QoS Policy Propagation via BGP

The QoS Policy Propagation via BGP feature allows you to classify packets by IP precedence based on the Border Gateway Protocol (BGP) community lists, BGP autonomous system paths, and access lists. After packets have been classified, you can use other quality of service (QoS) features such as committed access rate (CAR) and Weighted Random Early Detection (WRED) to specify and enforce policies to fit your business model.

• Finding Feature Information, on page 1
• Prerequisites for QoS Policy Propagation via BGP, on page 1
• Information About QoS Policy Propagation via BGP, on page 2
• How to Configure QoS Policy Propagation via BGP, on page 2
• Configuration Examples for QoS Policy Propagation via BGP, on page 9
• Additional References, on page 11
• Feature Information for QoS Policy Propagation via BGP, on page 12

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for QoS Policy Propagation via BGP

• Enable the Border Gateway Protocol (BGP) and Cisco Express Forwarding (CEF) or distributed CEF (dCEF) on the device. Subinterfaces on an ATM interface that have the bgp-policy command enabled must use CEF mode because dCEF is not supported. dCEF uses the Versatile Interface Processor (VIP) rather than the Route Switch Processor (RSP) to perform forwarding functions.
• Define the policy.
• Apply the policy through BGP.
• Configure the BGP community list, BGP autonomous system path, or access list and enable the policy on an interface.

• Enable committed access rate (CAR) or Weighted Random Early Detection (WRED) to use the policy.

### Information About QoS Policy Propagation via BGP

#### Benefits of QoS Policy Propagation via BGP

The QoS Policy Propagation via BGP feature allows you to classify packets by IP precedence based on Border Gateway Protocol (BGP) community lists, BGP autonomous system paths, and access lists. After a packet has been classified, you can use other quality of service (QoS) features such as committed access rate (CAR) and Weighted Random Early Detection (WRED) to specify and enforce policies to fit your business model.

### How to Configure QoS Policy Propagation via BGP

#### Configuring QoS Policy Propagation via BGP Based on Community Lists

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `route-map map-tag [permit | deny] [sequence-number] [ ]`
4. `match community {standard-list-number | expanded-list-number | community-list-name [exact]}`
5. `set ip precedence [number | name]`
6. `exit`
7. `router bgp autonomous-system`
8. `table-map route-map-name`
9. `exit`
10. `ip community-list standard-list-number {permit | deny} [community-number]`
11. `interface type number`
12. `bgp-policy {source | destination} ip-prec-map`
13. `exit`
14. `ip bgp-community new-format`
15. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>Device&gt; enable</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> route-map map-tag [permit</td>
<td>Configures a route map and specifies how the</td>
<td></td>
</tr>
<tr>
<td>deny] [sequence-number]</td>
<td>packets are to be distributed.</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config)# route-map</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alpha permit ordering-seq</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> match community {standard-</td>
<td>Matches a Border Gateway Protocol (BGP)</td>
<td></td>
</tr>
<tr>
<td>list-number</td>
<td>expanded-list-number</td>
<td>community-list-name [exact] }</td>
</tr>
<tr>
<td>Example: Device(config-route-map)#</td>
<td></td>
<td></td>
</tr>
<tr>
<td>match community 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> set ip precedence [number</td>
<td>Sets the IP Precedence field when the</td>
<td></td>
</tr>
<tr>
<td>name]</td>
<td>community list matches.</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-route-map)#</td>
<td></td>
<td></td>
</tr>
<tr>
<td>set ip precedence 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Note</strong> You can specify either a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>precedence number or a precedence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>name.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> exit</td>
<td>Exits route-map configuration mode and</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-route-map)#</td>
<td>returns to global configuration mode.</td>
<td></td>
</tr>
<tr>
<td>exit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> router bgp autonomous-system</td>
<td>Enables a BGP process and enters router</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config)# router bgp</td>
<td>configuration mode.</td>
<td></td>
</tr>
<tr>
<td>45000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> table-map route-map-name</td>
<td>Modifies the metric and tag values when the</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-router)#</td>
<td>IP routing table is updated with BGP learned</td>
<td></td>
</tr>
<tr>
<td>table-map rml</td>
<td>routes.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong> exit</td>
<td>Exits router configuration mode and returns</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-router)#</td>
<td>to global configuration mode.</td>
<td></td>
</tr>
<tr>
<td>exit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong> ip community-list</td>
<td>Creates a community list for BGP and controls</td>
<td></td>
</tr>
<tr>
<td>standard-list-number {permit</td>
<td>deny}</td>
<td>access to it.</td>
</tr>
<tr>
<td>[community-number]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Command or Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifies the interface (or subinterface) and enters interface configuration mode.</td>
<td>Device(config)# ip community-list 1 permit 2</td>
</tr>
</tbody>
</table>

