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A YANG Data Model for Resource Reservation Protocol (RSVP)
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Abstract

This document defines a YANG data model for the configuration and management of RSVP Protocol. The model covers the building blocks of the RSVP protocol that can be augmented and used by other RSVP extension models such as RVSP extensions to Traffic-Engineering (RSVP-TE). The model covers the configuration, operational state, remote procedural calls, and event notifications data.

Status of This Memo

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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 YANG data model that can be used to configure and manage the RSVP protocol [RFC2205]. This model covers RSVP protocol building blocks that can be augmented and used by other RSVP extension models- such as for signaling RSVP-TE MPLS (or other technology specific) Label Switched Paths (LSP)s.

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]
rt-type	ietf-routing-types	XX
key-chain	ietf-key-chain	XX

Table 1: Prefixes and corresponding YANG modules

2. Design Considerations

2.1. Module Hierarchy

The RSVP base YANG module augments the "control-plane-protocol" list in ietf-routing [RFC8022] module with specific RSVP parameters in an "rsvp" container. It also defines an extensiion identity "rsvp" of base "rt:routing-protocol" to identify the RSVP protocol.

During modeling discussion, some RSVP features are categorized as core to the functionality of the protocol, and hence, are supported by all vendors claiming the support for RSVP. These features' configuration and state were grouped in the RSVP base module.

Other extended RSVP features are categorized as either optional or providing additional knobs to provide better tune basic functionality of the RSVP protocol. The support for extended RSVP features by all vendors was considered optional. Such features were grouped in a separate RSVP extended module.

The augmentation of the RSVP model by other models (e.g. RSVP-TE for MPLS or other technologies) are considered outside the scope of this document and discussed in separate document(s).

```
                  +--------------+
         Routing  | ietf-routing |
                  +--------------+
                        o
                        |
                   +-----------+
     RSVP module   | ietf-rsvp |
                   +-----------+
                        o
                        |
     RSVP extended      |
       module       +--------------------+
                    | ietf-rsvp-extended |
                    +--------------------+
```

Figure 1: Relationship of RSVP and RSVP extended modules with other protocol modules

The RSVP base model does not aim to be feature complete. The primary intent is to cover a set of standard core features (listed below) that are commonly in use.

- o Authentication ([RFC2747])
- o Refresh Reduction ([RFC2961])
- o Hellos ([RFC3209])
- o Graceful Restart ([RFC3473], [RFC5063])

The extended RSVP YANG model covers non-basic configuration(s) for RSVP feature(s) as well as optional RSVP feature that are not a must for basic RSVP operation.

2.2. Data Organization

Throughout the model, the approach described in [I-D.openconfig-netmod-opstate] is adopted to represent data pertaining to configuration intended state, applied state and derived state data elements. Each container in the model hold a "config" and "state" sub-container.

The "config" sub-container is used to represent the intended configurable parameters, and the state sub-container is used to represent both the applied configurable parameters and any derived state, such as counters or statistical information.

The decision to use this approach was made to better align with the MPLS consolidated model in [I-D.openconfig-mpls-consolidated-model], and maximize reusability of groupings defined in this document and allow for possible convergence between the two models.

The approach described in [I-D.openconfig-netmod-opstate] allows for modeling the respective intended and applied configuration and derived state. The state data can be categorized into one of the following:

o State corresponding to applied configuration

o State corresponding to derived state, counters, stats, etc.

Pure state data (for example, protocol derived data) is placed inside the "state" sub-container, as shown in Figure 2.

2.3. Configuration Inheritance

The defined data model supports configuration inheritance for neighbors, and interfaces. Data elements defined in the main container (e.g. the container that encompasses the list of interfaces, or neighbors) are assumed to apply equally to all elements of the list, unless overridden explicitly for a certain element (e.g. interface). Vendors are expected to augment the above container(s) to provide the list of inheritance command for their implementations.

3. Model Organization

This document divides the RSVP model into two modules: the RSVP base and extended. Each module covers the configuration, state, notification and RPCs of data. The relationship between the different modules is depicted in Figure 1.

3.1. RSVP Base YANG Model

This section describes the RSVP base YANG data model. The container "rsvp" is the top level container in this data model. The presence of this container enables the RSVP protocol functionality.

Data for such state is contained under the respective "state" sub-container of the intended object (e.g. interface) as shown in Figure 2.

```
module: ietf-rsvp
   +--rw rsvp!
      +--rw globals
```

```
               +-- rw config
                  <<intended configuration>>
               .
               +-- ro state
                  <<applied configuration>>
                  <<derived state associated with the tunnel>>
            .
            .
         +--rw interfaces
               +-- rw config
                  <<intended configuration>>
               .
               +-- ro state
                  <<applied configuration>>
                  <<derived state associated with the tunnel>>
            .
            .
         +--rw neighbors
               +-- rw config
                  <<intended configuration>>
               .
               +-- ro state
                  <<applied configuration>>
                  <<derived state associated with the tunnel>>
            .
            .
         +--rw sessions
               +-- rw config
                  <<intended configuration>>
               .
               +-- ro state
                  <<applied configuration>>
                  <<derived state associated with the tunnel>>
            .
      rpcs:
         +--x global-rpc
         +--x interfaces-rpc
         +--x neighbors-rpc
         +--x sessions-rpc
      notifications:
         +--n global-notif
         +--n interfaces-notif
         +--n neighbors-notif
         +--n sessions-notif
```

Figure 2: RSVP high-level tree model view

The following subsections provide overview of the parts of the model pertaining to configuration and state data.

Configuration and state data are organized into those applicable globally (node scope), per interfaces, per neighbors, or per session.

3.1.1. Global Data

This branch of the data model covers global configuration and states that control RSVP protocol behavior.

3.1.2. Interface Data

This branch of the data model covers configuration and state elements relevant to one or all RSVP interfaces. Any data configuration applied at the "interfaces" container level are equally applicable to all interfaces - unless overridden by explicit configuration under a specific interface.

3.1.3. Neighbor Data

This branch of the data model covers configuration of elements relevant to RSVP neighbors. This would be discussed in detail in future revisions.

3.1.4. Session Data

This branch of the data model covers configuration of elements relevant to RSVP sessions. This would be discussed in detail in future revisions.

