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YANG Data Model for BGP about RPKI
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Abstract

This document defines YANG data models for configuring and managing BGP information about Resource Public Key Infrastructure (RPKI).

Status of this Memo

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

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1. Introduction

[RFC6810] and [RFC8210] describes a protocol to deliver Resource Public Key Infrastructure (RPKI) prefix origin data and router keys from a trusted cache server to a router, referred to as RPKI-Router protocol. [I-D.ietf-sidrops-8210bis] updates [RFC8210].

[RFC6811] validates the origination Autonomous System (AS) of BGP routes based on the Validated ROA Payload (VRP) received from the RPKI cache server. [I-D.ietf-sidrops-aspa-verification] makes use of Autonomous System Provider Authorization (ASPA) objects in the Resource Public Key Infrastructure (RPKI) to verify the Border Gateway Protocol (BGP) AS_PATH attribute of advertised routes. [RFC8635] describes that the public key is published in the Resource

Public Key Infrastructure (RPKI) and sent to the router via the RPKI to Router protocol for verifying the signature of BGPsec announcements.

This document defines YANG [RFC7950] data models for configuring and managing BGP information about RPKI.

The YANG data models in this document conform to the Network Management Datastore Architecture (NMDA) [RFC8342].

1.1. Terminology

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

2. Model Overview

Three YANG data models are defined in this document to augment BGP YANG model [I-D.ietf-idr-bgp-model].

The ietf-bgp-origin-as-validation.yang data model provides the methods for configuring BGP origin AS validation.

- Origin AS validation parameters for BGP routes.
- Origin AS validity states of BGP routes.

The ietf-bgp-sec.yang data model provides the methods for configuring BGPSec.

- BGPSec parameters for BGP routes.
- BGPSec validity states of BGP routes.

The ietf-bgp-aspa.yang data model provides the methods for configuring BGP AS PATH Verification Based on ASPA.

- BGP ASPA parameters for BGP routes.
- AS PATH validity states of BGP routes.

3. BGP Origin AS Validation YANG Module

3.1. Tree View

The complete tree of the ietf-bgp-origin-as-validation.yang data model is represented as following. See [RFC8340] for an explanation of the symbols used.

```
   module: ietf-bgp-origin-as-validation

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast:
       +--rw origin-as-validation
          +--rw enabled?             boolean
          +--rw eligible-prefix-policy?  leafref
          +--rw redistribution-as?   inet:as-number

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast:
       +--rw origin-as-validation
          +--rw enabled?             boolean
          +--rw eligible-prefix-policy?  leafref
          +--rw redistribution-as?   inet:as-number

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-pre:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-pre:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-post:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32
```

```
     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-post:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast/bgp:loc-
   rib:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast/bgp:loc-
   rib:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-pre:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-pre:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
```

```
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-post:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-post:
       +--ro statistics
          +--ro validation-state-unverified?   yang:gauge32
          +--ro validation-state-unknown?      yang:gauge32
          +--ro validation-state-invalid?      yang:gauge32
          +--ro validation-state-valid?        yang:gauge32

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro origin-as-validity?        origin-as-validity-state
       +--ro validity-invalid-reason?   route-validity-invalid-reason

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro origin-as-validity?        origin-as-validity-state
       +--ro validity-invalid-reason?   route-validity-invalid-reason

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:route-selection-options:
       +--rw origin-as
          +--rw enabled?           boolean
          +--rw allow-invalid?     boolean
          +--rw allow-not-found?   boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
               /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
```

```
            /bgp:ipv4-unicast:
      +--rw send-origin-as-validity?       boolean
      +--rw export-origin-as-validation
      |  +--rw enabled?           boolean
      |  +--rw allow-not-found?   boolean
      |  +--rw eligible-prefix-policy?  leafref
      +--rw statistics
         +--rw validation-state-unverified?   yang:gauge32
         +--rw validation-state-unknown?      yang:gauge32
         +--rw validation-state-invalid?      yang:gauge32
         +--rw validation-state-valid?        yang:gauge32

    augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
            /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv6-unicast:
      +--rw send-origin-as-validity?       boolean
      +--rw export-origin-as-validation
      |  +--rw enabled?           boolean
      |  +--rw allow-not-found?   boolean
      |  +--rw eligible-prefix-policy?  leafref
      +--rw statistics
         +--rw validation-state-unverified?   yang:gauge32
         +--rw validation-state-unknown?      yang:gauge32
         +--rw validation-state-invalid?      yang:gauge32
         +--rw validation-state-valid?        yang:gauge32

    augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
            /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv4-unicast:
      +--rw send-origin-as-validity?       boolean
      +--rw export-origin-as-validation
         +--rw enabled?           boolean
         +--rw allow-not-found?   boolean
         +--rw eligible-prefix-policy?  leafref

    augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
            /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv6-unicast:
      +--rw send-origin-as-validity?       boolean
      +--rw export-origin-as-validation
         +--rw enabled?           boolean
         +--rw allow-not-found?   boolean
         +--rw eligible-prefix-policy?  Leafref
```

