-TE and RSVP-TE MPLS modules defined in this document.

2.1. Module Relationship

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 MPLS technology specific RSVP-TE module that holds parameters specific to MPLS technology.

The relationship between the different modules is shown in Figure 1.

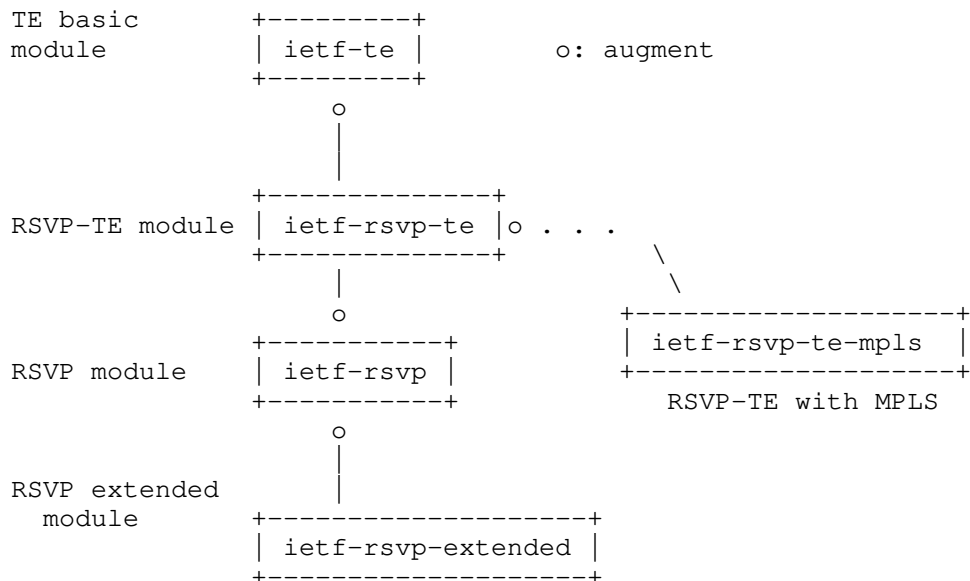


Figure 1: Relationship of RSVP and RSVP-TE modules with other protocol modules

2.2. Model Tree Diagrams

A full tree diagram of the module(s) defined in this document as per the syntax defined in [RFC8340] are given in subsequent sections.

2.2.1. RSVP-TE Model Tree Diagram

Figure 2 shows the YANG tree diagram of the RSVP-TE generic YANG model defined in module `ietf-rsvp-te.yang`.

```

module: ietf-rsvp-te
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp:
      +--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
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
      /rsvp:interface:
      +--rw rsvp-te-interface-attributes
  
```

```

augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:sessions:
    +--ro session-te* [tunnel-endpoint tunnel-id extended-tunnel-id]
      +--ro tunnel-endpoint      inet:ip-address
      +--ro tunnel-id            uint16
      +--ro extended-tunnel-id   inet:ip-address
      +--ro destination-port?    inet:port-number
      +--ro protocol-id?         uint8
      +--ro source?              inet:ip-address
      +--ro destination?         inet:ip-address
      +--ro session-name?        string
      +--ro session-status?      enumeration
      +--ro session-type         identityref
      +--ro psbs
        +--ro psb* []
          +--ro source-port?      inet:port-number
          +--ro expires-in?       uint32
          +--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
      +--ro rsbs
        +--ro rsb* []
          +--ro source-port?      inet:port-number
          +--ro reservation-style identityref
          +--ro expires-in?       uint32
          +--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-sigaled-name?  string
  +--rw session-attribute* identityref
  +--rw lsp-attribute*     identityref
  +--rw retry-timer?       uint16
augment /te:te/te:lsps/te:lsp:
  +--ro associated-rsvp-session? leafref
  +--ro lsp-sigaled-name?       string

