

Workgroup: TEAS Working Group
Internet-Draft: draft-ietf-teas-yang-rsvp-18
Published: 11 July 2022
Intended Status: Standards Track
Expires: 12 January 2023

Authors: V.P. Beeram T. Saad
 Juniper Networks Juniper Networks
 R. Gandhi X. Liu I. Bryskin
 Cisco Systems, Inc. Volta Networks Individual

A YANG Data Model for Resource Reservation Protocol (RSVP)

Abstract

This document defines a YANG data model for the configuration and management of the RSVP protocol. The YANG data model covers the building blocks that may be augmented by other RSVP extension data models such as RSVP Traffic-Engineering (RSVP-TE). It is divided into two modules that cover the basic and extended RSVP features.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 12 January 2023.

Copyright Notice

Copyright (c) 2022 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Revised BSD License text as described in

Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

Table of Contents

- [1. Introduction](#)
- [2. Requirements Language](#)
 - [2.1. Prefixes in Data Node Names](#)
 - [2.2. Model Tree Diagram](#)
- [3. Model Overview](#)
 - [3.1. Module\(s\) Relationship](#)
 - [3.2. Core Features](#)
 - [3.3. Optional Features](#)
 - [3.4. Data Model Structure](#)
 - [3.5. Model Notifications](#)
- [4. RSVP Base YANG Model](#)
 - [4.1. Tree Diagram](#)
 - [4.2. YANG Module](#)
- [5. RSVP Extended YANG Model](#)
 - [5.1. Tree Diagram](#)
 - [5.2. YANG Module](#)
- [6. IANA Considerations](#)
- [7. Security Considerations](#)
- [8. Acknowledgement](#)
- [9. Appendix A](#)
- [10. Contributors](#)
- [11. References](#)
 - [11.1. Normative References](#)
 - [11.2. Informative References](#)
- [Authors' Addresses](#)

1. Introduction

YANG [[RFC6020](#)] and [[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 YANG data model for the configuration and management of the RSVP protocol [[RFC2205](#)]. The data model is divided into two modules: a base and extended RSVP YANG modules. The RSVP base YANG 'ietf-rsvp' module covers the data that is core to the function of the RSVP protocol and MUST be supported by vendors that support RSVP protocol [[RFC2205](#)]. The RSVP extended 'ietf-rsvp-extended' module covers the data that is optional, or provides

ability to tune RSVP protocol base functionality. The support for RSVP extended module features by vendors is considered optional.

The RSVP YANG model provides the building blocks needed to allow augmentation by other models that extend the RSVP protocol- such as using RSVP extensions to signal Label Switched Paths (LSPs) as defined in [[RFC3209](#)].

The YANG module(s) defined in this document are compatible with the Network Management Datastore Architecture (NMDA) [[RFC7950](#)].

2. Requirements Language

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](#)].

2.1. 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
if	ietf-interfaces	[RFC8343]
rt	ietf-routing	[RFC8349]
rt-types	ietf-routing-types	[RFC8294]
inet	ietf-inet-types	[RFC6991]
yang	ietf-yang-types	[RFC6991]
key-chain	ietf-key-chain	[RFC8177]

Table 1: Prefixes and corresponding YANG modules

2.2. Model Tree Diagram

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

3. Model Overview

The RSVP YANG module augments the "control-plane-protocol" entry from the 'ietf-routing' module defined in [[RFC8349](#)]. It also defines the identity "rsvp" of base type "rt:routing-protocol" to identify the RSVP routing protocol.

The 'ietf-rsvp' model defines a single instance of the RSVP protocol. The top 'rsvp' container encompasses data for one such RSVP protocol instance. Multiple instances can be defined as multiple control-plane protocols instances as described in [RFC8349].

The YANG data model defined has the common building blocks for the operation of the base RSVP protocol for the session type defined in [RFC2205]. The augmentation of this model by other models (e.g. to support RSVP Traffic Engineering (TE) extensions for signaling Label Switched Paths (LSPs)) are outside the scope of this document and are discussed in separate document(s).

3.1. Module(s) Relationship

This RSVP YANG data model defined in this document is divided into two modules: a base and extended modules. The RSVP data covered in 'ietf-rsvp' module are categorized as core to the function of the protocol and MUST be supported by vendors claiming the support for RSVP protocol [RFC2205].

The RSVP extended features that are covered in 'ietf-rsvp-extended' module are categorized as either optional or providing ability to better tune the basic functionality of the RSVP protocol. The support for RSVP extended features by all vendors is considered optional.

The relationship between the base and RSVP extended YANG modules and the IETF routing YANG model is shown in [Figure 1](#).



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

3.2. Core Features

The RSVP data covered in the 'ietf-rsvp' YANG module provides the common building blocks that are required to configure, operate and manage the RSVP protocol and MUST be supported by vendors that claim the support for base RSVP protocol defined in [[RFC2205](#)].

In addition, the following standard RSVP core features are modeled under the 'ietf-rsvp' module:

- *Basic operational statistics, including protocol messages, packets and errors.
- *Basic RSVP authentication feature as defined in [[RFC2747](#)] using string based authentication key.
- *Basic RSVP Refresh Reduction feature as defined in ([[RFC2961](#)]).
- *Basic RSVP Hellos feature as defined in ([[RFC3209](#)])
- *Basic RSVP Graceful Restart feature as defined in [[RFC3473](#)], [[RFC5063](#)], and [[RFC5495](#)].

3.3. Optional Features

Optional features are beyond the basic configuration, and operation of the RSVP protocol. The decision whether to support these RSVP features on a particular device is left to the vendor that supports the RSVP core features.

The following optional features that are covered in the 'ietf-rsvp-extended' YANG module:

- *Advanced operational statistics, including protocol messages, packets and errors.
- *Advanced RSVP authentication features as defined in [[RFC2747](#)] using various authentication key types including those defined in [[RFC8177](#)].
- *Advanced RSVP Refresh Reduction features defined in ([[RFC2961](#)]).
- *Advanced RSVP Hellos features as defined in [[RFC3209](#)], and [[rfc4558](#)].
- *Advanced RSVP Graceful Restart features as defined in [[RFC3473](#)], [[RFC5063](#)], and [[RFC5495](#)].

3.4. Data Model Structure

The RSVP YANG data model defines the 'rsvp' top-level container that contains the configuration and operational state for the RSVP protocol. The presence of this container enables the RSVP protocol functionality.

The 'rsvp' top-level container also includes data that has router level scope (i.e. applicable to all objects modeled under rsvp). It also contains configuration and state data about the following types of RSVP objects:

*interfaces

*neighbors

*sessions

The derived state data is contained in "read-only" nodes directly under the intended object as shown in [Figure 2](#).

```
module: ietf-rsvp
  +--rw rsvp!
    +--rw <<router-level scope data>>
      .
      .
    +--rw interfaces
      .
      +-- ro <<derived state associated with interfaces>>
      .
      .
    +--rw neighbors
      .
      +-- ro <<derived state associated with the LSP Tunnel>>
      .
      .
    +--rw sessions
      .
      +-- ro <<derived state associated with the LSP Tunnel>>
      .
  rpcs:
    +--x clear-session
    +--x clear-neighbor
    +--x clear-authentication
```

Figure 2: RSVP high-level tree model view

The following

'router-level':

The router-level scope configuration and state data are applicable to all modeled objects under the top-level 'rsvp' container, and MAY affect the RSVP protocol behavior.