3.2. Yang Module

<CODE BEGINS> file "ietf-bgp-origin-as-validation@2022-10-18.yang"

```
module ietf-bgp-origin-as-validation {
  yang-version "1.1";
  namespace "urn:ietf:params:xml:ns:yang:"
          + "ietf-bgp-origin-as-validation";
  prefix "oav";

  import ietf-yang-types {
       prefix "yang";
       reference
         "RFC 6991: Common YANG Data Types.";
  }

  import ietf-inet-types {
    prefix "inet";
    reference
      "RFC 6991: Common YANG Data Types";
  }

  import ietf-routing {
    prefix "rt";
    reference
      "RFC 8349, A YANG Data Model for Routing Management
       (NMDA Version).";
  }

  import ietf-bgp {
    prefix "bgp";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-types {
    prefix "bt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-rib-types {
    prefix "brt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }
```

```
     import ietf-routing-policy {
       prefix rt-pol;
       reference
         "RFC 9067: A YANG Data Model for Routing Policy Management.";
     }

     organization
       "IETF SIDROPS Working Group";

     contact
       "TBD";

     description
       "This module describes configuration of the BGP origin AS
        validation.

        This YANG model conforms to the Network Management
        Datastore Architecture (NMDA) as described in RFC 8342.

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        (https://trustee.ietf.org/license-info).

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

        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 (RFC 2119) (RFC 8174) when, and only when,
        they appear in all capitals, as shown here.";

     reference "RFC XXXX";

     revision 2022-10-18 {
       description
         "Initial Version";
       reference
         "RFC XXXX, YANG Data Model for RPKI to Router Protocol";
     }

     identity ineligible-orgin-as {
```

```
      base brt:ineligible-route-reason;
      description
        "Route was ineligible due to origin as validation";
    }

    typedef route-validity-invalid-reason {
      type enumeration {
        enum ineligible-orgin-as {
          description
            "Route was ineligible due to origin as number mismatch";
        }
        enum ineligible-max-len {
          description
            "Route was ineligible due to prefix maximum length
  mismatch";
        }
      }
      description
      "Origin AS validation state invalid reason of BGP routes.";
    }

    typedef origin-as-validity-state {
      type enumeration {
        enum not-found {
          description
            "No VRP Covers the Route Prefix.";
        }
        enum valid {
          description
            "At least one VRP Matches the Route Prefix.";
        }
        enum invalid {
          description
            "At least one VRP Covers the Route Prefix, but no VRP
             Matches it.";
        }
        enum disabled {
          description
            "BGP origin AS validation is not enabled.";
        }
      }
      description
        "Origin AS validation state of BGP routes.";
      reference
        "RFC 6811, BGP Prefix Origin Validation.";
    }

    grouping origin-as-validation-config {
```

```
        description
          "Origin AS validation of BGP prefix.";
        container origin-as-validation {
          leaf enabled {
            type boolean;
            default "false";
            description
              "Whether origin-AS validation of BGP prefix is enabled.";
          }
          leaf eligible-prefix-policy {
            type leafref {
              path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                   + "rt-pol:policy-definition/rt-pol:name";
               }
            description
              "A reference to a routing policy which can be used to
               restrict the prefixes for which Origin AS validation
               is enabled.";
          }
          leaf redistribution-as {
            type inet:as-number;
            description
              "Uses this AS number in the origin-AS validation for
               redistributed routes since they have no AS-PATH.";
            reference
              "RFC 8481, Clarifications to BGP Origin Validation Based
               on Resource Public Key Infrastructure (RPKI).";
          }
          description
            "Origin AS validation of BGP prefix.";
        }
      }

      grouping origin-as-selection-option {
        description
          "Origin AS option for BGP route selection.";
        container origin-as {
          leaf enabled {
            type boolean;
            default "false";
            description
              "When enabled allows the origin AS validity states to be
               taken into consideration in the best-path calculation.";
          }
          leaf allow-invalid {