```

```

+--ro session-attribute*                identityref
+--ro lsp-attribute*                    identityref
+--ro rsvp-message-type?                identityref
+--ro rsvp-error-code?                  uint8
+--ro rsvp-error-subcode?               uint16
+--ro explicit-route-objects
|
|   +--ro incoming-explicit-route-hop* [index]
|   |   +--ro index                    uint32
|   |   +--ro (type)?
|   |   |   +--:(numbered-node-hop)
|   |   |   |   +--ro numbered-node-hop
|   |   |   |   |   +--ro node-id      te-node-id
|   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   +--:(numbered-link-hop)
|   |   |   |   |   +--ro numbered-link-hop
|   |   |   |   |   |   +--ro link-tp-id  te-tp-id
|   |   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   |   |   +--ro direction?  te-link-direction
|   |   |   |   +--:(unnumbered-link-hop)
|   |   |   |   |   +--ro unnumbered-link-hop
|   |   |   |   |   |   +--ro link-tp-id  te-tp-id
|   |   |   |   |   |   +--ro node-id      te-node-id
|   |   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   |   |   +--ro direction?  te-link-direction
|   |   |   |   +--:(as-number)
|   |   |   |   |   +--ro as-number-hop
|   |   |   |   |   |   +--ro as-number    inet:as-number
|   |   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   +--:(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                    uint32
|   |   |   +--ro (type)?
|   |   |   |   +--:(numbered-node-hop)
|   |   |   |   |   +--ro numbered-node-hop
|   |   |   |   |   |   +--ro node-id      te-node-id
|   |   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   +--:(numbered-link-hop)
|   |   |   |   |   +--ro numbered-link-hop
|   |   |   |   |   |   +--ro link-tp-id  te-tp-id
|   |   |   |   |   |   +--ro hop-type?    te-hop-type
|   |   |   |   |   |   +--ro direction?  te-link-direction

```

```

+---:(unnumbered-link-hop)
|   +---ro unnumbered-link-hop
|       +---ro link-tp-id      te-tp-id
|       +---ro node-id        te-node-id
|       +---ro hop-type?      te-hop-type
|       +---ro direction?     te-link-direction
+---:(as-number)
|   +---ro as-number-hop
|       +---ro as-number      inet:as-number
|       +---ro hop-type?      te-hop-type
+---:(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                               uint32
+---ro (type)?
+---:(numbered-node-hop)
|   +---ro numbered-node-hop
|       +---ro node-id      te-node-id
|       +---ro flags*       path-attribute-flags
+---:(numbered-link-hop)
|   +---ro numbered-link-hop
|       +---ro link-tp-id    te-tp-id
|       +---ro flags*       path-attribute-flags
+---:(unnumbered-link-hop)
|   +---ro unnumbered-link-hop
|       +---ro link-tp-id    te-tp-id
|       +---ro node-id?     te-node-id
|       +---ro flags*       path-attribute-flags
+---:(label)
|   +---ro label-hop
|       +---ro te-label
|           +---ro (technology)?
|               +---:(generic)
|                   +---ro generic?
|                       rt-types:generalized-label
|               +---ro direction?     te-label-direction
|       +---ro flags*       path-attribute-flags
+---ro outgoing-record-route-subobjects
+---ro outgoing-record-route-subobject* [index]
+---ro index                               uint32
+---ro (type)?

```



```

+---:(numbered-node-hop)
|   +---ro numbered-node-hop
|       +---ro node-id      te-node-id
|       +---ro flags*       path-attribute-flags
+---:(numbered-link-hop)
|   +---ro numbered-link-hop
|       +---ro link-tp-id    te-tp-id
|       +---ro flags*       path-attribute-flags
+---:(unnumbered-link-hop)
|   +---ro unnumbered-link-hop
|       +---ro link-tp-id    te-tp-id
|       +---ro node-id?     te-node-id
|       +---ro flags*       path-attribute-flags
+---:(label)
|   +---ro label-hop
|       +---ro te-label
|           +---ro (technology)?
|               +---:(generic)
|                   +---ro generic?
|                       rt-types:generalized-label
|       +---ro direction?   te-label-direction
|       +---ro flags*       path-attribute-flags
augment /te:te/te-dev:interfaces/te-dev:interface:

```

Figure 2: RSVP-TE model Tree diagram

2.2.2. RSVP-TE MPLS Model Tree Diagram

Figure 5 shows the YANG tree diagram of the RSVP-TE MPLS YANG model defined in module `ietf-rsvp-te-mpls.yang` and that augments RSVP-TE module as well as RSVP and TE YANG modules.

```

module: ietf-rsvp-te-mpls
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp:
      +---rw rsvp-frr-local-revert-delay?  uint32
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rt:rsvp:interfaces:
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rt:rsvp:interfaces
    /rsvp:interface:
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rt:rsvp:sessions:
  augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rt:rsvp:neighbors:
  augment /te:te/te:tunnels/te:tunnel:
    +---rw session-attribute*  identityref
  augment /te:te/te:lsps/te:lsp:

```

```

+---ro session-attribute*   identityref
+---ro backup-info
  +---ro backup-tunnel-name?   string
  +---ro backup-frr-on?        uint8
  +---ro backup-protected-lsp-num?  uint32
augment /te:te/te:tunnels/te:tunnel/te:primary-paths
  /te:primary-path/te:lsps/te:lsp:
+---ro session-attribute*   identityref
+---ro backup-info
  +---ro backup-tunnel-name?   string
  +---ro backup-frr-on?        uint8
  +---ro backup-protected-lsp-num?  uint32
augment /te:te/te:tunnels/te:tunnel/te:secondary-paths
  /te:secondary-path/te:lsps/te:lsp:
+---ro session-attribute*   identityref
+---ro backup-info
  +---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?   te-packet-types:bandwidth-kbps
  | | +---:(percentage)
  | | | +---rw percent-value?  uint32
+---rw (bc-model-type)?
+---:(bc-model-rdm)
  | +---rw bc-model-rdm
  | | +---rw bandwidth-mpls-constraints
  | | | +---rw maximum-reservable?
  | | | | te-packet-types:bandwidth-kbps
  | | | +---rw bc-value*      uint32
+---:(bc-model-mam)
  | +---rw bc-model-mam
  | | +---rw bandwidth-mpls-constraints
  | | | +---rw maximum-reservable?
  | | | | te-packet-types:bandwidth-kbps
  | | | +---rw bc-value*      uint32
+---:(bc-model-mar)
  | +---rw bc-model-mar
  | | +---rw bandwidth-mpls-constraints
  | | | +---rw maximum-reservable?
  | | | | te-packet-types:bandwidth-kbps
  | | | +---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 3: RSVP-TE MPLS Tree diagram

2.3. YANG Modules

2.3.1. RSVP-TE YANG Module

The RSVP-TE generic YANG module "ietf-rsvp-te" imports the following modules:

- o ietf-rsvp defined in [I-D.ietf-teas-yang-rsvp]
- o ietf-routing-types defined in [RFC8294]
- o ietf-te-types defined in [I-D.ietf-teas-yang-te-types]
- o ietf-te and ietf-te-dev defined in [I-D.ietf-teas-yang-te]

This module references the following documents:

[I-D.ietf-teas-yang-rsvp], [RFC8349], [I-D.ietf-teas-yang-te], [I-D.ietf-teas-yang-te-types], [RFC2210], [RFC4920], [RFC5420], [RFC7570], [RFC4859].

```

<CODE BEGINS> file "ietf-rsvp-te@2021-02-21.yang"
module ietf-rsvp-te {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-rsvp-te";
  prefix rsvp-te;

  import ietf-rsvp {
    prefix rsvp;
    reference
      "draft-ietf-teas-yang-rsvp: A YANG Data Model for
       Resource Reservation Protocol (RSVP)";
  }
  import ietf-routing {
    prefix rt;
    reference
      "RFC8349: A YANG Data Model for Routing Management";
  }

```

```
}
import ietf-routing-types {
  prefix rt-types;
  reference
    "RFC8294: Common YANG Data Types for the Routing Area";
}
import ietf-te {
  prefix te;
  reference
    "draft-ietf-teas-yang-te: A YANG Data Model for Traffic
    Engineering Tunnels and Interfaces";
}
import ietf-te-device {
  prefix te-dev;
  reference
    "draft-ietf-teas-yang-te: A YANG Data Model for Traffic
    Engineering Tunnels and Interfaces";
}

/* Import TE generic types */

import ietf-te-types {
  prefix te-types;
  reference
    "RFC8776: Common YANG Data Types for Traffic Engineering.";
}
import ietf-inet-types {
  prefix inet;
  reference
    "RFC6991: Common YANG Data Types";
}

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

"This module contains the RSVP-TE YANG generic data model.
The model fully conforms to the Network Management Datastore
Architecture (NMDA)."

