Removing Private AS Numbers from the AS Path in BGP

Private autonomous system numbers (ASNs) are used by ISPs and customer networks to conserve globally unique AS numbers. Private AS numbers cannot be used to access the global Internet because they are not unique. AS numbers appear in eBGP AS paths in routing updates. Removing private ASNs from the AS path is necessary if you have been using private ASNs and you want to access the global Internet.

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.

Restrictions on Removing and Replacing Private ASNs from the AS Path

- The feature applies to eBGP neighbors only.

- The feature applies to routers in a public AS only. The workaround to this restriction would be to apply the **neighbor local-as** command on a per-neighbor basis, with the local AS number being a public AS number.

Information About Removing and Replacing Private ASNs from the AS Path

Public and Private AS Numbers

Public AS numbers are assigned by InterNIC and are globally unique. They range from 1 to 64511. Private AS numbers are used to conserve globally unique AS numbers, and they range from 64512 to 65535. Private AS numbers cannot be leaked to a global BGP routing table because they are not unique, and BGP best path calculations require unique AS numbers. Therefore, it might be necessary to remove private AS numbers from an AS path before the routes are propagated to a BGP peer.

Benefit of Removing and Replacing Private ASNs from the AS Path

External BGP requires that globally unique AS numbers be used when routing to the global Internet. Using private AS numbers (which are not unique) would prevent access to the global Internet. This feature allows routers that belong to a private AS to access the global Internet. A network administrator configures the routers to remove private AS numbers from the AS path contained in outgoing update messages and optionally, to replace those numbers with the ASN of the local router, so that the AS Path length remains unchanged.

Former Restrictions to Removing Private ASNs from the AS Path

The ability to remove private AS numbers from the AS path has been available for a long time. Prior to Cisco IOS XE Release 3.1S, this feature had the following restrictions:

- If the AS path included both private and public AS numbers, using the **neighbor remove-private-as** command would not remove the private AS numbers.

- If the AS path contained confederation segments, using the **neighbor remove-private-as** command would remove private AS numbers only if the private AS numbers followed the confederation portion of the autonomous path.

- If the AS path contained the AS number of the eBGP neighbor, the private AS numbers would not be removed.

Enhancements to Removing Private ASNs from the AS Path

The ability to remove and replace private AS numbers from the AS path is enhanced in the following ways:

- The **neighbor remove-private-as** command will remove private AS numbers from the AS path even if the path contains both public and private ASNs.

- The **neighbor remove-private-as** command will remove private AS numbers even if the AS path contains only private AS numbers. There is no likelihood of a 0-length AS path because this command can be applied to eBGP peers only, in which case the AS number of the local router is appended to the AS path.

- The **neighbor remove-private-as** command will remove private AS numbers even if the private ASNs appear before the confederation segments in the AS path.

- The **replace-as** keyword is available to replace the private AS numbers being removed from the path with the local AS number, thereby retaining the same AS path length.

- The feature can be applied to neighbors per address family (address family configuration mode). Therefore, you can apply the feature for a neighbor in one address family and not on another, affecting update messages on the outbound side for only the address family for which the feature is configured.

- The feature can be applied in peer group template mode.

- When the feature is configured, output from the **show ip bgp update-group** and **show ip bgp neighbor** commands indicates that private AS numbers were removed or replaced.

How to Remove and Replace Private ASNs from the AS Path

Removing and Replacing Private ASNs from the AS Path (Cisco IOS XE Release 3.1S and Later)

To remove private AS numbers from the AS path on the outbound side of an eBGP neighbor, perform the following task. To also replace private AS numbers with the local router's AS number, include the **all replace-as** keywords in Step 17.

The examples in this task reflect the configuration for Router 2 in the scenario in the figure below.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **exit**
6. **interface** *type number*
7. **ip address** *ip-address mask*
8. **exit**
9. **interface** *type number*
10. **ip address** *ip-address mask*
11. **exit**
12. **router bgp** *autonomous-system-number*
13. **network** *network-number*
14. **network** *network-number*
15. **neighbor** {*ip-address* | *ipv6-address*[**%**]| *peer-group-name*} **remote-as** *autonomous-system-number*
16. **neighbor** {*ip-address* | *ipv6-address*[**%**]| *peer-group-name*} **remote-as** *autonomous-system-number*
17. **neighbor** {*ip-address* | *peer-group-name*} **remove-private-as** [**all** [**replace-as**]]
18. **end**
19. **show ip bgp update-group**
20. **show ip bgp neighbors**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 0/0	Configures an interface.