            type boolean;
            default "false";
            description
```

```
            "When enabled allows the route with 'invalid' origin AS
             to be taken into consideration in the best-path
             calculation.";
        }
        leaf allow-not-found {
          type boolean;
          default "true";
          description
            "When enabled allows the route with 'not-found' origin
             AS to be taken into consideration in the best-path
             calculation.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which Origin AS option
             is enabled for BGP route selection.";
        }
        description
          "Origin AS option for BGP route selection.";
      }
    }

    grouping origin-as-validity-advertisement {
      description
        "Advertisement of Origin Validation State Extended
         Community to neighbor(s).";
      leaf send-origin-as-validity {
        type boolean;
        default "false";
        description
          "If set to true, send the origin AS validity to the
           neighbor(s) using Origin Validation State Extended
           Community";
        reference
          "RFC 8097, BGP Prefix Origin Validation State Extended
           Community.";
      }
      leaf eligible-prefix-policy {
        type leafref {
          path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
               + "rt-pol:policy-definition/rt-pol:name";
           }
        description
```

```
            "A reference to a routing policy which can be used to
             restrict the prefixes for which Origin Validation
             State Extended Community is advertised.";
        }
      }

      grouping export-origin-as-validation-config {
        description
          "Export Origin AS validation of BGP prefix.";
        container export-origin-as-validation {
          leaf enabled {
            type boolean;
            default "false";
            description
              "When enabled allows the origin AS validity states to be
               taken into consideration in BGP export.";
          }
          leaf allow-not-found {
            type boolean;
            default "false";
            description
              "When enabled allows the route with 'not-found' origin
               AS to be sent to the neighbor.";
          }
          leaf eligible-prefix-policy {
            type leafref {
              path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                   + "rt-pol:policy-definition/rt-pol:name";
               }
            description
              "A reference to a routing policy which can be used to
               restrict the prefixes for which Origin AS validity
               states are considered in BGP export.";
          }
          description
            "Export Origin AS validation of BGP prefix.";
          reference
            "RFC 8893, Resource Public Key Infrastructure (RPKI) Origin
            Validation for BGP Export.";
           }
         }

      grouping origin-as-validity-statistics {
           description
             "Origin-AS validation statistics.";
           container statistics {
             leaf validation-state-unverified {
               type yang:gauge32;
```

```
            description
              "The number of routes with validation state as
   unverified.";
            }
            leaf validation-state-unknown {
              type yang:gauge32;
              description
                "The number of routes with validation state as
   unknown.";
            }
            leaf validation-state-invalid {
              type yang:gauge32;
              description
                "The number of routes with validation state as
   invalid.";
            }
            leaf validation-state-valid {
              type yang:gauge32;
              description
                "The number of routes with validation state as valid.";
            }
            description
              "Statistical data for Origin-AS validation states.";
        }
      }

      augment "/rt:routing/rt:control-plane-protocols"
            + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
            + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast" {
        description
          "Origin AS validation augmentation of BGP IPv4 Unicast
           Address Family.";
        uses origin-as-validation-config;
      }

      augment "/rt:routing/rt:control-plane-protocols"
            + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
            + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast" {
        description
          "Origin AS validation augmentation of BGP IPv6 Unicast
           Address Family.";
        uses origin-as-validation-config;
      }

      augment "/rt:routing/rt:control-plane-protocols"
            + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
            + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
               + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-pre" {
```

```
      description
        "Augmentation of BGP IPv4 Unicast route statistics.";

      uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-pre" {
      description
        "Augmentation of BGP IPv6 Unicast route statistics.";

      uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-post" {
      description
        "Augmentation of BGP IPv4 Unicast route statistics.";

      uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-in-post" {
      description
        "Augmentation of BGP IPv6 Unicast route statistics.";

      uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:loc-rib" {
      description
        "Augmentation of BGP IPv4 Unicast route statistics.";

      uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
```

```
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:loc-rib" {
        description
          "Augmentation of BGP IPv6 Unicast route statistics.";

        uses origin-as-validity-statistics;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-pre" {
        description
          "Augmentation of BGP IPv4 Unicast route statistics.";

        uses origin-as-validity-statistics;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-pre" {
        description
          "Augmentation of BGP IPv6 Unicast route statistics.";

        uses origin-as-validity-statistics;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-post" {
        description
          "Augmentation of BGP IPv4 Unicast route statistics.";

        uses origin-as-validity-statistics;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:neighbors/bgp:neighbor/bgp:adj-rib-out-post" {
        description
          "Augmentation of BGP IPv6 Unicast route statistics.";

        uses origin-as-validity-statistics;
      }
```

```
        augment "/rt:routing/rt:control-plane-protocols"
              + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
              + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
           + "/bgp:loc-rib/bgp:routes/bgp:route" {
        description
          "Origin AS validity augmentation of BGP IPv4 Unicast
           route.";
        leaf origin-as-validity {
          type origin-as-validity-state;
          description
            "Origin AS validity of BGP IPv4 Unicast prefix";
          }
          leaf validity-invalid-reason {
            type route-validity-invalid-reason;
            description
              "Reason for marking a BGP IPv4 Unicast prefix as
   invalid";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:loc-rib/bgp:routes/bgp:route" {
      description
        "Origin AS validity augmentation of BGP IPv6 Unicast
         route.";
      leaf origin-as-validity {
        type origin-as-validity-state;
        description
          "Origin AS validity of BGP IPv6 Unicast prefix";
        }
        leaf validity-invalid-reason {
          type route-validity-invalid-reason;
          description
            "Reason for marking a BGP IPv6 Unicast prefix as
   invalid";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:route-selection-options" {
      when "derived-from-or-self(../bgp:name, 'bt:ipv4-unicast') or "
         + "derived-from-or-self(../bgp:name, 'bt:ipv6-unicast')" {
        description
          "This augmentation is valid for IPv4 and IPv6 Unicast.";
```

```
      }
      description
        "augmentation of BGP route selection options";
      uses origin-as-selection-option;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
      description
        "augmentation of Origin Validation State Extended
         Community advertisement for IPv4 Unicast neighbor";
      uses origin-as-validity-advertisement;
      uses export-origin-as-validation-config;
         uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
      description
        "augmentation of Origin Validation State Extended
         Community advertisement for IPv6 Unicast neighbor";
      uses origin-as-validity-advertisement;
      uses export-origin-as-validation-config;
         uses origin-as-validity-statistics;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
      description
        "augmentation of Origin Validation State Extended
         Community advertisement for IPv4 Unicast peer group";
      uses origin-as-validity-advertisement;
      uses export-origin-as-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
      description
        "augmentation of Origin Validation State Extended
         Community advertisement for IPv6 Unicast peer group";
```

```
      uses origin-as-validity-advertisement;
      uses export-origin-as-validation-config;
    }
  }
```