'interfaces':

The 'interfaces' container includes a list of RSVP enabled interfaces. It also includes RSVP configuration and state data that is applicable to all interfaces. An entry in the interfaces list MAY carry its own configuration or state data. Any data or state under the "interfaces" container level is equally applicable to all interfaces unless it is explicitly overridden by configuration or state under a specific interface.

'neighbors' :

The 'neighbors' container includes a list of RSVP neighbors. An entry in the RSVP neighbor list MAY carry its own configuration and state relevant to the specific RSVP neighbor. The RSVP neighbors can be dynamically discovered using RSVP signaling, or can be explicitly configured.

'sessions':

The 'sessions' container includes a list RSVP sessions. An entry in the RSVP session list MAY carry its own configuration and state relevant to a specific RSVP session. RSVP sessions are usually derived state that are created as result of signaling. This model defines attributes related to IP RSVP sessions as defined in [[RFC2205](#)].

The defined YANG data model supports configuration inheritance for neighbors, and interfaces. Data nodes defined under 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).

3.5. Model Notifications

Modeling notifications data is key in any defined YANG data model. [[RFC8639](#)] and [[RFC8641](#)] define a subscription and push mechanism for YANG datastores. This mechanism currently allows the user to:

- *Subscribe notifications on a per client basis

- *Specify subtree filters [[RFC6241](#)] or XPath filters [[RFC8639](#)] so that only interested contents will be sent.

*Specify either periodic or on-demand notifications.

4. RSVP Base YANG Model

The RSVP base module includes the core features and building blocks for modeling the RSVP protocol as described in [Section 3.2](#).

4.1. Tree Diagram

[Figure 3](#) shows the YANG tree representation for configuration, state data and RPCs that are covered in 'ietf-rsvp' YANG module:

module: ietf-rsvp

augment /rt:routing/rt:control-plane-protocols
/rt:control-plane-protocol:

+--rw rsvp!

+--rw interfaces

| +--rw refresh-reduction

| | +--rw enabled? boolean

| +--rw hellos

| | +--rw enabled? boolean

| +--rw authentication

| | +--rw enabled? boolean

| | +--rw authentication-key? string

| | +--rw crypto-algorithm identityref

| +--ro statistics

| | +--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 srefresh-sent? yang:counter64

| | | +--ro srefresh-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-length?   yang:counter64
| +--rw interface* [name]
|   +--rw name                 if:interface-ref
|   +--rw refresh-reduction
|   | +--rw enabled?          boolean
|   +--rw hellos
|   | +--rw enabled?          boolean
|   +--rw authentication
|   | +--rw enabled?          boolean
|   | +--rw authentication-key? string
|   | +--rw crypto-algorithm  identityref
|   +--ro statistics
|     +--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 srefresh-sent?
|         | |       yang:counter64
|         | +--ro srefresh-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-length? yang:counter64
+--rw sessions
|   +--ro session-ip*
|     [destination protocol-id destination-port]
|     +--ro destination-port  uint16
|     +--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 rsbs
|     | +--ro rsb* []
|     | |   +--ro source-port?   inet:port-number
|     | |   +--ro reservation-style identityref

```

```

|           +--ro expires-in?           uint32
+--rw neighbors
|  +--rw neighbor* [address]
|    +--rw address                       inet:ip-address
|    +--rw epoch?                        uint32
|    +--rw expiry-time?                  uint32
|    +--rw graceful-restart
|      | +--ro neighbor-restart-time?    uint32
|      | +--ro neighbor-recovery-time?   uint32
|      | +--rw helper-mode
|      |   +--ro neighbor-restart-time-remaining?  uint32
|      |   +--ro neighbor-recovery-time-remaining?  uint32
|    +--ro hello-status?                 enumeration
|    +--rw interface?                    if:interface-ref
|    +--ro neighbor-status?              enumeration
|    +--rw refresh-reduction-capable?    boolean
|    +--ro restart-count?                yang:counter32
|    +--ro restart-time?                  yang:date-and-time
+--rw graceful-restart
  +--rw enabled?                          boolean
  +--rw local-restart-time?                uint32
  +--rw local-recovery-time?              uint32
  +--rw helper-mode
    +--rw enabled?                        boolean
    +--rw max-helper-restart-time?        uint32
    +--rw max-helper-recovery-time?       uint32

```

rpcs:

```

+---x clear-session
|  +---w input
|    +---w routing-protocol-instance-name  leafref
|    +---w (filter-type)
|      +--:(match-all)
|        | +---w all                          empty
|        +--:(match-one)
|          +---w session-info
|            +---w (session-type)
|              +--:(rsvp-session-ip)
|                +---w destination          leafref
|                +---w protocol-id          uint8
|                +---w destination-port     inet:ip-address
+---x clear-neighbor
|  +---w input
|    +---w routing-protocol-instance-name  leafref
|    +---w (filter-type)
|      +--:(match-all)
|        | +---w all                          empty
|        +--:(match-one)
|          +---w neighbor-address            leafref

```

```
+---x clear-authentication
+---w input
+---w routing-protocol-instance-name    leafref
+---w (filter-type)
+--:(match-all)
| +---w all                             empty
+--:(match-one-interface)
+---w interface?                       if:interface-ref
```

Figure 3: RSVP model tree diagram

4.2. YANG Module

The ietf-rsvp module imports from the following modules:

*ietf-interfaces defined in [[RFC8343](#)]

*ietf-yang-types and ietf-inet-types defined in [[RFC6991](#)]

*ietf-routing defined in [[RFC8349](#)]

*ietf-key-chain defined in [[RFC8177](#)]

*ietf-netconf-acm defined in [[RFC8341](#)]

This module also references the following documents: [[RFC2205](#)], [[RFC5495](#)], [[RFC3473](#)], [[RFC5063](#)], [[RFC2747](#)], [[RFC3209](#)], and [[RFC2961](#)].

```
<CODE BEGINS> file "ietf-rsvp@2021-12-02.yang"

module ietf-rsvp {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-rsvp";

  /* Replace with IANA when assigned */

  prefix rsvp;

  import ietf-interfaces {
    prefix if;
    reference
      "RFC8343: A YANG Data Model for Interface Management";
  }
  import ietf-inet-types {
    prefix inet;
    reference
      "RFC6991: Common YANG Data Types";
  }
  import ietf-yang-types {
    prefix yang;
    reference
      "RFC6991: Common YANG Data Types";
  }
  import ietf-routing {
    prefix rt;
    reference
      "RFC8349: A YANG Data Model for Routing Management
      (NMDA Version)";
  }
  import ietf-key-chain {
    prefix key-chain;
    reference
      "RFC8177: YANG Data Model for Key Chains";
  }
  import ietf-netconf-acm {
    prefix nacm;
    reference
      "RFC8341: Network Configuration Access Control Model";
  }
  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:tsaad@juniper.net>

Editor: Rakesh Gandhi
<mailto:rgandhi@cisco.com>

Editor: Xufeng Liu
<mailto:xufeng.liu.ietf@gmail.com>

Editor: Igor Bryskin
<mailto:i_bryskin@yahoo.com>";

description

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

Copyright (c) 2019 IETF Trust and the persons
identified as authors of the code. All rights reserved.