3.1.5. Tree Diagram

```
module: ietf-rsvp
  augment
  /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:
    +--rw rsvp!
       +--rw globals
       |  +--rw sessions
       |  |  +--ro session* [local-index]
       |  |     +--ro local-index    -> ../state/local-index
       |  |     +--ro state
       |  |        +--ro local-index?        uint64
       |  |        +--ro destination-port?   inet:port-number
       |  |        +--ro source?             inet:ip-address
       |  |        +--ro destination?        inet:ip-address
       |  |        +--ro session-name?       string
       |  |        +--ro session-state?      enumeration
```

```
        |  |        +--ro session-type?       identityref
        |  |        +--ro psbs
        |  |        |  +--ro psb*
        |  |        |     +--ro source-port?   inet:port-number
        |  |        |     +--ro expires-in?    uint32
        |  |        +--ro rsbs
        |  |           +--ro rsb*
        |  |              +--ro source-port?         inet:port-number
        |  |              +--ro reservation-style?   identityref
        |  |              +--ro expires-in?          uint32
        |  +--rw statistics
        |  |  +--ro state
        |  |     +--ro messages
        |  |     |  +--ro ack-sent?                      yang:counter64
        |  |     |  +--ro ack-received?                  yang:counter64
        |  |     |  +--ro bundle-sent?                   yang:counter64
        |  |     |  +--ro bundle-received?               yang:counter64
        |  |     |  +--ro hello-sent?                    yang:counter64
        |  |     |  +--ro hello-received?                yang:counter64
        |  |     |  +--ro integrity-challenge-sent?      yang:counter64
        |  |     |  +--ro integrity-challenge-received?  yang:counter64
        |  |     |  +--ro integrity-response-sent?       yang:counter64
        |  |     |  +--ro integrity-response-received?   yang:counter64
        |  |     |  +--ro notify-sent?                   yang:counter64
        |  |     |  +--ro notify-received?               yang:counter64
        |  |     |  +--ro path-sent?                     yang:counter64
        |  |     |  +--ro path-received?                 yang:counter64
        |  |     |  +--ro path-err-sent?                 yang:counter64
        |  |     |  +--ro path-err-received?             yang:counter64
        |  |     |  +--ro path-tear-sent?                yang:counter64
        |  |     |  +--ro path-tear-received?            yang:counter64
        |  |     |  +--ro resv-sent?                     yang:counter64
        |  |     |  +--ro resv-received?                 yang:counter64
        |  |     |  +--ro resv-confirm-sent?             yang:counter64
        |  |     |  +--ro resv-confirm-received?         yang:counter64
        |  |     |  +--ro resv-err-sent?                 yang:counter64
        |  |     |  +--ro resv-err-received?             yang:counter64
        |  |     |  +--ro resv-tear-sent?                yang:counter64
        |  |     |  +--ro resv-tear-received?            yang:counter64
        |  |     |  +--ro summary-refresh-sent?          yang:counter64
        |  |     |  +--ro summary-refresh-received?      yang:counter64
        |  |     |  +--ro unknown-messages-received?     yang:counter64
        |  |     +--ro packets
        |  |     |  +--ro sent?       yang:counter64
        |  |     |  +--ro received?   yang:counter64
        |  |     +--ro errors
        |  |        +--ro authenticate?   yang:counter64
        |  |        +--ro checksum?       yang:counter64
```

```
       |  |        +--ro packet-len?     yang:counter64
       |  +--rw graceful-restart
       |     +--rw config
       |     |  +--rw enabled?   boolean
       |     +--ro state
       |        +--ro enabled?   boolean
       +--rw interfaces
       |  +--rw config
       |  +--ro state
       |  +--rw refresh-reduction
       |  |  +--rw config
       |  |  |  +--rw enabled?   boolean
       |  |  +--ro state
       |  |     +--ro enabled?   boolean
       |  +--rw hellos
       |  |  +--rw config
       |  |  |  +--rw enabled?   boolean
       |  |  +--ro state
       |  |     +--ro enabled?   boolean
       |  +--rw authentication
       |  |  +--rw config
       |  |  |  +--rw enabled?              boolean
       |  |  |  +--rw authentication-key?   string
       |  |  |  +--rw crypto-algorithm      identityref
       |  |  +--ro state
       |  |     +--ro enabled?              boolean
       |  |     +--ro authentication-key?   string
       |  |     +--ro crypto-algorithm      identityref
       |  +--rw statistics
       |  |  +--ro state
       |  |     +--ro messages
       |  |     |  +--ro ack-sent?                       yang:counter64
       |  |     |  +--ro ack-received?                   yang:counter64
       |  |     |  +--ro bundle-sent?                    yang:counter64
       |  |     |  +--ro bundle-received?                yang:counter64
       |  |     |  +--ro hello-sent?                     yang:counter64
       |  |     |  +--ro hello-received?                 yang:counter64
       |  |     |  +--ro integrity-challenge-sent?       yang:counter64
       |  |     |  +--ro integrity-challenge-received?   yang:counter64
       |  |     |  +--ro integrity-response-sent?        yang:counter64
       |  |     |  +--ro integrity-response-received?    yang:counter64
       |  |     |  +--ro notify-sent?                    yang:counter64
       |  |     |  +--ro notify-received?                yang:counter64
       |  |     |  +--ro path-sent?                      yang:counter64
       |  |     |  +--ro path-received?                  yang:counter64
       |  |     |  +--ro path-err-sent?                  yang:counter64
       |  |     |  +--ro path-err-received?              yang:counter64
       |  |     |  +--ro path-tear-sent?                 yang:counter64
```

```
        |  |     |  +--ro path-tear-received?            yang:counter64
        |  |     |  +--ro resv-sent?                     yang:counter64
        |  |     |  +--ro resv-received?                 yang:counter64
        |  |     |  +--ro resv-confirm-sent?             yang:counter64
        |  |     |  +--ro resv-confirm-received?         yang:counter64
        |  |     |  +--ro resv-err-sent?                 yang:counter64
        |  |     |  +--ro resv-err-received?             yang:counter64
        |  |     |  +--ro resv-tear-sent?                yang:counter64
        |  |     |  +--ro resv-tear-received?            yang:counter64
        |  |     |  +--ro summary-refresh-sent?          yang:counter64
        |  |     |  +--ro summary-refresh-received?      yang:counter64
        |  |     |  +--ro unknown-messages-received?     yang:counter64
        |  |     +--ro packets
        |  |     |  +--ro sent?       yang:counter64
        |  |     |  +--ro received?   yang:counter64
        |  |     +--ro errors
        |  |        +--ro authenticate?   yang:counter64
        |  |        +--ro checksum?       yang:counter64
        |  |        +--ro packet-len?     yang:counter64
        |  +--rw interface* [interface]
        |     +--rw interface            if:interface-ref
        |     +--rw config
        |     +--ro state
        |     +--rw refresh-reduction
        |     |  +--rw config
        |     |  |  +--rw enabled?   boolean
        |     |  +--ro state
        |     |     +--ro enabled?   boolean
        |     +--rw hellos
        |     |  +--rw config
        |     |  |  +--rw enabled?   boolean
        |     |  +--ro state
        |     |     +--ro enabled?   boolean
        |     +--rw authentication
        |     |  +--rw config
        |     |  |  +--rw enabled?              boolean
        |     |  |  +--rw authentication-key?   string
        |     |  |  +--rw crypto-algorithm      identityref
        |     |  +--ro state
        |     |     +--ro enabled?              boolean
        |     |     +--ro authentication-key?   string
        |     |     +--ro crypto-algorithm      identityref
        |     +--rw statistics
        |        +--ro state
        |           +--ro messages
        |           |  +--ro ack-sent?                    yang:counter64
        |           |  +--ro ack-received?                yang:counter64
        |           |  +--ro bundle-sent?                 yang:counter64
```

```
       |           |  +--ro bundle-received?              yang:counter64
       |           |  +--ro hello-sent?                   yang:counter64
       |           |  +--ro hello-received?               yang:counter64
       |           |  +--ro integrity-challenge-sent?     yang:counter64
       |           |  +--ro integrity-challenge-received? yang:counter64
       |           |  +--ro integrity-response-sent?      yang:counter64
       |           |  +--ro integrity-response-received?  yang:counter64
       |           |  +--ro notify-sent?                  yang:counter64
       |           |  +--ro notify-received?              yang:counter64
       |           |  +--ro path-sent?                    yang:counter64
       |           |  +--ro path-received?                yang:counter64
       |           |  +--ro path-err-sent?                yang:counter64
       |           |  +--ro path-err-received?            yang:counter64
       |           |  +--ro path-tear-sent?               yang:counter64
       |           |  +--ro path-tear-received?           yang:counter64
       |           |  +--ro resv-sent?                    yang:counter64
       |           |  +--ro resv-received?                yang:counter64
       |           |  +--ro resv-confirm-sent?            yang:counter64
       |           |  +--ro resv-confirm-received?        yang:counter64
       |           |  +--ro resv-err-sent?                yang:counter64
       |           |  +--ro resv-err-received?            yang:counter64
       |           |  +--ro resv-tear-sent?               yang:counter64
       |           |  +--ro resv-tear-received?           yang:counter64
       |           |  +--ro summary-refresh-sent?         yang:counter64
       |           |  +--ro summary-refresh-received?     yang:counter64
       |           |  +--ro unknown-messages-received?    yang:counter64
       |           +--ro packets
       |           |  +--ro sent?       yang:counter64
       |           |  +--ro received?   yang:counter64
       |           +--ro errors
       |              +--ro authenticate?   yang:counter64
       |              +--ro checksum?       yang:counter64
       |              +--ro packet-len?     yang:counter64
       +--rw neighbors
          +--rw neighbor* [address]
             +--rw address    -> ../config/address
             +--rw config
             |  +--rw address?   inet:ip-address
             +--ro state
                +--ro address?                     inet:ip-address
                +--ro epoch?                       uint32
                +--ro expiry-time?                 uint32
                +--ro graceful-restart
                |  +--ro enabled?                  boolean
                |  +--ro local-restart-time?       uint32
                |  +--ro local-recovery-time?      uint32
                |  +--ro neighbor-restart-time?    uint32
                |  +--ro neighbor-recovery-time?   uint32
```

```
                |  +--ro helper-mode
                |     +--ro enabled?                            boolean
                |     +--ro max-helper-restart-time?            uint32
                |     +--ro max-helper-recovery-time?           uint32
                |     +--ro neighbor-restart-time-remaining?    uint32
                |     +--ro neighbor-recovery-time-remaining?   uint32
                +--ro hello-status?                enumeration
                +--ro interface?                   if:interface-ref
                +--ro neighbor-state?              enumeration
                +--ro refresh-reduction-capable?   boolean
                +--ro restart-count?               yang:counter32
                +--ro restart-time?                yang:date-and-time
```