<CODE ENDS>

4. BGPSec YANG Module

4.1. Tree View

The complete tree of the ietf-bgp-sec.yang data model is represented as following. See [RFC8340] for an explanation of the symbols used.

```
   module: ietf-bgp-sec

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast:
       +--rw bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast:
       +--rw bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro bgpsec-validity?     bgpsec-validity-state

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro bgpsec-validity?     bgpsec-validity-state

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:route-selection-options:
       +--rw bgpsec
          +--rw enabled?                 boolean
          +--rw allow-invalid?           boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
               /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
               /bgp:ipv4-unicast:
       +--rw export-bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
               /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
               /bgp:ipv6-unicast:
```

```
       +--rw export-bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
               /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
               /bgp:ipv4-unicast:
       +--rw export-bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
               /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
               /bgp:ipv6-unicast:
       +--rw export-bgpsec-validation
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref
```

4.2. Yang Module

<CODE BEGINS> file "ietf-bgp-sec@2022-10-18.yang"

```
module ietf-bgp-sec {
  yang-version "1.1";
  namespace "urn:ietf:params:xml:ns:yang:"
          + "ietf-bgp-sec";
  prefix "sec";

  import ietf-routing {
    prefix "rt";
    reference
      "RFC 8349, A YANG Data Model for Routing Management
       (NMDA Version).";
  }

  import ietf-bgp {
    prefix "bgp";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-types {
    prefix "bt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-rib-types {
    prefix "brt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import ietf-routing-policy {
    prefix rt-pol;
    reference
      "RFC 9067: A YANG Data Model for Routing Policy Management.";
  }

  organization
    "IETF SIDROPS Working Group";

  contact
    "TBD";

  description
```

```
       "This module describes configuration of BGPsec.

        This YANG model conforms to the Network Management
        Datastore Architecture (NMDA) as described in RFC 8342.

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        (https://trustee.ietf.org/license-info).

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

        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 (RFC 2119) (RFC 8174) when, and only when,
        they appear in all capitals, as shown here.";

     reference "RFC XXXX";

     revision 2022-10-18 {
       description
         "Initial Version";
       reference
         "RFC XXXX, YANG Data Model for RPKI to Router Protocol";
     }

     identity ineligible-bgp {
       base brt:ineligible-route-reason;
       description
         "Route was ineligible due to bgpsec";
     }

     typedef bgpsec-validity-state {
       type enumeration {
         enum valid {
           description
             "The BGPsec UPDATE message is valid.";
         }
         enum invalid {
           description
             "The BGPsec UPDATE message is invalid.";
```

```
        }
        enum disabled {
          description
            "BGPsec validation is not enabled.";
        }
      }
      description
        "BGPsec validation state of BGP routes.";
      reference
        "RFC 8205, BGPsec Protocol Specification.";
    }

    grouping bgpsec-validation-config {
      description
        "BGPsec validation of BGP prefix.";
      container bgpsec-validation {
        leaf enabled {
          type boolean;
          default "false";
          description
            "Whether BGPsec validation of BGP prefix is enabled.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which BGPsec validation
             is enabled.";
        }
        description
          "BGPsec validation of BGP prefix.";
      }
    }

    grouping bgpsec-selection-option {
      description
        "BGPsec option for BGP route selection.";
      container bgpsec {
        leaf enabled {
          type boolean;
          default "false";
          description
            "When enabled allows the BGPsec validity states to be
             taken into consideration in the best-path calculation.";
        }
```

```
        leaf allow-invalid {
          type boolean;
          default "false";
          description
            "When enabled allows the route with 'invalid' BGPsec
             to be taken into consideration in the best-path
             calculation.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which BGPsec option
             is enabled in BGP route selection.";
        }
        description
          "BGPsec option for BGP route selection.";
      }
    }

    grouping export-bgpsec-validation-config {
      description
        "Export BGPsec validation of BGP prefix.";
      container export-bgpsec-validation {
        leaf enabled {
          type boolean;
          default "false";
          description
            "When enabled allows the BGPsec validity states to be
             taken into consideration in BGP export.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which BGPsec validity
             states are considered in BGP export.";
        }
        description
          "Export BGPsec validation of BGP prefix.";
      }
    }
```

```
    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast" {
      description
        "BGPSec augmentation of BGP IPv4 Unicast Address Family.";
      uses bgpsec-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast" {
      description
        " BGPSec augmentation of BGP IPv6 Unicast Address Family.";
      uses bgpsec-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:loc-rib/bgp:routes/bgp:route" {
      description
        " BGPSec augmentation of BGP IPv4 Unicast route.";
      leaf bgpsec-validity {
        type bgpsec-validity-state;
        description
          "BGPsec validity of BGP IPv4 Unicast prefix";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:loc-rib/bgp:routes/bgp:route" {
      description
        "BGPSec augmentation of BGP IPv6 Unicast route.";
      leaf bgpsec-validity {
        type bgpsec-validity-state;
        description
          "BGPsec validity of BGP IPv6 Unicast prefix";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:route-selection-options" {
      when "derived-from-or-self(../bgp:name, 'bt:ipv4-unicast') or "
```

```
          + "derived-from-or-self(../bgp:name, 'bt:ipv6-unicast')" {
        description
          "This augmentation is valid for IPv4 and IPv6 Unicast.";
      }
      description
        "augmentation of BGP route selection options";
      uses bgpsec-selection-option;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
      description
        "augmentation of BGPSec for IPv4 Unicast neighbor";
      uses export-bgpsec-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
      description
        "augmentation of BGPSec for IPv6 Unicast neighbor";
      uses export-bgpsec-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
      description
        "augmentation of BGPSec for IPv4 Unicast peer group";
      uses export-bgpsec-validation-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
      description
        "augmentation of BGPSec for IPv6 Unicast peer group";
      uses export-bgpsec-validation-config;
    }
  }

  <CODE ENDS>
```