Redistribution and use in source and binary forms, with or
without modification, is permitted pursuant to, and subject
to the license terms contained in, the Simplified BSD License
set forth in Section 4.c of the IETF Trust's Legal Provisions
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 2021-12-02 {  
  description  
    "Initial version.";  
  reference  
    "RFCXXXX: A YANG Data Model for Resource Reservation Protocol  
    (RSVP)";  
}
```

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

```
identity rsvp-session-type {
```



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

  identity rsvp-session-ip {
    base rsvp-session-type;
    description
      "RSVP IP 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 {
    description
      "RSVP graceful restart local parameters grouping.";
    container graceful-restart {
      description
        "Graceful restart local information.";
      leaf enabled {
        type boolean;
        default "false";
        description

```

```

        "'true' if RSVP Graceful Restart is enabled.
        'false' if RSVP Graceful Restart is disabled.";
    reference "RFC5495";
}
leaf local-restart-time {
    type uint32;
    units "seconds";
    default "120";
    description
        "Time it takes the local node to restart its RSVP-TE
        component (to the point where it can exchange RSVP
        Hello with its neighbors). A value of 0xffffffff
        indicates that the restart of the neighbor's control plane
        may occur over an indeterminate interval and that the
        operation of its data plane is unaffected by control plane
        failures.";
    reference "RFC3473";
}
leaf local-recovery-time {
    type uint32;
    units "seconds";
    default "120";
    description
        "The period of time, in seconds, that the local
        node requires to re-synchronize RSVP and MPLS
        forwarding state with its neighbor. A value of zero (0)
        indicates that MPLS forwarding state was not preserved
        across a particular reboot.";
    reference "RFC3473";
}
container helper-mode {
    description
        "Helper mode information. In this mode, the node
        resynchronizes its stored states with a neighbor whose
        control plane has restarted. The helper mode term is
        borrowed from RFC3623 and adopted by several vendors
        vendors in their implementation of RSVP graceful
        restart.";
    leaf enabled {
        type boolean;
        default "true";
        description
            "'true' if helper mode is enabled.";
    }
    leaf max-helper-restart-time {
        type uint32;
        units "seconds";
        default "20";
        description

```

```

        "The maximum time the router or switch waits after it
        discovers that the neighboring router has gone down
        before it declares the neighbor down.";
    reference "RFC5063";
}
leaf max-helper-recovery-time {
    type uint32;
    units "seconds";
    default "180";
    description
        "The maximum amount of time the router retains the state
        of its RSVP neighbors while they undergo a graceful
        restart.";
    reference "RFC5063";
}
}
}
}
grouping neighbor-graceful-restart {
    description
        "RSVP graceful restart neighbor parameters grouping.";
    container graceful-restart {
        description
            "Graceful restart information.";
        leaf neighbor-restart-time {
            type uint32;
            units "seconds";
            default "120";
            config false;
            description
                "Time it takes the neighbor node to restart its RSVP-TE
                component (to the point where it can exchange RSVP
                Hello with its neighbors). A value of 0xffffffff
                indicates that the restart of the neighbor's control plane
                may occur over an indeterminate interval and that the
                operation of its data plane is unaffected by control plane
                failures.";
            reference "RFC3473";
        }
        leaf neighbor-recovery-time {
            type uint32;
            units "seconds";
            default "120";
            config false;
            description
                "The period of time, in milliseconds, that the neighbor
                node requires to re-synchronize RSVP and MPLS
                forwarding state with its neighbor. A value of zero (0)
                indicates that MPLS forwarding state was not preserved

```

```

        across a particular reboot.";
        reference "RFC3473";
    }
    container helper-mode {
        description
            "Helper mode information.";
        leaf neighbor-restart-time-remaining {
            type uint32;
            units "seconds";
            config false;
            description
                "Number of seconds remaining for neighbor to send Hello
                message after restart.";
            reference "RFC5063";
        }
        leaf neighbor-recovery-time-remaining {
            type uint32;
            units "seconds";
            config false;
            description
                "Number of seconds remaining for neighbor to refresh.";
            reference "RFC5063";
        }
    }
}
// helper-mode
}

grouping refresh-reduction {
    description
        "Top level grouping for RSVP refresh reduction parameters.";
    container refresh-reduction {
        description
            "Top level container for RSVP refresh reduction parameters.";
        leaf enabled {
            type boolean;
            default "true";
            description
                "'true' if RSVP Refresh Reduction is enabled.
                'false' if RSVP Refresh Reduction is disabled.";
        }
        reference
            "RFC2961 RSVP Refresh Overhead Reduction Extensions";
    }
}

grouping authentication {
    description
        "Top level grouping for RSVP authentication parameters.";

```

```

container authentication {
  description
    "Top level container for RSVP authentication parameters.";
  leaf enabled {
    type boolean;
    default "false";
    description
      "'true' if RSVP Authentication is enabled.
      'false' if RSVP Authentication is disabled.";
  }
  leaf authentication-key {
    type string;
    default "";
    description
      "An authentication key string.";
    reference
      "RFC2747: RSVP Cryptographic Authentication";
  }
  leaf crypto-algorithm {
    type identityref {
      base key-chain:crypto-algorithm;
    }
    mandatory true;
    description
      "Cryptographic algorithm associated with key.";
  }
}
}

grouping hellos {
  description
    "Top level grouping for RSVP hellos parameters.";
  container hellos {
    description
      "Top level container for RSVP hello parameters.";
    leaf enabled {
      type boolean;
      default "true";
      description
        "'true' if RSVP Hello is enabled.
        'false' if RSVP Hello is disabled.";
    }
    reference
      "RFC3209: RSVP-TE: Extensions to RSVP for LSP Tunnels.
      RFC5495: Description of the Resource Reservation Protocol -
      Traffic-Engineered (RSVP-TE) Graceful Restart Procedures.";
  }
}
}

```

```

grouping session-attributes {
  description
    "Top level grouping for RSVP session properties.";
  leaf destination-port {
    type uint16;
    description
      "RSVP destination port.";
    reference
      "RFC2205";
  }
  leaf protocol-id {
    type uint8;
    description
      "The IP protocol ID.";
    reference
      "RFC2205, section 3.2";
  }
  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;
    default "";
    description
      "The signaled name of this RSVP session.";
  }
  leaf session-status {
    type enumeration {
      enum up {
        description
          "RSVP session is up.";
      }
      enum down {
        description
          "RSVP session is down.";
      }
    }
    default "down";
  }
}

```

```

    description
      "Enumeration of RSVP session states.";
  }
  leaf session-type {
    type identityref {
      base rsvp-session-type;
    }
    mandatory "true";
    description
      "RSVP session type.";
  }
  container psbs {
    description
      "Path State Block (PSB) 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";
        default "180";
        description
          "Time to expiry (in seconds).";
      }
    }
  }
  container rsbs {
    description
      "Reservation State Block (RSB) 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;
        }
      }
    }
  }