	Command or Action	**Purpose**

Step 4	**ip address** *ip-address mask*
	
	Example:
	
	`Router(config-if)# ip address 172.30.1.1`
	`255.255.0.0`
		Sets a primary or secondary IP address for an interface.

Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to the next highest configuration mode.
Step 6	**interface** *type number* **Example:** `Router(config)# interface serial 0/0`	Configures an interface.

Step 7	**ip address** *ip-address mask*
	
	Example:
	
	`Router(config-if)# ip address 172.16.0.2`
	`255.255.255.0`
		Sets a primary or secondary IP address for an interface.

Step 8	**exit** **Example:** `Router(config-if)# exit`	Returns to the next highest configuration mode.
Step 9	**interface** *type number* **Example:** `Router(config)# interface serial 1/0`	Configures an interface.

Step 10	**ip address** *ip-address mask*
	
	Example:
	
	`Router(config-if)# ip address 192.168.0.1`
	`255.255.255.0`
		Sets a primary or secondary IP address for an interface.

Step 11	**exit** **Example:** `Router(config-if)# exit`	Returns to the next highest configuration mode.

	Command or Action	Purpose
Step 12	**router bgp** *autonomous-system-number* **Example:** Router(config)# router bgp 5	Specifies a BGP instance.
Step 13	**network** *network-number* **Example:** Router(config-router)# network 172.30.0.0	Specifies a network to be advertised by BGP.
Step 14	**network** *network-number* **Example:** Router(config-router)# network 192.168.0.0	Specifies a network to be advertised by BGP.
Step 15	**neighbor** {*ip-address* | *ipv6-address*[**%**]| *peer-group-name*} **remote-as** *autonomous-system-number* **Example:** Router(config-router)# neighbor 172.16.0.1 remote-as 65000	Adds an entry to the routing table. • This example configures Router 3 as an eBGP neighbor in private AS 65000.
Step 16	**neighbor** {*ip-address* | *ipv6-address*[**%**]| *peer-group-name*} **remote-as** *autonomous-system-number* **Example:** Router(config-router)# neighbor 192.168.0.2 remote-as 1	Adds an entry to the routing table. • This example configures Router 1 as an eBGP neighbor in public AS 1.
Step 17	**neighbor** {*ip-address* | *peer-group-name*} **remove-private-as** [**all** [**replace-as**]] **Example:** Router(config-router)# neighbor 192.168.0.2 remove-private-as all replace-as	Removes private AS numbers from the AS Path in outgoing updates. • This example removes the private AS numbers from the AS path in outgoing eBGP updates and replaces them with 5, which is the public AS number of the local router.
Step 18	**end** **Example:** Router(config-router)# end	Ends the current configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 19	**show ip bgp update-group** **Example:** `Router# show ip bgp update-group`	(Optional) Displays information about BGP update groups.
Step 20	**show ip bgp neighbors** **Example:** `Router# show ip bgp neighbors`	(Optional) Displays information about BGP neighbors.

Configuration Examples for Removing and Replacing Private ASNs from the AS Path

Example Removing Private ASNs (Cisco IOS XE Release 3.1S)

In the example below, Router A has the **neighbor remove-private-as** command configured, which removes private AS numbers in updates sent to the neighbor at 172.30.0.7. The subsequent **show** command asks for information about the route to host 1.1.1.1. The output includes private AS numbers 65200, 65201, 65201 in the AS path of 1001 65200 65201 65201 1002 1003 1003.

To prove that the private AS numbers were removed from the AS path, the **show** command on Router B also asks for information about the route to host 1.1.1.1. The output indicates a shorter AS path of 100 1001 1002 1003 1003, which excludes private AS numbers 65200, 65201, and 65201. The 100 prepended in the path is Router B's own AS number.