5. BGP ASPA YANG Module

5.1. Tree View

The complete tree of the ietf-bgp-aspa.yang data model is represented as following. See [RFC8340] for an explanation of the symbols used.

```
   module: ietf-bgp-aspa

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
               /bgp:neighbor:
       +--rw peer-role?           peer-role

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
               /bgp:peer-group:
       +--rw peer-role?           peer-role

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast:
       +--rw aspa-verification
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast:
       +--rw aspa-verification
          +--rw enabled?                 boolean
          +--rw eligible-prefix-policy?  leafref

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro aspa-verification-state?  aspa-verification-state

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:rib
               /bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast
               /bgp:loc-rib/bgp:routes/bgp:route:
       +--ro aspa-verification-state?  aspa-verification-state

     augment /rt:routing/rt:control-plane-protocols
               /rt:control-plane-protocol/bgp:bgp/bgp:global
               /bgp:afi-safis/bgp:afi-safi/bgp:route-selection-options:
       +--rw aspa
          +--rw enabled?                 boolean
          +--rw allow-invalid?           boolean
          +--rw allow-unknown?           boolean
          +--rw eligible-prefix-policy?  leafref

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

```
            /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
            /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv4-unicast:
      +--rw export-aspa-validation
         +--rw enabled?                 boolean
         +--rw eligible-prefix-policy?  leafref

   augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:neighbors
            /bgp:neighbor/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv6-unicast:
      +--rw export-aspa-validation
         +--rw enabled?                 boolean
         +--rw eligible-prefix-policy?  leafref

   augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
            /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv4-unicast:
      +--rw export-aspa-validation
         +--rw enabled?                 boolean
         +--rw eligible-prefix-policy?  leafref

   augment /rt:routing/rt:control-plane-protocols
            /rt:control-plane-protocol/bgp:bgp/bgp:peer-groups
            /bgp:peer-group/bgp:afi-safis/bgp:afi-safi
            /bgp:ipv6-unicast:
      +--rw export-aspa-validation
         +--rw enabled?                 boolean
         +--rw eligible-prefix-policy?  leafref
```

5.2. Yang Module

<CODE BEGINS> file "ietf-bgp-aspa@2022-10-18.yang"

```
module ietf-bgp-aspa {
  yang-version "1.1";
  namespace "urn:ietf:params:xml:ns:yang:"
          + "ietf-bgp-aspa";
  prefix "aspa";

  import ietf-routing {
    prefix "rt";
    reference
      "RFC 8349, A YANG Data Model for Routing Management
       (NMDA Version).";
  }

  import ietf-bgp {
    prefix "bgp";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-types {
    prefix "bt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import iana-bgp-rib-types {
    prefix "brt";
    reference
      "RFC XXXX: YANG Model for Border Gateway Protocol (BGP-4)";
  }

  import ietf-routing-policy {
    prefix rt-pol;
    reference
      "RFC 9067: A YANG Data Model for Routing Policy Management.";
  }

  organization
    "IETF SIDROPS Working Group";

  contact
    "TBD";

  description
```

```
       "This module describes configuration of the BGP AS PATH
        Verification Based on ASPA.

        This YANG model conforms to the Network Management
        Datastore Architecture (NMDA) as described in RFC 8342.

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        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.

        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 (RFC 2119) (RFC 8174) when, and only when,
        they appear in all capitals, as shown here.";

     reference "RFC XXXX";

     revision 2022-10-18 {
       description
         "Initial Version";
       reference
         "RFC XXXX, YANG Data Model for RPKI to Router Protocol";
     }

     identity ineligible-aspa {
       base brt:ineligible-route-reason;
       description
         "Route was ineligible due to ASPA verification";
     }

     typedef peer-role {
       type enumeration {
         enum customer {
           description
             "The role of the BGP peer is customer.";
         }
         enum provider {
           description
```

```
            "The role of the BGP peer is provider.";
        }
        enum lateral-peer {
          description
            "The role of the BGP peer is lateral peer.";
        }
        enum rs {
          description
            "The role of the BGP peer is Route Server (RS).";
        }
        enum rs-client {
          description
            "The role of the BGP peer is RS-client.";
        }
        enum mutual-transit {
          description
            "The role of the BGP peer is mutual-transit.";
        }
      }
      description
        "Roles of BGP peers.";
      reference
        "RFC XXXX, BGP AS_PATH Verification Based on Autonomous
         System Provider Authorization (ASPA) Objects.";
    }

    typedef aspa-verification-state {
      type enumeration {
        enum valid {
          description
            "The ASPA verification outcome is valid.";
        }
        enum invalid {
          description
            "The ASPA verification outcome is invalid.";
        }
        enum unknown {
          description
            "The ASPA verification outcome is unknown.";
        }
        enum disabled {
          description
            "BGP ASPA verification is not enabled.";
        }
      }
      description
        "ASPA verification state of BGP routes.";
      reference
```

