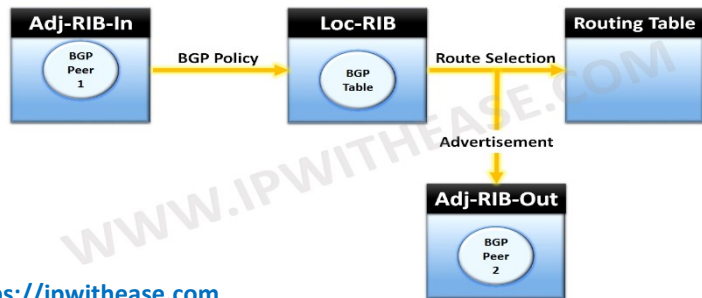


## BGP TABLE TYPES

For BGP **Routing Information Base (RIB)** to learn BGP routes through its neighbours, store the best BGP routes and then advertise the best routes to neighbours/peers, there is need for multiple BGP tables. BGP Routing Information Base consists of three parts: **Adj-RIBs-In**, **Loc-RIB** and **Adj-RIBs-Out**

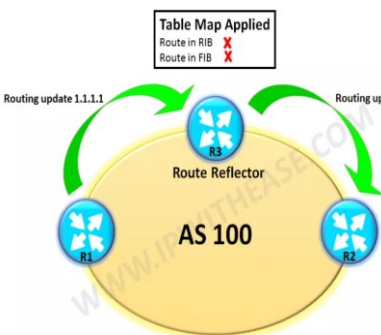


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Following are the commands to find output for 3 BGP tables (**Adj-RIBs-Out**, **Loc-RIB** and **Adj-RIBs-In**) :

BGP Command	BGP Table
show ip bgp neighbor x.x.x.x advertise-routes	Adj-RIBs-Out
show ip bgp	Loc-RIB
show ip bgp neighbor x.x.x.x received-routes	Adj-RIBs-In

## EXAMPLE TOPOLOGY TO UNDERSTAND THE USE OF TABLE-MAPS:

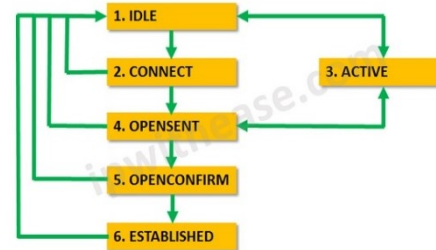


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R1 is advertising a route of its loopback 1 i.e. 1.1.1.1 to Route Reflector. We have applied a route-map on Route-Reflector to deny everything and then this route-map is called in the table-map command so as to avoid the installation of the route in the RIB and FIB on the RR. Though RR doesn't install the route in its RIB & FIB it still reflects the route to R2.

## BGP NEIGHBOR STATES

When BGP is configured with a neighbour IP address, it goes through a series of stages before it reaches the desired Established state. Per RFC 1771, BGP goes through the following stages of a neighbour relationship –



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State	Listen for TCP?	Initiate TCP?	TCP Up?	Open Sent?	Open Received?	Neighbor Up?
Idle	No					
Connect	Yes					
Active	Yes	Yes				
Open sent	Yes	Yes	Yes	Yes		
Open confirm	Yes	Yes	Yes	Yes	Yes	
Established	Yes	Yes	Yes	Yes	Yes	Yes

## BGP MESSAGE TYPES

All BGP message are unicast to the one neighbour over the TCP connection.



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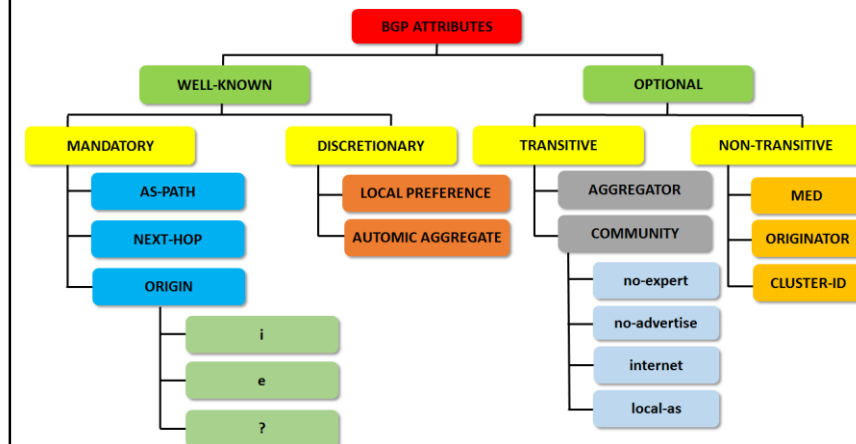
## BGP TERMINOLOGY

Autonomous System or AS	A logical domain under the control of a single administration.
External BGP or eBGP	BGP adjacencies between different autonomous systems.
Internal BGP or iBGP	BGP adjacencies within the same autonomous system.

## BGP BASICS

PROTOCOL	IP
TYPE	Path Vector
TRANSPORT	TCP (port 179)
ADMINISTRATIVE DISTANCE	eBGP 20 iBGP 200

## BGP PATH ATTRIBUTES



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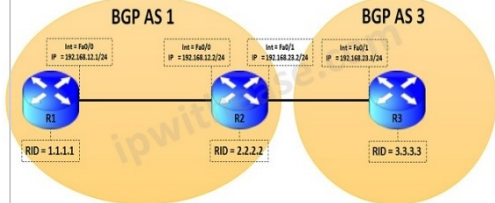
## BGP BEST PATH SELECTION

ATTRIBUTE	PREFERENCE
WEIGHT	Highest
LOCAL PREFERENCE	Highest
SELF-ORIGINATED	True
AS PATH	Shortest
ORIGIN	IGP over EGP
MED	Lowest
EXTERNAL	eBGP over iBGP
IGP Cost	Lowest
eBGP Peering	Oldest
Rouer ID	Lowest

**How does BGP choose the best path?**

Using the best path selection algorithm, BGP works through each attribute until it finds one to that gives a preference. If there is no preferred attribute BGP will always route over the shortest AS path.