Router A

```
router bgp 100
 bgp log-neighbor-changes
 neighbor 19.0.101.1 remote-as 1001
 neighbor 172.30.0.7 remote-as 200
 neighbor 172.30.0.7 remove-private-as all
 no auto-summary

RouterA# show ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 2
Paths: (1 available, best #1, table default)
  Advertised to update-groups:
     1         2
  1001 65200 65201 65201 1002 1003 1003
    19.0.101.1 from 19.0.101.1 (19.0.101.1)
      Origin IGP, localpref 100, valid, external, best RouterA#
```

Router B (All Private ASNs Have Been Removed)

```
RouterB# show ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 3
Paths: (1 available, best #1, table default)
  Not advertised to any peer
  100 1001 1002 1003 1003
    172.30.0.6 from 172.30.0.6 (19.1.0.1)
      Origin IGP, localpref 100, valid, external, best RouterB#
```

Example Removing and Replacing Private ASNs (Cisco IOS XE Release 3.1S)

In the following example, when Router A sends prefixes to the peer 172.30.0.7, all private ASNs in the AS path are replaced with the router's own ASN, which is 100.

Router A

```
router bgp 100
 bgp log-neighbor-changes
 neighbor 172.16.101.1 remote-as 1001
 neighbor 172.16.101.1 update-source Loopback0
 neighbor 172.30.0.7 remote-as 200
 neighbor 172.30.0.7 remove-private-as all replace-as
 no auto-summary
```

Router A receives 1.1.1.1 from peer 172.16.101.1 which has some private ASNs (65200, 65201, and 65201) in the AS path list, as shown in the following output:

```
RouterA# show ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 2
Paths: (1 available, best #1, table default)
  Advertised to update-groups:
      1          2
  1001 65200 65201 65201 1002 1003 1003
    172.16.101.1 from 172.16.101.1 (172.16.101.1)
      Origin IGP, localpref 100, valid, external, best RouterA#
```

Because Router A is configured with **neighbor 172.30.0.7 remove-private-as all replace-as**, Router A sends prefix 1.1.1.1 with all private ASNs replaced with 100:

Router B

```
RouterB# show ip bgp 1.1.1.1
BGP routing table entry for 1.1.1.1/32, version 3
Paths: (1 available, best #1, table default)
  Not advertised to any peer
  100 1001 100 100 100 1002 1003 1003
    172.30.0.6 from 172.30.0.6 (192.168.1.2)
      Origin IGP, localpref 100, valid, external, best RouterB#
```
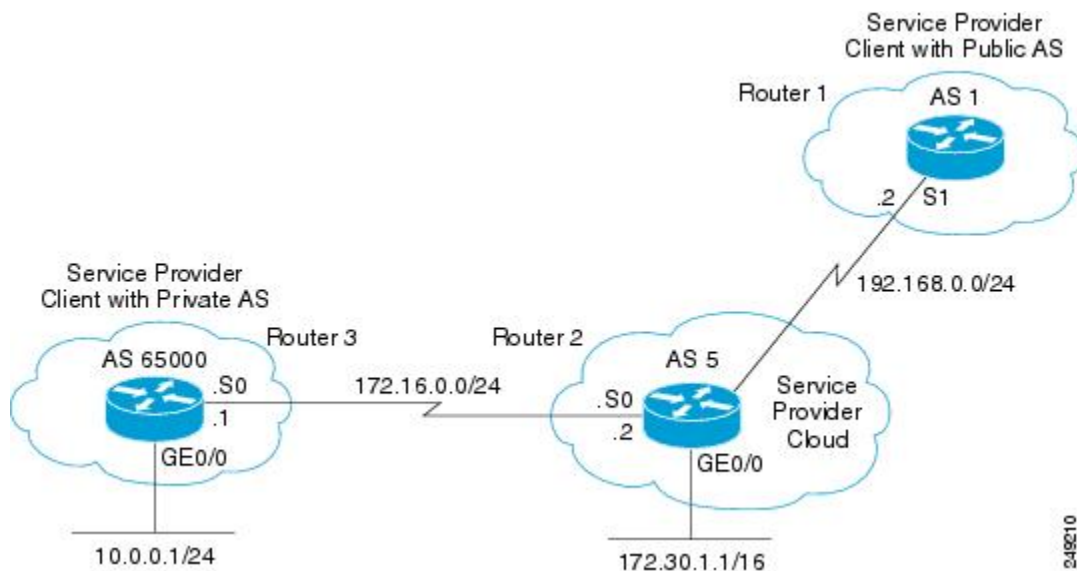
Router B

```
router bgp 200
 bgp log-neighbor-changes
 neighbor 172.30.0.6 remote-as 100
 no auto-summary
```

