BGP Path Selection

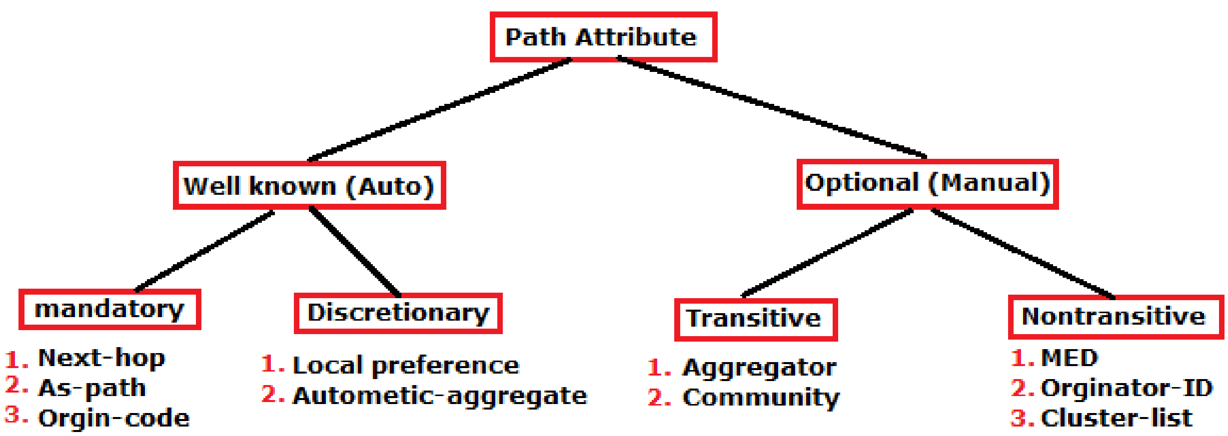
IGPs, such as EIGRP or OSPF, choose routes based on lowest metric. They attempt to find the shortest, fastest way to get traffic to its destination. BGP, however, has a different way of route selection. It assigns various attributes to each path; these attributes can be administratively manipulated to control the path that is selected.

- RIP selects the path with the lowest hop count.
- OSPF selects the path with the lowest cost.
- EIGRP selects the path with the highest bandwidth and lowest delay (unless you change the K values)
- **BGP** – best path depends on the attributes.

BGP selects the best path based on a **list of attributes.**

Point to be noted-

When BGP has multiple paths to reach the destination they are stored in the BGP table. but only one gets installed in the routing table.



Path attributes –

Path attributes is one kind of criteria which is used for best path selection in bgp.

BGP chooses a route to a network based on the attributes of its path. Four categories of attributes exist as follows:

Well-known mandatory –

Must be recognized by all BGP routers, present in all BGP updates, and passed on to other BGP routers. Such as - Next hop AS path, origin code.

Well-known discretionary –

Must be recognized by all BGP routers and passed on to other BGP routers but need not be present in an update, such as - local preference.

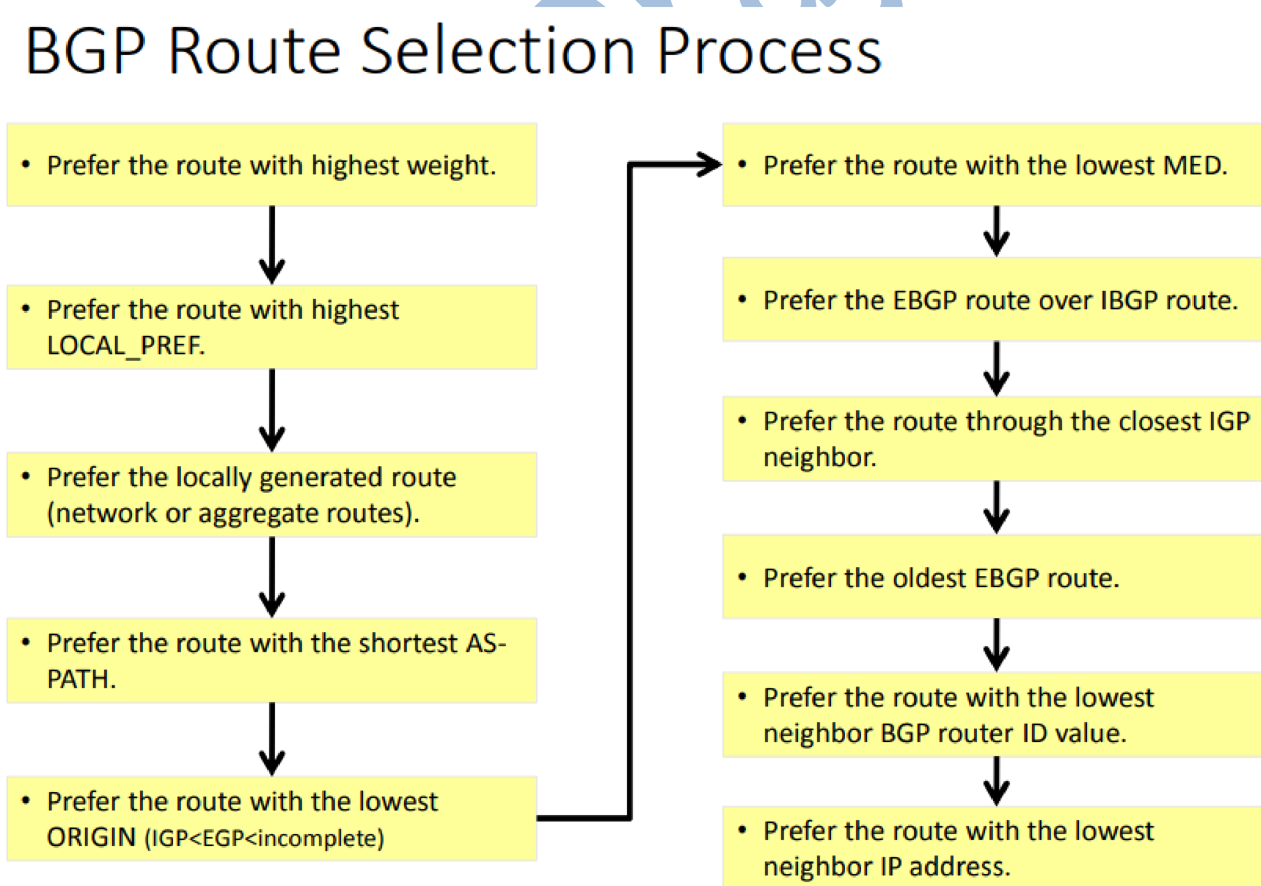
Optional transitive –

Might or might not be recognized by a BGP router but is passed on to other BGP routers. If not recognized, it is marked as partial, such as - Aggregator, community.

Optional nontransitive –

Might or might not be recognized by a BGP router and is not passed on to other routers, for such as - Multi-Exit Discriminator (MED), originator ID.

Best path selection attributes in BGP –



BGP Path Selection Criteria –

BGP uses following attributes for best path selection –

1. Next hop reach ability
2. Weight
3. Local preference
4. Self advertised (originate - 0.0.0.0)
5. As_path length
6. Origin code
7. MED (metric)
8. eBGP path over iBGP path (External over internal)
9. Shortest IGP path to BGP next hop (IGP cost to reach next hop)
10. Lower NBR router ID (in case of IBGP)
11. Oldest Path (in case of EBGP)
12. Lower NBR neighbor IP address

Next hop reach ability –

1. If next hop not reachable then it will not compare other path attribute, if any router is receiving any prefix from two NBR and next hop is reachable via both router, then BGP will not define best path based on next hop only.
2. Next hop is a well-known mandatory attribute.
3. Automatically included in update msg.