Figure 3: RSVP model tree diagram

3.1.6. YANG Module

```
<CODE BEGINS> file "ietf-rsvp@2017-03-10.yang"
module ietf-rsvp {

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

  /* Replace with IANA when assigned */
  prefix "rsvp";

  import ietf-interfaces {
    prefix "if";
  }

  import ietf-inet-types {
    prefix inet;
  }

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

  import ietf-routing {
    prefix "rt";
  }

  import ietf-key-chain {
    prefix "key-chain";
  }

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

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

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

     revision "2017-03-10" {
       description "Latest revision of RSVP yang module.";
       reference "RFC2205";
     }

     identity rsvp {
       base "rt:routing-protocol";
       description "RSVP protocol";
     }

     identity rsvp-session-type {
```

```
      description "Base RSVP session type";
    }

    identity rsvp-session-ipv4 {
      base rsvp-session-type;
      description "RSVP IPv4 session type";
    }

    identity rsvp-session-ipv6 {
      base rsvp-session-type;
      description "RSVP IPv4 session type";
    }

    identity reservation-style {
      description "Base identity for reservation style";
    }

    identity reservation-wildcard-filter {
      base reservation-style;
      description "Wildcard-Filter (WF) Style";
      reference "RFC2205";
    }

    identity reservation-fixed-filter {
      base reservation-style;
      description "Fixed-Filter (FF) Style";
      reference "RFC2205";
    }

    identity reservation-shared-explicit {
      base reservation-style;
      description "Shared Explicit (SE) Style";
      reference "RFC2205";
    }

    grouping graceful-restart_config {
      description
        "Base configuration parameters relating to RSVP
         Graceful-Restart";
      leaf enabled {
        type boolean;
        description
          "'true' if RSVP Graceful Restart is enabled.
           'false' if RSVP Graceful Restart is disabled.";
      }
    }

    grouping graceful-restart {
```

```
      description
        "RSVP graceful restart parameters grouping";
      container graceful-restart {
        description
          "RSVP graceful restart parameters container";
        container config {
          description
            "Configuration parameters for graceful restart
             properties";
          uses graceful-restart_config;
        }
        container state {
          config false;
          description
            "State parameters for graceful restart
             properties";
          uses graceful-restart_config;
        }
      }
    }

    grouping refresh-reduction_config {
      description
        "Configuration parameters relating to RSVP
         refresh reduction";

      leaf enabled {
        type boolean;
        description
          "'true' if RSVP Refresh Reduction is enabled.
           'false' if RSVP Refresh Reduction is disabled.";
      }
    }

    grouping refresh-reduction {
      description
        "Top level grouping for RSVP refresh reduction
         parameters";
      container refresh-reduction {
        description
          "Top level container for RSVP refresh reduction
           parameters";
        container config {
          description
            "Configuration parameters relating to
             RSVP refresh reduction parameters";
          uses refresh-reduction_config;
        }
```

```
        container state {
          config false;
          description
            "State information associated with RSVP
             refresh reduction parameters";
          uses refresh-reduction_config;
        }
      }
    }

    grouping authentication_config {
      description
        "Configuration parameters relating to RSVP
         authentication";
      leaf enabled {
        type boolean;
        description
          "'true' if RSVP Authentication is enabled.
           'false' if RSVP Authentication is disabled.";
      }
      leaf authentication-key {
        type string;
        description
          "An authentication key string";
        reference
          "RFC 2747: RSVP Cryptographic Authentication";
      }
      leaf crypto-algorithm {
       type identityref {
         base key-chain:crypto-algorithm;
       }
       mandatory true;
       description
         "Cryptographic algorithm associated with key.";
      }
    }

    grouping authentication {
      description
        "Top level grouping for RSVP authentication parameters";
      container authentication {
        description
          "Top level container for RSVP authentication
           parameters";
        container config {
          description
            "Configuration parameters relating to
             RSVP authentication parameters";
```

```
          uses authentication_config;
        }
        container state {
          config false;
          description
            "State information associated with RSVP
             authentication parameters";
          uses authentication_config;
        }
      }
    }

    grouping hellos_config {
      description
        "Configuration parameters relating to RSVP
        hellos";
      leaf enabled {
        type boolean;
        description
          "'true' if RSVP Hello is enabled.
           'false' if RSVP Hello is disabled.";
      }
    }

    grouping hellos {
      description
        "Top level grouping for RSVP hellos parameters";
      container hellos {
        description
          "Top level container for RSVP hello parameters";
        container config {
          description
            "Configuration parameters relating to
             RSVP hello parameters";
          uses hellos_config;
        }
        container state {
          config false;
          description
            "State information associated with RSVP
             hello parameters";
          uses hellos_config;
        }
      }
    }

    grouping signaling-parameters_config {
      description
```

```
        "Configuration parameters relating to RSVP
        signaling";
    }

    grouping signaling-parameters {
      description
        "Top level grouping for RSVP signaling  parameters";
      container config {
        description
          "Configuration parameters relating to
           RSVP signaling parameters";
        uses signaling-parameters_config;
      }
      container state {
        config false;
        description
          "State information associated with RSVP
           signaling parameters";
        uses signaling-parameters_config;
      }
    }

    grouping session-attributes_state {
      description
        "Top level grouping for RSVP session properties";
      leaf local-index {
        type uint64;
        description
          "The index used to identify the RSVP session
           on the local network element. This index is
           generated by the device and is unique only
           to the local network element.";
      }
      leaf destination-port {
        type inet:port-number;
        description "RSVP destination port";
        reference "RFC2205";
      }
      leaf source {
        type inet:ip-address;
        description "RSVP source address";
        reference "RFC2205";
      }
      leaf destination {
        type inet:ip-address;
        description "RSVP destination address";
        reference "RFC2205";
      }
```

```
        leaf session-name {
          type string;
          description
            "The signaled name of this RSVP session.";
        }
        leaf session-state {
          type enumeration {
            enum "up" {
              description
                "RSVP session is up";
            }
            enum "down" {
              description
                "RSVP session is down";
            }
          }
          description
            "Enumeration of RSVP session states";
        }
        leaf session-type {
          type identityref {
            base rsvp-session-type;
          }
          description "RSVP session type";
        }
        container psbs {
          description "Path State Block container";
          list psb {
            description "List of path state blocks";
            leaf source-port {
              type inet:port-number;
              description "RSVP source port";
              reference "RFC2205";
            }
            leaf expires-in {
              type uint32;
              units seconds;
              description "Time to reservation expiry (in seconds)";
            }
          }
        }
        container rsbs {
          description "Reservation State Block container";
          list rsb {
            description "List of reservation state blocks";
            leaf source-port {
              type inet:port-number;
              description "RSVP source port";
```

```
            reference "RFC2205";
          }
          leaf reservation-style {
            type identityref {
              base reservation-style;
            }
            description "RSVP reservation style";
          }
          leaf expires-in {
            type uint32;
            units seconds;
            description "Time to reservation expiry (in seconds)";
          }
        }
      }
    }

    grouping neighbor-attributes {
      description
        "Top level grouping for RSVP neighbor properties";
      container config {
        description
          "Configuration for neighbor properties";
        leaf address {
          type inet:ip-address;
          description
            "Address of RSVP neighbor";
        }
      }
      container state {
        config false;
        description
          "State information associated with RSVP
           neighbor properties";
        uses neighbor-derived_state;
      }
    }

    grouping packets_state {
      description
        "Packet statistics grouping";
      container packets {
        description
          "Packet statistics container";
        leaf sent {
          type yang:counter64;
          description
            "Packet sent count";
```

```
        }

        leaf received {
          type yang:counter64;
          description
            "Packet received count";
        }
      }
    }

    grouping protocol_state {
      description
        "RSVP protocol statistics grouping";
      container messages {
        description
          "RSVP protocol statistics container";
        leaf ack-sent {
          type yang:counter64;
          description
            "Hello sent count";
        }

        leaf ack-received {
          type yang:counter64;
          description
            "Hello received count";
        }

        leaf bundle-sent {
          type yang:counter64;
          description
            "Bundle sent count";
        }

        leaf bundle-received {
          type yang:counter64;
          description
            "Bundle received count";
        }

        leaf hello-sent {
          type yang:counter64;
          description
            "Hello sent count";
        }

        leaf hello-received {
          type yang:counter64;
```

```
          description
            "Hello received count";
        }

        leaf integrity-challenge-sent {
          type yang:counter64;
          description
            "Integrity Challenge sent count";
        }