```

```

    }
    mandatory "true";
    description
        "RSVP reservation style.";
    }
    leaf expires-in {
        type uint32;
        units "seconds";
        default "180";
        description
            "Time to expiry (in seconds).";
    }
    }
}

grouping neighbor-attributes {
    description
        "Top level grouping for RSVP neighbor properties.";
    leaf address {
        type inet:ip-address;
        description
            "Address of the RSVP neighbor.";
    }
    leaf epoch {
        type uint32;
        default "0";
        description
            "Neighbor epoch.";
        reference "RFC5063";
    }
    leaf expiry-time {
        type uint32;
        units "seconds";
        default "180";
        description
            "Neighbor expiry time after which the neighbor state is
            purged if no states associated with it.";
    }
    uses neighbor-graceful-restart {
        description
            "Allows configuration applicable to all
            neighbors";
    }
    leaf hello-status {
        type enumeration {
            enum enabled {
                description
                    "RSVP Hellos enabled.";
            }
        }
    }
}

```



```

    }
    enum disabled {
        description
            "RSVP Hellos disabled.";
    }
    enum restarting {
        description
            "RSVP restarting.";
    }
}
config false;
description
    "RSVP Hello status.";
}
leaf interface {
    type if:interface-ref;
    description
        "Interface where RSVP neighbor was detected.";
}
leaf neighbor-status {
    type enumeration {
        enum up {
            description
                "Neighbor state up.";
        }
        enum down {
            description
                "Neighbor state down.";
        }
        enum hello-disable {
            description
                "RSVP Hellos disabled.";
        }
        enum restarting {
            description
                "RSVP neighbor restarting.";
        }
    }
}
config false;
description
    "RSVP neighbor state.";
}
leaf refresh-reduction-capable {
    type boolean;
    default "true";
    description
        "Enables all RSVP refresh reduction message bundling, RSVP
        message ID, reliable message delivery and Srefresh
        messages.";
}

```

```

        reference
            "RFC2961 RSVP Refresh Overhead Reduction Extensions";
    }
    leaf restart-count {
        type yang:counter32;
        config false;
        description
            "Number of times this RSVP neighbor has restarted.";
    }
    leaf restart-time {
        type yang:date-and-time;
        config false;
        description
            "Last restart time of the RSVP neighbor.";
        reference "RFC3473";
    }
}

grouping packet-statistics {
    description
        "Packet statistics grouping.";
    container packets {
        description
            "Packet statistics container.";
        leaf sent {
            type yang:counter64;
            description
                "RSVP packet sent count.";
        }
        leaf received {
            type yang:counter64;
            description
                "RSVP packet received count.";
        }
    }
}

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

```

```
    type yang:counter64;
    description
      "RSVP Hello received count.";
  }
  leaf bundle-sent {
    type yang:counter64;
    description
      "RSVP Bundle message sent count.";
  }
  leaf bundle-received {
    type yang:counter64;
    description
      "RSVP Bundle message received count.";
  }
  leaf hello-sent {
    type yang:counter64;
    description
      "RSVP Hello message sent count.";
  }
  leaf hello-received {
    type yang:counter64;
    description
      "RSVP Hello message received count.";
  }
  leaf integrity-challenge-sent {
    type yang:counter64;
    description
      "RSVP Integrity Challenge message sent count.";
  }
  leaf integrity-challenge-received {
    type yang:counter64;
    description
      "RSVP Integrity Challenge message received count.";
  }
  leaf integrity-response-sent {
    type yang:counter64;
    description
      "RSVP Integrity Response message sent count.";
  }
  leaf integrity-response-received {
    type yang:counter64;
    description
      "RSVP Integrity Response message received count.";
  }
  leaf notify-sent {
    type yang:counter64;
    description
      "RSVP Notify message sent count.";
  }
}
```

```
leaf notify-received {
    type yang:counter64;
    description
        "RSVP Notify message received count.";
}
leaf path-sent {
    type yang:counter64;
    description
        "RSVP Path message sent count.";
}
leaf path-received {
    type yang:counter64;
    description
        "RSVP Path message received count.";
}
leaf path-err-sent {
    type yang:counter64;
    description
        "RSVP Path error message sent count.";
}
leaf path-err-received {
    type yang:counter64;
    description
        "RSVP Path error message received count.";
}
leaf path-tear-sent {
    type yang:counter64;
    description
        "RSVP Path tear message sent count.";
}
leaf path-tear-received {
    type yang:counter64;
    description
        "RSVP Path tear message received count.";
}
leaf resv-sent {
    type yang:counter64;
    description
        "RSVP Resv message sent count.";
}
leaf resv-received {
    type yang:counter64;
    description
        "RSVP Resv message received count.";
}
leaf resv-confirm-sent {
    type yang:counter64;
    description
        "RSVP Confirm message sent count.";
```

```

}
leaf resv-confirm-received {
    type yang:counter64;
    description
        "RSVP Confirm message received count.";
}
leaf resv-err-sent {
    type yang:counter64;
    description
        "RSVP Resv error message sent count.";
}
leaf resv-err-received {
    type yang:counter64;
    description
        "RSVP Resv error message received count.";
}
leaf resv-tear-sent {
    type yang:counter64;
    description
        "RSVP Resv tear message sent count.";
}
leaf resv-tear-received {
    type yang:counter64;
    description
        "RSVP Resv tear message received count.";
}
leaf srefresh-sent {
    type yang:counter64;
    description
        "RSVP Srefresh message sent count.";
}
leaf srefresh-received {
    type yang:counter64;
    description
        "RSVP Srefresh message received count.";
}
leaf unknown-messages-received {
    type yang:counter64;
    description
        "Unknown messages received count.";
}
}
}

grouping errors-statistics {
    description
        "Error statistics grouping.";
    container errors {
        description

```

```

    "Error statistics container.";
  leaf authenticate {
    type yang:counter64;
    description
      "The total number of RSVP packets received with an
        authentication failure.";
  }
  leaf checksum {
    type yang:counter64;
    description
      "The total number of RSVP packets received with an invalid
        checksum value.";
  }
  leaf packet-length {
    type yang:counter64;
    description
      "The total number of packets received with an invalid
        packet length.";
  }
}
}

grouping statistics {
  description
    "RSVP statistic attributes.";
  container statistics {
    config false;
    description
      "RSVP statistics container.";
    uses message-statistics;
    uses packet-statistics;
    uses errors-statistics;
  }
}

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

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 interfaces {
            description
                "RSVP interfaces container.";
            uses intf-attributes;
            list interface {
                key "name";
                description
                    "RSVP interfaces.";
                leaf name {
                    type if:interface-ref;
                    description
                        "RSVP interface.";
                }
                uses intf-attributes;
            }
        }
    }
    container sessions {
        description
            "RSVP sessions container.";
        list session-ip {
            key "destination protocol-id destination-port";
            config false;
            description
                "List of RSVP sessions.";
            uses session-attributes;
        }
    }
    container neighbors {
        description
            "RSVP neighbors container";
        list neighbor {
            key "address";
            description
                "List of RSVP neighbors";
            uses neighbor-attributes;
        }
    }
    uses graceful-restart;
}
}