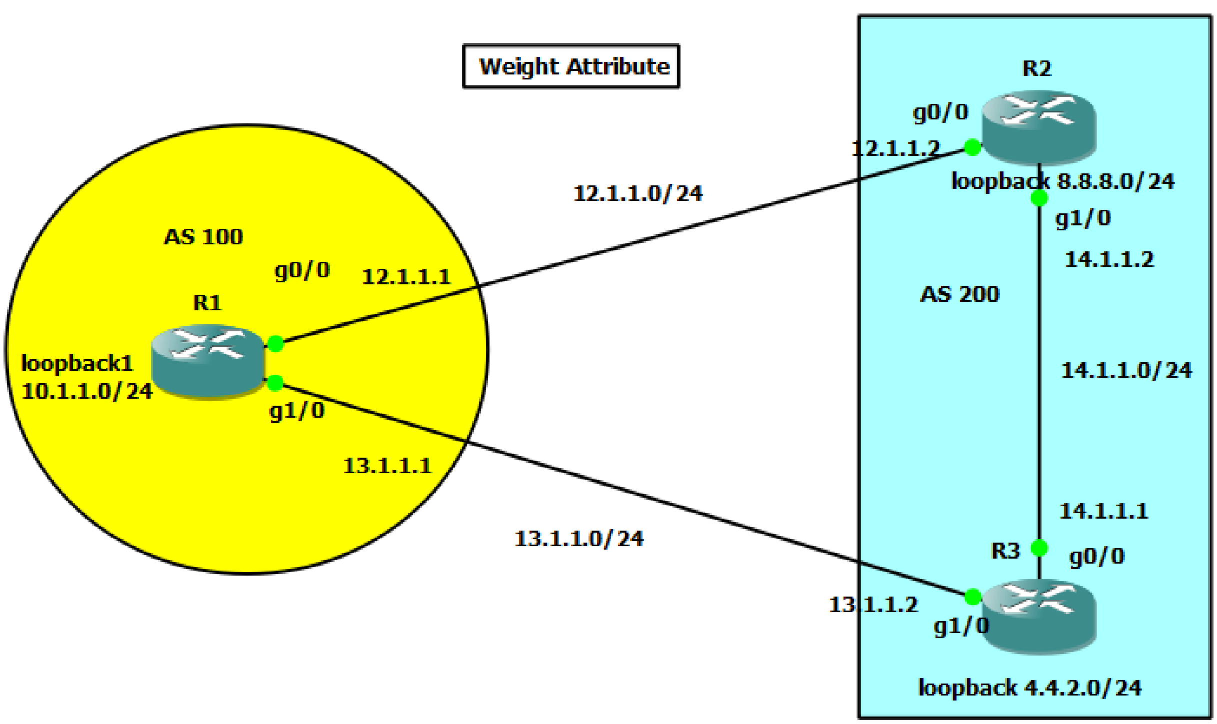
Note – this attributes' you can easily verify using two or three routers.

Weight Attribute-

1. It is a Cisco proprietary attribute; it means you won't find it on other vendor router.
2. With using we can manipulate the path, we can decide which path/route should be more preferable than other path.
3. For self advertised prefix weight will be always – **32768**
4. Weight range **(0- 65535**), it means we can change weight up to 65535.
5. For receiving prefix weight will be always – **0**; it means Weight is not exchanged between BGP routers.
6. BGP will not carry weight information with bgp updates.
7. It is a locally significant, it means for locally generated routes or it is only locally significant in the Router where it is configured.
8. Higher weight will be always preferred.
9. This attribute is not advertised to any bgp NBR.
10. It is used to manipulate route-selection to for **outbound traffic.**
11. You can configure weight per neighbor using the weight command.

Point to be remembered – Weight is applied where routers have two or multiple exit points.

Now let's grasp these things that we have discussed above. By the simple topology.



```
R1#show ip bgp
BGP table version is 4, 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
*  4.4.4.0/24       12.1.1.2                               0 200 i
*>                  13.1.1.2                 0             0 200 i
*  8.8.8.0/24       13.1.1.2                               0 200 i
*>                  12.1.1.2                 0             0 200 i
*> 10.1.1.0/24      0.0.0.0                  0         32768 i
R1#
R1#
R1#traceroute 8.8.8.8 source loopback 1

Type escape sequence to abort.
Tracing the route to 8.8.8.8

  1 12.1.1.2 16 msec 20 msec 24 msec
R1#
```

For self advertised weight will be always - 32768

```
R2#show ip bgp
BGP table version is 4, 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
*>i4.4.4.0/24       14.1.1.1                 0    100      0 i
*> 8.8.8.0/24       0.0.0.0                  0         32768 i
* i10.1.1.0/24      13.1.1.1                 0    100      0 100 i
*>                  12.1.1.1                 0             0 100 i
R2#
```

```
R3# show ip bgp
BGP table version is 4, 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
*> 4.4.4.0/24       0.0.0.0                  0         32768 i
*>i8.8.8.0/24       14.1.1.2                 0    100      0 i
* i10.1.1.0/24      12.1.1.1                 0    100      0 100 i
*>                  13.1.1.1                 0             0 100 i
R3#
```

For receving prefix weight will be always 0

So far I didn’t configure weight as you can see R1 router select path via 12.1.1.2, now I’m going to apply weight on R1 router you will be able to see that traffic will be going through 13.1.1.2 (R3 router).

All right everything is okay till now.

Weight configuration –

- R1(config)#router bgp 100
- R1(config-router)#neighbor 13.1.1.2 weight 40000

R1#clear ip bgp * soft in

(Before apply this command you should know what can be potential impact on your network)

```
R1#show ip bgp
BGP table version is 6, 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
*  4.4.4.0/24       12.1.1.2                               0 200 i
*>                  13.1.1.2                 0         40000 200 i
*> 8.8.8.0/24       13.1.1.2                           40000 200 i
*                   12.1.1.2                 0             0 200 i
*> 10.1.1.0/24      0.0.0.0                  0         32768 i
R1#
R1#tr
R1#traceroute lo
R1#traceroute 8.8.8.8 so
R1#traceroute 8.8.8.8 source lo
R1#traceroute 8.8.8.8 source loopback 1

Type escape sequence to abort.
Tracing the route to 8.8.8.8

  1 13.1.1.2 12 msec 24 msec 12 msec
  2 14.1.1.2 4 msec 20 msec 24 msec
```

Now you can see we have applied weight on the R1 router - 40000 you can also check the via traceroute command it has prefered path - 13.1.1.2.

Hence using the weight attribute we can manipulate path for outgoing traffic, **OR** you can say using weight attribute we can make the decision with path/ route should be more preferable.

When you applies clear ip bgp * soft in what happens in the backhand.