Example Removing Private ASNs (Cisco IOS XE Release 2)

In this example, Router 3 uses private ASN 65000. Router 1 and Router 2 use public ASNs AS 1 and AS 5 respectively.

The figure below illustrates Router 2 belonging to a service provider, with Router 1 and Router 3 as its clients.

Figure 1: Removing Private AS Numbers

In this example, Router 2, belonging to the Service Provider, removes private AS numbers as follows.

1 Router 3 advertises the network 10.0.0.0/24 with the AS path attribute 65000 to Router 2.

2 Router 2 receives the update from Router 3 and makes an entry for the network 10.0.0.0/24 in its routing table with the next hop as 172.16.0.1 (serial interface S0 on Router 3).

3 Router 2 (service provider device), when configured with the **neighbor 192.168.0.2 remove-private-as** command, strips off the private AS number and constructs a new update packet with its own AS number as the AS path attribute for the 10.0.0.0/24 network and sends the packet to Router 1.

4 Router 1 receives the eBGP update for network 10.0.0.0/24 and makes an entry in its routing table with the next hop as 192.168.0.1 (serial interface S1 on Router 2). The AS path attribute for this network as seen on Router 1 is AS 5 (Router 2). Thus, the private AS numbers are prevented from entering the BGP tables of the Internet.

The configurations of Router 3, Router 2, and Router 1 follow.

Router 3

```
interface gigabitethernet 0/0
 ip address 10.0.0.1 255.255.255.0
!
interface Serial 0
 ip address 172.16.0.1 255.255.255.0
!
```

```
router bgp 65000
 network 10.0.0.0 mask 255.255.255.0
 neighbor 172.16.0.2 remote-as 5
!---Configures Router 2 as an eBGP neighbor in public AS 5.
!
end
```

Router 2

```
interface gigabitethernet 0/0
 ip address 172.30.1.1 255.255.0.0
!
interface Serial 0
 ip address 172.16.0.2 255.255.255.0
!
interface Serial 1
 ip address 192.168.0.1 255.255.255.0
!
router bgp 5
 network 172.30.0.0
 network 192.168.0.0
 neighbor 172.16.0.1 remote-as 65000
!---Configures Router 3 as an eBGP neighbor in private AS 65000.
 neighbor 192.168.0.2 remote-as 1
!---Configures Router 1 as an eBGP neighbor in public AS 1.
 neighbor 192.168.0.2 remove-private-as
!---Removes the private AS numbers from outgoing eBGP updates.
!
end
```

Router 1

```
version 12.2
!
!
interface Serial 0
 ip address 192.168.0.2 255.255.255.0
!
router bgp 1
 neighbor 192.168.0.1 remote-as 5
!---Configures Router 2 as an eBGP neighbor in public AS 5.
!
end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
BGP commands	*Cisco IOS IP Routing: BGP Command Reference*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

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/cisco/web/support/index.html

Feature Information for Removing and Replacing Private ASNs from the AS Path

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--Remove/Replace Private AS

Feature Name	Releases	Feature Information
BGP--Remove/Replace Private AS Filter	Cisco IOS XE Release 3.1S	Private autonomous system (AS) numbers are used by ISPs and customer networks to conserve globally unique AS numbers. Private AS numbers cannot be used to access the globalInternet because they are not unique. AS numbers appear in eBGP AS paths in routing tables. Removing private AS numbers from the AS path is necessary if you have been using private AS numbers and you want to access the global Internet. The following command is modified: • **neighbor remove-private-as**