```

```

grouping session-ref {
  description
    "Session reference information";
  leaf destination {
    type leafref {
      path "/rt:routing/rt:control-plane-protocols"
        + "/rt:control-plane-protocol/rsvp:rsvp"
        + "/rsvp:sessions/rsvp:session-ip/destination";
    }
    mandatory true;
    description
      "The RSVP session destination.";
  }
  leaf protocol-id {
    type uint8;
    mandatory true;
    description
      "The RSVP session protocol ID.";
  }
  leaf destination-port {
    type inet:ip-address;
    mandatory true;
    description
      "The RSVP session destination port.";
  }
}

rpc clear-session {
  nacm:default-deny-all;
  description
    "Clears RSVP sessions RPC";
  input {
    leaf routing-protocol-instance-name {
      type leafref {
        path "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/rt:name";
      }
      mandatory true;
      description
        "Name of the RSVP protocol instance whose session
          is being cleared.

          If the corresponding RSVP instance doesn't exist,
          then the operation will fail with an error-tag of
          'data-missing' and an error-app-tag of
          'routing-protocol-instance-not-found'.";
    }
  }
  choice filter-type {
    mandatory true;
  }
}

```



```

choice filter-type {
  mandatory true;
  description
    "The Filter choice.";
  case match-all {
    leaf all {
      type empty;
      mandatory true;
      description
        "Match all RSVP neighbor sessions.";
    }
  }
  case match-one {
    leaf neighbor-address {
      type leafref {
        path "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/rsvp:rsvp"
          + "/rsvp:neighbors/rsvp:neighbor/address";
      }
      mandatory true;
      description
        "Match the specific RSVP neighbor session.";
    }
  }
}
}
}
}

rpc clear-authentication {
  nacm:default-deny-all;
  description
    "Clears the RSVP Security Association (SA) before the
    lifetime expires.";
  input {
    leaf routing-protocol-instance-name {
      type leafref {
        path "/rt:routing/rt:control-plane-protocols/"
          + "rt:control-plane-protocol/rt:name";
      }
      mandatory true;
      description
        "Name of the RSVP protocol instance whose session
        is being cleared.

        If the corresponding RSVP instance doesn't exist,
        then the operation will fail with an error-tag of
        'data-missing' and an error-app-tag of
        'routing-protocol-instance-not-found'.";
    }
  }
}

```


module: ietf-rsvp-extended

```
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp
  /rsvp:graceful-restart:
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces:
  +-rw refresh-interval?      uint32
  +-rw refresh-misses?       uint32
  +-rw checksum-enable?      empty
  +-rw patherr-state-removal? empty
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
  /rsvp:statistics/rsvp:packets:
  +-ro discontinuity-time?    yang:date-and-time
  +-ro out-dropped?          yang:counter64
  +-ro in-dropped?          yang:counter64
  +-ro out-errors?          yang:counter64
  +-ro in-errors?           yang:counter64
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
  /rsvp:refresh-reduction:
  +-rw bundle-message-max-size? uint32
  +-rw ack-hold-time?           uint32
  +-rw ack-max-size?           uint32
  +-rw ack-retransmit-time?    uint32
  +-rw srefresh-ack-desired?   empty
  +-rw srefresh-max-size?     uint32
  +-rw srefresh-relative-period? uint8
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
  /rsvp:hellos:
  +-rw interface-based?      empty
  +-rw hello-interval?      uint32
  +-rw hello-misses?        uint32
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
  /rsvp:authentication:
  +-rw lifetime?            uint32
  +-rw window-size?        uint32
  +-rw challenge?          empty
  +-rw retransmits?        uint32
  +-rw key-chain?          key-chain:key-chain-ref
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
  /rsvp:interface:
  +-rw refresh-interval?      uint32
  +-rw refresh-misses?       uint32
  +-rw checksum-enable?      empty
```

```
+-rw patherr-state-removal? empty
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
    /rsvp:interface/rsvp:statistics/rsvp:packets:
+-ro discontinuity-time? yang:date-and-time
+-ro out-dropped? yang:counter64
+-ro in-dropped? yang:counter64
+-ro out-errors? yang:counter64
+-ro in-errors? yang:counter64
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
    /rsvp:interface/rsvp:refresh-reduction:
+-rw bundle-message-max-size? uint32
+-rw ack-hold-time? uint32
+-rw ack-max-size? uint32
+-rw ack-retransmit-time? uint32
+-rw srefresh-ack-desired? empty
+-rw srefresh-max-size? uint32
+-rw srefresh-relative-period? uint8
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
    /rsvp:interface/rsvp:hellos:
+-rw interface-based? empty
+-rw hello-interval? uint32
+-rw hello-misses? uint32
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces
    /rsvp:interface/rsvp:authentication:
+-rw lifetime? uint32
+-rw window-size? uint32
+-rw challenge? empty
+-rw retransmits? uint32
+-rw key-chain? key-chain:key-chain-ref
```

Figure 4: RSVP extended module tree diagram

5.2. YANG Module

The 'ietf-rsvp-extended' module imports from the following modules:

- *ietf-rsvp defined in this document

- *ietf-routing defined in [[RFC8349](#)]

- *ietf-yang-types and ietf-inet-types defined in [[RFC6991](#)]

- *ietf-key-chain defined in [[RFC8177](#)]

[Figure 5](#) shows the RSVP extended YANG module:

This module also references the following documents: [[RFC3473](#)], [[RFC2747](#)], [[RFC3209](#)], [[RFC2205](#)], [[RFC2961](#)], and [[RFC5495](#)].