402 2021-08-17 13:04:48.775795	13.1.1.1	13.1.1.2	BGP	77 ROUTE-REFRESH Message
403 2021-08-17 13:04:48.982509	13.1.1.2	13.1.1.1	TCP	60 46774 → 179 [ACK] Seq=785 Ack=665 Win=14998 Len=0
404 2021-08-17 13:04:53.193654	13.1.1.2	13.1.1.1	BGP	155 UPDATE Message, UPDATE Message
405 2021-08-17 13:04:53.197412	13.1.1.1	13.1.1.2	TCP	60 179 → 46774 [ACK] Seq=665 Ack=886 Win=16384 Len=0

```
> Internet Protocol Version 4, Src: 13.1.1.2, Dst: 13.1.1.1
> Transmission Control Protocol, Src Port: 46774, Dst Port: 179, Seq: 785, Ack: 665, Len: 101
v Border Gateway Protocol - UPDATE Message
    Marker: ffffffffffffffffffffffffffffffff
    Length: 54
    Type: UPDATE Message (2)
    Withdrawn Routes Length: 0
    Total Path Attribute Length: 27
  v Path attributes
    > Path Attribute - ORIGIN: IGP
    > Path Attribute - AS_PATH: 200
    v Path Attribute - NEXT_HOP: 13.1.1.2
      > Flags: 0x40, Transitive, Well-known, Complete
        Type Code: NEXT_HOP (3)
        Length: 4
        Next hop: 13.1.1.2
    > Path Attribute - MULTI_EXIT_DISC: 0
  > Network Layer Reachability Information (NLRI)
v Border Gateway Protocol - UPDATE Message
    Marker: ffffffffffffffffffffffffffffffff
    Length: 47
    Type: UPDATE Message (2)
    Withdrawn Routes Length: 0
    Total Path Attribute Length: 20
  v Path attributes
    > Path Attribute - ORIGIN: IGP
    > Path Attribute - AS_PATH: 200
    v Path Attribute - NEXT_HOP: 13.1.1.2
      > Flags: 0x40, Transitive, Well-known, Complete
        Type Code: NEXT_HOP (3)
        Length: 4
        Next hop: 13.1.1.2
  v Network Layer Reachability Information (NLRI)
    v 8.8.8.0/24
        NLRI prefix length: 24
        NLRI prefix: 8.8.8.0
```

Destination Route

Local Preference attribute in BGP.

1. Local preference is a well known discretionary attribute.
2. Local preference is exchanged within the AS (IBGP) and it only stays within the AS (iBGP).
3. Not exchanged between the AS.
4. Local preference defines how data traffic should be exit from an AS.
5. By default local preference value is – **100**
6. Higher local preference will be always preferred.
7. Local Preference is a 32-bit number.
8. Local preference range is - **0 to 4294967295**
9. It is configured on a router and exchanged between IBGP routers.
10. local preference attribute is part of the routing update and is exchanged among routers in The same AS.

Note –

Local Preference is passed on to iBGP peers. If multiple paths exist, Local Preference BGP informs iBGP routers how to exit the AS. Which path to prefer for outgoing traffic.

- Exchanged between IBGP peers only
- It is not advertised to EBGP peers

There are many ways to set local preference but here we have described only two methods.

- Using the bgp default local-preference command
- Using a Route Map to Set Local Preference

BGP Local preferences can be applied in 2 ways

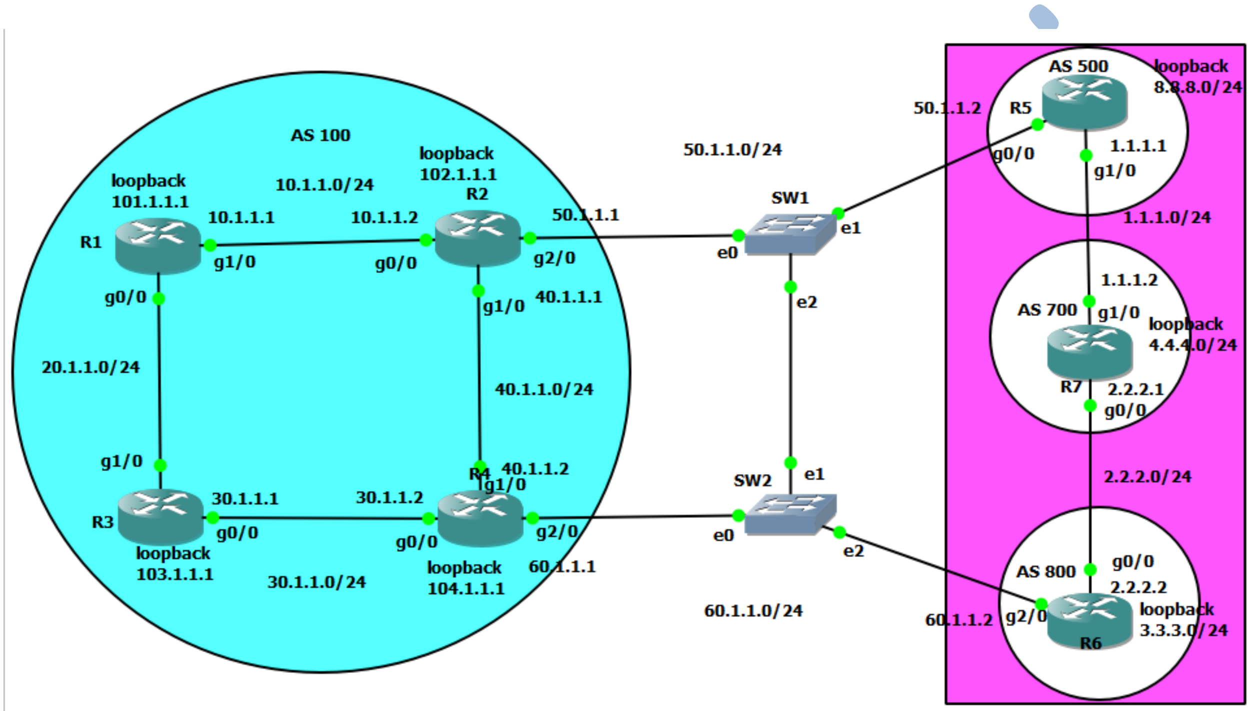
- Directly putting default local preference by iBGP router to its neighbors. **For an example.**
  R(config)# router bgp 100.
  R(config-router)# bgp default local-preference 200

- On per route basis by calling a Route-map and access list/prefix-list through a neighbor**. For an example**
  R(config)# ip prefix-list Google 8.8.8.0/24
  R(config)# route-map PREF permit 10
  R(config-route-map)# match ip address prefix-list Google
  R(config-route-map)# set local-preference 300

R(config)# router bgp 100

R(config)# neighbour 50.1.1.2 route-map PREF in

Lets understand from the below topology. –



- R2(config)#ip prefix-list Google permit 8.8.8.0/24
- R2(config)#route-map router5 permit 10
- R2(config-route-map)#match ip address prefix-list Google
- R2(config-route-map)#set local-preference 200
- R2(config-route-map)#router bgp 100
- R2(config-router)#neighbor 50.1.1.2 route-map router5 in

- R3#show ip bgp 8.8.8.0 bestpath

BGP routing table entry for 8.8.8.0/24, version 8
Paths: (2 available, best #1, table Default-IP-Routing-Table)
Not advertised to any peer
600 700 500
104.1.1.1 (metric 2) from 104.1.1.1 (104.1.1.1)
Origin IGP, metric 0, localpref 100, valid, internal, best