**Step 11**

interface type number

Example:

Device(config)# interface gigabitethernet 0/0/0

**Step 12**

bgp-policy {source | destination} ip-prec-map

Example:

Device(config-if)# bgp-policy source ip-prec-map

**Step 13**

exit

Example:

Device(config-if)# exit

**Step 14**

ip bgp-community new-format

Example:

Device(config)# ip bgp-community new-format

(Optional) Displays the BGP community number in AA:NN (autonomous system:community number/4-byte number) format.

**Step 15**

end

Example:

Device(config)# end

#### Configuring QoS Policy Propagation via BGP Based on the Autonomous System Path Attribute

**SUMMARY STEPS**

1. enable
2. configure terminal
3. named-ordering-route-map enable
4. route-map map-tag [permit | deny] [sequence-number] [ordering-seq sequence-name]
5. match as-path path-list-number
6. set ip precedence [number | name]
7. exit
8. router bgp autonomous-system
9. table-map route-map-name
10. exit
11. ip as-path access-list access-list-number {permit | deny} as-regular-expression
12. interface type number
13. bgp-policy \{source | destination\} ip-prec-map
14. end

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
Example:  
Device> enable |
| **Step 2** configure terminal | Enters global configuration mode.  
Example:  
Device# configure terminal |
| **Step 3** named-ordering-route-map enable | Enables ordering of route-maps based on a string provided by the user.  
Example:  
Device(config)# named-ordering-route-map enable |
| **Step 4** route-map map-tag \[permit | deny\] \[sequence-number\] \[ordering-seq sequence-name\] | Configures a route map and specifies how the packets are to be distributed. ordering-seq indicates the sequence that is to be used for ordering of route-maps.  
Example:  
Device(config)# route-map alpha permit ordering-seq sequence1 |
| **Step 5** match as-path path-list-number | Matches a Border Gateway Protocol (BGP) autonomous system path access list.  
Example:  
Device(config-route-map)# match as-path 2 |
| **Step 6** set ip precedence \[number | name\] | Sets the IP Precedence field when the autonomous-system path matches.  
**Note** You can specify either a precedence number or a precedence name.  
Example:  
Device(config-route-map)# set ip precedence 5 |
| **Step 7** exit | Exits route-map configuration mode and returns to global configuration mode.  
Example:  
Device(config-route-map)# exit |
| **Step 8** router bgp autonomous-system | Enables a BGP process and enters router configuration mode.  
Example:  
Device(config)# router bgp 45000 |
| **Step 9** table-map route-map-name | Modifies the metric and tag values when the IP routing table is updated with BGP learned routes.  
Example:  

---

**QoS Policy Propagation via BGP**

**Configuring QoS Policy Propagation via BGP Based on the Autonomous System Path Attribute**
### Purpose

**Command or Action**

```
Device(config-router)# table-map rm1
```

**Purpose**

Exits router configuration mode and returns to global configuration mode.

---

**Step 10**

```
exit
```

**Example:**

```
Device(config-router)# exit
```

Defines an autonomous system path access list.

**Step 11**

```
ip as-path access-list access-list-number {permit | deny} as-regular-expression
```

**Example:**

```
Device(config)# ip as-path access-list 500 permit 45000
```

---

**Step 12**

```
interface type number
```

**Example:**

```
Device(config)# interface gigabitethernet 0/0/0
```

Specifies the interface (or subinterface) and enters interface configuration mode.

---

**Step 13**

```
bgp-policy {source | destination} ip-prec-map
```

**Example:**

```
Device(config-if)# bgp-policy source ip-prec-map
```

Classifies packets using IP precedence.

---

**Step 14**

```
end
```

**Example:**

```
Device(config-if)# end
```

Exits interface configuration mode and returns to privileged EXEC mode.