```
          "RFC XXXX, BGP AS_PATH Verification Based on Autonomous
           System Provider Authorization (ASPA) Objects.";
      }

      grouping aspa-config {
        description
          "ASPA verification of BGP prefix.";
        container aspa-verification {
          leaf enabled {
            type boolean;
            default "false";
            description
              "Whether ASPA verification of BGP prefix is enabled.";
          }
          leaf eligible-prefix-policy {
            type leafref {
              path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                    + "rt-pol:policy-definition/rt-pol:name";
               }
            description
              "A reference to a routing policy which can be used to
               restrict the prefixes for which ASPA verification
               is enabled.";
          }
          description
            "ASPA verification of BGP prefix.";
        }
      }

      grouping aspa-selection-option {
        description
          "ASPA option for BGP route selection.";
        container aspa {
          leaf enabled {
            type boolean;
            default "false";
            description
              "When enabled allows the ASPA verification states to be
               taken into consideration in the best-path calculation.";
          }
          leaf allow-invalid {
            type boolean;
            default "false";
            description
              "When enabled allows the route with 'invalid' ASPA
               verification state to be taken into consideration in
               the best-path calculation.";
          }
```

```
        leaf allow-unknown {
          type boolean;
          default "true";
          description
            "When enabled allows the route with 'unknown' ASPA
             verification state to be taken into consideration in
             the best-path calculation.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which ASPA option
             is enabled in BGP route selection.";
        }
        description
          "ASPA option for BGP route selection.";
      }
    }

    grouping export-aspa-validation-config {
      description
        "Export AS PATH validation of BGP prefix.";
      container export-aspa-validation {
        leaf enabled {
          type boolean;
          default "false";
          description
            "When enabled allows the AS PATH validity states to be
             taken into consideration in BGP export.";
        }
        leaf eligible-prefix-policy {
          type leafref {
            path "/rt-pol:routing-policy/rt-pol:policy-definitions/"
                 + "rt-pol:policy-definition/rt-pol:name";
             }
          description
            "A reference to a routing policy which can be used to
             restrict the prefixes for which AS PATH validity
             states are considered in BGP export.";
        }
        description
          "Export AS PATH validation of BGP prefix.";
      }
    }
```

```
    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor" {
      description
        "augmentation of BGP peer roles for neighbors";
      leaf peer-role {
        type peer-role;
        description
          "Role of the peer";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group" {
      description
        "augmentation of BGP peer roles for peer groups";
      leaf peer-role {
        type peer-role;
        description
          "Role of the peer group";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast" {
      description
        "ASPA verification augmentation of BGP IPv4 Unicast
         Address Family.";
      uses aspa-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast" {
      description
        "ASPA verification augmentation of BGP IPv6 Unicast
         Address Family.";
      uses aspa-config;
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast"
          + "/bgp:loc-rib/bgp:routes/bgp:route" {
      description
```

```
        "ASPA verification state augmentation of BGP IPv4
         Unicast route.";
      leaf aspa-verification-state {
        type aspa-verification-state;
        description
          "ASPA verification state of BGP IPv4 Unicast prefix.";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:rib"
          + "/bgp:afi-safis/bgp:afi-safi/bgp:ipv6-unicast"
          + "/bgp:loc-rib/bgp:routes/bgp:route" {
      description
        "ASPA verification state augmentation of BGP IPv6
         Unicast route.";
      leaf aspa-verification-state {
        type aspa-verification-state;
        description
          "ASPA verification state of BGP IPv6 Unicast prefix.";
      }
    }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:global"
          + "/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:route-selection-options" {
      when "derived-from-or-self(../bgp:name, 'bt:ipv4-unicast') or "
         + "derived-from-or-self(../bgp:name, 'bt:ipv6-unicast')" {
        description
          "This augmentation is valid for IPv4 and IPv6 Unicast.";
      }
      description
        "augmentation of BGP route selection options";
      uses aspa-selection-option;
    }
  }

    augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
      description
        "augmentation of AS PATH for IPv4 Unicast neighbor";
      uses export-aspa-validation-config;
    }

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

```
          + "/rt:control-plane-protocol/bgp:bgp/bgp:neighbors"
          + "/bgp:neighbor/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
        description
          "augmentation of AS PATH for IPv6 Unicast neighbor";
        uses export-aspa-validation-config;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv4-unicast" {
        description
          "augmentation of AS PATH for IPv4 Unicast peer group";
        uses export-aspa-validation-config;
      }

      augment "/rt:routing/rt:control-plane-protocols"
          + "/rt:control-plane-protocol/bgp:bgp/bgp:peer-groups"
          + "/bgp:peer-group/bgp:afi-safis/bgp:afi-safi"
          + "/bgp:ipv6-unicast" {
        description
          "augmentation of AS PATH for IPv6 Unicast peer group";
        uses export-aspa-validation-config;
      }
    }

    <CODE ENDS>
```

6. Security Considerations

This section is modeled after the template described in Section 3.7 of [YANG-GUIDE].