- #Show ip bgp

```
R1#show ip bgp
BGP table version is 11, local router ID is 101.1.1.1
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
* i3.3.3.0/24       60.1.1.2                 0    100      0 600 i
* i4.4.4.0/24       60.1.1.2                 0    100      0 600 700 i
* i8.8.8.0/24       60.1.1.2                 0    100      0 600 700 500 i
*>i                 102.1.1.1                0    200      0 500 i
*> 101.1.1.0/24     0.0.0.0                  0         32768 i
*>i102.1.1.0/24     102.1.1.1                0    100      0 i
*>i103.1.1.0/24     103.1.1.1                0    100      0 i
*>i104.1.1.0/24     104.1.1.1                0    100      0 i
R1#
```

```
R2#show ip bgp
BGP table version is 11, local router ID is 102.1.1.1
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
* i3.3.3.0/24       60.1.1.2                 0    100      0 600 i
* i4.4.4.0/24       60.1.1.2                 0    100      0 600 700 i
* i8.8.8.0/24       60.1.1.2                 0    100      0 600 700 500 i
*>                  50.1.1.2                 0    200      0 500 i
*>i101.1.1.0/24     101.1.1.1                0    100      0 i
*> 102.1.1.0/24     0.0.0.0                  0         32768 i
*>i103.1.1.0/24     103.1.1.1                0    100      0 i
*>i104.1.1.0/24     104.1.1.1                0    100      0 i
R2#
```

```
R3#show ip bgp
BGP table version is 8, local router ID is 103.1.1.1
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
*>i3.3.3.0/24       104.1.1.1                0    100      0 600 i
*>i4.4.4.0/24       104.1.1.1                0    100      0 600 700 i
*>i8.8.8.0/24       104.1.1.1                0    100      0 600 700 500 i
* i                 50.1.1.2                 0    200      0 500 i
*>i101.1.1.0/24     101.1.1.1                0    100      0 i
*>i102.1.1.0/24     102.1.1.1                0    100      0 i
*> 103.1.1.0/24     0.0.0.0                  0         32768 i
*>i104.1.1.0/24     104.1.1.1                0    100      0 i
R3#
```

```
R4#show ip bgp
BGP table version is 8, local router ID is 104.1.1.1
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
*> 3.3.3.0/24       60.1.1.2                 0             0 600 i
*> 4.4.4.0/24       60.1.1.2                               0 600 700 i
*> 8.8.8.0/24       60.1.1.2                               0 600 700 500 i
* i                 50.1.1.2                 0    200      0 500 i
*>i101.1.1.0/24     101.1.1.1                0    100      0 i
*>i102.1.1.0/24     102.1.1.1                0    100      0 i
*>i103.1.1.0/24     103.1.1.1                0    100      0 i
*> 104.1.1.0/24     0.0.0.0                  0         32768 i
R4#
```

Another method –

- Access-list 10 permit 8.8.8.0 0.0.0.255
- route-map loca_pre permit 10
  match ip address 10
  set local-prefrence 200
  route-map local_pre permit 20
  exit
- router bgp 100
  neighbor 50.1.1.2 route-map local_pre in

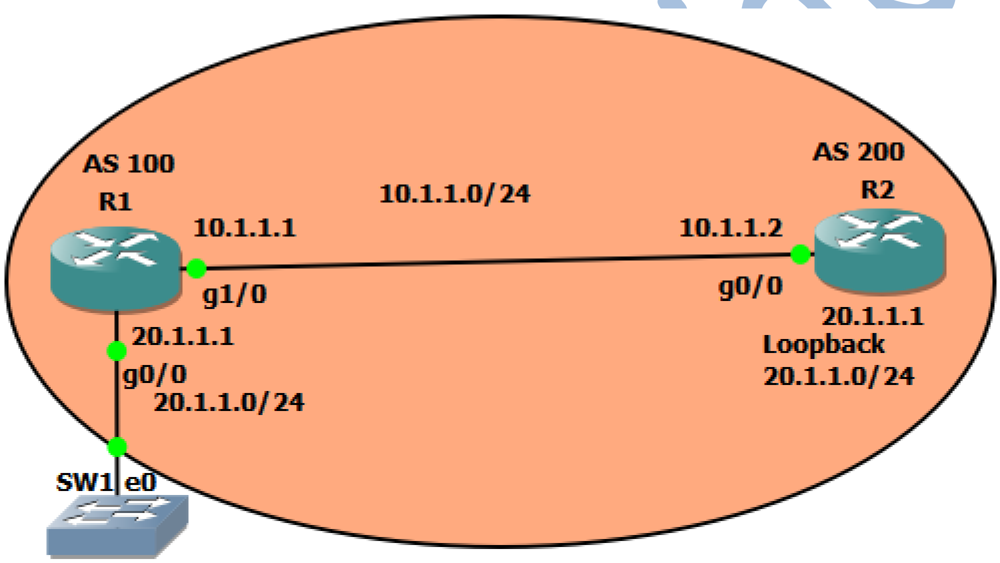
R1#clear ip bgp * soft in

Point to be noted - All the routers inside the AS, should exit via XYZ routers we generally use local preference.

Whenever router prefix information with IBGP NBR then local preference will be add and whenever IBGP router share prefix with EBGP neighbor then local preference will not add.

Self advertised –

1. Prefer route originated by the local router (next hop= 0.0.0.0)
2. Self advertised prefix will be always preferred.
3. If router receiving same prefix from different NBR then it will not compare self advertised.
4. Prefer the path that the local router originated. In the BGP table, you will see **next hop 0.0.0.0**. You can get a path in the BGP table through the BGP network command, aggregation, or redistribution. A BGP router will prefer routes that it installed into BGP itself over a route that another router installed in BGP.




```
R1#show ip bgp
BGP table version is 2, 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
*  20.1.1.0/24      10.1.1.2                 0             0 200 i
*>                  0.0.0.0                  0         32768 i
R1#
```

```
R2#show ip bgp
BGP table version is 2, 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
*  20.1.1.0/24      10.1.1.1                 0             0 100 i
*>                  0.0.0.0                  0         32768 i
R2#
```

As you can see above the both router only advertised self advertised route/path.

- R1#show run | section bgp
- router bgp 100

  no synchronization
  bgp router-id 1.1.1.1
  bgp log-neighbor-changes
  network 20.1.1.0 mask 255.255.255.0
  neighbor 10.1.1.2 remote-as 200
  no auto-summary
  R1#

- R2#show run | section bgp
- router bgp 200

  no synchronization
  bgp router-id 2.2.2.2
  bgp log-neighbor-changes
  network 20.1.1.0 mask 255.255.255.0
  neighbor 10.1.1.1 remote-as 100
  no auto-summary
  R2#

```
R1(config-if)#exi
*Aug 26 17:04:35.371: BGP(0): route 20.1.1.0/24 down
*Aug 26 17:04:35.371: BGP(0): Revise route installing 1 of 1 routes for 20.1.1.0/24 -> 10.1.1.2(main) to main IP table
*Aug 26 17:04:35.375: BGP(0): 10.1.1.2 send unreachable (format) 20.1.1.0/24
*Aug 26 17:04:35.375: BGP(0): 10.1.1.2 send UPDATE 20.1.1.0/24 -- unreachable
*Aug 26 17:04:35.379: BGP(0): 10.1.1.2 Format UPDATE -- unreachable :
*Aug 26 17:04:36.379: BGP(0): lost route 20.1.1.0/24 for main IP table
*Aug 26 17:04:36.399: BGP(0): route 20.1.1.0/24 up
*Aug 26 17:04:36.399: BGP(0): route 20.1.1.0/24 up
*Aug 26 17:04:36.403: BGP(0): nettable_walker 20.1.1.0/24 route sourced locally
R1(config-if)#exit
R1(config)#ex
*Aug 26 17:05:05.511: BGP(0): 10.1.1.2 send UPDATE (format) 20.1.1.0/24, next 10.1.1.1, metric 0
R1(config)#ex
```

```
R2#debug ip bgp updates
BGP updates debugging is on for address family: IPv4 Unicast
R2#
*Aug 26 17:04:26.327: BGP(0): 10.1.1.1 rcv UPDATE about 20.1.1.0/24 -- withdrawn
R2#
*Aug 26 17:04:56.407: BGP(0): 10.1.1.1 rcvd UPDATE w/ attr: nexthop 10.1.1.1, origin i, metric 0, merged path 100, AS_PATH
*Aug 26 17:04:56.407: BGP(0): 10.1.1.1 rcvd 20.1.1.0/24
R2#show ip bgp
```

