BGP Policy Accounting Output Interface Accounting

Border Gateway Protocol (BGP) policy accounting (PA) measures and classifies IP traffic that is sent to, or received from, different peers. Policy accounting was previously available on an input interface only. The BGP Policy Accounting Output Interface Accounting feature introduces several extensions to enable BGP PA on an output interface and to include accounting based on a source address for both input and output traffic on an interface. Counters based on parameters such as community list, autonomous system number, or autonomous system path are assigned to identify the IP traffic.

Prerequisites for BGP PA Output Interface Accounting

Before using the BGP Policy Accounting Output Interface Accounting feature, you must enable BGP and Cisco Express Forwarding or distributed CEF on the router.

Information About BGP PA Output Interface Accounting

BGP PA Output Interface Accounting

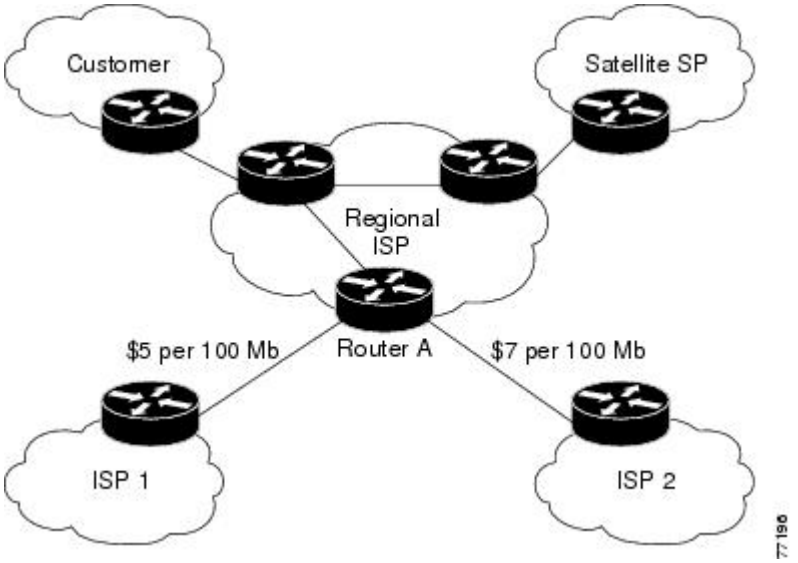
Policy accounting using BGP measures and classifies IP traffic that is sent to, or received from, different peers. Originally, BGP PA was available on an input interface only. BGP PA output interface accounting introduces several extensions to enable BGP PA on an output interface and to include accounting based on a source address for both input and output traffic on an interface. Counters based on parameters such as community list, autonomous system number, or autonomous system path are assigned to identify the IP traffic.

Using the BGP **table-map** command, prefixes added to the routing table are classified by BGP attribute, autonomous system number, or autonomous system path. Packet and byte counters are incremented per input

or output interface. A Cisco policy-based classifier maps the traffic into one of eight possible buckets that represent different traffic classes.

Using BGP PA, you can account for traffic according to its origin or the route it traverses. Service providers (SPs) can identify and account for all traffic by customer and can bill accordingly. In the figure below, BGP PA can be implemented in Router A to measure packet and byte volumes in autonomous system buckets. Customers are billed appropriately for traffic that is routed from a domestic, international, or satellite source.

Figure 1: Sample Topology for BGP Policy Accounting



BGP policy accounting using autonomous system numbers can be used to improve the design of network circuit peering and transit agreements between Internet service providers (ISPs).

Benefits of BGP PA Output Interface Accounting

Accounting for IP Traffic Differentially

BGP policy accounting classifies IP traffic by autonomous system number, autonomous system path, or community list string, and increments packet and byte counters. Policy accounting can also be based on the source address. Service providers can account for traffic and apply billing according to the origin of the traffic or the route that specific traffic traverses.

Efficient Network Circuit Peering and Transit Agreement Design

Implementing BGP policy accounting on an edge router can highlight potential design improvements for peering and transit agreements.