        leaf integrity-challenge-received {
          type yang:counter64;
          description
            "Integrity Challenge received count";
        }

        leaf integrity-response-sent {
          type yang:counter64;
          description
            "Integrity Response sent count";
        }

        leaf integrity-response-received {
          type yang:counter64;
          description
            "Integrity Response received count";
        }

        leaf notify-sent {
          type yang:counter64;
          description
            "Notify sent count";
        }

        leaf notify-received {
          type yang:counter64;
          description
            "Notify received count";
        }

        leaf path-sent {
          type yang:counter64;
          description
            "Path sent count";
        }

        leaf path-received {
          type yang:counter64;
```

```
          description
            "Path received count";
        }

        leaf path-err-sent {
          type yang:counter64;
          description
            "Path error sent count";
        }

        leaf path-err-received {
          type yang:counter64;
          description
            "Path error received count";
        }

        leaf path-tear-sent {
          type yang:counter64;
          description
            "Path tear sent count";
        }

        leaf path-tear-received {
          type yang:counter64;
          description
            "Path tear received count";
        }

        leaf resv-sent {
          type yang:counter64;
          description
            "Resv sent count";
        }

        leaf resv-received {
          type yang:counter64;
          description
            "Resv received count";
        }

        leaf resv-confirm-sent {
          type yang:counter64;
          description
            "Confirm sent count";
        }

        leaf resv-confirm-received {
          type yang:counter64;
```

```
          description
            "Confirm received count";
        }

        leaf resv-err-sent {
          type yang:counter64;
          description
            "Resv error sent count";
        }

        leaf resv-err-received {
          type yang:counter64;
          description
            "Resv error received count";
        }

        leaf resv-tear-sent {
          type yang:counter64;
          description
            "Resv tear sent count";
        }

        leaf resv-tear-received {
          type yang:counter64;
          description
            "Resv tear received count";
        }

        leaf summary-refresh-sent {
          type yang:counter64;
          description
            "Summary refresh sent count";
        }

        leaf summary-refresh-received {
          type yang:counter64;
          description
            "Summary refresh received count";
        }

        leaf unknown-messages-received {
          type yang:counter64;
          description
            "Unknown packet received count";
        }
      }
    }
```

```
     grouping errors_state {
       description
         "Error statistics state grouping";
       container errors {
         description
           "Error statistics state container";
         leaf authenticate {
           type yang:counter64;
           description
             "The total number of packets received with an
             authentication failure.";
         }

         leaf checksum {
           type yang:counter64;
           description
             "The total number of packets received with an invalid
             checksum value.";
         }

         leaf packet-len {
           type yang:counter64;
           description
             "The total number of packets received with an invalid
             packet length.";
         }
       }
     }

     grouping statistics_state {
       description "RSVP statistic attributes.";
       container statistics {
         description
           "statistics state container";
         container state {
           config false;
           description
             "State information associated with RSVP
              hello parameters";
           uses protocol_state;
           uses packets_state;
           uses errors_state;
         }
       }
     }

     grouping neighbor-derived_state {
       description
```

```
         "Derived state at neighbor level.";

       leaf address {
         type inet:ip-address;
         description
           "Address of RSVP neighbor";
       }

       leaf epoch {
         type uint32;
         description
           "Neighbor epoch.";
       }

       leaf expiry-time {
         type uint32;
         units seconds;
         description
           "Neighbor expiry time after which the neighbor state
           is purged if no states associated with it";
       }

       container graceful-restart {
         description
           "Graceful restart information.";

         leaf enabled {
           type boolean;
           description
             "'true' if graceful restart is enabled for the
             neighbor.";
         }

         leaf local-restart-time {
           type uint32;
           units seconds;
           description
             "Local node restart time";
         }

         leaf local-recovery-time {
           type uint32;
           units seconds;
           description
             "Local node recover time";
         }

         leaf neighbor-restart-time {
```

```
            type uint32;
            units seconds;
            description
              "Neighbor restart time";
          }

          leaf neighbor-recovery-time {
            type uint32;
            units seconds;
            description
              "Neighbor recover time";
          }

          container helper-mode {
            description
              "Helper mode information ";

            leaf enabled {
              type boolean;
              description
                "'true' if helper mode is enabled.";
            }

            leaf max-helper-restart-time {
              type uint32;
              units seconds;
              description
                "The time the router or switch waits after it
                 discovers that a neighboring router has gone down
                 before it declares the neighbor down";
            }

            leaf max-helper-recovery-time {
              type uint32;
              units seconds;
              description
                "The amount of time the router retains the state of its
                 RSVP neighbors while they undergo a graceful restart";
            }

            leaf neighbor-restart-time-remaining {
              type uint32;
              units seconds;
              description
                "Number of seconds remaining for neighbor to send
                 Hello message after restart.";
            }
```

```
          leaf neighbor-recovery-time-remaining {
            type uint32;
            units seconds;
            description
              "Number of seconds remaining for neighbor to
              refresh.";
          }
        } // helper-mode
      } // graceful-restart

      leaf hello-status {
        type enumeration {
          enum "enabled" {
            description
              "Enabled";
          }
          enum "disabled" {
            description
              "Disabled";
          }
          enum "restarting" {
            description
              "Restarting";
          }
        }
        description
          "Hello status";
      }

      leaf interface {
        type if:interface-ref;
        description
          "Interface where RSVP neighbor was detected";
      }

      leaf neighbor-state {
        type enumeration {
          enum "up" {
            description
              "up";
          }
          enum "down" {
            description
              "down";
          }
          enum "hello-disable" {
            description
              "hello-disable";
```

```
          }
          enum "restarting" {
            description
              "restarting";
          }
        }
        description
          "Neighbor state";
      }

      leaf refresh-reduction-capable {
        type boolean;
        description
          "enables all RSVP refresh reduction message
           bundling, RSVP message ID, reliable message delivery
           and summary refresh";
        reference
          "RFC 2961 RSVP Refresh Overhead Reduction
           Extensions";
      }

      leaf restart-count {
        type yang:counter32;
        description
          "Number of times this neighbor restart";
      }

      leaf restart-time {
        type yang:date-and-time;
        description
          "Last restart time of the neighbor";
      }
    }

    grouping global-attributes {
      description
        "Top level grouping for RSVP global properties";
      container sessions {
        description
          "RSVP sessions container";
        list session {
          key "local-index";
          config false;
          description
            "List of RSVP sessions";

          leaf local-index {
            type leafref {
```

```
                path "../state/local-index";
              }
              description
                "Reference to the local index for the RSVP
                session";
            }
            container state {
              config false;
              description
                "State information associated with RSVP
                 session parameters";
              uses session-attributes_state;
            }
          }
        }
        uses statistics_state;
      }

      grouping intf-attributes {
        description
          "Top level grouping for RSVP interface properties";
        uses signaling-parameters;
        uses refresh-reduction;
        uses hellos;
        uses authentication;
        uses statistics_state;
      }

      augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol" {
        when "rt:type = 'rsvp:rsvp'" {
        description
         "This augment is only valid when routing protocol
          instance type is RSVP.";
        }
        description
          "RSVP protocol augmentation";
        container rsvp {
          presence "Enable RSVP feature";
          description "RSVP feature container";
          container globals {
            description "RSVP global properties.";
            uses global-attributes;
            uses graceful-restart;
          }

          container interfaces {
            description
```

```
            "RSVP interfaces container";
          uses intf-attributes;

          list interface {
            key "interface";
            description
              "RSVP interfaces.";
            leaf interface {
              type if:interface-ref;
              description
                "RSVP interface.";
            }
            uses intf-attributes;
          }
        }

        container neighbors {
          description
            "RSVP neighbors container";
          list neighbor {
            key "address";
            description
              "List of RSVP neighbors";
            leaf address {
              type leafref {
                path "../config/address";
              }
              description
                "Address of RSVP neighbor";
            }
            uses neighbor-attributes;
          }
        }
      }
    }
  }
<CODE ENDS>
```

