BGP Model for Service Provider Networks

OpenConfig network operator working group
www.openconfig.net

draft-idr-shaikh-bgp-model-01

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Recap of OpenConfig BGP model

- OpenConfig operator working group -- models based on real usage
  - operators examining our own configurations and operational parameters
  - items that are widely available in major implementations

- Scope of the model
  - base BGP protocol configuration (global, neighbor, and peer-group templates)
  - support for multiple address families
  - policy (in conjunction with generic routing policy model)
  - operational state data

```
+--rw bgp!
     +--rw global
     |     ...
     +--rw neighbors
     |     ...
     +--rw peer-groups
           ...
```

Changes from -00 version

- Updates to BGP and policy model in draft-01
  - new operational state structure and data items
  - restructured AFI / SAFI configuration (generic and per AFI/SAFI)
  - separation of routing policy from BGP
  - new base protocol configuration items

- Several vendor implementations in progress
  - many changes in the model based on implementor feedback
  - related to model structure, location in the hierarchy, support for specific features, etc.

Coordination with other BGP models

Discussion with co-authors of draft-zhdankin-netmod-bgp-cfg

Summary of feedback / differences:

- policy
  - draft-zhdankin leaves routing policy largely out of scope due to perceived implementation differences
- operational state
  - draft-zhdankin leaves operational state out of scope for vendor-specific state data and statistics
- we have addressed a number of structural suggestions

Latest modules available in: `https://github.com/YangModels/yang/tree/master/experimental/openconfig`

Additional material

BGP AFI / SAFI configuration structure

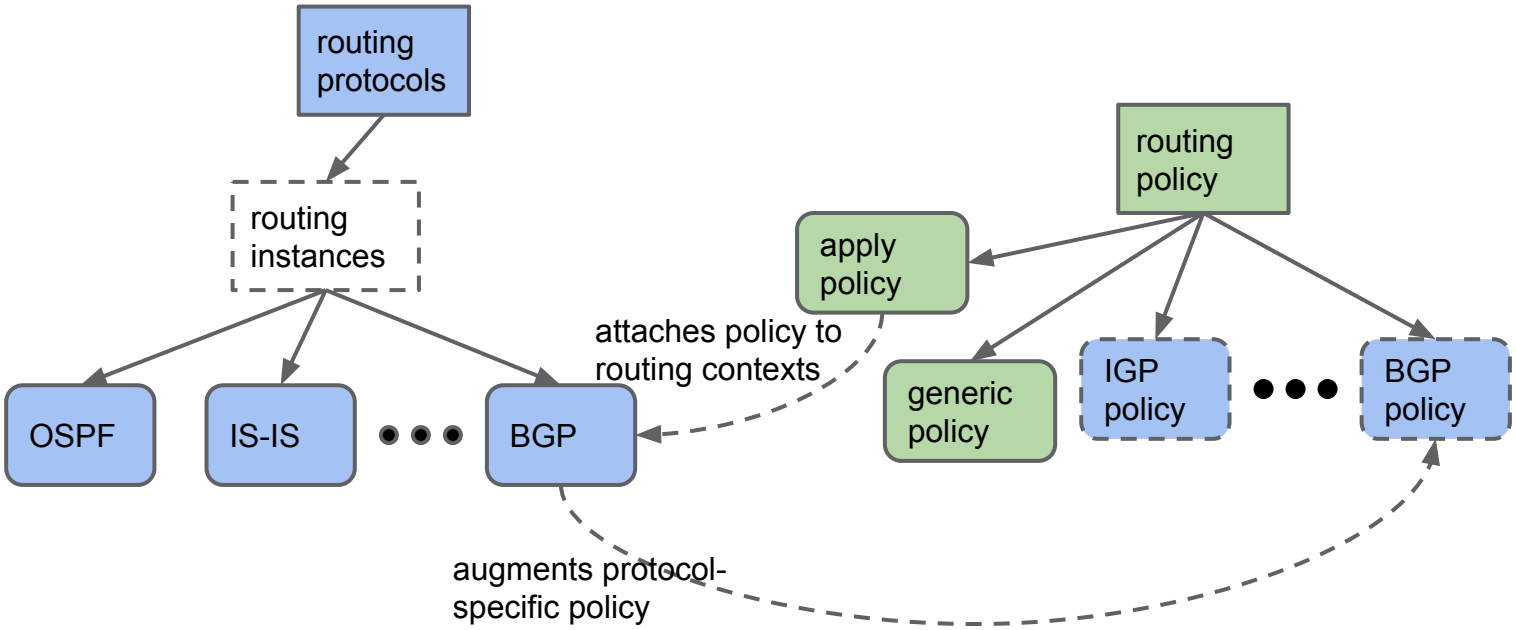
```
+--rw bgp!
   +--rw global
      +--rw afi-safi
         +--rw afi-safi* [afi-safi-name]
            +--rw afi-safi-name
            +--rw route-selection-options
            +--rw use-multiple-paths!
            +--rw config
            +--ro state
            +--rw apply-policy
            +--rw ipv4-unicast!
            +--rw ipv6-unicast!
            +--rw ipv4-labelled-unicast!
            +--rw ipv6-labelled-unicast!
            +--rw l3vpn-ipv4-unicast!
            +--rw l3vpn-ipv6-unicast!
            +--rw l3vpn-ipv4-multicast!
            +--rw l3vpn-ipv6-multicast!
            +--rw l2vpn-vpls!
            +--rw l2vpn-evpn!
```

