

Routing
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IPv6

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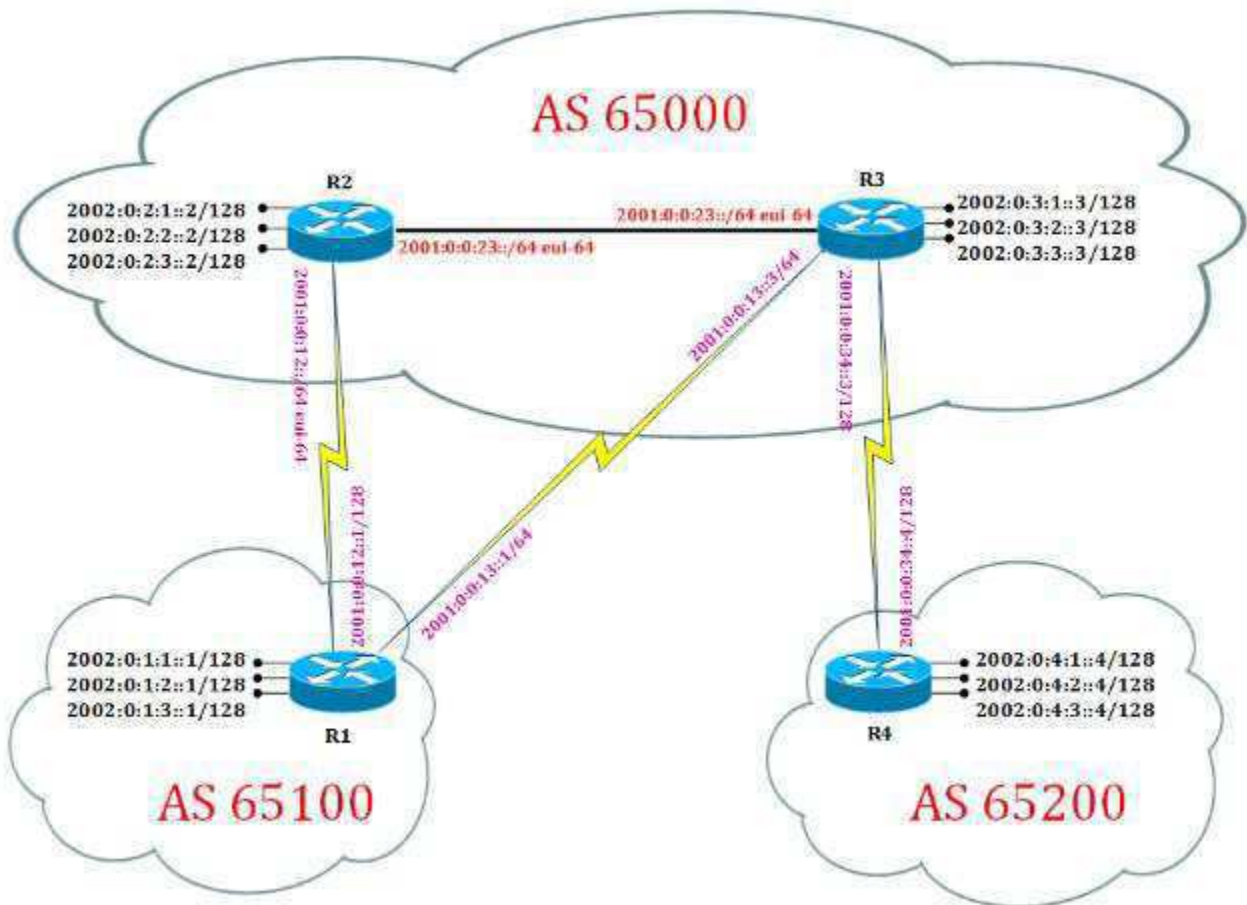
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IPv6 BGP AS Path

Disclaimer

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Cisco IOS Software, 7200 Software (C7200-ADVENTERPRISEK9-M), Version 15.0(1)M9, RELEASE SOFTWARE (fc1)



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```
R1 Router Config:  
!  
ipv6 unicast-routing  
ipv6 cef
```