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(<https://trustee.ietf.org/license-info>).
This version of this YANG module is part of RFC XXXX; see
the RFC itself for full legal notices.";

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

```
revision 2021-02-21 {  
  description  
    "A YANG Data Model for RSVP-TE";  
  reference  
    "RFCXXXX: A YANG Data Model for RSVP-TE Protocol";  
}
```

```
identity rsvp-message-type {  
  description  
    "RSVP message types";  
}
```

```
identity rsvp-message-path {  
  base rsvp-message-type;  
  description  
    "RSVP Path message";  
  reference  
    "RFC2205";  
}
```

```
}

identity rsvp-message-resv {
  base rsvp-message-type;
  description
    "RSVP Resv message";
  reference
    "RFC2205";
}

identity rsvp-message-path-err {
  base rsvp-message-type;
  description
    "RSVP Path-Err message";
  reference
    "RFC2205";
}

identity rsvp-message-resv-err {
  base rsvp-message-type;
  description
    "RSVP Resv-Err message";
  reference
    "RFC2205";
}

identity rsvp-message-path-tear {
  base rsvp-message-type;
  description
    "RSVP Path Tear message";
  reference
    "RFC2205";
}

identity rsvp-message-resv-conf {
  base rsvp-message-type;
  description
    "RSVP Resv Confirm message";
  reference
    "RFC2205";
}

identity rsvp-message-srefresh {
  base rsvp-message-type;
  description
    "RSVP SRefresh message";
  reference
    "RFC2961";
}
```

```
}

identity rsvp-message-hello {
  base rsvp-message-type;
  description
    "RSVP Hello message";
  reference
    "RFC3209";
}

identity rsvp-message-bundle {
  base rsvp-message-type;
  description
    "RSVP Bundle message";
  reference
    "RFC2961";
}

identity rsvp-message-notify {
  base rsvp-message-type;
  description
    "RSVP Notify message";
  reference
    "RFC3473";
}

/**
 * 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";
      ordered-by user;
      description
        "List of RSVP Path record-route objects";
      uses te-types:record-route-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";
        ordered-by user;
        description
          "List of RSVP Resv record-route objects";
        uses te-types:record-route-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";
        ordered-by user;
        description
          "List of incoming RSVP Path explicit-route objects";
        leaf index {
          type uint32;
          description
            "Explicit route hop index. The index is used to
            identify an entry in the list. The order of entries
            is defined by the user without relying on key values";
        }
        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";
        ordered-by user;
      }
    }
  }
```



```
    description
      "List of outgoing RSVP Path explicit-route objects";
    leaf index {
      type uint32;
      description
        "Explicit route hop index. The index is used to
        identify an entry in the list. The order of entries
        is defined by the user without relying on key values";
    }
    uses te-types:explicit-route-hop;
  }
}

grouping lsp-attributes-flags {
  description
    "Configuration parameters relating to RSVP-TE LSP
    attribute flags";
  leaf-list lsp-attribute {
    type identityref {
      base te-types:lsp-attributes-flags;
    }
    description
      "RSVP per LSP attributes flags";
    reference
      "RFC4920, RFC5420, RFC7570";
  }
}

grouping lsp-session-attributes-obj-flags {
  description
    "Configuration parameters relating to RSVP-TE LSP
    session attribute flags";
  reference
    "RFC4859: Registry for RSVP-TE Session Flags";
  leaf-list session-attribute {
    when "../session-attribute !=
      'te-types:bandwidth-protection-desired' or
      ../session-attribute !=
      'te-types:soft-preemption-desired'" {
      description
        "Session attributes applicable to generic technologies
        only.";
    }
    type identityref {
      base te-types:session-attributes-flags;
    }
    description

```

```
        "RSVP session attributes flags";
        reference
        "RFC4859: Registry for RSVP-TE Session Flags";
    }
}

grouping lsp-properties {
    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;
    uses lsp-attributes-flags;
}

grouping tunnel-properties {
    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 {
    description
        "Configuration for global RSVP-TE soft preemption";
    container global-soft-preemption {
        presence "Enables soft preemption on a node.";
        description
            "Top level container for RSVP-TE soft-preemption";
        leaf soft-preemption-timeout {
            type uint16 {
```

```
        range "0..300";
    }
    units "seconds";
    default "0";
    description
        "Timeout value for soft preemption to revert
         to hard preemption";
    }
}

/** 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";
    }
}

/** End of RSVP-TE generic groupings */
/* 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 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:sessions" {
description
  "RSVP-TE generic data augmentation pertaining to session";
list session-te {
  key "tunnel-endpoint tunnel-id extended-tunnel-id";
  config false;
  description
    "List of RSVP sessions";
  leaf tunnel-endpoint {
    type inet:ip-address;
    description
      "XX";
  }
  leaf tunnel-id {
    type uint16;
    description
      "XX";
  }
  leaf extended-tunnel-id {
    type inet:ip-address;
    description
      "XX";
  }
  uses rsvp:session-attributes;
}
}

augment "/rt:routing/rt:control-plane-protocols/"
  + "rt:control-plane-protocol/rsvp:rsvp/"
  + "rsvp:sessions/session-te/psbs/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:sessions/session-te/rsbs/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:primary-paths/te:primary-path"
    + "/te:signaling-type = '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;
uses tunnel-properties;
}

/* TE LSP augmentation */

grouping rsvp-te-lsp-error-info {
  description
    "Grouping for RSVP-TE error reporting information";
  leaf rsvp-message-type {
    type identityref {
      base rsvp-message-type;
    }
    description
      "The RSVP message type that delivered the error";
  }
  leaf rsvp-error-code {
    type uint8;
    description
      "RSVP error code";
    reference
      "RFC2205";
  }
  leaf rsvp-error-subcode {
    type uint16;
    description
      "RSVP Error sub-codes";
    reference
      "RFC2205";
  }
}

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