The YANG data models in this document define data models that is designed to be accessed via YANG-based management protocols, such as NETCONF [RFC6241] and RESTCONF [RFC8040]. These protocols have to use a secure transport layer (e.g., SSH [RFC4252], TLS [RFC8446], and QUIC [RFC9000]) and have to use mutual authentication.

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 this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes can 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. Specifically, the following subtrees and data nodes have particular sensitivities/vulnerabilities:

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. Specifically, the following subtrees and data nodes have particular sensitivities/vulnerabilities:

There are no particularly sensitive RPC or action operations.

7. IANA Considerations

RFC Ed.: In this section, replace all occurrences of 'XXXX' with the actual RFC number (and remove this note).

7.1. IETF XML Registry

The IANA is requested to assign the following URI in the "IETF XML Registry" [RFC3688]:

URI: urn:ietf:params:xml:ns:yang:ietf-bgp-origin-as-validation
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

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

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

7.2. YANG Module Names Registry

This document registers the following YANG modules in the "YANG Module Names" registry [RFC6020]:

```
   Name:       ietf-bgp-origin-as-validation
   Maintained by IANA?  N
   Namespace:  urn:ietf:params:xml:ns:yang:ietf-bgp-origin-as-
validation
   Prefix:     oav
   Reference:  RFC XXXX



   Name:       ietf-bgp-sec
   Maintained by IANA?  N
   Namespace:  urn:ietf:params:xml:ns:yang:ietf-bgp-sec
   Prefix:     sec
   Reference:  RFC XXXX



   Name:       ietf-bgp-aspa
   Maintained by IANA?  N
   Namespace:  urn:ietf:params:xml:ns:yang:ietf-bgp-aspa
   Prefix:     aspa
   Reference:  RFC XXXX
```

8. References

9. References

9.1. Normative References

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[RFC6810] Bush, R. and R. Austein, "The Resource Public Key Infrastructure (RPKI) to Router Protocol", RFC 6810, DOI 10.17487/RFC6810, January 2013, <https://www.rfc-editor.org/info/rfc6810>.

[RFC6811] Mohapatra, P., Scudder, J., Ward, D., Bush, R., and R. Austein, "BGP Prefix Origin Validation", RFC 6811, DOI 10.17487/RFC6811, January 2013, <https://www.rfc-editor.org/info/rfc6811>.

[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>.

[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>.

[RFC8210] Bush, R. and R. Austein, "The Resource Public Key Infrastructure (RPKI) to Router Protocol, Version 1", RFC 8210, DOI 10.17487/RFC8210, September 2017, <https://www.rfc-editor.org/info/rfc8210>.

[RFC8342] Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture (NMDA)", RFC 8342, DOI 10.17487/RFC8342, March 2018, <https://www.rfc-editor.org/info/rfc8342>.

[RFC8635] Bush, R., Turner, S., and K. Patel, "Router Keying for BGPsec", RFC 8635, DOI 10.17487/RFC8635, August 2019, <https://www.rfc-editor.org/info/rfc8635>.

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[I-D.ietf-sidrops-aspa-verification] Azimov, A., Bogomazov, E., Bush, R., Patel, K., Snijders, J., and K. Sriram, "BGP AS_PATH Verification Based on Autonomous System Provider Authorization (ASPA) Objects", Work in Progress, Internet-Draft, draft-ietf-sidrops-aspa-verification-20, 4 January 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-sidrops-aspa-verification-20>.

[I-D.ietf-idr-bgp-model] Jethanandani, M., Patel, K., Hares, S., and J. Haas, "YANG Model for Border Gateway Protocol (BGP-4)", Work in Progress, Internet-Draft, draft-ietf-idr-bgp-model-18, 21 October 2024, <https://datatracker.ietf.org/doc/html/draft-ietf-idr-bgp-model-18>.

9.2. Informative References

[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>.

[YANG-GUIDE] Bierman, A., Boucadair, M., and Q. Wu, "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models", Work in Progress, Internet-Draft, draft-ietf-netmod-rfc8407bis-28, 5 June 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-netmod-rfc8407bis-28>.

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