

## BGP Configuration Guide 2 – Cisco Routers



### Configuration Example

```
hostname R3
!
interface Loopback 0
 ip address 10.10.254.3 255.255.255.255 ! Announce all these
!                                     ! subnets in IGP
!
interface GigabitEthernet0/0
 ip address 10.254.100.2 255.255.255.252 ! to ensure that BGP
!                                     ! paths always have
description link to ISP1                 ! a next hop in the
!                                     ! forwarding table
!
interface GigabitEthernet0/1
 ip address 10.20.100.2 255.255.255.252 ! E.g. Use OSPF's
!                                     ! redistribute
description link to Peer                 ! connected subnets
!
router BGP 65000
 bgp log-neighbor-changes
 no synchronization
 no auto-summary
 distance bgp 200 200 200
 bgp default local-preference 100
 neighbor 10.254.100.1 remote-as 64500 ! eBGP with ISP1
 neighbor 10.254.100.1 password N$RC
 neighbor 10.254.100.1 prefix-list from-ME out
 neighbor 10.254.100.1 route-map SET-LP-AS64500 in
 neighbor 10.20.100.1 remote-as 64700 ! eBGP with Peer
 neighbor 10.20.100.1 password N$RC
 neighbor 10.20.100.1 route-map SET-LP-AS64700 in
 neighbor 10.20.100.1 route-map SET-MED out
 neighbor 10.10.254.4 remote-as 65000 ! iBGP peer R4
 neighbor 10.10.254.4 password N$RC
 neighbor 10.10.254.4 update-source Loopback0
 network 10.10.0.0 mask 255.255.0.0

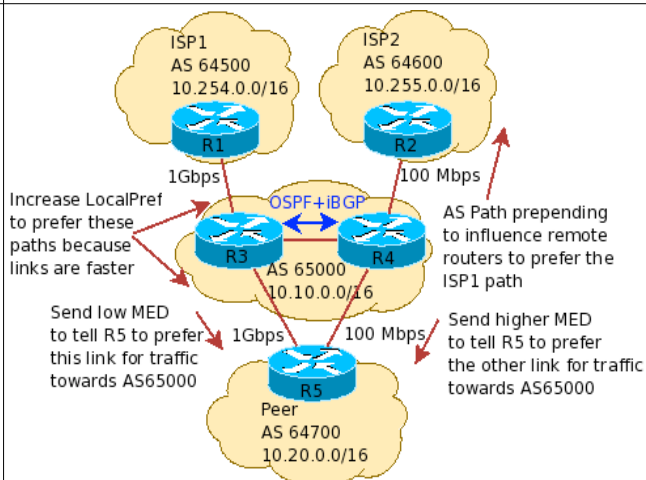
!
ip route 10.10.0.0 255.255.0.0 null0 250 ! Need for network cmd
!
ip prefix-list from-ME permit 10.10.0.0/16
!
ip prefix-list from-AS64500 deny 10.10.0.0/16 le 32
ip prefix-list from-AS64500 permit 0.0.0.0/0 le 24
!
ip prefix-list from-AS64700 deny 10.10.0.0/16 le 32
ip prefix-list from-AS64700 permit 10.20.0.0/16
!
route-map SET-LP-AS64500 permit 10 ! Higher LocalPref for
 match ip address prefix-list from-AS64500 ! prefixes coming via
 set local-preference 150 ! ISP1 and denies else
!
route-map SET-LP-AS64700 permit 10 ! Higher LocalPref
 match ip address prefix-list from-AS64700 ! and denies prefixes
 set local-preference-peer 150 ! not from peer
!
route-map SET-MED permit 10 ! Sets higher MED
 match ip address prefix-list from-ME ! and allows only my
 set metric 10 ! prefix out
```

```
hostname R5
!
interface Loopback 0
 ip address 10.20.254.5 255.255.255.255 ! Announce in IGP
!
interface FastEthernet0/0
 ip address 10.20.100.1 255.255.255.252 ! Announce in IGP
description link to R3
!
interface FastEthernet0/1
 ip address 10.20.200.1 255.255.255.252 ! Announce in IGP
description link to R4
!
router BGP 64700
 bgp log-neighbor-changes
 no synchronization
 no auto-summary
 distance bgp 200 200 200
 neighbor AS65000 peer-group ! Define peer group
 neighbor AS65000 remote-as 65000
 neighbor AS65000 password N$RC
 neighbor AS65000 prefix-list from-AS65000 in
 neighbor AS65000 filter-list 5 in
 neighbor AS65000 prefix-list from-ME out
 neighbor 10.20.100.1 peer-group AS65000 ! Assign neighbors
 neighbor 10.20.200.1 peer-group AS65000 ! to peer group
 network 10.20.0.0 mask 255.255.0.0

!
ip route 10.20.0.0 255.255.0.0 null0 250
!
ip prefix-list from-AS65000 deny 10.20.0.0/16 le 32
ip prefix-list from-AS65000 permit 10.10.0.0/16
ip prefix-list from-ME permit 10.20.0.0/16
! Only allow prefixes directly from AS65000 (AS_PATH length=1)
ip as-path access-list 5 permit ^65000$
```

```
hostname R4
!
interface Loopback 0
 ip address 10.10.254.4 255.255.255.255 ! Announce in IGP
!
interface FastEthernet0/0
 ip address 10.255.100.2 255.255.255.252 ! Announce in IGP
description link to ISP2
!
interface FastEthernet0/1
 ip address 10.20.200.2 255.255.255.252 ! Announce in IGP
description link to Peer
!
router BGP 65000
 bgp log-neighbor-changes
 no synchronization
 no auto-summary
 distance bgp 200 200 200
 bgp default local-preference 100
 neighbor 10.255.100.1 remote-as 64600 ! eBGP with ISP2
 neighbor 10.255.100.1 password N$RC
 neighbor 10.255.100.1 prefix-list from-AS64600 in
 neighbor 10.255.100.1 route-map SET-PREPEND out
 neighbor 10.20.200.1 remote-as 64700 ! eBGP with Peer
 neighbor 10.20.200.1 password N$RC
 neighbor 10.20.200.1 prefix-list from-AS64700 in
 neighbor 10.20.200.1 route-map SET-MED out
 neighbor 10.10.254.3 remote-as 65000 ! iBGP peer R3
 neighbor 10.10.254.3 password N$RC
 neighbor 10.10.254.3 update-source Loopback0
 network 10.10.0.0 mask 255.255.0.0

!
ip route 10.10.0.0 255.255.0.0 null0 250 ! Need for network cmd
!
ip prefix-list from-ME permit 10.10.0.0/16
!
ip prefix-list from-AS64600 deny 10.10.0.0/16 le 32
ip prefix-list from-AS64600 permit 0.0.0.0/0 le 24
!
ip prefix-list from-AS64700 deny 10.10.0.0/16 le 32
ip prefix-list from-AS64700 permit 10.20.0.0/16
!
route-map SET-PREPEND permit 10 ! Prepends my AS twice
 match ip address prefix-list from-ME ! in AS_PATH to infl.
 set as-path prepend 65000 65000 ! inbound traffic
!
route-map SET-MED permit 10 ! Sets lower MED and
 match ip address prefix-list from-ME ! and allows only my
 set metric 50 ! prefix out
```