```
leaf associated-rsvp-session {
  type leafref {
    path "/rt:routing/rt:control-plane-protocols/"
      + "rt:control-plane-protocol/rsvp:rsvp/"
      + "rsvp:sessions/session-te/tunnel-id";
  }
  config false;
  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;
uses rsvp-te-lsp-error-info;
uses lsp-explicit-route-information-state;
uses lsp-record-route-information-state;
}

/* 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 4: RSVP TE generic YANG module

2.3.2. RSVP-TE MPLS YANG Module

The RSVP-TE MPLS YANG module "ietf-rsvp-te-mpls" imports the following module(s):

- o ietf-rsvp defined in [I-D.ietf-teas-yang-rsvp]
- o ietf-routing-types defined in [RFC8294]
- o ietf-te-mpls-types defined in [I-D.ietf-teas-yang-te-types]
- o ietf-te and ietf-te-dev defined in [I-D.ietf-teas-yang-te]

This module references the following documents:
[I-D.ietf-teas-yang-rsvp], [RFC8349], [I-D.ietf-teas-yang-te-types],
[I-D.ietf-teas-yang-te], [RFC3209].


```
<CODE BEGINS> file "ietf-rsvp-te-mpls@2021-02-21.yang"
module ietf-rsvp-te-mpls {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-rsvp-te-mpls";
  prefix rsvp-te-mpls;

  import ietf-rsvp {
    prefix rsvp;
    reference
      "draft-ietf-teas-yang-rsvp: A YANG Data Model for
      Resource Reservation Protocol (RSVP)";
  }
  import ietf-routing {
    prefix rt;
    reference
      "RFC8349: A YANG Data Model for Routing Management";
  }
  import ietf-te-packet-types {
    prefix te-packet-types;
    reference
      "RFC8776: Common YANG Data Types for Traffic Engineering.";
  }
  import ietf-te-types {
    prefix te-types;
    reference
      "RFC8776: Common YANG Data Types for Traffic Engineering.";
  }
  import ietf-te {
    prefix te;
    reference
      "draft-ietf-teas-yang-te: A YANG Data Model for Traffic
      Engineering Tunnels and Interfaces";
  }
  import ietf-te-device {
    prefix te-dev;
    reference
      "draft-ietf-teas-yang-te: A YANG Data Model for Traffic
      Engineering Tunnels and Interfaces";
  }

  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>

    Editor:   Vishnu Pavan Beeram
```

<mailto:vbeeram@juniper.net>

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

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Editor: Igor Bryskin
<mailto:Igor.Bryskin@huawei.com>

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

description

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

The model fully conforms to the Network Management Datastore Architecture (NMDA).

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Relating to IETF Documents
(<https://trustee.ietf.org/license-info>).

This version of this YANG module is part of RFC XXXX; see
the RFC itself for full legal notices.";

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

```
revision 2021-02-21 {  
  description  
    "Update to MPLS RSVP-TE YANG initial revision.";  
  reference  
    "RFCXXXX: A YANG Data Model for RSVP-TE Protocol";  
}
```

