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Yang Data Model for BGP extended features  
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## Abstract

This document defines a YANG data model that can be used to configure and manage BGP features which are not covered in the base BGP YANG data model.

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## [1.](#) Introduction

YANG [[RFC6020](#)] is a data definition language that was introduced to define the contents of a conceptual data store that allows networked devices to be managed using NETCONF [[RFC6241](#)]. YANG is proving relevant beyond its initial confines, as bindings to other interfaces (e.g. ReST) and encodings 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 that can be used to configure and manage BGP features which are not covered in the base model [[I-D.ietf-idr-bgp-model](#)]. This model is defined by augmenting the applicable containers from the base BGP model.

### [1.1.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

## [2.](#) Definitions and Acronyms

AF: Address Family

AIGP: Accumulated IGP

AS: Autonomous System

BGP: Border Gateway Protocol

DMZ: Demilitarized zone. Used in context of DMZ link bandwidth for a link that connects two single hop eBGP peers.

IGP: Interior Gateway Protocol

MED(med): Multi Exit Discriminator

NETCONF: Network Configuration Protocol

ReST: Representational State Transfer, a style of stateless interface and protocol that is generally carried over HTTP

YANG: Data definition language for NETCONF

## [3.](#) BGP extended features

This yang model covers a number of BGP extended features by augmenting BGP base model defiend in [[I-D.ietf-idr-bgp-model](#)]. These features are described below. This model is expected to grow with more such features in future.

### [3.1.](#) AIGP

The Accumulated IGP Metric Attribute for BGP is an optional non-transitive BGP path attribute and is specified in [\[RFC7311\]](#). Configuration to enable and set the parameters for AIGP are applicable per address family per neighbor granularity. These are defined by augmenting AF containers under neighbor and peer-group from base BGP model [\[I-D.ietf-idr-bgp-model\]](#).

### [3.2.](#) Aggregate routes

This refers to the BGP specific configuration for enabling mechanisms for route aggregation as per [\[RFC4271\]](#) [\[RFC2519\]](#) . These parameters are modeled as new leafs augmenting global address family containers from the BGP base yang model [\[I-D.ietf-idr-bgp-model\]](#).

### [3.3.](#) DMZ link bandwidth

The BGP link bandwidth feature is used to advertise the bandwidth of an autonomous system exit link as an extended community [TODO: reference]. Configuration to enable DMZ link bandwidth extended community is modeled by augmenting BGP neighbor and peer-group containers defined in [\[I-D.ietf-idr-bgp-model\]](#).

### [3.4.](#) Network

Leafs to add network in BGP routing table. BGP global address family container from the base BGP model [\[I-D.ietf-idr-bgp-model\]](#) is augmented for this purpose.

### [3.5.](#) Dampening

Configuration parameters for BGP dampening behavior as defined in [\[RFC2439\]](#). These parameters are defined under BGP global address family mode.

## [4.](#) Yang model

```

        module: ietf-bgp-extensions
augment /bgp:bgp/bgp:global:
augment /bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi:
  +--rw aggregate-addr
  |   +--rw aggregate-address?    inet:ip-address
  |   +--rw summary-only?        boolean
  |   +--rw as-set?              boolean
  |   +--rw as-confed-set?       boolean
  |   +--rw route-policy?        string
  +--rw aggregate-timer
  |   +--rw enable?              boolean
  |   +--rw threshold?          uint16
  +--rw network
  |   +--rw network?            inet:ip-address
  |   +--rw policy?             string
  +--rw bgp-dampening
  |   +--rw half-time?           uint8
  |   +--rw reuse-limit?        uint16

```

```

  |   +--rw supresss-limit?      uint16
  |   +--rw max-supress-time?    uint8
  |   +--rw policy?              string
  |   ...
  +--rw auto-summary?           boolean
  +--rw advertise-best-external? boolean

augment /bgp:bgp/bgp:neighbors/bgp:neighbor:
  +--rw propagate-dmzlink-bw?   boolean

augment /bgp:bgp/bgp:neighbors/bgp:neighbor/bgp:afi-safis/bgp:afi-safi:
  +--rw aigp
  |   +--rw enable?              boolean
  |   +--rw send-med?            boolean
  |   +--rw send-cost-community
  |       +--rw id?              uint32
  |       +--rw igp-cost-transitive? boolean
  |       +--rw point-of-insertion? enumeration
  +--rw soft-reconfig?          enumeration

augment /bgp:bgp/bgp:peer-groups/bgp:peer-group:

```

```

    +--rw propagate-dmzlink-bw?    boolean

augment /bgp:bgp/bgp:peer-groups/bgp:peer-group/bgp:afi-safis/bgp:afi-safi:
  +--rw aigp
  |   +--rw enable?                boolean
  |   +--rw send-med?              boolean
  |   +--rw send-cost-community
  |       +--rw id?                uint32
  |       +--rw igp-cost-transitive? boolean
  |       +--rw point-of-insertion? enumeration
  +--rw soft-reconfig?    enumeration