3.2. RSVP Extended YANG Model

The RSVP extended YANG model covers optional or non-core RSVP feature(s). It also covers feature(s) that are not necessarily supported by all vendors, and hence, guarded with "if-feature" checks.

3.2.1. Tree Diagram

Figure 4 shows the YANG tree representation for configuration and state data that is augmenting the RSVP basic module:

```
module: ietf-rsvp
  augment
    /rt:routing/rt:control-plane-protocols/rt:control-plane-protocol:
    +--rw rsvp!
       +--rw globals
       |  +--rw sessions
       |  |  +--ro session* [local-index]
       |  |     +--ro local-index    -> ../state/local-index
       |  |     +--ro state
       |  |        +--ro local-index        uint64
       |  |        +--ro destination-port?   inet:port-number
       |  |        +--ro source?             inet:ip-address
       |  |        +--ro destination?        inet:ip-address
       |  |        +--ro session-name?       string
       |  |        +--ro session-state?      enumeration
       |  |        +--ro session-type?       identityref
       |  |        +--ro psbs
       |  |        |  +--ro psb*
       |  |        |     +--ro source-port?   inet:port-number
       |  |        |     +--ro expires-in?    uint32
       |  |        +--ro rsbs
       |  |           +--ro rsb*
       |  |              +--ro source-port?         inet:port-number
       |  |              +--ro reservation-style?   identityref
       |  |              +--ro expires-in?          uint32
       |  +--rw statistics
       |  |  +--ro state
       |  |     +--ro messages
       |  |     |  +--ro ack-sent?                      yang:counter64
       |  |     |  +--ro ack-received?                  yang:counter64
       |  |     |  +--ro bundle-sent?                   yang:counter64
       |  |     |  +--ro bundle-received?               yang:counter64
       |  |     |  +--ro hello-sent?                    yang:counter64
       |  |     |  +--ro hello-received?                yang:counter64
       |  |     |  +--ro integrity-challenge-sent?      yang:counter64
       |  |     |  +--ro integrity-challenge-received?  yang:counter64
       |  |     |  +--ro integrity-response-sent?       yang:counter64
       |  |     |  +--ro integrity-response-received?   yang:counter64
       |  |     |  +--ro notify-sent?                   yang:counter64
       |  |     |  +--ro notify-received?               yang:counter64
       |  |     |  +--ro path-sent?                     yang:counter64
       |  |     |  +--ro path-received?                 yang:counter64
       |  |     |  +--ro path-err-sent?                 yang:counter64
```

```
        |  |     |  +--ro path-err-received?             yang:counter64
        |  |     |  +--ro path-tear-sent?                yang:counter64
        |  |     |  +--ro path-tear-received?            yang:counter64
        |  |     |  +--ro resv-sent?                     yang:counter64
        |  |     |  +--ro resv-received?                 yang:counter64
        |  |     |  +--ro resv-confirm-sent?             yang:counter64
        |  |     |  +--ro resv-confirm-received?         yang:counter64
        |  |     |  +--ro resv-err-sent?                 yang:counter64
        |  |     |  +--ro resv-err-received?             yang:counter64
        |  |     |  +--ro resv-tear-sent?                yang:counter64
        |  |     |  +--ro resv-tear-received?            yang:counter64
        |  |     |  +--ro summary-refresh-sent?          yang:counter64
        |  |     |  +--ro summary-refresh-received?      yang:counter64
        |  |     |  +--ro unknown-messages-received?     yang:counter64
        |  |     +--ro packets
        |  |     |  +--ro sent?                         yang:counter64
        |  |     |  +--ro received?                     yang:counter64
        |  |     |  +--ro rsvp-ext:discontinuity-time? yang:date-and-time
        |  |     |  +--ro rsvp-ext:out-dropped?         yang:counter64
        |  |     |  +--ro rsvp-ext:in-dropped?          yang:counter64
        |  |     |  +--ro rsvp-ext:out-error?           yang:counter64
        |  |     |  +--ro rsvp-ext:in-error?            yang:counter64
        |  |     +--ro errors
        |  |        +--ro authenticate?   yang:counter64
        |  |        +--ro checksum?       yang:counter64
        |  |        +--ro packet-len?     yang:counter64
        |  +--rw graceful-restart
        |     +--rw config
        |     |  +--rw enabled?                  boolean
        |     |  +--rw rsvp-ext:restart-time?    uint32
        |     |  +--rw rsvp-ext:recovery-time?   uint32
        |     +--ro state
        |        +--ro enabled?                  boolean
        |        +--ro rsvp-ext:restart-time?    uint32
        |        +--ro rsvp-ext:recovery-time?   uint32
        +--rw interfaces
        |  +--rw config
        |  |  +--rw rsvp-ext:refresh-interval?        uint32
        |  |  +--rw rsvp-ext:refresh-misses?          uint32
        |  |  +--rw rsvp-ext:checksum?                boolean
        |  |  +--rw rsvp-ext:patherr-state-removal?   empty
        |  +--ro state
        |  |  +--ro rsvp-ext:refresh-interval?        uint32
        |  |  +--ro rsvp-ext:refresh-misses?          uint32
        |  |  +--ro rsvp-ext:checksum?                boolean
        |  |  +--ro rsvp-ext:patherr-state-removal?   empty
        |  +--rw refresh-reduction
        |  |  +--rw config
```

```
        |  |  |  +--rw enabled?                              boolean
        |  |  |  +--rw rsvp-ext:bundle-message-max-size?    uint32
        |  |  |  +--rw rsvp-ext:reliable-ack-hold-time?     uint32
        |  |  |  +--rw rsvp-ext:reliable-ack-max-size?      uint32
        |  |  |  +--rw rsvp-ext:reliable-retransmit-time?   uint32
        |  |  |  +--rw rsvp-ext:reliable-srefresh?          empty
        |  |  |  +--rw rsvp-ext:summary-max-size?           uint32
        |  |  +--ro state
        |  |     +--ro enabled?                              boolean
        |  |     +--ro rsvp-ext:bundle-message-max-size?    uint32
        |  |     +--ro rsvp-ext:reliable-ack-hold-time?     uint32
        |  |     +--ro rsvp-ext:reliable-ack-max-size?      uint32
        |  |     +--ro rsvp-ext:reliable-retransmit-time?   uint32
        |  |     +--ro rsvp-ext:reliable-srefresh?          empty
        |  |     +--ro rsvp-ext:summary-max-size?           uint32
        |  +--rw hellos
        |  |  +--rw config
        |  |  |  +--rw enabled?                    boolean
        |  |  |  +--rw rsvp-ext:interface-based?   empty
        |  |  |  +--rw rsvp-ext:hello-interval?    uint32
        |  |  |  +--rw rsvp-ext:hello-misses?      uint32
        |  |  +--ro state
        |  |     +--ro enabled?                    boolean
        |  |     +--ro rsvp-ext:interface-based?   empty
        |  |     +--ro rsvp-ext:hello-interval?    uint32
        |  |     +--ro rsvp-ext:hello-misses?      uint32
        |  +--rw authentication
        |  |  +--rw config
        |  |  |  +--rw enabled?                boolean
        |  |  |  +--rw authentication-key?     string
        |  |  |  +--rw crypto-algorithm        identityref
        |  |  |  +--rw rsvp-ext:lifetime?      uint32
        |  |  |  +--rw rsvp-ext:window-size?   uint32
        |  |  |  +--rw rsvp-ext:challenge?     empty
        |  |  |  +--rw rsvp-ext:retransmits?   uint32
        |  |  |  +--rw rsvp-ext:key-chain?     key-chain:key-chain-ref
        |  |  +--ro state
        |  |     +--ro enabled?                boolean
        |  |     +--ro authentication-key?     string
        |  |     +--ro crypto-algorithm        identityref
        |  |     +--ro rsvp-ext:lifetime?      uint32
        |  |     +--ro rsvp-ext:window-size?   uint32
        |  |     +--ro rsvp-ext:challenge?     empty
        |  |     +--ro rsvp-ext:retransmits?   uint32
        |  |     +--ro rsvp-ext:key-chain?     key-chain:key-chain-ref
        |  +--rw statistics
        |  |  +--ro state
        |  |     +--ro messages
```

```
        |  |     |  +--ro ack-sent?                       yang:counter64
        |  |     |  +--ro ack-received?                   yang:counter64
        |  |     |  +--ro bundle-sent?                    yang:counter64
        |  |     |  +--ro bundle-received?                yang:counter64
        |  |     |  +--ro hello-sent?                     yang:counter64
        |  |     |  +--ro hello-received?                 yang:counter64
        |  |     |  +--ro integrity-challenge-sent?       yang:counter64
        |  |     |  +--ro integrity-challenge-received?   yang:counter64
        |  |     |  +--ro integrity-response-sent?        yang:counter64
        |  |     |  +--ro integrity-response-received?    yang:counter64
        |  |     |  +--ro notify-sent?                    yang:counter64
        |  |     |  +--ro notify-received?                yang:counter64
        |  |     |  +--ro path-sent?                      yang:counter64