<CODE BEGINS> file "ietf-rsvp-extended@2021-12-02.yang"

```
module ietf-rsvp-extended {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-rsvp-extended";
  prefix rsvp-extended;

  import ietf-rsvp {
    prefix rsvp;
    reference
      "RFCXXXX: A YANG Data Model for Resource Reservation Protocol
      (RSVP)";
  }
  import ietf-routing {
    prefix rt;
    reference
      "RFC8349: A YANG Data Model for Routing Management
      (NMDA Version)";
  }
  import ietf-yang-types {
    prefix yang;
    reference
      "RFC6991: Common YANG Data Types";
  }
  import ietf-key-chain {
    prefix key-chain;
    reference
      "RFC8177: YANG Data Model for Key Chains";
  }

  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:tsaad@juniper.net>

    Editor: Rakesh Gandhi
           <mailto:rgandhi@cisco.com>

    Editor: Xufeng Liu
           <mailto:xufeng.liu.ietf@gmail.com>

    Editor: Igor Bryskin
```

```
<mailto:i_bryskin@yahoo.com>";
description
  "This module contains the Extended RSVP YANG data model.
  The model fully conforms to the Network Management Datastore
  Architecture (NMDA).

  Copyright (c) 2019 IETF Trust and the persons
  identified as authors of the code. All rights reserved.

  Redistribution and use in source and binary forms, with or
  without modification, is permitted pursuant to, and subject
  to the license terms contained in, the Simplified BSD License
  set forth in Section 4.c of the IETF Trust's Legal Provisions
  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 2021-12-02 {
  description
    "Initial version.";
  reference
    "RFCXXXX: A YANG Data Model for Resource Reservation Protocol
    (RSVP)";
}

grouping graceful-restart-extended {
  description
    "Configuration parameters relating to RSVP Graceful-Restart.";
}

grouping authentication-extended {
  description
    "Configuration parameters relating to RSVP authentication.";
  leaf lifetime {
    type uint32 {
      range "30..86400";
    }
    units "seconds";
    default "30";
    description
      "Life time for each security association.";
    reference
      "RFC2747: RSVP Cryptographic Authentication";
```



```

}
leaf window-size {
  type uint32 {
    range "1..64";
  }
  default "2";
  description
    "Window-size to limit number of out-of-order messages.";
  reference
    "RFC2747: RSVP Cryptographic Authentication";
}
leaf challenge {
  type empty;
  description
    "Enable challenge messages.";
  reference
    "RFC2747: RSVP Cryptographic Authentication";
}
leaf retransmits {
  type uint32 {
    range "1..10000";
  }
  default "1";
  description
    "Number of retransmits when messages are dropped.";
  reference
    "RFC2747: RSVP Cryptographic Authentication";
}
leaf key-chain {
  type key-chain:key-chain-ref;
  description
    "Key chain name to authenticate RSVP
    signaling messages.";
  reference
    "RFC2747: RSVP Cryptographic Authentication";
}
}

grouping hellos-extended {
  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";
  }
}

```

```

    default "9000";
    description
        "Configure interval between successive Hello messages in
        milliseconds.";
    reference
        "RFC3209: RSVP-TE: Extensions to RSVP for LSP Tunnels.
        RFC5495: Description of the Resource Reservation Protocol -
        Traffic-Engineered (RSVP-TE) Graceful Restart Procedures.";
}
leaf hello-misses {
    type uint32 {
        range "1..10";
    }
    default "3";
    description
        "Configure max number of consecutive missed Hello messages.";
    reference
        "RFC3209: RSVP-TE: Extensions to RSVP for LSP Tunnels.
        RFC5495: Description of the Resource Reservation Protocol -
        Traffic- Engineered (RSVP-TE) Graceful Restart Procedures.";
}
}

grouping signaling-parameters-extended {
    description
        "Configuration parameters relating to RSVP signaling";
    leaf refresh-interval {
        type uint32;
        units "seconds";
        default "30";
        description
            "Set interval between successive refreshes";
        reference "RFC2205";
    }
    leaf refresh-misses {
        type uint32;
        default "9";
        description
            "Set max number of consecutive missed messages for state
            expiry";
        reference "RFC2205";
    }
    leaf checksum-enable {
        type empty;
        description
            "Enable RSVP message checksum computation";
        reference "RFC2205";
    }
    leaf patherr-state-removal {

```

```

    type empty;
    description
      "State-Removal flag in Path Error message if present.";
    reference "RFC3473";
  }
}

grouping refresh-reduction-extended {
  description
    "Configuration parameters relating to RSVP refresh reduction.";
  leaf bundle-message-max-size {
    type uint32 {
      range "512..65000";
    }
    default "1500";
    description
      "Configure maximum size (bytes) of a single RSVP Bundle
      message.";
    reference "RFC2961";
  }
  leaf ack-hold-time {
    type uint32;
    units "milliseconds";
    default "9000";
    description
      "Configure hold time in milliseconds for sending RSVP ACK
      message(s).";
    reference "RFC2961";
  }
  leaf ack-max-size {
    type uint32;
    default "1500";
    description
      "Configure max size of a single RSVP ACK message.";
    reference "RFC2961";
  }
  leaf ack-retransmit-time {
    type uint32;
    units "milliseconds";
    default "500";
    description
      "Configure min delay in milliseconds to wait for an
      acknowledgment before being retransmitted.";
    reference "RFC2961";
  }
  leaf srefresh-ack-desired {
    type empty;
    description
      "Enables the sending of MESSAGE_ID with ACK_Desired

```

```

        set with Srefresh messages.";
        reference "RFC2961";
    }
    leaf srefresh-max-size {
        type uint32 {
            range "20..65000";
        }
        default "1500";
        description
            "Configure max size (bytes) of a single RSVP Srefresh
            message.";
        reference "RFC2961";
    }
    leaf srefresh-relative-period {
        type uint8 {
            range "10..100";
        }
        description
            "Configures the period of Srefreshes relative to standard
            refresh message period in percentage.";
    }
}

grouping packets-extended-statistics {
    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 RSVP packet drop count.";
    }
    leaf in-dropped {
        type yang:counter64;
        description
            "In RSVP packet drop count.";
    }
    leaf out-errors {
        type yang:counter64;
        description

```

```

        "Out RSVP packet errors count.";
    }
    leaf in-errors {
        type yang:counter64;
        description
            "In RSVP packet rx errors count.";
    }
}

/**
 * RSVP extensions augmentations
 */
/* RSVP graceful restart*/

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

/**
 * RSVP all interfaces extensions
 */

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

/* Packet statistics extension */
augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp/rsvp:interfaces/"
    + "rsvp:statistics/rsvp:packets" {
    description
        "RSVP packets all interfaces configuration extensions";
    uses packets-extended-statistics;
}

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

```

```

        "RSVP refresh-reduction all interface configuration
        extensions";
    uses refresh-reduction-extended;
}

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

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

/**
 * RSVP per interface extensions
 */
/* RSVP interface signaling extensions */

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

/* Packet statistics extension */
augment "/rt:routing/rt:control-plane-protocols/"
    + "rt:control-plane-protocol/rsvp:rsvp:rsvp:interfaces/"
    + "rsvp:interface/rsvp:statistics/rsvp:packets" {
    description
        "RSVP packet stats extensions";
    uses packets-extended-statistics;
}

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

```

```

    description
      "RSVP refresh-reduction interface configuration extensions";
    uses refresh-reduction-extended;
  }

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

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

<CODE ENDS>

```

Figure 5: RSVP extended YANG module

6. 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
 Registrant Contact: The IESG.
 XML: N/A, the requested URI is an XML namespace.

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

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

7. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [[RFC6241](#)] or RESTCONF [[RFC8040](#)]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [[RFC6242](#)]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [[RFC8446](#)].

The Network Configuration Access Control Model (NACM) [[RFC8341](#)] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in the YANG module(s) defined in this document that 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. These are the subtrees and data nodes and their sensitivity/vulnerability:

```
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/  
rsvp:rsvp/ /rsvp:globals /rsvp:interfaces /rsvp:sessions
```

All of which are considered sensitive and if access to either of these is compromised, it can result in temporary network outages or be employed to mount DoS attacks.

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes. These are the subtrees and data nodes and their sensitivity/vulnerability:


```
/rt:routing/rt:control-plane-protocols/rt:control-plane-protocol/  
rsvp:rsvp/ /rsvp:globals /rsvp:interfaces /rsvp:sessions
```

Additional information from these state data nodes can be inferred with respect to the network topology, and device location and subsequently be used to mount other attacks in the network.