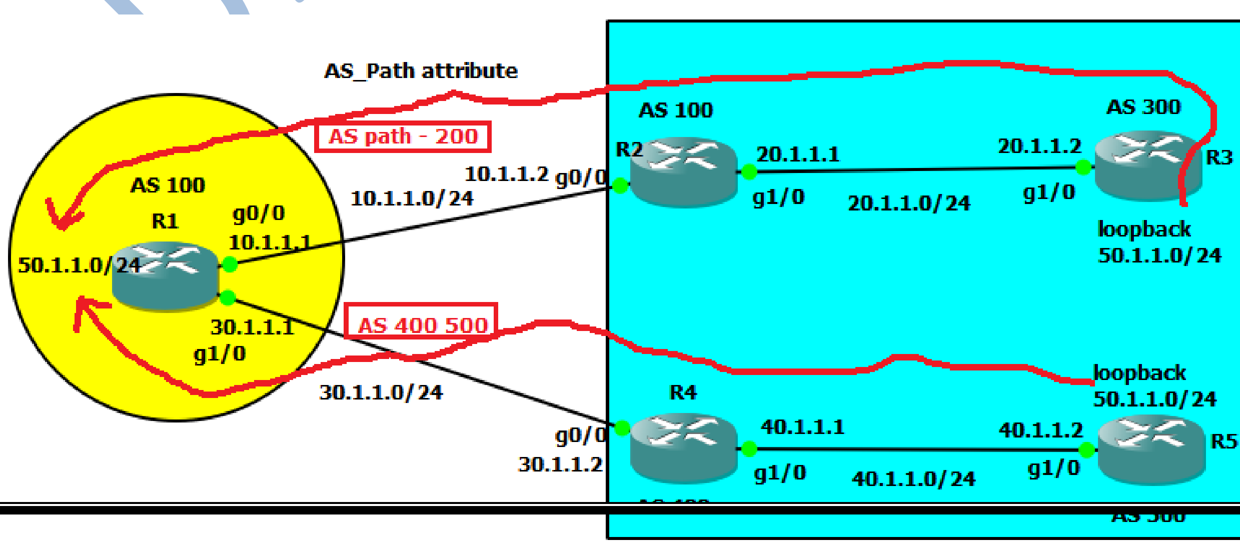
After that you will check whether bgp route installed in routing or not – there is no route.

```
Gateway of last resort is not set

     20.0.0.0/24 is subnetted, 1 subnets
C       20.1.1.0 is directly connected, GigabitEthernet0/0
     10.0.0.0/24 is subnetted, 1 subnets
C       10.1.1.0 is directly connected, GigabitEthernet1/0
R1#
```

```
Gateway of last resort is not set

     20.0.0.0/24 is subnetted, 1 subnets
C       20.1.1.0 is directly connected, Loopback1
```

AS Path attribute-

- In AS Path Attribute mechanism, whenever a route passes an AS (Autonomous System), it adds the number of AS it passed. So, AS Path Attribute is **a list of AS numbers, that the router traverse**. With this mechanism AS Path Attribute is also used for loop detection and loop avoidance.
- Using AS path BGP router will decide which path will be best path.
- router will define that path as best which is providing destination network after crossing less number of AS , **For example, AS path 1 2 3 is preferred over AS path 1 2 3 4 5.**
- A prefix which is having less no of AS available inside its AS-path list.
- AS- path list can have maximum 64 AS's.
- In case of IBGP router will not add AS number, it adds only in case of EBGP.
- Less number of AS path will be always become as best path to reach the destination network.
- Suppose if we have to multiple path to reach the destination network and one path is having lowest AS than second path, then first path will be always preferred due to less no of AS.
- You can say that lowest AS shortest path will become as a best path to reach the destination network.
- The AS_PATH attribute is a shortest path determinant. Given multiple routes to the same destination, the route with an AS_PATH listing the fewest AS numbers is assumed to be the shortest path.
- The AS numbers on the AS_PATH list are used for loop detection; a router receiving a BGP route with its own AS number in the AS_PATH assumes a loop and discards the route.
- If a router has a BGP session to a neighbor with a different AS number, the session is called external BGP (EBGP); if the neighbor has the same AS number as the router, the session is called internal BGP (IBGP). The neighbors are called, respectively, external or internal neighbors.



As you can see R1 router has preferred to 10.1.1.2 (R2 path) as a best path to reach the destination prefix 50.1.1.0/24 is receiving less no of AS that's the reason.

```
R1#show ip bgp
BGP table version is 3, 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
*  50.1.1.0/24      30.1.1.2                               0 400 500 i
*>i                 10.1.1.2                 0    100      0 200 i
R1#
```

10.1.1.2 is a best path as less no of AS

```
R2#show ip bgp
BGP table version is 2, 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
*> 50.1.1.0/24      20.1.1.2                 0             0 200 i
R2#
```

```
R3#show ip bgp
BGP table version is 2, 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
*> 50.1.1.0/24      0.0.0.0                  0         32768 i
R3#
```

```
R4#show ip bgp
BGP table version is 2, local router ID is 4.4.4.4
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
*  50.1.1.0/24      30.1.1.1                               0 100 200 i
*>                  40.1.1.2                 0             0 500 i
R4#
```

```
R5#show ip bgp
BGP table version is 2, local router ID is 5.5.5.5
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
*> 50.1.1.0/24      0.0.0.0                  0         32768 i
R5#
```

Note – if you want to verify which path will become a best path just run the **debug ip bgp updates**

On every router to check bgp updates message after that shut down the loopback of R3 router then you will see which path will become as a best path, I'm just showing you for an example only here.

```
R1#show ip bgp
BGP table version is 4, 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
*> 50.1.1.0/24      30.1.1.2                               0 400 500 i
R1#show ip bgp            to reach the destination network via 30.1.1.2 from R1
```

Configuration –

```
R1#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 neighbor 10.1.1.2 remote-as 100
 neighbor 30.1.1.2 remote-as 400
 no auto-summary
===============================
R2#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 neighbor 10.1.1.1 remote-as 100
 neighbor 10.1.1.1 next-hop-self
 neighbor 20.1.1.2 remote-as 200
 no auto-summary
R2#
================================
R3#show run | section bgp
router bgp 200
 no synchronization
 bgp router-id 3.3.3.3
```

```
 bgp log-neighbor-changes
 network 50.1.1.0 mask 255.255.255.0
 neighbor 20.1.1.1 remote-as 100
 no auto-summary
R3#
================================

R4#show run | section bgp
router bgp 400
 no synchronization
 bgp router-id 4.4.4.4
 bgp log-neighbor-changes
 neighbor 30.1.1.1 remote-as 100
 neighbor 40.1.1.2 remote-as 500
 no auto-summary
R4#
================================
R5#show run | section bgp
router bgp 500
 no synchronization
 bgp router-id 5.5.5.5
 bgp log-neighbor-changes
 network 50.1.1.0 mask 255.255.255.0
 neighbor 40.1.1.1 remote-as 400
 no auto-summary
R5#
==================================
```

```
R1#show ip bgp summary
BGP router identifier 1.1.1.1, local AS number 100
BGP table version is 5, main routing table version 5
1 network entries using 132 bytes of memory
2 path entries using 104 bytes of memory
3/1 BGP path/bestpath attribute entries using 504 bytes of memory
2 BGP AS-PATH entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 1 (at peak 2) using 32 bytes of memory
BGP using 820 total bytes of memory
BGP activity 1/0 prefixes, 3/1 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.1.1.2        4          100      44      44        5    0    0 00:40:37        1
30.1.1.2        4          400      41      43        5    0    0 00:39:11        1
R1#
```

