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SPRING Working Group

BGP Segment Routing Yang Model

https://tools.ietf.org/html/draft-dhjain-spring-bgp-sr-yang-00

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Introduction

- BGP Segment Routing (SR) YANG data model can be used to configure and manage Segment Routing extensions in BGP
- 00 version submitted prior to IETF-102
  - https://tools.ietf.org/html/draft-dhjain-spring-bgp-sr-yang-00
- This Yang model covers following SR extensions in BGP
  - Prefix Sid extensions in the context of SR MPLS, as described in [I-D.ietf-idr-bgp-prefix-sid]
  - Egress Peer Engineering (EPE) as described in [I-D.ietf-spring- segment-routing-central-epe]
  - BGP Signaled SR Policy as described in [I-D.ietf-idr-segment-routing-te-policy]
  - Automatic Steering as described in [I-D.ietf-spring-segment-routing-policy] and [I-D.ietf-idr-segment-routing-te-policy]
  - SRv6 VPN extensions as described in [I-D.draft-dawra-idr- srv6-vpn]
- This model will be evolved to cover remaining SR extensions in subsequent revisions

BGP SR Yang Model

- This model augments base BGP model defined in [I-D.ietf-idr-bgp-model]
- The model complies with the Network Management Datastore Architecture (NMDA) [RFC8342].
- Imports common Routing Yang data types from [RFC8294]
- Expected to import/augment SR specific common elements from
  - Base SR Yang model
  - Base SR Policy Yang model
  - Base SRv6 Yang model

SR Prefix SID

- Prefix SID attribute in BGP in the context of SR MPLS, carries the label index and SRGB block information
- The configuration to attach the label index is modeled as a new route-policy set action
- Per BGP route Prefix SID attribute state is modeled under BGP AF mode for select address families

```
module: ietf-bgp-sr
augment /rpol:routing-policy/rpol:policy-definitions/rpol:policy-definition +
        /rpol:statements/rpol:statement/rpol:actions/bgp-pol:bgp-actions:
    +--rw set-label-index?   Uint32


augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-labeled-unicast:
    +--ro routes
       +--ro route* [prefix neighbor add-path-id]
          +--ro prefix                inet:ip-prefix
          +--ro neighbor              inet:ip-address
          +--ro add-path-id           uint32
          +--ro prefix-sid
          |  +--ro label-index?       Uint32
          |  +--ro originator-srgb
          |     +--ro srgb-ranges* [srgb-min srgb-max]
          |        +--ro srgb-min    rt-types:mpls-label
          |        +--ro srgb-max    rt-types:mpls-label
```

Egress Peer Engineering

- The configuration and state for the EPE parameters is modeled by augmenting the neighbor container defined in the base BGP model [I-D.ietf-idr-bgp-model]
- Peer node SID, Peer adjacency SID and Peer set SID
- Static and dynamic EPE SID configuration
- FRR backup policy and backup SID specification

```
module: ietf-bgp-sr
augment /bgp:bgp/bgp:neighbors/bgp:neighbor:
+--rw egress-peer-engineering
  +--rw sid-allocation-type?   enumeration
  +--rw explicit-sid?          sid-type
  +--ro allocated-sid?         sid-type
  +--rw peer-set-name?         string
  +--rw backup
  |  +--ro active?        boolean
  |  +--rw backup-type?   enumeration
  |  +--rw backup-peer?   inet:ip-address
  |  +--rw backup-sid?    sid-type
  +--rw peer-adjacency* [first-hop-ipaddress]
     +--rw first-hop-ipaddress    inet:ip-address
     +--ro first-hop-interface?   string
     +--rw sid-allocation-type?   enumeration
     +--rw explicit-sid?          sid-type
     +--ro allocated-sid?         sid-type
     +--rw backup                +--ro active?
boolean
     +--rw backup-type?   enumeration
     +--rw backup-peer?   inet:ip-address
     +--rw backup-sid?    sid-type
```

SR Policies

- SR Policies configuration and state data in the context of BGP
  - Addition of two AF identities corresponding to IPv4 SR-policy and IPv6 SR-policy
  - BGP Signaled SR Policy Explicit Candidate paths
  - On Demand SR Policy Candidate paths triggered by BGP
  - SR Policy state in the context of BGP