        |  |     |  +--ro path-received?                  yang:counter64
        |  |     |  +--ro path-err-sent?                  yang:counter64
        |  |     |  +--ro path-err-received?              yang:counter64
        |  |     |  +--ro path-tear-sent?                 yang:counter64
        |  |     |  +--ro path-tear-received?             yang:counter64
        |  |     |  +--ro resv-sent?                      yang:counter64
        |  |     |  +--ro resv-received?                  yang:counter64
        |  |     |  +--ro resv-confirm-sent?              yang:counter64
        |  |     |  +--ro resv-confirm-received?          yang:counter64
        |  |     |  +--ro resv-err-sent?                  yang:counter64
        |  |     |  +--ro resv-err-received?              yang:counter64
        |  |     |  +--ro resv-tear-sent?                 yang:counter64
        |  |     |  +--ro resv-tear-received?             yang:counter64
        |  |     |  +--ro summary-refresh-sent?           yang:counter64
        |  |     |  +--ro summary-refresh-received?       yang:counter64
        |  |     |  +--ro unknown-messages-received?      yang:counter64
        |  |     +--ro packets
        |  |     |  +--ro sent?       yang:counter64
        |  |     |  +--ro received?   yang:counter64
        |  |     +--ro errors
        |  |        +--ro authenticate?   yang:counter64
        |  |        +--ro checksum?       yang:counter64
        |  |        +--ro packet-len?     yang:counter64
        |  +--rw interface* [interface]
        |     +--rw interface            if:interface-ref
        |     +--rw config
        |     |  +--rw rsvp-ext:refresh-interval?        uint32
        |     |  +--rw rsvp-ext:refresh-misses?          uint32
        |     |  +--rw rsvp-ext:checksum?                boolean
        |     |  +--rw rsvp-ext:patherr-state-removal?   empty
        |     +--ro state
        |     |  +--ro rsvp-ext:refresh-interval?        uint32
        |     |  +--ro rsvp-ext:refresh-misses?          uint32
        |     |  +--ro rsvp-ext:checksum?                boolean
        |     |  +--ro rsvp-ext:patherr-state-removal?   empty
```

```
        |     +--rw refresh-reduction
        |     |  +--rw config
        |     |  |  +--rw enabled?                            boolean
        |     |  |  +--rw rsvp-ext:bundle-message-max-size?    uint32
        |     |  |  +--rw rsvp-ext:reliable-ack-hold-time?     uint32
        |     |  |  +--rw rsvp-ext:reliable-ack-max-size?      uint32
        |     |  |  +--rw rsvp-ext:reliable-retransmit-time?   uint32
        |     |  |  +--rw rsvp-ext:reliable-srefresh?          empty
        |     |  |  +--rw rsvp-ext:summary-max-size?           uint32
        |     |  +--ro state
        |     |     +--ro enabled?                            boolean
        |     |     +--ro rsvp-ext:bundle-message-max-size?    uint32
        |     |     +--ro rsvp-ext:reliable-ack-hold-time?     uint32
        |     |     +--ro rsvp-ext:reliable-ack-max-size?      uint32
        |     |     +--ro rsvp-ext:reliable-retransmit-time?   uint32
        |     |     +--ro rsvp-ext:reliable-srefresh?          empty
        |     |     +--ro rsvp-ext:summary-max-size?           uint32
        |     +--rw hellos
        |     |  +--rw config
        |     |  |  +--rw enabled?                    boolean
        |     |  |  +--rw rsvp-ext:interface-based?   empty
        |     |  |  +--rw rsvp-ext:hello-interval?    uint32
        |     |  |  +--rw rsvp-ext:hello-misses?      uint32
        |     |  +--ro state
        |     |     +--ro enabled?                    boolean
        |     |     +--ro rsvp-ext:interface-based?   empty
        |     |     +--ro rsvp-ext:hello-interval?    uint32
        |     |     +--ro rsvp-ext:hello-misses?      uint32
        |     +--rw authentication
        |     |  +--rw config
        |     |  |  +--rw enabled?                boolean
        |     |  |  +--rw authentication-key?     string
        |     |  |  +--rw crypto-algorithm        identityref
        |     |  |  +--rw rsvp-ext:lifetime?      uint32
        |     |  |  +--rw rsvp-ext:window-size?   uint32
        |     |  |  +--rw rsvp-ext:challenge?     empty
        |     |  |  +--rw rsvp-ext:retransmits?   uint32
        |     |  |  +--rw rsvp-ext:key-chain?     key-chain:key-chain-ref
        |     |  +--ro state
        |     |     +--ro enabled?                boolean
        |     |     +--ro authentication-key?     string
        |     |     +--ro crypto-algorithm        identityref
        |     |     +--ro rsvp-ext:lifetime?      uint32
        |     |     +--ro rsvp-ext:window-size?   uint32
        |     |     +--ro rsvp-ext:challenge?     empty
        |     |     +--ro rsvp-ext:retransmits?   uint32
        |     |     +--ro rsvp-ext:key-chain?     key-chain:key-chain-ref
        |     +--rw statistics
```

```
       |        +--ro state
       |           +--ro messages
       |           |  +--ro ack-sent?                     yang:counter64
       |           |  +--ro ack-received?                 yang:counter64
       |           |  +--ro bundle-sent?                  yang:counter64
       |           |  +--ro bundle-received?              yang:counter64
       |           |  +--ro hello-sent?                   yang:counter64
       |           |  +--ro hello-received?               yang:counter64
       |           |  +--ro integrity-challenge-sent?     yang:counter64
       |           |  +--ro integrity-challenge-received? yang:counter64
       |           |  +--ro integrity-response-sent?      yang:counter64
       |           |  +--ro integrity-response-received?  yang:counter64
       |           |  +--ro notify-sent?                  yang:counter64
       |           |  +--ro notify-received?              yang:counter64
       |           |  +--ro path-sent?                    yang:counter64
       |           |  +--ro path-received?                yang:counter64
       |           |  +--ro path-err-sent?                yang:counter64
       |           |  +--ro path-err-received?            yang:counter64
       |           |  +--ro path-tear-sent?               yang:counter64
       |           |  +--ro path-tear-received?           yang:counter64
       |           |  +--ro resv-sent?                    yang:counter64
       |           |  +--ro resv-received?                yang:counter64
       |           |  +--ro resv-confirm-sent?            yang:counter64
       |           |  +--ro resv-confirm-received?        yang:counter64
       |           |  +--ro resv-err-sent?                yang:counter64
       |           |  +--ro resv-err-received?            yang:counter64
       |           |  +--ro resv-tear-sent?               yang:counter64
       |           |  +--ro resv-tear-received?           yang:counter64
       |           |  +--ro summary-refresh-sent?         yang:counter64
       |           |  +--ro summary-refresh-received?     yang:counter64
       |           |  +--ro unknown-messages-received?    yang:counter64
       |           +--ro packets
       |           |  +--ro sent?       yang:counter64
       |           |  +--ro received?   yang:counter64
       |           +--ro errors
       |              +--ro authenticate?   yang:counter64
       |              +--ro checksum?       yang:counter64
       |              +--ro packet-len?     yang:counter64
       +--rw neighbors
          +--rw neighbor* [address]
             +--rw address    -> ../config/address
             +--rw config
             |  +--rw address?   inet:ip-address
             +--ro state
                +--ro address?                     inet:ip-address
                +--ro epoch?                       uint32
                +--ro expiry-time?                 uint32
                +--ro graceful-restart
```

```
                |  +--ro enabled?                  boolean
                |  +--ro local-restart-time?       uint32
                |  +--ro local-recovery-time?      uint32
                |  +--ro neighbor-restart-time?    uint32
                |  +--ro neighbor-recovery-time?   uint32
                |  +--ro helper-mode
                |     +--ro enabled?                            boolean
                |     +--ro max-helper-restart-time?            uint32
                |     +--ro max-helper-recovery-time?           uint32
                |     +--ro neighbor-restart-time-remaining?    uint32
                |     +--ro neighbor-recovery-time-remaining?   uint32
                +--ro hello-status?                enumeration
                +--ro interface?                   if:interface-ref
                +--ro neighbor-state?              enumeration
                +--ro refresh-reduction-capable?   boolean
                +--ro restart-count?               yang:counter32
                +--ro restart-time?                yang:date-and-time
```