---

### Configuring QoS Policy Propagation via BGP Based on an Access List

**SUMMARY STEPS**

1. enable
2. configure terminal
3. named-ordering-route-map enable ]
4. route-map map-tag [permit | deny] [sequence-number] [ordering-seq sequence-name]
5. match ip address access-list-number
6. set ip precedence [number | name]
7. exit
8. router bgp autonomous-system
9. table-map route-map-name
10. exit
11. access-list access-list-number {permit | deny} source
12. interface type number
13. bgp-policy {source | destination} ip-prec-map
14. end
### Detailed Steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** | enable<br>**Example:**<br>Device> enable | Enables privileged EXEC mode.  
- Enter your password if prompted. |
| **Step 2** | configure terminal<br>**Example:**<br>Device# configure terminal | Enters global configuration mode. |
| **Step 3** | named-ordering-route-map enable<br>**Example:**<br>Device(config)# named-ordering-route-map enable | Enables ordering of route-maps based on a string provided by the user. |
| **Step 4** | route-map map-tag [permit | deny] [sequence-number] [ordering-seq sequence-name<br>**Example:**<br>Device(config)# route-map alpha permit ordering-seq sequence1 | Configures a route map and specifies how the packets are to be distributed. **ordering-seq** indicates the sequence that is to be used for ordering of route-maps. |
| **Step 5** | match ip address access-list-number<br>**Example:**<br>Device(config-route-map)# match ip address 69 | Matches an access list. |
| **Step 6** | set ip precedence [number | name<br>**Example:**<br>Device(config-route-map)# set ip precedence routine | Sets the IP precedence field when the autonomous system path matches. |
| **Step 7** | exit<br>**Example:**<br>Device(config-route-map)# exit | Exits route-map configuration mode and returns to global configuration mode. |
| **Step 8** | router bgp autonomous-system<br>**Example:**<br>Device(config)# router bgp 45000 | Enables a Border Gateway Protocol (BGP) process and enters router configuration mode. |
| **Step 9** | table-map route-map-name<br>**Example:**<br>Device(config-router)# table-map rm1 | Modifies the metric and tag values when the IP routing table is updated with BGP learned routes. |
| **Step 10** | exit<br>**Example:** | Exits router configuration mode and returns to global configuration mode. |
### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Device(config-router)# exit</code></td>
<td></td>
</tr>
</tbody>
</table>

### Step 11

<table>
<thead>
<tr>
<th>access-list access-list-number {permit</th>
<th>deny} source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config)# access-list 69 permit 10.69.0.0</code></td>
</tr>
<tr>
<td><strong>Purpose:</strong></td>
<td>Defines an access list.</td>
</tr>
</tbody>
</table>

### Step 12

<table>
<thead>
<tr>
<th>interface type number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
</tr>
<tr>
<td><strong>Purpose:</strong></td>
</tr>
</tbody>
</table>

### Step 13

<table>
<thead>
<tr>
<th>bgp-policy {source</th>
<th>destination} ip-prec-map</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config-if)# bgp-policy source ip-prec-map</code></td>
</tr>
<tr>
<td><strong>Purpose:</strong></td>
<td>Classifies packets using IP Precedence.</td>
</tr>
</tbody>
</table>

### Step 14

<table>
<thead>
<tr>
<th>end</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong> <code>Device(config-if)# end</code></td>
</tr>
<tr>
<td><strong>Purpose:</strong> Exits interface configuration mode and returns to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

---

## Monitoring QoS Policy Propagation via BGP

To monitor the QoS Policy Propagation via the BGP feature configuration, use the following optional commands.

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>show ip bgp</code></td>
<td>Displays entries in the Border Gateway Protocol (BGP) routing table to verify whether the correct community is set on the prefixes.</td>
</tr>
<tr>
<td><code>show ip bgp community-list community-list-number</code></td>
<td>Displays routes permitted by the BGP community to verify whether correct prefixes are selected.</td>
</tr>
<tr>
<td><code>show ip cef network</code></td>
<td>Displays entries in the forwarding information base (FIB) table based on the specified IP address to verify whether Cisco Express Forwarding has the correct precedence value for the prefix.</td>
</tr>
<tr>
<td><code>show ip interface</code></td>
<td>Displays information about the interface.</td>
</tr>
</tbody>
</table>
### Configuration Examples for QoS Policy Propagation via BGP

#### Example: Configuring QoS Policy Propagation via BGP

The following example shows how to create route maps to match access lists, Border Gateway Protocol (BGP) community lists, and BGP autonomous system paths, and apply IP precedence to routes learned from neighbors.

In the figure below, Device A learns routes from autonomous system 10 and autonomous system 60. The quality of service (QoS) policy is applied to all packets that match defined route maps. Any packets from Device A to autonomous system 10 or autonomous system 60 are sent the appropriate QoS policy, as the numbered steps in the figure indicate.