## SAMPLE SCENARIO eBGP MULTIHOP

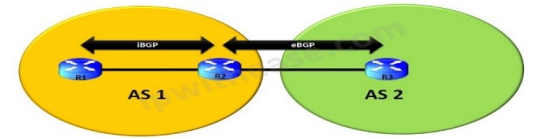


**R1#**  
 router bgp 1  
 no synchronization  
 bgp log-neighbor-changes  
 network 192.168.12.0  
 neighbor 2.2.2.2 remote-as 1  
 neighbor 2.2.2.2 update-source Loopback0 ———>R1 to use Loopback 0 as source for BGP neighborship and updates  
 no auto-summary  
 !  
 ip route 2.2.2.0 255.255.255.0  
 192.168.12.2 ———>Static Route to reach Loopback0 of R2

**R3#sh run**  
 router bgp 3  
 no synchronization  
 network 192.168.23.0  
 neighbor 2.2.2.2 remote-as 1  
 neighbor 2.2.2.2 update-source Loopback0 ———>R3 to use Loopback 0 as a source for BGP neighborship and updates with R2  
 no auto-summary  
 !  
 ip route 2.2.2.0 255.255.255.0  
 192.168.23.2 ———>Static Route to reach Loopback0 of R2

**R2#sh run**  
 router bgp 1  
 no synchronization  
 network 192.168.12.0  
 network 192.168.23.0  
 neighbour 1.1.1.1 remote-as 1  
 neighbour 1.1.1.1 update-source Loopback0 ———>R2 to use Loopback 0 as a source for BGP neighborship and updates with R1  
 neighbor 1.1.1.1 next-hop-self  
 neighbour 3.3.3.3 remote-as 3  
 neighbor 3.3.3.3 update-source Loopback0 ———>R2 to use Loopback 0 as a source for BGP neighborship and updates with R3  
 no auto-summary  
 !  
 ip route 1.1.1.0 255.255.255.0 192.168.12.1 ———>Static Route to reach Loopback0 of R1  
 ip route 3.3.3.0 255.255.255.0 192.168.23.3 ———>Static Route to reach Loopback0 of R3

## BGP TYPES – eBGP and iBGP



PARAMETER	eBGP	iBGP
Abbreviation for	External BGP	Internal BGP
Neighborhood	Both the Routers forming eBGP neighborhood need to be in separate AS (Autonomous Systems)	Both the Routers forming iBGP neighborhood need to be in same AS (Autonomous Systems)
Route advertisement	A route learnt from an eBGP peer will be advertised back to another iBGP or eBGP neighbor by default.	A route learnt from an iBGP peer will not be advertised back to another iBGP neighbor by default.
As Path addition	AS path is prepended to route when advertised to eBGP peer	AS path is not prepended to the route when advertised to an iBGP peer.
Attributes	Attributes like local preference are not sent to the eBGP peers but are sent to iBGP peer.	Attributes like local preference are sent to the iBGP peers but not to an eBGP peer.
Scope	Used Between organization or between organization and Internet Service provider	Used within the same organization
TTL	By default, eBGP peers are set with TTL = 1, which means neighbors are assumed to be directly connected	By default, iBGP peers are set with TTL = 255
AD (Administrative Distance)	EBGP routes have administrative distance of 20	iBGP routes have administrative distance of 200
Next Hop attribute	Next hop is changed to local router when it is advertised to EBGP peer by default	Next hop remains unchanged when route is advertised to iBGP peer
Topology	Doesn't require full mesh neighborhood	Requires full mesh or else either of Route reflectors or Confederation
Loop prevention mechanism	Utilizes As Path for loop prevention	Uses BGP Split horizon i.e. non advertisement from iBGP to iBGP neighbor.

## TROUBLE SHOOTING COMMANDS

COMMAND	USE
show ip route [bgp]	To show BGP routes in routing table
clear ip bgp * [soft]	To reset a BGP connection using BGP soft
debug ip bgp [...]	To debug BGP communication packet
Rx#show ip bgp summary	To check neighbor status
Rx#show ip bgp neighbor <Neighbor-IP>	To verify Neighbor Detail information
Rx#show tcp brief	To verify TCP socket detail
Rx#show process cpu	To verify BGP running process

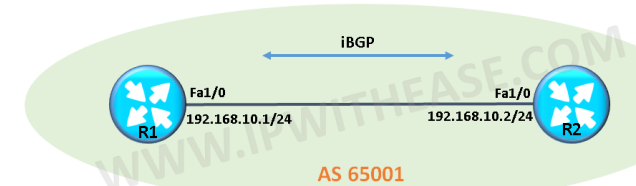
## SAMPLE CONFIGURATION FOR eBGP AND iBGP

### eBGP Sample Configuration:



**R1**  
 R1(config)#Router BGP 65001  
 R1(config-router)#Neighbor 192.168.10.2 remote-as 65002  
 R1(config-router)#exit  
**R2**  
 R1(config)#Router BGP 65002  
 R1(config-router)#Neighbor 192.168.10.1 remote-as 65001  
 R1(config-router)#exit

### iBGP Sample Configuration:



**R1**  
 R1(config)#Router BGP 65001  
 R1(config-router)#Neighbor 192.168.10.2 remote-as 65001  
 R1(config-router)#exit  
**R2**  
 R1(config)#Router BGP 65001  
 R1(config-router)#Neighbor 192.168.10.1 remote-as 65001  
 R1(config-router)#exit