There are two NBR of R1

Origin Code-

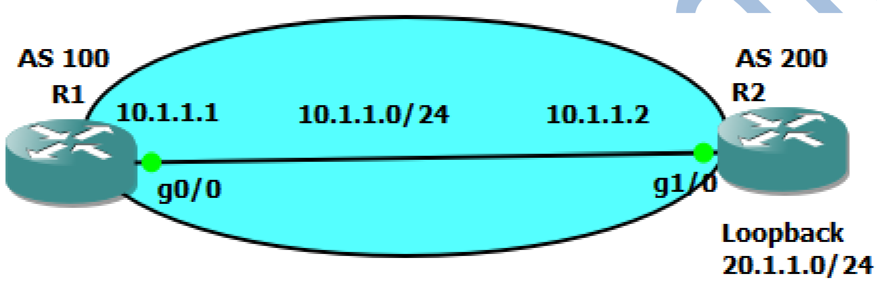
There are three origin codes you could see in the BGP table:-

- I = BGP prefix
- E= EGP prefix
- ? = Redistributed prefix

I = it means you have advertised this prefix using network command therefore you are getting this code.

Or you can say that - You will see IGP when you use the network command for BGP. It means you advertised the network yourself in BGP.

Let's prove it –




```
R1#show ip bgp
BGP table version is 2, 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
*> 20.1.1.0/24      10.1.1.2                 0             0 200 i
R1#
```

Origin code =i

```
R2#show ip bgp
BGP table version is 2, 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
*> 20.1.1.0/24      0.0.0.0                  0         32768 i
R2#
```

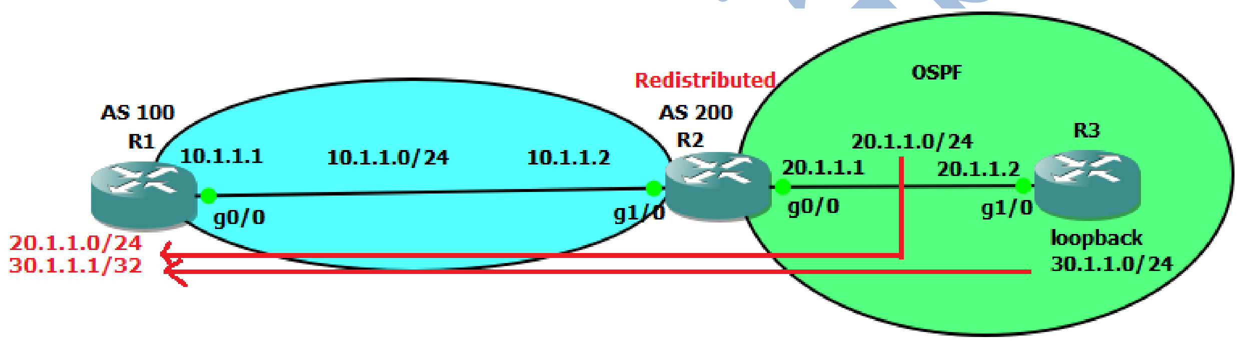
E= EGP prefix:-

EGP is historical and you won't see it in the BGP table anymore. EGP is an old routing protocol we don't use it anymore.

Or you can say it – it is a old version of BGP, before it was using EGP, in legacy IOS were support it.

? = Redistributed prefix:-

Incomplete means you have redistributed something into BGP. Here's a demonstration:-



?= it means this is bgp prefix, it is coming from any other routing protocol means redistributed prefix.

I is more preferable than E and E is more preferable than ? ----> (i>E>?)

```
R1#show ip bgp
BGP table version is 5, 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
*> 20.1.1.0/24      10.1.1.2                 0             0 200 ?
*> 30.1.1.1/32      10.1.1.2                 1             0 200 ?
R1#
```

```
R2#show ip bgp                                       Redistributed prefix
BGP table version is 5, 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
*> 20.1.1.0/24      0.0.0.0                  0         32768 ?
*> 30.1.1.1/32      20.1.1.2                 1         32768 ?
R2#
```

Whatever configuration I have done so far you can see the below sheet.

```
R1#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 neighbor 10.1.1.2 remote-as 200
 no auto-summary
R1#
==================================
R2#show run | section bgp
router bgp 200
 no synchronization
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 redistribute ospf 300 metric 1
 neighbor 10.1.1.1 remote-as 100
 no auto-summary
R2#
===================================
R2#show run | section ospf
router ospf 300
 router-id 2.2.2.2
 log-adjacency-changes
 passive-interface GigabitEthernet1/0
 network 20.1.1.0 0.0.0.255 area 0
 redistribute ospf 300 metric 1
R2#
===================================
R3#show run | section ospf
router ospf 500
 router-id 3.3.3.3
 log-adjacency-changes
 network 20.1.1.0 0.0.0.255 area 0
 network 30.1.1.0 0.0.0.255 area 0
R3#
```