How to Configure BGP PA Output Interface Accounting

Specifying the Match Criteria for BGP PA

The first task in configuring BGP PA is to specify the criteria that must be matched. Community lists, autonomous system paths, or autonomous system numbers are examples of BGP attributes that can be specified and subsequently matched using a route map. Perform this task to specify the BGP attribute to use for BGP PA and to create the match criteria in a route map.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip community-list** {*standard-list-number* | *expanded-list-number* [*regular-expression*] | {**standard** | **expanded**} *community-list-name*} {**permit** | **deny**} {*community-number* | *regular-expression*}
4. **route-map** *map-name* [**permit** | **deny**] [*sequence-number*]
5. **match community-list** *community-list-number* [**exact**]
6. **set traffic-index** *bucket-number*
7. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip community-list** {*standard-list-number* | *expanded-list-number* [*regular-expression*] | {**standard** | **expanded**} *community-list-name*} {**permit** | **deny**} {*community-number* | *regular-expression*} **Example:** `Device(config)# ip community-list 30 permit 100:190`	Creates a community list for BGP and controls access to it. • Repeat this step for each community to be specified.
Step 4	**route-map** *map-name* [**permit** | **deny**] [*sequence-number*] **Example:**	Enters route-map configuration mode and defines the conditions for policy routing.

	Command or Action	Purpose
	`Device(config)# route-map set_bucket permit 10`	• The *map-name* argument identifies a route map. • The optional **permit** and **deny** keywords work with the match and set criteria to control how the packets are accounted for. • The optional *sequence-number* argument indicates the position that a new route map is to have in the list of route maps already configured with the same name.
Step 5	**match community-list** *community-list-number* [**exact**] **Example:** `Router(config-route-map)# match community-list 30`	Matches a BGP community.
Step 6	**set traffic-index** *bucket-number* **Example:** `Device(config-route-map)# set traffic-index 2`	Indicates where to output packets that pass a match clause of a route map for BGP policy accounting.
Step 7	**exit** **Example:** `Device(config-route-map)# exit`	Exits route-map configuration mode and returns to global configuration mode.

Classifying the IP Traffic and Enabling BGP PA

After a route map has been defined to specify match criteria, you must configure a way to classify the IP traffic before enabling BGP policy accounting.

Using the **table-map** command, BGP classifies each prefix that it adds to the routing table according to the match criteria. When the **bgp-policy accounting** command is configured on an interface, BGP policy accounting is enabled.

Perform this task to classify the IP traffic and enable BGP policy accounting.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **table-map** *route-map-name*
5. **network** *network-number* [**mask** *network-mask*]
6. **neighbor** *ip-address* **remote-as** *as-number*
7. **exit**
8. **interface** *type number*
9. **ip address** *ip-address mask*
10. **bgp-policy accounting** [**input** | **output**] [**source**]

11. **exit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Device(config)# router bgp 65000`	Configures a BGP routing process and enters router configuration mode for the specified routing process. • The *as-number* argument identifies a BGP autonomous system number.
Step 4	**table-map** *route-map-name* **Example:** `Device(config-router)# table-map set_bucket`	Classifies BGP prefixes entered in the routing table.
Step 5	**network** *network-number* [**mask** *network-mask*] **Example:** `Device(config-router)# network 10.15.1.0 mask 255.255.255.0`	Specifies a network to be advertised by the BGP routing process.
Step 6	**neighbor** *ip-address* **remote-as** *as-number* **Example:** `Device(config-router)# neighbor 10.14.1.1 remote-as 65100`	Specifies a BGP peer by adding an entry to the BGP routing table.
Step 7	**exit** **Example:** `Device(config-router)# exit`	Exits router configuration mode and returns to global configuration mode.
Step 8	**interface** *type number* **Example:** `Device(config)# interface POS 7/0`	Specifies the interface type and number and enters interface configuration mode. • The *type* argument identifies the type of interface.

	Command or Action	Purpose
		• The *number* argument identifies the slot and port numbers of the interface. The space between the interface type and number is optional.
Step 9	**ip address** *ip-address mask* **Example:** `Device(config-if)# ip-address 10.15.1.2 255.255.255.0`	Configures the interface with an IP address.
Step 10	**bgp-policy accounting** [**input** | **output**] [**source**] **Example:** `Device(config-if)# bgp-policy accounting input source`	Enables BGP policy accounting for the interface. • Use the optional **input** or **output** keyword to account for traffic either entering or leaving the router. By default, BGP policy accounting is based on traffic entering the router. • Use the optional **source** keyword to account for traffic based on source address.
Step 11	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.