supported AFI-SAFI types

global AFI-SAFI options

```
+--rw bgp!
   +--rw neighbors
      +--rw neighbor* [neighbor-address]
         +--rw afi-safi
            +--rw afi-safi* [afi-safi-name]
               +--rw afi-safi-name
                  +--rw route-selection-options
                  |  +--rw config
                  |     +--rw always-compare-med
                  |     +--rw ignore-as-path-length?
                  |     +--rw external-compare-router-id?
                  |     +--rw advertise-inactive-routes?
                  |     +--rw enable-aigp?
                  |     +--rw ignore-next-hop-igp-metric?
                  +--rw use-multiple-paths!
                  |  +--rw ebgp
                  |  |  +--rw config
                  |  |     +--rw allow-multiple-as?
                  |  |     +--rw maximum-paths?
                  |  +--rw ibgp
                  |     +--rw config
                  |        +--rw maximum-paths?   uint32
                  +--rw config
                     +--rw enabled?   boolean
```

Routing model structure decouples protocol and policy



Routing policy structure

generic routing policy model

```
+--rw routing-policy
      +--rw defined-sets!
      |  +--rw prefix-set* [prefix-set-name]
      |  |  +--rw prefix-set-name    string
      |  |  +--rw prefix*
      |  |        ...
      |  +--rw neighbor-set* [neighbor-set-name]
      |  |  +--rw neighbor-set-name    string
      |  |  +--rw neighbor* [address]
      |  |        ...
      |  +--rw tag-set* [tag-set-name]
      |     +--rw tag-set-name    string
      |     +--rw tag* [value]
      |           ...
      +--rw policy-definition* [name]
         +--rw name          string
         +--rw statement* [name]
            +--rw name           string
            +--rw conditions!
            |     ...
            +--rw actions!
                  ...
```

augmented with BGP-specific defined sets

```
+--rw routing-policy
      +--rw defined-sets!
      |  +--rw prefix-set* [prefix-set-name]
      |  |  +--rw prefix-set-name    string
      |  |  +--rw prefix*
      |  |        ...
      |  +--rw neighbor-set* [neighbor-set-name]
      |  |  +--rw neighbor-set-name    string
      |  |  +--rw neighbor* [address]
      |  |        ...
      |  +--rw tag-set* [tag-set-name]
      |  |  +--rw tag-set-name    string
      |  |  +--rw tag* [value]
      |  |        ...
      |  +--rw bgp-pol:bgp-defined-sets
      |     +--rw bgp-pol:community-set*
      |     |     ...
      |     +--rw bgp-pol:ext-community-set*
      |     |     ...
      |     +--rw bgp-pol:as-path-set*
      |           ...
```

BGP model overall structure

```
+--rw bgp!
   +--rw global
   |  +-- (global-configuration-options)
   +--rw neighbors
   |  +--rw neighbor* [neighbor-address]
   |  +-- (neighbor-configuration-options)
   +--rw peer-groups
      +--rw peer-group* [peer-group-name]
      +-- (neighbor-configuration-options)
```

- hierarchical configuration with overrides as in most existing implementations
- primary configuration at neighbor level with peer group templates
- policies may be applied at multiple levels or specific address families

BGP neighbor configuration items

```
+--rw bgp!
      +--rw neighbor* [neighbor-address]
         +--rw neighbor-address
         +--rw peer-as
         +--rw description?
         +--rw graceful-restart!
         +--rw apply-policy
         +--rw afi-safi* [afi-safi-name]
         +--rw auth-password?
         +--rw peer-type?
         +--rw timers
         +--rw ebgp-multihop
         +--rw route-reflector
         +--rw remove-private-as?
         +--rw bgp-logging-options
         +--rw transport-options
         +--rw local-address?
         +--rw route-flap-damping?
         +--rw send-community?
         +--rw error-handling
         +--rw as-path-options
         +--rw add-paths!
```

Summary

- OpenConfig BGP model updates have been reviewed by a number of operators
- Policy is now decoupled into OpenConfig generic routing policy model
- Model is under review by several vendors -- early feedback on implementation readiness has been positive
- Updated model addresses many differences between OpenConfig and draft-zhdankin BGP models
- Models available in public YangModels repository

`https://github.com/YangModels/yang/tree/master/experimental/openconfig`