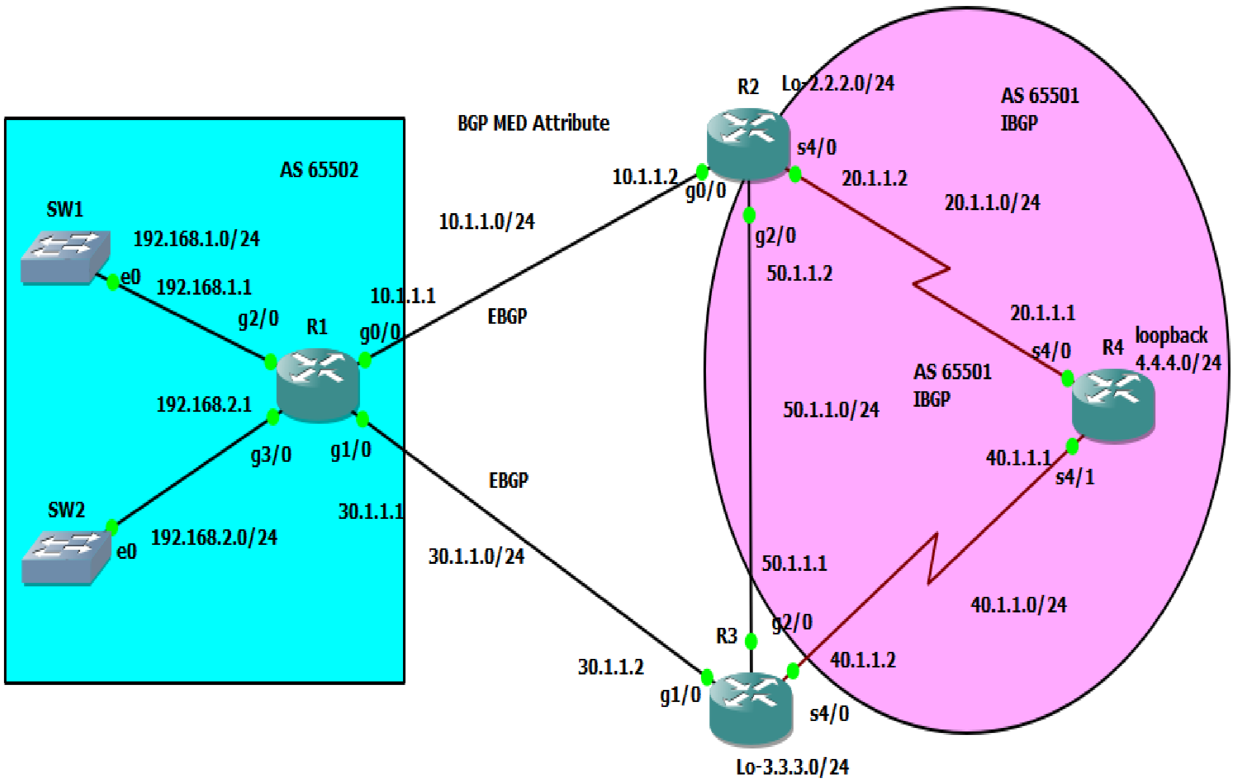
```
R1#show ip route
Gateway of last resort is not set

     20.0.0.0/24 is subnetted, 1 subnets
B       20.1.1.0 [20/0] via 10.1.1.2, 00:16:02
     10.0.0.0/24 is subnetted, 1 subnets
C       10.1.1.0 is directly connected, GigabitEthernet0/0
```

```
    30.0.0.0/32 is subnetted, 1 subnets
B      30.1.1.1 [20/1] via 10.1.1.2, 00:16:02
R1#
```

1. MED attribute:-

1. MED is an optional non transitive attribute.
2. MED stands for Multiple Exit Discriminator, MED is also called **metric**.
3. Lower MED value will be always preferred over a higher MED value.
4. By default MED value is – **0** OR lower is better. (Default MED is 0)
5. Used to manipulate route-selection for inbound traffic.
6. MED is exchanged between autonomous systems.
7. MED can be used to advertise to your neighbors how they should enter your AS.
8. MED is propagated to all routers within the neighbor AS but not passed along any other autonomous systems.
9. MED type code is = **type code 4**
10. The MED is sent to EBGP peers and those routers propagate the MED within their AS.
11. The routers within the AS use the MED, but do not pass it on to the next AS.
12. When BGP sends that update to another AS, the MED is reset to 0.
13. By using the MED attribute, BGP is the only protocol that can affect how routes are sent into an AS.
14. **Point to be noted** - Local preference is used for **outbound traffic** and MED is for **inbound traffic.**

Let's understand below sample topology –



Configuration –

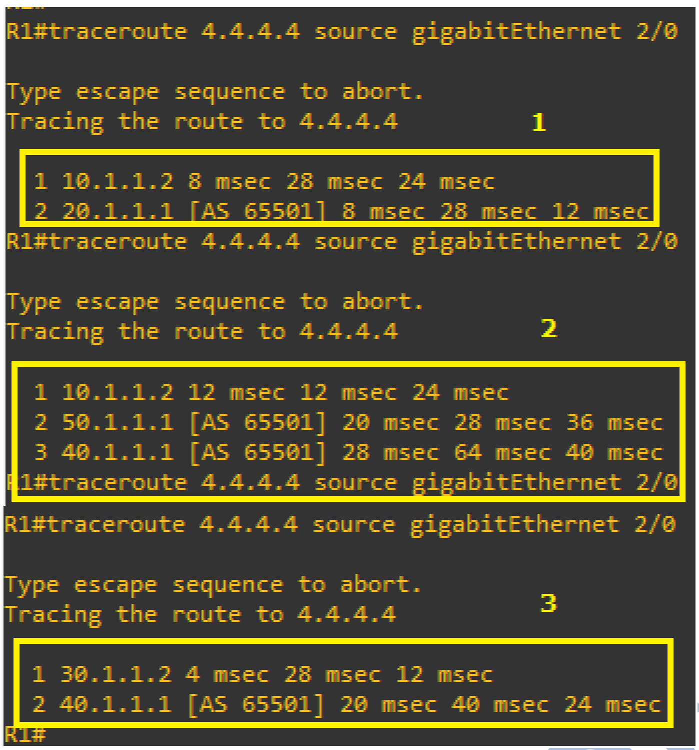
```
R1#show run | section bgp
router bgp 65502
 no synchronization
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 network 192.168.1.0
 network 192.168.2.0
 neighbor 10.1.1.2 remote-as 65501
 neighbor 30.1.1.2 remote-as 65501
 no auto-summary
R1#
=================================
R2#show run | section bgp
router bgp 65501
 no synchronization
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 redistribute ospf 100 metric 2
 neighbor 4.4.4.4 remote-as 65501
 neighbor 4.4.4.4 update-source Loopback2
 neighbor 10.1.1.1 remote-as 65502
 neighbor 20.1.1.1 remote-as 65501
 neighbor 50.1.1.1 remote-as 65501
 no auto-summary
R2#
=====================================
R2#show run | section ospf
router ospf 100
 router-id 2.2.2.2
 log-adjacency-changes
 redistribute connected subnets
 passive-interface GigabitEthernet0/0
 network 2.2.2.0 0.0.0.255 area 0
 network 20.1.1.0 0.0.0.255 area 0
 network 50.1.1.0 0.0.0.255 area 0
 redistribute ospf 100 metric 2
======================================
R3#show run | section bgp
router bgp 65501
 no synchronization
 bgp router-id 3.3.3.3
 bgp log-neighbor-changes
 redistribute ospf 100 metric 3
 neighbor 4.4.4.4 remote-as 65501
 neighbor 4.4.4.4 update-source Loopback3
 neighbor 30.1.1.1 remote-as 65502
 neighbor 40.1.1.1 remote-as 65501
 neighbor 50.1.1.2 remote-as 65501
```

```
 no auto-summary
R3#
==========================================
R3#show run | section ospf
router ospf 100
 router-id 3.3.3.3
 log-adjacency-changes
 redistribute connected subnets
 passive-interface GigabitEthernet1/0
 network 3.3.3.0 0.0.0.255 area 0
 network 40.1.1.0 0.0.0.255 area 0
 network 50.1.1.0 0.0.0.255 area 0
 redistribute ospf 100 metric 3
===========================================
R4#show run | section bgp
router bgp 65501
 no synchronization
 bgp router-id 4.4.4.4
 bgp log-neighbor-changes
 neighbor 2.2.2.2 remote-as 65501
 neighbor 2.2.2.2 update-source Loopback4
 neighbor 3.3.3.3 remote-as 65501
 neighbor 3.3.3.3 update-source Loopback4
 neighbor 20.1.1.2 remote-as 65501
 neighbor 40.1.1.2 remote-as 65501
 no auto-summary
R4#
==========================================
R4#show run | section ospf
router ospf 100
 router-id 4.4.4.4
 log-adjacency-changes
 network 4.4.4.0 0.0.0.255 area 0
 network 20.1.1.0 0.0.0.255 area 0
 network 40.1.1.0 0.0.0.255 area 0
R4#
```

As you can see that we have designed topology for the redundancy in order to network should be available forever. let me show you one by one .