```
R4 Router Config:  
!  
ipv6 unicast-routing  
ipv6 cef
```

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```

!
interface Loopback0
no ip address
ipv6 address 2002:0:1:1::1/128
ipv6 ospf 1 area 0
!
interface Loopback1
no ip address
ipv6 address 2002:0:1:2::1/128
ipv6 ospf 1 area 0
!
interface Loopback2
no ip address
ipv6 address 2002:0:1:3::1/128
ipv6 ospf 1 area 0
!
interface Serial1/0
no ip address
ipv6 address 2001:0:0:12::1/128
ipv6 ospf 1 area 0
no fair-queue
serial restart-delay 0
!
interface Serial1/1
ipv6 address 2001:0:0:13::1/64
serial restart-delay 0
!
router bgp 65100
bgp router-id 1.1.1.1
no bgp default ipv4-unicast
bgp log-neighbor-changes
neighbor 2001:0:0:13::3 remote-as 65000
neighbor 2002:0:2:1::2 remote-as 65000
neighbor 2002:0:2:1::2 ebgp-multihop 5
neighbor 2002:0:2:1::2 update-source
Loopback0
!
address-family ipv6
no synchronization
network 2002:0:1:2::1/128
network 2002:0:1:3::1/128
neighbor 2001:0:0:13::3 activate
neighbor 2002:0:2:1::2 activate

```

```

!
interface Loopback0
no ip address
ipv6 address 2002:0:4:1::4/128
!
interface Loopback1
no ip address
ipv6 address 2002:0:4:2::4/128
!
interface Loopback2
no ip address
ipv6 address 2002:0:4:3::4/128
!
interface Serial1/0
no ip address
ipv6 address 2001:0:0:34::4/128
serial restart-delay 0
clock rate 64000
!
router bgp 65200
bgp router-id 4.4.4.4
no bgp default ipv4-unicast
bgp log-neighbor-changes
neighbor 2002:0:3:1::3 remote-as 65000
neighbor 2002:0:3:1::3 ebgp-multihop 5
neighbor 2002:0:3:1::3 update-source
Loopback0
!
address-family ipv6
no synchronization
network 2002:0:4:2::4/128
network 2002:0:4:3::4/128
neighbor 2002:0:3:1::3 activate
exit-address-family
!
ipv6 route 2001:0:0:34::3/128 Serial1/0
ipv6 route 2002:0:3:1::3/128 Serial1/0
!

```

```
exit-address-family
!  
ipv6 router ospf 1  
router-id 1.1.1.1  
log-adjacency-changes  
!
```

R2 Router Config:

```
!  
ipv6 unicast-routing  
ipv6 cef  
!  
interface Loopback0  
no ip address  
ipv6 address 2002:0:2:1::2/128  
ipv6 ospf 1 area 0  
!  
interface Loopback1  
no ip address  
ipv6 address 2002:0:2:2::2/128  
ipv6 ospf 1 area 0  
!  
interface Loopback2  
no ip address  
ipv6 address 2002:0:2:3::2/128  
ipv6 ospf 1 area 0  
!  
interface Serial1/0  
no ip address  
ipv6 address 2001:0:0:12::/64 eui-64  
ipv6 ospf 1 area 0  
no fair-queue  
serial restart-delay 0  
clock rate 64000  
!  
interface FastEthernet2/0  
no ip address  
duplex full  
speed 100  
ipv6 address 2001:0:0:23::/64 eui-64  
ipv6 ospf 1 area 0  
!
```

R3 Router Config:

```
!  
ipv6 unicast-routing  
ipv6 cef  
!  
interface Loopback0  
no ip address  
ipv6 address 2002:0:3:1::3/128  
ipv6 ospf 1 area 0  
!  
interface Loopback1  
no ip address  
ipv6 address 2002:0:3:2::3/128  
ipv6 ospf 1 area 0  
!  
interface Loopback2  
no ip address  
ipv6 address 2002:0:3:3::3/128  
ipv6 ospf 1 area 0  
!  
interface Serial1/0  
no ip address  
ipv6 address 2001:0:0:34::3/128  
no fair-queue  
serial restart-delay 0  
clock rate 64000  
!  
interface Serial1/1  
no ip address  
ipv6 address 2001:0:0:13::3/64  
serial restart-delay 0  
!  
interface FastEthernet2/0  
mac-address ca03.0c78.0038  
no ip address
```

```

router bgp 65000
bgp router-id 2.2.2.2
no bgp default ipv4-unicast
bgp log-neighbor-changes
neighbor 2001::23:C803:CFF:FE78:38
remote-as 65000
neighbor 2002:0:1:1::1 remote-as 65100
neighbor 2002:0:1:1::1 ebgp-multihop 5
neighbor 2002:0:1:1::1 update-source
Loopback0
!
address-family ipv6
no synchronization
network 2002:0:2:2::2/128
network 2002:0:2:3::2/128
neighbor 2001::23:C803:CFF:FE78:38
activate
neighbor 2002:0:1:1::1 activate
exit-address-family
!
ipv6 router ospf 1
router-id 2.2.2.2
log-adjacency-changes
!