```

<CODE BEGINS> file "ietf-bgp-extensions@2016-07-08.yang"

```

module ietf-bgp-extensions {
  namespace "urn:ietf:params:xml:ns:yang:ietf-bgp-extensions";
  // replace with IANA namespace when assigned

  prefix bgp-ext;

  import ietf-inet-types {
    prefix inet;

```

```

}

```

```

import ietf-bgp {
  prefix bgp;
  revision-date 2016-01-06;
}

```

```

organization
  "Cisco Systems
  170 West Tasman Drive
  San Jose, CA 95134-1706
  USA";
contact
  "Keyur Patel keyupate@cisco.com

```

Dhanendra Jain dhjain@cisco.com  
Susan Hares shares@ndzh.com";

description

"This YANG module defines the extensions to the base BGP yang model common across all of the vendor implementations of the protocol. It is intended that the model will be extended by vendors to define vendor-specific models.

Terms and Acronyms

AIGP (aigp): Accumulated IGP

BGP (bgp): Border Gateway Protocol

IGP (igp): Interior Gateway Protocol

IP (ip): Internet Protocol

IPv4 (ipv4): Internet Protocol Version 4

IPv6 (ipv6): Internet Protocol Version 6

MED(med): Multi Exit Discriminator

MTU (mtu) Maximum Transmission Unit

";

revision 2016-07-08 {  
description  
"Initial revision.";

reference

"RFC XXXX: A YANG Data Model for BGP extended features";  
}

//

// AIGP parameters used in global mode and neighbor AF mode.

//

grouping bgp-aigp {

```

description
  "A set of configuration parameters applicable for AIGP configuration";
container aigp {
  description "AIGP configuration parameters";
  leaf enable {
    type boolean;
    description "Enable AIGP";
  }
  leaf send-med {
    type boolean;
    description "Send AIGP value in MED";
  }
  container send-cost-community {
    description "Send AIGP value in Cost Community";
    leaf id {
      type uint32;
      description "Cost Community ID";
    }
    leaf igp-cost-transitive {
      type boolean;
      description "Enable transitive cost community";
    }
    leaf point-of-insertion {
      type enumeration {
        enum igp-cost {
          description "Cost community is used after IGP distance to next-hop";
        }
        enum pre-bestpath {
          description "Cost community is first step in best-path calculation";
        }
      }
      description "Point of insertion for best-path calculation";
    }
  }
}

//
// DMZ link bandwidth params
//

```

```

grouping bgp-dmz-link-bw {

```



```

description
  "A set of configuration parameters for DMZ link bandwidth";
leaf propagate-dmzlink-bw {
  type boolean;
  description
    "Propagate the DMZ link bandwidth.";
}
}

//
// BGP dampening params
//
grouping bgp-dampening-params {
  description "BGP dampening parameters";
  container bgp-dampening {
    description
      "BGP Route Flap Dampening.";

    leaf half-time {
      type uint8 {
        range "1..45";
      }
      description
        "Half Time (in minutes) to reduce the penalty
        assigned to a route by half.";
    }

    leaf reuse-limit {
      type uint16 {
        range "1..20000";
      }
      description
        "A configurable numeric value that is compared with the penalty.
        If the penalty is less than the reuse limit, a suppressed route
        that is up will no longer be suppressed. ";
    }

    leaf supresss-limit {
      type uint16 {
        range "1..20000";
      }
      description
        "A configurable numeric value that is compared with the penalty.
        If the penalty is greater than the suppress limit,
        the route is suppressed";
    }
  }
}