/* RSVP-TE MPLS LSPs groupings */

```
grouping lsp-attributes-flags-mpls {
```

```
    description
      "Configuration parameters relating to RSVP-TE MPLS LSP
       attribute flags";
  }

  grouping lsp-session-attributes-obj-flags-mpls {
    description
      "Configuration parameters relating to RSVP-TE MPLS LSP
       session attribute flags";
    reference
      "RFC4859: Registry for RSVP-TE Session Flags";
    leaf-list session-attribute {
      when "../session-attribute =
        'te-types:bandwidth-protection-desired' or
        ../session-attribute =
        'te-types:soft-preemption-desired'" {
        description
          "Session attributes applicable to mpls technology";
      }
      type identityref {
        base te-types:session-attributes-flags;
      }
    }
    description
      "RSVP session attributes flags";
    reference
      "RFC4859: Registry for RSVP-TE Session Flags";
  }
}

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

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

/* 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 te-packet-types:bandwidth-kbps;
    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 te-packet-types:bandwidth-kbps;
      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/te:lsp/"
            + "te:source";
        }
        description
          "Tunnel sender address extracted from
           SENDER_TEMPLATE object";
        reference
          "RFC3209";
      }
      leaf destination {
        type leafref {
          path "/te:te/te:lsps/te:lsp/"
            + "te:destination";
        }
        description
          "Tunnel endpoint address extracted from
           SESSION object";
        reference
          "RFC3209";
      }
    }
  }
}
```

```
    leaf tunnel-id {
      type leafref {
        path "/te:te/te:lsps/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/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/te:lsp/"
          + "te:extended-tunnel-id";
      }
      description
        "Extended Tunnel ID of the LSP.";
      reference
        "RFC3209";
    }
    leaf type {
      type leafref {
        path "/te:te/te:lsps/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 te-packet-types:bandwidth-kbps;
    description
      "The maximum reservable bandwidth on the
       interface in kbps";
  }
  leaf-list bc-value {
    type uint32 {
      range "0..4294967295";
    }
    max-elements 8;
    description
      "The bandwidth constraint type";
  }
}

grouping bandwidth-constraint-values {
  description
    "Packet bandwidth constraints 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 {
  description
    "Interface bandwidth reservable configuration grouping";
```

```
container bandwidth-mpls-reservable {
  description
    "Interface bandwidth reservable container";
  choice bandwidth-value {
    description
      "Reservable bandwidth configuration choice";
    case absolute {
      leaf absolute-value {
        type te-packet-types:bandwidth-kbps;
        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.";
      }
    }
  }
}

/* End of RSVP-TE interface groupings */
/* RSVP-TE FRR groupings */

grouping rsvp-te-frr-auto-tunnel-backup {
  description
    "Auto-tunnel backup configuration grouping";
  leaf auto-backup-protection {
    type identityref {
      base te-packet-types:backup-protection-type;
    }
    default "te-packet-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 {
  description
    "Top level container for RSVP-TE FRR backup parameters";
  container rsvp-te-frr-backups {
    description
      "RSVP-TE facility backup properties";
    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;
    }
  }
}

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";
        uses lsp-backup-info-state;
    }
}

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

/* RSVP-TE global properties */

augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp" {
    description
        "RSVP-TE augmentation to RSVP globals";
    leaf rsvp-frr-local-revert-delay {
        type uint32;
        description
            "Time to wait after primary link is restored
            before node attempts local revertive
            procedures.";
    }
}

/* 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:sessions" {
      description
        "Augmentation 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;
    }

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

    augment "/te:te/te:tunnels/te:tunnel/te:primary-paths"
      + "/te:primary-path/te:lsps/te:lsp" {
      when "/te:te/te:tunnels/te:tunnel"
        + "/te:secondary-paths/te:secondary-path/"
        + "te:signaling-type = '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:secondary-paths"
  + "/te:secondary-path/te:lsps/te:lsp" {
  when "/te:te/te:tunnels/te:tunnel"
  + "/te:secondary-paths/te:secondary-path/"
  + "te:signaling-type = '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

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
 Registrant Contact: The IESG.
 XML: N/A, the requested URI is an XML namespace.

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

This document registers two YANG modules in the YANG Module Names registry [RFC6020].

```
name:      ietf-rsvp-te
namespace: urn:ietf:params:xml:ns:yang:ietf-rsvp-te
prefix:    rsvp-te
reference:  RFCXXXX

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

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 [RFC8341] 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(s) defined in this document 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.

/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/rsvp:rsvp/globals: The data nodes defined in this document and under this branch are applicable device-wide and can affect all RSVP established sessions. Unauthorized access to this container can potentially cause disruptive event(s) on all established sessions.

/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/rsvp:rsvp/globals/rsvp:sessions: The data nodes defined in this document and under this branch are applicable to one or all RSVP-TE session(s). Unauthorized access to this container can potentially affect the impacted RSVP session(s).

/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces: The data nodes defined in this document and under this branch are applicable to one or all RSVP interfaces. Unauthorized access to this container can potentially affect established session(s) over impacted interface(s).

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