Figure 4: RSVP extended model tree diagram

3.2.2. YANG Module

Figure 5 shows the RSVP extended YANG module:

```
<CODE BEGINS> file "ietf-rsvp-extended@2017-03-10.yang"
module ietf-rsvp-extended {

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

  prefix "rsvp-ext";

  import ietf-rsvp {
    prefix "rsvp";
  }

  import ietf-routing {
    prefix "rt";
  }

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

  import ietf-key-chain {
    prefix "key-chain";
  }

  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
                  <mailto:vbeeram@juniper.net>

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

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

        Editor:   Xufeng Liu
                  <mailto:Xufeng_Liu@jabil.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 Extended RSVP YANG data model.";

     revision "2017-03-10" {
       description "Latest revision of RSVP extended yang module.";
       reference "RFC2205";
     }

     /* RSVP features */
     feature authentication {
```

```
      description
        "Indicates support for RSVP authentication";
    }

    feature error-statistics {
      description
        "Indicates support for error statistics";
    }

    feature global-statistics {
      description
        "Indicates support for global statistics";
    }

    feature graceful-restart {
      description
        "Indicates support for RSVP graceful restart";
    }

    feature hellos {
      description
        "Indicates support for RSVP hellos (RFC3209).";
    }

    feature notify {
      description
        "Indicates support for RSVP notify message (RFC3473).";
    }

    feature refresh-reduction {
      description
        "Indicates support for RSVP refresh reduction
         (RFC2961).";
    }

    feature refresh-reduction-extended {
      description
        "Indicates support for RSVP refresh reduction
         (RFC2961).";
    }

    feature per-interface-statistics {
      description
        "Indicates support for per interface statistics";
    }

    grouping graceful-restart-extended_config {
      description
```

```
         "Configuration parameters relating to RSVP
          Graceful-Restart";
       leaf restart-time {
         type uint32;
         units seconds;
         description
           "Graceful restart time (seconds).";
         reference
           "RFC 5495: Description of the Resource
            Reservation Protocol - Traffic-Engineered
            (RSVP-TE) Graceful Restart Procedures";
       }
       leaf recovery-time {
         type uint32;
         units seconds;
         description
           "RSVP state recovery time";
       }
     }

     grouping authentication-extended_config {
       description
         "Configuration parameters relating to RSVP
         authentication";
       leaf lifetime {
         type uint32 {
           range "30..86400";
         }
                           units seconds;
         description
           "Life time for each security association";
         reference
           "RFC 2747: RSVP Cryptographic
           Authentication";
       }
       leaf window-size {
         type uint32 {
           range "1..64";
         }
         description
           "Window-size to limit number of out-of-order
            messages.";
         reference
           "RFC 2747: RSVP Cryptographic
            Authentication";
       }
       leaf challenge {
         type empty;
```

```
        description
          "Enable challenge messages.";
        reference
          "RFC 2747: RSVP Cryptographic
           Authentication";
      }
      leaf retransmits {
        type uint32 {
          range "1..10000";
        }
        description
          "Number of retransmits when messages are
           dropped.";
        reference
          "RFC 2747: RSVP Cryptographic
           Authentication";
      }
      leaf key-chain {
                           type key-chain:key-chain-ref;
        description
          "Key chain name to authenticate RSVP
           signaling messages.";
        reference
          "RFC 2747: RSVP Cryptographic
           Authentication";
      }
    }

    grouping hellos-extended_config {
      description
        "Configuration parameters relating to RSVP
         hellos";
      leaf interface-based {
        type empty;
        description
          "Enable interface-based Hello adjacency if present.";
      }
      leaf hello-interval {
        type uint32;
        units milliseconds;
        description
          "Configure interval between successive Hello
           messages in milliseconds.";
        reference
          "RFC 3209: RSVP-TE: Extensions to RSVP for LSP Tunnels.
           RFC 5495: Description of the Resource
           Reservation Protocol - Traffic-Engineered
           (RSVP-TE) Graceful Restart Procedures";
```

```
      }
      leaf hello-misses {
        type uint32 {
          range "1..10";
        }
        description
          "Configure max number of consecutive missed
           Hello messages.";
        reference
          "RFC 3209: RSVP-TE: Extensions to RSVP for
           LSP Tunnels RFC 5495: Description of the
           Resource Reservation Protocol - Traffic-
           Engineered (RSVP-TE) Graceful Restart
           Procedures";
      }
    }

    grouping signaling-parameters-extended_config {
      description
        "Configuration parameters relating to RSVP
         signaling";
      leaf refresh-interval {
        type uint32;
        description
          "Set interval between successive refreshes";
      }
      leaf refresh-misses {
        type uint32;
        description
          "Set max number of consecutive missed
          messages for state expiry";
      }
      leaf checksum {
        type boolean;
        description
          "Enable RSVP message checksum computation";
      }
      leaf patherr-state-removal {
        type empty;
        description
          "State-Removal flag in Path Error message
          if present.";
      }
    }

    grouping refresh-reduction-extended_config {
      description
        "Configuration parameters relating to RSVP
```

```
          refresh reduction";

        leaf bundle-message-max-size {
          type uint32 {
            range "512..65000";
          }
          description
            "Configure maximum size (bytes) of a
            single RSVP Bundle message.";
        }
        leaf reliable-ack-hold-time {
          type uint32;
          units milliseconds;
          description
            "Configure hold time in milliseconds for
            sending RSVP ACK message(s).";
        }
        leaf reliable-ack-max-size {
          type uint32;
          description
            "Configure max size of a single RSVP ACK
            message.";
        }
        leaf reliable-retransmit-time {
          type uint32;
          units milliseconds;
          description
            "Configure min delay in milliseconds to
            wait for an ACK before a retransmit.";
        }
        leaf reliable-srefresh {
          type empty;
          description
            "Configure use of reliable messaging for
            summary refresh if present.";
        }
        leaf summary-max-size {
          type uint32 {
            range "20..65000";
          }
          description
            "Configure max size (bytes) of a single