SR Explicit Policies

- SR Explicit Policies refer to BGP Signaled SR Policy Candidate paths
- Signaled via BGP within SR Policy SAFI
- This is modeled by adding SR Policy address family specific container under generic BGP afi-safi list

```
module:ietf-bgp-sr

 augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi:
       +--rw ipv4-srpolicy
          +--ro explicit-policies
             +--ro sr-policy* [distinguisher color endpoint]
                +--ro distinguisher           uint32
                +--ro color                   uint32
                +--ro endpoint                inet:ip-address
                +--ro preference?             Uint32
                +--ro explicit-binding-sid
                |  +--ro binding-sid?       sid-type
                |  +--ro strict?            Boolean
                |  +--ro drop-on-invalid?   Boolean
                +--ro usable?                 Boolean
                +--ro registered?             boolean
```

SR ODN Policies

- There are two parts to the On Demand Policies in the context of BGP.
  - A set of authorized SR Policy Colors for On Demand Policy triggers
  - The actual instantiated candidate paths per BGP next-hop.
- New containers and lists are added under BGP global mode to model this information

```
augment /bgp:bgp/bgp:global:
       +--rw segment-routing
          +--rw on-demand-policies
          |  +--ro authorized-colors
          |  |  +--ro colors* [color]
          |  |     +--ro color    uint32
          |  +--ro installed-policies
          |     +--ro sr-policy* [color end-point]
          |        +--ro color        uint32
          |        +--ro end-point    inet:ip-address
```

SR Policy State and Automatic Steering

- SR Policy state in BGP (regardless of method of instantiation of SR Policy)
- Automatic Steering (AS) refers to the ability to forward traffic over a SR Policy on the head-end
- Automatic Steering is modeled as state information per BGP path

```
module: ietf-bgp-sr
augment /bgp:bgp/bgp:global:
       +--rw segment-routing
          +--ro policy-state
             +--ro sr-policy* [color end-point]
                +--ro color                uint32
                +--ro end-point            inet:ip-address
                +--ro policy-state?        Enumeration
                +--ro binding-sid?         sid-type
                +--ro steering-disabled?   Empty
                +--ro ref-count?           Uint32

augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast:
    +--ro routes
       +--ro route* [prefix neighbor add-path-id]
          +--ro prefix                union
          +--ro neighbor              inet:ip-address
          +--ro add-path-id           uint32
          +--ro automatic-steering
          |  +--ro color?         -> /bgp:bgp/global/bgp-sr:segment-routing/policy-state/sr-policy/color
          |  +--ro end-point?     -> /bgp:bgp/global/bgp-sr:segment-routing/policy-state/sr-policy/end-point
          |  +--ro co-flag?       Enumeration
          |  +--ro binding-sid?   -> /bgp:bgp/global/bgp-sr:segment-routing/policy-state/sr-policy/binding-sid
```

SRv6 extensions

- SRv6 extensions for BGP refer to VPN programming as described in
  - [I-D.draft-dawra-idr-srv6-vpn]
  - [I-D.draft-filsfils-spring-srv6-network-programming]
- SRv6 SID allocation mode
- SRv6 SID state per route

```
module: ietf-bgp-sr
  augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi/bgp:ipv4-unicast:
    +--rw segment-routing
       +--rw srv6
          +--rw sid-alloc-mode?   Enumeration


 augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi/bgp:l3vpn-ipv4-unicast:
    +--ro routes
       +--ro route* [rd prefix neighbor add-path-id]
          +--ro rd                    rt-types:route-distinguisher
          +--ro prefix                union
          +--ro neighbor              inet:ip-address
          +--ro add-path-id           uint32
          +--ro srv6
             +--ro received-sids* [received-sid]
             |  +--ro received-sid    srv6-types:srv6-sid
             +--ro local-sids* [local-sid]
                +--ro local-sid    srv6-types:srv6-sid
                +--ro locator?     string
```

Next Steps

- Submit new revision with TBDs taken care of
- Discussion on dependencies on base BGP yang model.
- Request detailed review