```

```
    leaf max-supress-time {
      type uint8 {
        range "1..255";
      }
      description
        "The longest amount of time, in minutes, that a route can be suppressed";
    }
    leaf policy {
      type string ; //TBD leafref to policy model
      description
        "Policy to specify criteria for dampening";
    }
  }
}

//
// Grouping for Aggregate address
//
grouping bgp-aggregate-addr {
  description "BGP aggregate address parameters grouping";
  container aggregate-addr {
    description "Aggregate address configuration";
    leaf aggregate-address {
      type inet:ip-address;
      description
        "Configure BGP aggregate address.";
    }
    leaf summary-only {
      type boolean;
      description "Filter more specific routes from updates";
    }
    leaf as-set {
      type boolean;
      description "Generate AS set path information";
    }
    leaf as-confed-set {
      type boolean;
      description "Generate AS confed set path information";
    }
    leaf route-policy {
      type string;
      description "Policy to filter routes and specify conditions";
    }
  }
}
```

```
//  
// Grouping for soft reconfig
```

```
//  
grouping soft-reconfig {  
    description "Soft reconfig parameters. Configuring this enables storing  
                of routes as received by this node, prior to applying  
                inbound route-policy";  
    leaf soft-reconfig {  
        type enumeration {  
            enum "always" {  
                description "Use soft reconfig database upon neighbor reset even  
                            if route refresh is configured";  
            }  
            enum "backup" {  
                description "Use soft reconfig database as backup to route refresh";  
            }  
        }  
        description "Enable storing of unprocessed routes as received by this node";  
    }  
}  
  
//  
// Grouping for all AF extensions.  
//  
grouping bgp-af-extension-cfg {  
    description  
        "Grouping for configuration parameters which are applicable  
        to all address families of the BGP router."  
  
    // Aggregate related  
    uses bgp-aggregate-addr;  
  
    // Aggregate Timer  
    container aggregate-timer {  
        description  
            "Configure aggregation timer to specify time interval at which BGP routes  
            will be aggregated for route aggregation."  
        leaf enable {  
            type boolean;  
            default "true";  
            description "Enable aggregate timer";  
        }  
    }  
}
```

```

    }
    leaf threshold {
        type uint16 {
            range "6..60";
        }
        description "Threshold value in seconds";
    }
}

```

```

//Network
container network {
    description "Add networks to BGP table";
    leaf network {
        type inet:ip-address;
        description
            "Specify a network to announce via BGP.";
    }
    leaf policy {
        type string; //TBD leaf to policy model.
        description "Modify route attribute as per policy";
    }
}

// Dampening
uses bgp-dampening-params;

//Other leafs
leaf auto-summary {
    type boolean;
    description
        "Enable automatic network number summarization";
}
// Best external
leaf advertise-best-external {
    type boolean;
    description
        "Advertise best external path to the internal peers.";
}
}

```

```
// Global mode extensions can go here.
grouping bgp-gbl-extension-cfg {
    description "BGP process global extensions grouping";
    // BGP process global extensions here.
}

// Global address family specific extensions.
grouping bgp-gbl-af-extension-cfg {
    description "BGP global address family specific extensions";

    //AF extensions common to all AFs
    uses bgp-af-extension-cfg;
}

// Neighbor mode extensions.
grouping bgp-nbr-extension-cfg {
```

```
    description "BGP neighbor specific extensions";
    //NBR extensions go here
    uses bgp-dmz-link-bw;
}

// Neighbor address family specific extensions.
grouping bgp-nbr-af-extension-cfg {
    description "BGP neighbor address-family specific extensions";
    // NBR-AF extensions go here
    uses bgp-aigp ;
    uses soft-reconfig;
}

//-----
// Augment BGP model in various places.
//-----

// BGP Global parameters
augment "/bgp:bgp:bgp:global" {
    description "BGP global mode specific extensions";
    //add BGP global extensions here
    uses bgp-gbl-extension-cfg;
}

// BGP Global Address Family Specific
```

```

augment "/bgp:bgp/bgp:global/bgp:afi-safis/bgp:afi-safi" {
    description "BGP global address family mode specific extensions";
    //add BGP global AF extensions here
    uses bgp-gbl-af-extension-cfg;
}

//BGP Neighbor Specific
augment "/bgp:bgp/bgp:neighbors/bgp:neighbor" {
    description "BGP neighbor mode specific extensions";
    // add nbr specific extensions here
    uses bgp-nbr-extension-cfg;
}

//BGP Neighbor address-family Specific
augment "/bgp:bgp/bgp:neighbors/bgp:neighbor/bgp:afi-safis/bgp:afi-safi" {
    description "BGP neighbor address family mode specific extensions";
    // add nbr AFI-SAFI specific extensions here.
    uses bgp-nbr-af-extension-cfg;
}

// BGP Neighbor Groups specific
augment "/bgp:bgp/bgp:peer-groups/bgp:peer-group" {

```

```

    description "BGP peer-group mode specific extensions";
    // add nbr specific extensions here
    uses bgp-nbr-extension-cfg;
}

// BGP Neighbor Group address-family Specific.
augment "/bgp:bgp/bgp:peer-groups/bgp:peer-group/bgp:afi-safis/bgp:afi-safi" {
    description "BGP peer-group address family mode specific extensions";
    // add nbr AFI-SAFI specific extensions here.
    uses bgp-nbr-af-extension-cfg;
}
}

```

<CODE ENDS>

## [5.](#) IANA Considerations

## 6. Security Considerations

The transport protocol used for sending the BGP configuration data MUST support authentication and SHOULD support encryption. The data-model by itself does not create any security implications.

This draft does not change any underlying security issues inherent in the base BGP model [[I-D.ietf-idr-bgp-model](#)], that it augments to define yang model for extended features.

## 7. Acknowledgements

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