For RSVP authentication, the configuration supported is via the specification of key-chains [[RFC8177](#)] or the direct specification of key and authentication algorithm, and hence security considerations of [[RFC8177](#)] are inherited. This includes the considerations with respect to the local storage and handling of authentication keys.

Some of the RPC operations defined in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control access to these operations. The RSVP YANG module support the "clear-session" and "clear-neighbor" RPCs. If access to either of these is compromised, they can result in temporary network outages be employed to mount DoS attacks.

The security considerations spelled out in the YANG 1.1 specification [[RFC7950](#)] apply for this document as well.

8. Acknowledgement

The authors would like to thank Tom Petch for reviewing and providing useful feedback about the document. The authors would also like to thank Lou Berger for reviewing and providing valuable feedback on this document.

9. Appendix A

A simple network setup is shown in {fig-example title}. R1 runs the RSVP routing protocol on both interfaces 'ge0/0/0/1', and 'ge0/0/0/2'.

State on R1:

Sessions:

=====

Destination	Protocol-ID	Dest-port
198.51.100.1	10	10

Neighbors:

=====

Neighbor Address	Interface
192.0.2.6	ge0/0/0/1

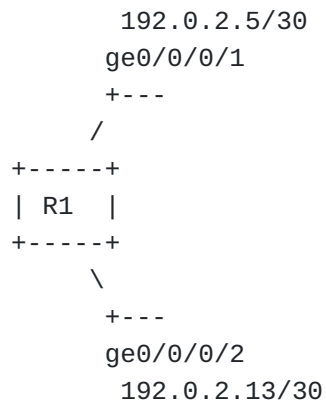


Figure 6: Example of network configuration.

The instance data tree could then be as follows:

```

{
  "ietf-routing:routing": {
    "control-plane-protocols": {
      "control-plane-protocol": [
        {
          "type": "rt:routing-protocol",
          "name": "rsvp:rsvp",
          "ietf-rsvp:rsvp": {
            "interfaces": {
              "refresh-reduction": {
                "enabled": true,
                "ietf-rsvp-extended:bundle-message-max-size": 2000,
                "ietf-rsvp-extended:reliable-ack-hold-time": 180,
                "ietf-rsvp-extended:reliable-ack-max-size": 2000,
                "ietf-rsvp-extended:reliable-retransmit-time": 180,
                "ietf-rsvp-extended:reliable-srefresh": [
                  null
                ],
                "ietf-rsvp-extended:summary-max-size": 2000
              },
              "hellos": {
                "enabled": true,
                "ietf-rsvp-extended:interface-based": [
                  null
                ],
                "ietf-rsvp-extended:hello-interval": 27000,
                "ietf-rsvp-extended:hello-misses": 3
              },
              "statistics": {
                "messages": {
                  "ack-sent": "777",
                  "ack-received": "4840",
                  "bundle-sent": "2195",
                  "bundle-received": "293",
                  "hello-sent": "2516",
                  "hello-received": "3535",
                  "integrity-challenge-sent": "2737",
                  "integrity-challenge-received": "2330",
                  "integrity-response-sent": "895",
                  "integrity-response-received": "1029",
                  "path-sent": "1197",
                  "path-received": "3568",
                  "path-err-sent": "4658",
                  "path-err-received": "695",
                  "path-tear-sent": "3706",
                  "path-tear-received": "2604",
                  "resv-sent": "3353",
                  "resv-received": "3129",
                  "resv-err-sent": "1787",

```

```
    "resv-err-received": "3205",
    "resv-tear-sent": "4465",
    "resv-tear-received": "3056",
    "summary-refresh-sent": "655",
    "summary-refresh-received": "3856"
  },
  "packets": {
    "sent": "2147",
    "received": "4374",
    "ietf-rsvp-extended:discontinuity-time":
    "2015-10-24T17:11:27+02:00",
    "ietf-rsvp-extended:out-dropped": "2696",
    "ietf-rsvp-extended:in-dropped": "941",
    "ietf-rsvp-extended:out-errors": "19",
    "ietf-rsvp-extended:in-errors": "2732"
  },
  "errors": {
    "authenticate": "2540",
    "checksum": "2566",
    "packet-length": "267"
  }
},
"interface": [
  {
    "interface": "ge0/0/0/1",
    "statistics": {
      "messages": {
        "ack-sent": "2747",
        "ack-received": "4934",
        "bundle-sent": "1618",
        "bundle-received": "3668",
        "hello-sent": "4288",
        "hello-received": "1194",
        "integrity-challenge-sent": "4850",
        "integrity-challenge-received": "3979",
        "integrity-response-sent": "479",
        "integrity-response-received": "1773",
        "path-sent": "2230",
        "path-received": "1793",
        "path-err-sent": "465",
        "path-err-received": "1859",
        "path-tear-sent": "923",
        "path-tear-received": "3924",
        "resv-sent": "3203",
        "resv-received": "2507",
        "resv-err-sent": "1259",
        "resv-err-received": "2445",
        "resv-tear-sent": "3045",
        "resv-tear-received": "4676",
```

```
    "summary-refresh-sent": "365",
    "summary-refresh-received": "2129"
  },
  "packets": {
    "sent": "847",
    "received": "3114",
    "ietf-rsvp-extended:discontinuity-time":
    "2015-10-24T17:11:27+02:00",
    "ietf-rsvp-extended:out-dropped": "1841",
    "ietf-rsvp-extended:in-dropped": "4832",
    "ietf-rsvp-extended:out-errors": "1334",
    "ietf-rsvp-extended:in-errors": "3900"
  },
  "errors": {
    "authenticate": "3494",
    "checksum": "4374",
    "packet-length": "2456"
  }
}
},
{
  "interface": "ge0/0/0/2",
  "statistics": {
    "messages": {
      "ack-sent": "1276",
      "ack-received": "2427",
      "bundle-sent": "4053",
      "bundle-received": "3509",
      "hello-sent": "3261",
      "hello-received": "2863",
      "integrity-challenge-sent": "4744",
      "integrity-challenge-received": "3554",
      "integrity-response-sent": "3155",
      "integrity-response-received": "169",
      "path-sent": "3853",
      "path-received": "409",
      "path-err-sent": "4227",
      "path-err-received": "2830",
      "path-tear-sent": "1742",
      "path-tear-received": "3344",
      "resv-sent": "3154",
      "resv-received": "3492",
      "resv-err-sent": "3112",
      "resv-err-received": "3974",
      "resv-tear-sent": "3657",
      "resv-tear-received": "533",
      "summary-refresh-sent": "4036",
      "summary-refresh-received": "2123"
    }
  },
}
```

```

    "packets": {
      "sent": "473",
      "received": "314",
      "ietf-rsvp-extended:discontinuity-time":
        "2015-10-24T17:11:27+02:00",
      "ietf-rsvp-extended:out-dropped": "2042",
      "ietf-rsvp-extended:in-dropped": "90",
      "ietf-rsvp-extended:out-errors": "1210",
      "ietf-rsvp-extended:in-errors": "1361"
    },
    "errors": {
      "authenticate": "543",
      "checksum": "2241",
      "packet-length": "480"
    }
  }
},
"ietf-rsvp-extended:refresh-interval": 30,
"ietf-rsvp-extended:refresh-misses": 5,
"ietf-rsvp-extended:checksum_enabled": true,
"ietf-rsvp-extended:patherr-state-removal": [
  null
]
},
"sessions": {
  "session-ip": [
    {
      "destination-port": 10,
      "protocol-id": 10,
      "destination": "198.51.100.1",
      "psbs": {
        "psb": [
          {
            "source-port": 10,
            "expires-in": 100
          }
        ]
      },
      "rsbs": {
        "rsb": [
          {
            "source-port": 10,
            "reservation-style":
              "rsvp:reservation-wildcard-filter",
            "expires-in": 100
          }
        ]
      }
    }
  ]
}