**Figure 1: Device Learning Routes and Applying QoS Policy**

![Diagram showing route learning and QoS policy application](image)

**Device A Configuration**

```plaintext
interface serial 5/0/0/1:0
ip address 10.28.38.2 255.255.255.0
bgp-policy destination ip-prec-map
no ip mroute-cache
no cdp enable
frame-relay interface-dlci 20 IETF
router bgp 30
  table-map precedence-map
  neighbor 10.20.20.1 remote-as 10
  neighbor 10.20.20.1 send-community
! ip bgp-community new-format
! Match community 1 and set the IP precedence to priority
route-map precedence-map permit 10
  match community 1
  set ip precedence priority
! Match community 2 and set the IP precedence to immediate
route-map precedence-map permit 20
```

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>show ip route prefix</code></td>
<td>Displays the current status of the routing table to verify whether correct precedence values are set on the prefixes.</td>
</tr>
</tbody>
</table>
match community 2
set ip precedence immediate

! Match community 3 and set the IP precedence to flash
route-map precedence-map permit 30
match community 3
set ip precedence flash

! Match community 4 and set the IP precedence to flash-override
route-map precedence-map permit 40
match community 4
set ip precedence flash-override

! Match community 5 and set the IP precedence to critical
route-map precedence-map permit 50
match community 5
set ip precedence critical

! Match community 6 and set the IP precedence to internet
route-map precedence-map permit 60
match community 6
set ip precedence internet

! Match community 7 and set the IP precedence to network
route-map precedence-map permit 70
match community 7
set ip precedence network

! Match ip address access list 69 or match autonomous system path 1
! and set the IP precedence to critical
route-map precedence-map permit 75
match ip address 69
match as-path 1
set ip precedence critical

! For everything else, set the IP precedence to routine
route-map precedence-map permit 80
set ip precedence routine

! Define community lists
ip community-list 1 permit 60:1
ip community-list 2 permit 60:2
ip community-list 3 permit 60:3
ip community-list 4 permit 60:4
ip community-list 5 permit 60:5
ip community-list 6 permit 60:6
ip community-list 7 permit 60:7

! Define the AS path
ip as-path access-list 1 permit ^10_60

! Define the access list
access-list 69 permit 10.69.0.0

Device B Configuration

router bgp 10
neighbor 10.30.30.1 remote-as 30
neighbor 10.30.30.1 send-community
neighbor 10.30.30.1 route-map send_community out

ip bgp-community new-format
! Match prefix 10 and set community to 60:1
route-map send_community permit 10
  match ip address 10
  set community 60:1
!
! Match prefix 20 and set community to 60:2
route-map send_community permit 20
  match ip address 20
  set community 60:2
!
! Match prefix 30 and set community to 60:3
route-map send_community permit 30
  match ip address 30
  set community 60:3
!
! Match prefix 40 and set community to 60:4
route-map send_community permit 40
  match ip address 40
  set community 60:4
!
! Match prefix 50 and set community to 60:5
route-map send_community permit 50
  match ip address 50
  set community 60:5
!
! Match prefix 60 and set community to 60:6
route-map send_community permit 60
  match ip address 60
  set community 60:6
!
! Match prefix 70 and set community to 60:7
route-map send_community permit 70
  match ip address 70
  set community 60:7
!
! For all others, set community to 60:8
route-map send_community permit 80
  set community 60:8
!
! Define access lists
access-list 10 permit 10.61.0.0
access-list 20 permit 10.62.0.0
access-list 30 permit 10.63.0.0
access-list 40 permit 10.64.0.0
access-list 50 permit 10.65.0.0
access-list 60 permit 10.66.0.0
access-list 70 permit 10.67.0.0

---

**Additional References**

**Related Documents**

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Command List, All Releases</td>
</tr>
</tbody>
</table>
Feature Information for QoS Policy Propagation via BGP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 1: Feature Information for QoS Policy Propagation via BGP

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>QoS Policy Propagation via BGP</td>
<td></td>
<td>The QoS Policy Propagation via BGP feature allows you to classify packets by IP precedence based on Border Gateway Protocol (BGP) community lists, BGP autonomous system paths, and access lists. After a packet has been classified, you can use other quality of service (QoS) features such as committed access rate (CAR) and Weighted Random Early Detection (WRED) to specify and enforce policies to fit your business model.</td>
</tr>
<tr>
<td>Policy Routing Infrastructure</td>
<td></td>
<td>The Policy Routing Infrastructure feature provides full support of IP policy-based routing with Cisco Express Forwarding (CEF). As CEF gradually obsoletes fast switching, policy routing is integrated with CEF to increase customer performance requirements. When policy routing is enabled, redundant processing is avoided.</td>
</tr>
</tbody>
</table>