

BGP Configuration Model for Service Provider Networks

OpenConfig network operator working group
www.openconfig.net

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OpenConfig: operator working group

- OpenConfig data models based on real usage
 - operators examining our own configurations and operational parameters
 - including items that are widely available in major implementations
 - BGP protocol and policy configuration are first models
- Updates to BGP and policy model in draft-01
 - new base protocol configuration items
 - restructured AFI/SAFI configuration
 - separation of routing policy from BGP
 - new operational state data

BGP model overall structure

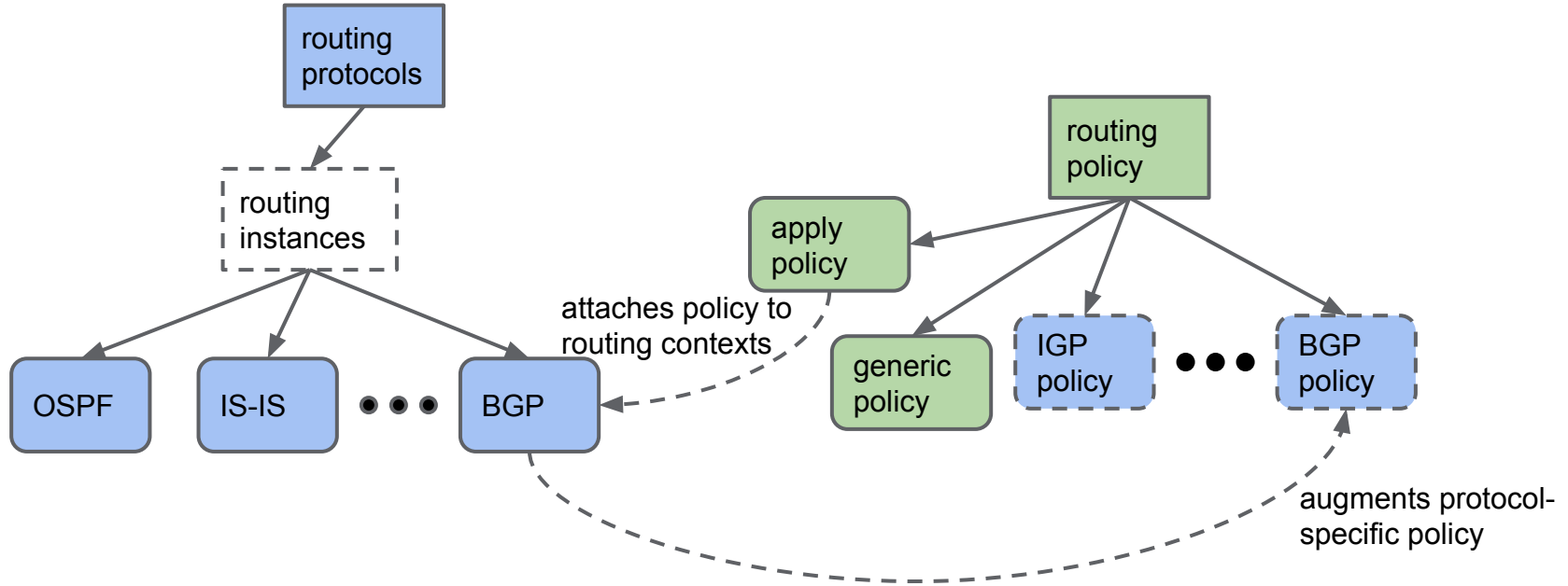
```
+--rw bgp!  
  +--rw global  
  |   ...  
  +--rw peer-group* [group-name]  
  |   ...  
  +--rw neighbor* [neighbor-address]  
  |   ...  
  +--rw apply-policy  
     ...
```

- hierarchical configuration with overrides as in most existing implementations
- primary configuration at peer group and neighbor level
- policies may be applied at multiple levels

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!
```

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 AFI / SAFI configuration structure

```
+--rw bgp!  
  +--rw neighbor* [neighbor-address]  
    +--rw afi-safi* [afi-safi-name]  
      +--rw afi-safi-name      identityref  
      +--rw ipv4-unicast  
      +--rw ipv6-unicast  
      +--rw ipv4-multicast  
      +--rw ipv6-multicast  
      +--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

```
+--rw bgp!  
  +--rw global  
    +--rw afi-safi* [afi-safi-name]  
      +--rw afi-safi-name  
      +--rw route-selection-options  
        | +--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 allow-multiple-as?  
        | | +--rw maximum-paths?  
        | +--rw ibgp  
        |   +--rw maximum-paths?  
      +--rw ipv4-unicast  
        | +--rw enabled?  
        | +--rw prefix-limit  
        | | +--rw max-prefixes?  
        | | ...  
      +--rw ipv6-unicast  
        + ...
```

global afi-
safi options

per afi-safi
options

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
- multiprotocol
 - draft-zhdankin prefers to express as series of containers rather than list due to ease of their implementation

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>