```

```
    }
  ]
},
"neighbors": {
  "neighbor": [
    {
      "address": "192.0.2.6",
      "epoch": 130,
      "expiry-time": 260,
      "graceful-restart": {
        "enabled": true,
        "local-restart-time": 271,
        "local-recovery-time": 138,
        "neighbor-restart-time": 341,
        "neighbor-recovery-time": 342
      },
      "hello-status": "enabled",
      "interface": "ge0/0/0/1",
      "restart-count": 2,
      "restart-time": "2015-10-24T17:11:27+02:00"
    }
  ]
},
"graceful-restart": {
  "enabled": true,
  "local-restart-time": 60,
  "local-recovery-time": 180,
  "neighbor-restart-time": 80,
  "neighbor-recovery-time": 200,
  "helper-mode": {
    "enabled": true
  }
}
}
]
}
}
```

Figure 7: Example RSVP JSON encoded data instance tree.

10. Contributors

Himanshu Shah
Ciena

Email: hshah@ciena.com

Xia Chen
Huawei Technologies

Email: jescia.chenxia@huawei.com

Raqib Jones
Brocade

Email: raqib@Brocade.com

Bin Wen
Comcast

Email: Bin_Wen@cable.comcast.com

11. References

11.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <<https://www.rfc-editor.org/info/rfc3688>>.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.
- [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.

- [RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.
- [RFC6991] Schoenwaelder, J., Ed., "Common YANG Data Types", RFC 6991, DOI 10.17487/RFC6991, July 2013, <<https://www.rfc-editor.org/info/rfc6991>>.
- [RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <<https://www.rfc-editor.org/info/rfc7950>>.
- [RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017, <<https://www.rfc-editor.org/info/rfc8040>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8177] Lindem, A., Ed., Qu, Y., Yeung, D., Chen, I., and J. Zhang, "YANG Data Model for Key Chains", RFC 8177, DOI 10.17487/RFC8177, June 2017, <<https://www.rfc-editor.org/info/rfc8177>>.
- [RFC8294] Liu, X., Qu, Y., Lindem, A., Hopps, C., and L. Berger, "Common YANG Data Types for the Routing Area", RFC 8294, DOI 10.17487/RFC8294, December 2017, <<https://www.rfc-editor.org/info/rfc8294>>.
- [RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.
- [RFC8341] Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.
- [RFC8343] Bjorklund, M., "A YANG Data Model for Interface Management", RFC 8343, DOI 10.17487/RFC8343, March 2018, <<https://www.rfc-editor.org/info/rfc8343>>.
- [RFC8349] Lhotka, L., Lindem, A., and Y. Qu, "A YANG Data Model for Routing Management (NMDA Version)", RFC 8349, DOI

10.17487/RFC8349, March 2018, <<https://www.rfc-editor.org/info/rfc8349>>.

[RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

[RFC8639] Voit, E., Clemm, A., Gonzalez Prieto, A., Nilsen-Nygaard, E., and A. Tripathy, "Subscription to YANG Notifications", RFC 8639, DOI 10.17487/RFC8639, September 2019, <<https://www.rfc-editor.org/info/rfc8639>>.

[RFC8641] Clemm, A. and E. Voit, "Subscription to YANG Notifications for Datastore Updates", RFC 8641, DOI 10.17487/RFC8641, September 2019, <<https://www.rfc-editor.org/info/rfc8641>>.

11.2. Informative References

[RFC2205] Braden, R., Ed., Zhang, L., Berson, S., Herzog, S., and S. Jamin, "Resource ReSerVation Protocol (RSVP) -- Version 1 Functional Specification", RFC 2205, DOI 10.17487/RFC2205, September 1997, <<https://www.rfc-editor.org/info/rfc2205>>.

[RFC2747] Baker, F., Lindell, B., and M. Talwar, "RSVP Cryptographic Authentication", RFC 2747, DOI 10.17487/RFC2747, January 2000, <<https://www.rfc-editor.org/info/rfc2747>>.

[RFC2961] Berger, L., Gan, D., Swallow, G., Pan, P., Tommasi, F., and S. Molendini, "RSVP Refresh Overhead Reduction Extensions", RFC 2961, DOI 10.17487/RFC2961, April 2001, <<https://www.rfc-editor.org/info/rfc2961>>.

[RFC3209] Awduche, D., Berger, L., Gan, D., Li, T., Srinivasan, V., and G. Swallow, "RSVP-TE: Extensions to RSVP for LSP Tunnels", RFC 3209, DOI 10.17487/RFC3209, December 2001, <<https://www.rfc-editor.org/info/rfc3209>>.

[RFC3473] Berger, L., Ed., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource Reservation Protocol-Traffic Engineering (RSVP-TE) Extensions", RFC 3473, DOI 10.17487/RFC3473, January 2003, <<https://www.rfc-editor.org/info/rfc3473>>.

[rfc4558] Ali, Z., Rahman, R., Prairie, D., and D. Papadimitriou, "Node-ID Based Resource Reservation Protocol (RSVP) Hello: A Clarification Statement", RFC 4558, DOI

10.17487/RFC4558, June 2006, <<https://www.rfc-editor.org/info/rfc4558>>.

[RFC5063] Satyanarayana, A., Ed. and R. Rahman, Ed., "Extensions to GMPLS Resource Reservation Protocol (RSVP) Graceful Restart", RFC 5063, DOI 10.17487/RFC5063, October 2007, <<https://www.rfc-editor.org/info/rfc5063>>.

[RFC5495] Li, D., Gao, J., Satyanarayana, A., and S. Bardalai, "Description of the Resource Reservation Protocol - Traffic-Engineered (RSVP-TE) Graceful Restart Procedures", RFC 5495, DOI 10.17487/RFC5495, March 2009, <<https://www.rfc-editor.org/info/rfc5495>>.

Authors' Addresses

Vishnu Pavan Beeram
Juniper Networks

Email: vbeeram@juniper.net

Tarek Saad
Juniper Networks

Email: tsaad@juniper.net

Rakesh Gandhi
Cisco Systems, Inc.

Email: rgandhi@cisco.com

Xufeng Liu
Volta Networks

Email: xufeng.liu.ietf@gmail.com

Igor Bryskin
Individual

Email: i_bryskin@yahoo.com