```

```

duplex auto
speed auto
ipv6 address 2001:0:0:23::/64 eui-64
ipv6 ospf 1 area 0
!
router bgp 65000
bgp router-id 3.3.3.3
no bgp default ipv4-unicast
bgp log-neighbor-changes
neighbor 2001:0:0:13::1 remote-as 65100
neighbor 2001::23:C802:CFF:FE78:38
remote-as 65000
neighbor 2002:0:4:1::4 remote-as 65200
neighbor 2002:0:4:1::4 ebgp-multihop 5
neighbor 2002:0:4:1::4 update-source
Loopback0
!
address-family ipv6
no synchronization
network 2002:0:3:2::3/128
network 2002:0:3:3::3/128
neighbor 2001:0:0:13::1 activate
neighbor 2001::23:C802:CFF:FE78:38
activate
neighbor 2001::23:C802:CFF:FE78:38
next-hop-self
neighbor 2002:0:4:1::4 activate
exit-address-family
!
ipv6 route 2001:0:0:34::4/128 Serial1/0
ipv6 route 2002:0:4:1::4/128 Serial1/0
!
ipv6 router ospf 1
router-id 3.3.3.3
log-adjacency-changes
!

```

Note 1: In above topology OSPFv3 has been run over R1, R2 and R3 within same area AREA 0.
Note 2: Static routes has been used between R3 and R4 for reach-ability.

Verification:

R1#sh bgp ipv6 unicast

BGP table version is 15, local router ID is 1.1.1.1

Status codes: s suppressed, d damped, h history, * valid, > best, i – internal,
r RIB-failure, S Stale

Origin codes: i – IGP, e – EGP, ? – incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 2002:0:1:2::1/128	::	0		32768	i
*> 2002:0:1:3::1/128	::	0		32768	i
*> 2002:0:2:2::2/128	2001:0:0:13::3	0		0	65000 i
*	2002:0:2:1::2	0		0	65000 i
*> 2002:0:2:3::2/128	2001:0:0:13::3	0		0	65000 i
*	2002:0:2:1::2	0		0	65000 i
*> 2002:0:3:2::3/128	2001:0:0:13::3	0		0	65000 i
*	2002:0:2:1::2	0		0	65000 i
*> 2002:0:3:3::3/128	2001:0:0:13::3	0		0	65000 i
*	2002:0:2:1::2	0		0	65000 i
*> 2002:0:4:2::4/128	2001:0:0:13::3	0		0	65000 65200 i
*	2002:0:2:1::2	0		0	65000 65200 i
*> 2002:0:4:3::4/128	2001:0:0:13::3	0		0	65000 65200 i
*	2002:0:2:1::2	0		0	65000 65200 i

Here we can observe that all the routes have crossed the same AS though learnt via different next-hops.

Modifications on R3

```
R3(config)#route-map AS permit 10
R3(config-route-map)# set as-path prepend 33
R3(config)#route-map AS permit 20
R3(config)#router bgp 65000
R3(config-router)#address-family ipv6
R3(config-router-af)#neighbor 2001:0:0:13::1 route-map AS out
```

The above configurations will add an extra AS 33 to all route updates send to neighbor 2001:0:0:13::1.

Verification:

R1#sh bgp ipv6 unicast

BGP table version is 57, local router ID is 1.1.1.1

Status codes: s suppressed, d damped, h history, * valid, > best, i – internal,
r RIB-failure, S Stale

Origin codes: i – IGP, e – EGP, ? – incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 2002:0:1:2::1/128	::	0		32768	i
*> 2002:0:1:3::1/128	::	0		32768	i

```

* 2002:0:2:2::2/128 2001:0:0:13::3 0 0 65000 33 i
*> 2002:0:2:1::2 0 0 65000 i
* 2002:0:2:3::2/128 2001:0:0:13::3 0 0 65000 33 i
*> 2002:0:2:1::2 0 0 65000 i
* 2002:0:3:2::3/128 2001:0:0:13::3 0 0 65000 33 i
*> 2002:0:2:1::2 0 0 65000 i
* 2002:0:3:3::3/128 2001:0:0:13::3 0 0 65000 33 i
*> 2002:0:2:1::2 0 0 65000 i
* 2002:0:4:2::4/128 2001:0:0:13::3 0 0 65000 33 65200 i
*> 2002:0:2:1::2 0 0 65000 65200 i
* 2002:0:4:3::4/128 2001:0:0:13::3 0 0 65000 33 65200 i
*> 2002:0:2:1::2 0 0 65000 65200 i

```

Now we can see that all updates are learn via 2001:0:0:13::3 have an extra AS 33 added to them.

The result is that now the routes are learn via 2002:0:2:1::2 have become best as they have crossed less AS that the routes learnt via 001:0:0:13::3.