Verifying BGP Policy Accounting

Perform this task to verify that BGP policy accounting is operating.

SUMMARY STEPS

1. **show ip cef** [*network* [*mask*]] [**detail**]
2. **show ip bgp** [*network*] [*network-mask*] [**longer-prefixes**]
3. **show cef interface** [*type number*] **policy-statistics** [**input** | **output**]
4. **show cef interface** [*type number*] [**statistics**] [**detail**]

DETAILED STEPS

Procedure

Step 1 **show ip cef** [*network* [*mask*]] [**detail**]

Enter the **show ip cef** command with the **detail** keyword to learn which accounting bucket is assigned to a specified prefix.

In this example, the output is displayed for the prefix 192.168.5.0. It shows that accounting bucket number 4 (traffic_index 4) is assigned to this prefix.

Example:

```
Device# show ip cef 192.168.5.0 detail

192.168.5.0/24, version 21, cached adjacency to POS7/2
0 packets, 0 bytes, traffic_index 4
  via 10.14.1.1, 0 dependencies, recursive
   next hop 10.14.1.1, POS7/2 via 10.14.1.0/30
   valid cached adjacency
```

Step 2 **show ip bgp** [*network*] [*network-mask*] [**longer-prefixes**]

Enter the **show ip bgp** command for the same prefix used in Step 1--192.168.5.0--to learn which community is assigned to this prefix.

In this example, the output is displayed for the prefix 192.168.5.0. It shows that the community of 100:197 is assigned to this prefix.

Example:

```
Device# show ip bgp 192.168.5.0

BGP routing table entry for 192.168.5.0/24, version 2
Paths: (1 available, best #1)
  Not advertised to any peer
  100
    10.14.1.1 from 10.14.1.1 (32.32.32.32)
      Origin IGP, metric 0, localpref 100, valid, external, best
      Community: 100:197
```

Step 3 **show cef interface** [*type number*] **policy-statistics** [**input** | **output**]

Displays the per-interface traffic statistics.

In this example, the output shows the number of packets and bytes that have been assigned to each accounting bucket:

Example:

```
Device# show cef interface policy-statistics input

FastEthernet1/0/0 is up (if_number 6)
  Corresponding hwidb fast_if_number 6
  Corresponding hwidb firstsw->if_number 6
  BGP based Policy accounting on input is enabled
 Index         Packets          Bytes
     1            9999         999900
     2               0              0
     3               0              0
     4               0              0
     5               0              0
     6               0              0
     7               0              0
     8               0              0
     9               0              0
    10               0              0
    11               0              0
    12               0              0
    13               0              0
    14               0              0
    15               0              0
    16               0              0
    17               0              0
    18               0              0
```

```
  19               0               0
  20               0               0
  21               0               0
  22               0               0
  23               0               0
  24               0               0
  25               0               0
  26               0               0
  27               0               0
  28               0               0
  29               0               0
  30               0               0
  31               0               0
  32               0               0
  33               0               0
  34            1234          123400
  35               0               0
  36               0               0
  37               0               0
  38               0               0
  39               0               0
  40               0               0
  41               0               0
  42               0               0
  43               0               0
  44               0               0
  45            1000          100000
  46               0               0
  47               0               0
  48               0               0
  49               0               0
  50               0               0
  51               0               0
  52               0               0
  53               0               0
  54            5123         1198782
  55               0               0
  56               0               0
  57               0               0
  58               0               0
  59               0               0
  60               0               0
  61               0               0
  62               0               0
  63               0               0
  64               0               0
```

Step 4 **show cef interface** [*type number*] [**statistics**] [**detail**]

Displays the state of BGP policy accounting on a specified interface.