            RSVP summary refresh message.";
        }
      }

      grouping packets-extended_state {
        description
```

```
        "Packet statistics.";
      leaf discontinuity-time {
        type yang:date-and-time;
        description
          "The time on the most recent occasion at which any one
          or more of the statistic counters suffered a
          discontinuity. If no such discontinuities have occurred
          since the last re-initialization of the local
          management subsystem, then this node contains the time
          the local management subsystem re-initialized itself.";
      }
      leaf out-dropped {
        type yang:counter64;
        description
          "Out packet drop count";
      }

      leaf in-dropped {
        type yang:counter64;
        description
          "In packet drop count";
      }

      leaf out-error {
        type yang:counter64;
        description
          "Out packet error count";
      }

      leaf in-error {
        type yang:counter64;
        description
          "In packet rx error count";
      }
    }

    grouping protocol-extended_state {
      description
        "RSVP protocol statistics.";
    }

    grouping errors-extended_state {
      description
        "Error statistics.";
    }

    grouping extended_state {
      description "RSVP statistic attributes.";
```

```
      uses packets-extended_state;
      uses protocol-extended_state;
      uses errors-extended_state;
    }

    /**
     * RSVP extensions augmentations
     */

    /* RSVP globals graceful restart*/

    augment "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/" +
            "rsvp:graceful-restart/rsvp:config" {
      description
        "RSVP globals configuration extensions";
      uses graceful-restart-extended_config;
    }

    augment "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/" +
            "rsvp:graceful-restart/rsvp:state" {
      description
        "RSVP globals configuration extensions";
      uses graceful-restart-extended_config;
    }

    /* RSVP statistics augmentation */
    augment "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/" +
            "rsvp:statistics/rsvp:state/rsvp:packets" {
      description
        "RSVP packet stats extensions";
      uses packets-extended_state;
    }
    augment "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/" +
            "rsvp:statistics/rsvp:state/rsvp:messages" {
      description
        "RSVP protocol message stats extensions";
      uses protocol-extended_state;
    }
    augment "/rt:routing/rt:control-plane-protocols/" +
            "rt:control-plane-protocol/rsvp:rsvp/rsvp:globals/" +
            "rsvp:statistics/rsvp:state/rsvp:errors" {
      description
        "RSVP errors stats extensions";
      uses errors-extended_state;
```

```
     }

     /**
      * RSVP all interfaces extensions
      */

     /* RSVP interface signaling extensions */
     augment "/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
         + "rsvp:config" {
       description
         "RSVP signaling all interfaces configuration extensions";
       uses signaling-parameters-extended_config;
     }
     augment "/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
         + "rsvp:state" {
       description
         "RSVP signaling all interfaces state extensions";
       uses signaling-parameters-extended_config;
     }

     /* RSVP refresh reduction extension */
     augment "/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
         + "rsvp:refresh-reduction/rsvp:config" {
       description
         "RSVP refresh-reduction all interface configuration
          extensions";
       uses refresh-reduction-extended_config;
     }
     augment "/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
         + "rsvp:refresh-reduction/rsvp:state" {
       description
         "RSVP refresh-reduction all interfaces state extensions";
       uses refresh-reduction-extended_config;
     }

     /* RSVP hellos extension */
     augment "/rt:routing/rt:control-plane-protocols/"
         + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
         + "rsvp:hellos/rsvp:config" {
       description
         "RSVP hello all interfaces configuration extensions";
       uses hellos-extended_config;
     }
     augment "/rt:routing/rt:control-plane-protocols/"
```

```
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
        + "rsvp:hellos/rsvp:state" {
      description
        "RSVP hello all interfaces state extensions";
      uses hellos-extended_config;
    }

    /* RSVP authentication extension */
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
        + "rsvp:authentication/rsvp:config" {
      description
        "RSVP authentication all interfaces configuration extensions";
      uses authentication-extended_config;
    }
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
        + "rsvp:authentication/rsvp:state" {
      description
        "RSVP authentication all interfaces state extensions";
      uses authentication-extended_config;
    }

    /**
     * RSVP interface extensions
     */

    /* RSVP interface signaling extensions */
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:config" {
      description
        "RSVP signaling interface configuration extensions";
      uses signaling-parameters-extended_config;
    }
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:state" {
      description
        "RSVP signaling interface state extensions";
      uses signaling-parameters-extended_config;
    }

    /* RSVP refresh reduction extension */
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:refresh-reduction/rsvp:config" {
      description
```

```
        "RSVP refresh-reduction interface configuration extensions";
      uses refresh-reduction-extended_config;
    }
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:refresh-reduction/rsvp:state" {
      description
        "RSVP refresh-reduction interface state extensions";
      uses refresh-reduction-extended_config;
    }

    /* RSVP hellos extension */
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:hellos/rsvp:config" {
      description
        "RSVP hello interface configuration extensions";
      uses hellos-extended_config;
    }
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:hellos/rsvp:state" {
      description
        "RSVP hello interface state extensions";
      uses hellos-extended_config;
    }

    /* RSVP authentication extension */
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:authentication/rsvp:config" {
      description
        "RSVP authentication interface configuration extensions";
      uses authentication-extended_config;
    }
    augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/" +
        "rsvp:interface/rsvp:authentication/rsvp:state" {
      description
        "RSVP authentication interface state extensions";
      uses authentication-extended_config;
    }
  }
  <CODE ENDS>
```

Figure 5: RSVP extended YANG module

4. 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 XML: N/A, the requested URI is an XML namespace.

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

name: ietf-rsvp-extended namespace: urn:ietf:params:xml:ns:yang:ietf-rsvp-extended prefix: ietf-rsvp-extendeed reference: RFC3209

5. 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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