Hence it is proved that BGP prefers the path that has crossed less AS.

Another thing that can be noted here is though the best has been changed yet previous best path is installed as valid path.

R3#sh bgp ipv6 unicast

BGP table version is 23, local router ID is 3.3.3.3

Status codes: s suppressed, d damped, h history, * valid, > best, i – internal, r RIB-failure, S Stale

Origin codes: i – IGP, e – EGP, ? – incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 2002:0:1:2::1/128	2001:0:0:13::1	0		0	65100 i
* i	2002:0:1:1::1	0	100	0	65100 i
*> 2002:0:1:3::1/128	2001:0:0:13::1	0		0	65100 i
* i	2002:0:1:1::1	0	100	0	65100 i
*>i2002:0:2:2::2/128	2001::23:C802:CFF:FE78:38	0	100	0	i
*>i2002:0:2:3::2/128	2001::23:C802:CFF:FE78:38	0	100	0	i
*> 2002:0:3:2::3/128	::	0		32768	i
*> 2002:0:3:3::3/128	::	0		32768	i
*> 2002:0:4:2::4/128	2002:0:4:1::4	0		0	65200 i
*> 2002:0:4:3::4/128	2002:0:4:1::4	0		0	65200 i

Here routes 2002:0:1:2::1/128 and 2002:0:1:3::1/128 are learnt via eBGP and iBGP crossing similar number of AS. As usual eBGP routes are best.

Modifications on R1:

```
R1(config)#route-map AS permit 10
R1(config-route-map)#set as-path prepend 11 111
R1(config-route-map)#exit
R1(config)#route-map AS permit 20
R1(config-route-map)#exit
R1(config)#router bgp 65100
R1(config-router)#address-family ipv6
R1(config-router-af)#neigh 2002:0:2:1::2 route-map AS out
```

Effects: R1 will add additional AS 11 and 111 to all route updates send to neighbor 2002:0:2:1::2.

Verification:

R2#sh bgp ipv6 unicast

BGP table version is 11, local router ID is 2.2.2.2

Status codes: s suppressed, d damped, h history, * valid, > best, i – internal,
r RIB-failure, S Stale

Origin codes: i – IGP, e – EGP, ? – incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
* 2002:0:1:2::1/128	2002:0:1:1::1	0		0	65100 11 111
i					
*>i	2001::23:C803:CFF:FE78:38	0	100	0	65100 i
* 2002:0:1:3::1/128	2002:0:1:1::1	0		0	65100 11 111
i					
*>i	2001::23:C803:CFF:FE78:38	0	100	0	65100 i
*> 2002:0:2:2::2/128	::	0		32768	i
*> 2002:0:2:3::2/128	::	0		32768	i
*>i2002:0:3:2::3/128	2001::23:C803:CFF:FE78:38	0	100	0	i
*>i2002:0:3:3::3/128	2001::23:C803:CFF:FE78:38	0	100	0	i
*>i2002:0:4:2::4/128	2001::23:C803:CFF:FE78:38	0	100	0	65200 i
*>i2002:0:4:3::4/128	2001::23:C803:CFF:FE78:38	0	100	0	65200 i

Here it can be noted that routes are learn via 2002:0:1:1::1 have added AS 11 and 111 to them. Now the paths learn via eBGP are not the best path, instead path via iBGP has become best.

R3#sh bgp ipv6 unicast

BGP table version is 27, local router ID is 3.3.3.3

Status codes: s suppressed, d damped, h history, * valid, > best, i – internal,
r RIB-failure, S Stale

Origin codes: i – IGP, e – EGP, ? – incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 2002:0:1:2::1/128	2001:0:0:13::1	0		0	65100 i


```

*> 2002:0:1:3::1/128 2001:0:0:13::1 0 0 65100 i
*>i2002:0:2:2::2/128 2001::23:C802:CFF:FE78:38 0 100 0 i
*>i2002:0:2:3::2/128 2001::23:C802:CFF:FE78:38 0 100 0 i
*> 2002:0:3:2::3/128 :: 0 32768 i
*> 2002:0:3:3::3/128 :: 0 32768 i
*> 2002:0:4:2::4/128 2002:0:4:1::4 0 0 65200 i
*> 2002:0:4:3::4/128 2002:0:4:1::4 0 0 65200 i

```

The paths previously learnt via 2002:0:1:1::1 (iBGP routes) were not best. When administrator configured R1 such that those path become inferior (in other words paths via 2001:0:0:13::1 has been declared superior by administrator) on R3 BGP has removed paths via 2002:0:1:1::1 from its BGP table.

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