In this example, the output shows that BGP policy accounting has been configured to be based on input traffic at Fast Ethernet interface 1/0/0:

Example:

```
Device# show cef interface Fast Ethernet 1/0/0

FastEthernet1/0/0 is up (if_number 6)
  Corresponding hwidb fast_if_number 6
  Corresponding hwidb firstsw->if_number 6
  Internet address is 10.1.1.1/24
  ICMP redirects are always sent
  Per packet load-sharing is disabled
```

```
IP unicast RPF check is disabled
Inbound access list is not set
Outbound access list is not set
IP policy routing is disabled
BGP based policy accounting on input is enabled
BGP based policy accounting on output is disabled
Hardware idb is FastEthernet1/0/0 (6)
Software idb is FastEthernet1/0/0 (6)
Fast switching type 1, interface type 18
IP Distributed CEF switching enabled
IP Feature Fast switching turbo vector
IP Feature CEF switching turbo vector
Input fast flags 0x100, Output fast flags 0x0, Flags 0x0
ifindex 7(7)
Slot 1 Slot unit 0 VC -1
Transmit limit accumulator 0xE8001A82 (0xE8001A82)
IP MTU 1500
```

Configuration Examples for BGP PA Output Interface Accounting

Specifying the Match Criteria for BGP Policy Accounting Example

In the following example, BGP communities are specified in community lists, and a route map named set_bucket is configured to match each of the community lists to a specific accounting bucket using the **set traffic-index** command:

```
ip community-list 30 permit 100:190
ip community-list 40 permit 100:198
ip community-list 50 permit 100:197
ip community-list 60 permit 100:296
!
route-map set_bucket permit 10
 match community-list 30
 set traffic-index 2
!
route-map set_bucket permit 20
 match community-list 40
 set traffic-index 3
!
route-map set_bucket permit 30
 match community-list 50
 set traffic-index 4
!
route-map set_bucket permit 40
 match community-list 60
 set traffic-index 5
```

Classifying the IP Traffic and Enabling BGP Policy Accounting Example

In the following example, BGP policy accounting is enabled on POS interface 2/0/0. The policy accounting criteria is based on the source address of the input traffic, and the **table-map** command is used to modify the bucket number when the IP routing table is updated with routes learned from BGP.

```
router bgp 65000
 table-map set_bucket
 network 10.15.1.0 mask 255.255.255.0
 neighbor 10.14.1.1 remote-as 65100
!
ip classless
ip bgp-community new-format
!
interface POS2/0/0
 ip address 10.15.1.2 255.255.255.0
 bgp-policy accounting input source
 no keepalive
 crc 32
 clock source internal
```

Additional References

The following sections provide references related to the BGP policy accounting output interface accounting feature.

Related Documents

Related Topic	Document Title
BGP commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IP Routing: BGP Command Reference*
Switching commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS IP Switching Command Reference*
Cisco IOS master command list, all releases	Cisco IOS Master Command List, All Releases

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
CISCO-BGP-POLICY-ACCOUNTING-MIB	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for BGP Policy Accounting Output Interface Accounting

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 BGP Policy Accounting Output Interface Accounting

Feature Name	Releases	Feature Information
BGP Policy Accounting	Cisco IOS XE Release 2.1	BGP policy accounting measures and classifies IP traffic that is sent to, or received from, different peers. This feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.

Feature Name	Releases	Feature Information
BGP Policy Accounting Output Interface Accounting	Cisco IOS XE Release 2.1	This feature introduces several extensions to enable BGP PA on an output interface and to include accounting based on a source address for both input and output traffic on an interface. This feature was introduced on the Cisco ASR 1000 Series Routers. The following commands were introduced or modified for this feature: **bgp-policy**, **set traffic-index**, **show cef interface**, **show cef interface policy-statistics**
SNMP Support for BGP Policy Accounting	Cisco IOS XE Release 2.1	The CISCO-BGP-POLICY-ACCOUNTING-MIB was introduced. This feature was introduced on the Cisco ASR 1000 Series Routers.

Glossary

AS --autonomous system. An IP term to describe a routing domain that has its own independent routing policy and is administered by a single authority.

BGP --Border Gateway Protocol. Interdomain routing protocol that exchanges reachability information with other BGP systems.

CEF --Cisco Express Forwarding.

dCEF --distributed Cisco Express Forwarding.