BGP Attributes		
Attribute	Description	Type
Origin	How the route was originated (IGP, EGP, Incomplete)	Well-known Mandatory
AS Path	List of ASs traversed by the route advertisement	Well-known Mandatory
Next Hop	The next router to send the packet to for a given route	Well-known Mandatory
Local Preference	Metric to influence internal selection of paths for outbound traffic	Well-known Discretionary
Atomic Aggregate	Includes ASs not shown in the path because of route aggregation	Well-known Discretionary
Aggregator	ID and AS of router in the path that is aggregating prefixes	Optional Transitive
Community	A label assigned to a prefix or group of prefixes	Optional Transitive
Multiple Exit Discriminator (MED)	Metric sent to neighbor to influence their path selection for traffic destined to us	Optional Non-Transitive
Originator ID	Identification for a route reflector	Optional Non-Transitive
Cluster List	List of cluster IDs	Optional Non-Transitive
Cluster ID	Originating Cluster	Optional Non-Transitive
Weight	Preference local to router	Cisco proprietary

BGP Selection Process	
Order	Description
1	Do not consider path if there is no route to next hop (Internally, AS should run an IGP to announce loopbacks)
2	Highest Weight (Only Cisco)
3	Highest Local Preference (global within AS)
4	Prefer locally-originated route
5	Shortest AS Path
6	Lowest Origin Code IGP < EGP < Incomplete
7	Lowest Multiple Exit Discriminator (MED). Default is 0
8	Prefer eBGP over iBGP path
9	Path with Lowest IGP metric to next hop
10	For eBGP paths: <ul style="list-style-type: none"> <li>• If multipath is enabled, install N parallel routes in forwarding table</li> <li>• If Router ID is not the same, select oldest route</li> <li>• if Router ID is the same, go to next step</li> </ul>
11	Lowest Router ID (originator ID for reflected routes)
12	Shortest Cluster List (Client must be aware of Route Reflector attributes)
13	Lowest neighbor address

Prefix List Examples	
<code>ip prefix-list mylist permit 10.10.0.0/16 le 32</code>	(less than or equal /32) Allows all prefixes within 10.10.0.0/16, including 10.10.0.0/16
<code>ip prefix-list mylist permit 10.20.0.0/16 le 24</code>	Allows prefixes within 10.20.0.0/16 except /25, /26, /27, /28, /29, /30, /31 and /32
<code>ip prefix-list mylist deny 10.20.0.0/16 ge 25</code>	(greater than or equal /25) Denies prefixes within 10.20.0.0/16 of size /25, /26, /27, /28, /29, /30, /31 and /32 (same result as list above)

Regular Expressions for AS Path Matching			
.	Match anything	<code>_65000_64500_</code>	Via AS 65000 and AS 64500
+	Match at least one character	<code>_(65000)_+</code>	Any sequence of this same AS (prepending)
^\$	Match routes local to this AS	<code>^[0-9]+\$</code>	Match AS path of length 1 (neighbor ASs)
<code>_65000\$</code>	Originated by AS 65000	<code>^[0-9]*_[0-9]+\$</code>	Match AS path length 1 or 2
<code>_65000_</code>	Via AS 65000	<code>_(100 200)_</code>	Any path through either AS 100 or AS 200