Just look the trace route from R1 router, what did I do? Simply I have gone on R2 router shut down the S4/0 interface & gigabitEthernet2/0. Then you get below output.

Traceroute from R1 to 4.4.4.0/24



Now What am I going to do to test MED but before that we have to verify from which path traffic is going on then we will apply MED according to that.

- **R1#traceroute 4.4.4.4 source gigabitEthernet 2/0**
  Type escape sequence to abort.
  Tracing the route to 4.4.4.4
  1 30.1.1.2 20 msec 8 msec 8 msec
  2 40.1.1.1 [AS 65501] 12 msec 16 msec 36 msec
  R1#

Now Im going to apply MED on R2 router.

BGP table & routing table of R1

BGP table of R1

```
R1#show ip bgp
BGP table version is 61, 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
*  2.2.2.0/24       30.1.1.2                              0 65501 ?
*>                  10.1.1.2                 0            0 65501 ?
*> 2.2.2.2/32       30.1.1.2                 3            0 65501 ?
*  3.3.3.0/24       10.1.1.2                              0 65501 ?
*>                  30.1.1.2                 0            0 65501 ?
*> 3.3.3.3/32       10.1.1.2                 2            0 65501 ?
*> 4.4.4.4/32       10.1.1.2                 2            0 65501 ?
*                   30.1.1.2                 3            0 65501 ?
*  20.1.1.0/24      30.1.1.2                 3            0 65501 ?
*>                  10.1.1.2                 0            0 65501 ?
*  40.1.1.0/24      10.1.1.2                 2            0 65501 ?
*>                  30.1.1.2                 0            0 65501 ?
*  50.1.1.0/24      10.1.1.2                 0            0 65501 ?
*>                  30.1.1.2                 0            0 65501 ?
*> 192.168.1.0      0.0.0.0                  0        32768 i
*> 192.168.2.0      0.0.0.0                  0        32768 i
R1#
```

Routing table of R4

```
Gateway of last resort is not set

     50.0.0.0/24 is subnetted, 1 subnets
B       50.1.1.0 [20/0] via 30.1.1.2, 00:31:18
     2.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
B       2.2.2.2/32 [20/3] via 30.1.1.2, 00:06:53
B       2.2.2.0/24 [20/0] via 10.1.1.2, 00:25:53
     3.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
B       3.3.3.3/32 [20/2] via 10.1.1.2, 00:06:39
B       3.3.3.0/24 [20/0] via 30.1.1.2, 00:31:18
     4.0.0.0/32 is subnetted, 1 subnets
B       4.4.4.4 [20/2] via 10.1.1.2, 00:06:39
     20.0.0.0/24 is subnetted, 1 subnets
B       20.1.1.0 [20/0] via 10.1.1.2, 00:06:39
     40.0.0.0/24 is subnetted, 1 subnets
B       40.1.1.0 [20/0] via 30.1.1.2, 00:31:18
     10.0.0.0/24 is subnetted, 1 subnets
C       10.1.1.0 is directly connected, GigabitEthernet0/0
C    192.168.1.0/24 is directly connected, GigabitEthernet2/0
C    192.168.2.0/24 is directly connected, GigabitEthernet3/0
     30.0.0.0/24 is subnetted, 1 subnets
C       30.1.1.0 is directly connected, GigabitEthernet1/0
R1#
R1#
```

Now I'm going to configure MED configuration –

- R2(config)#access-list 1 permit 4.4.4.0 0.0.0.255
- R2(config)#route-map test permit 10
- R2(config-route-map)#set metric 100
- R2(config-route-map)#exit
- R2(config)#route-map test permit 20
- R2(config-route-map)#exit
- R2(config)#router bgp
- R2(config)#router bgp 65501
- R2(config-router)#neighbor 10.1.1.1 route-map test out

Lets check using trace route on R1 router –

```
R1#
R1#traceroute 4.4.4.4 source gigabitEthernet 2/0

Type escape sequence to abort.        Proved using MED
Tracing the route to 4.4.4.4

  1 30.1.1.2 12 msec 12 msec 8 msec
  2 40.1.1.1 [AS 65501] 16 msec 32 msec 20 msec
R1#
```

Check the hit count of ACL –

R2#show access-lists

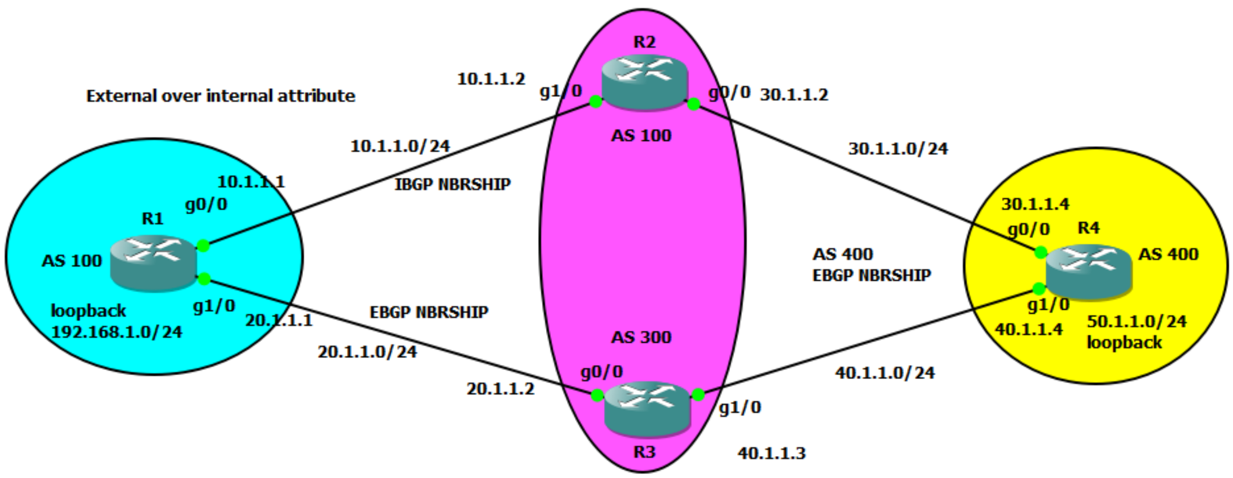
Standard IP access list 1

    10 permit 4.4.4.0, wildcard bits 0.0.0.255 (3 matches)

R2#

2. eBGP path over iBGP path (External over internal)

1. Prefer EBGP path over IBGP path it means if any prefix coming from to different NBR one is IBGP NBR and another is one EBGP NBR then BGP will prefer external prefix means EBGP prefixes'.



It can prove using R2#show ip bgp and via routing table

```
R1#show ip bgp
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
* i50.1.1.0/24      30.1.1.4                 0    100      0 400 i
*>                  20.1.1.2                               0 300 400 i
*> 192.168.1.0      0.0.0.0                  0         32768 i
R1#
```

```
Gateway of last resort is not set

     50.0.0.0/24 is subnetted, 1 subnets
B       50.1.1.0 [20/0] via 20.1.1.2, 00:11:31
     20.0.0.0/24 is subnetted, 1 subnets
C       20.1.1.0 is directly connected, GigabitEthernet1/0
     10.0.0.0/24 is subnetted, 1 subnets
C       10.1.1.0 is directly connected, GigabitEthernet0/0
C    192.168.1.0/24 is directly connected, Loopback1
R1#
```

Preffered EBGP As you can see AD =20

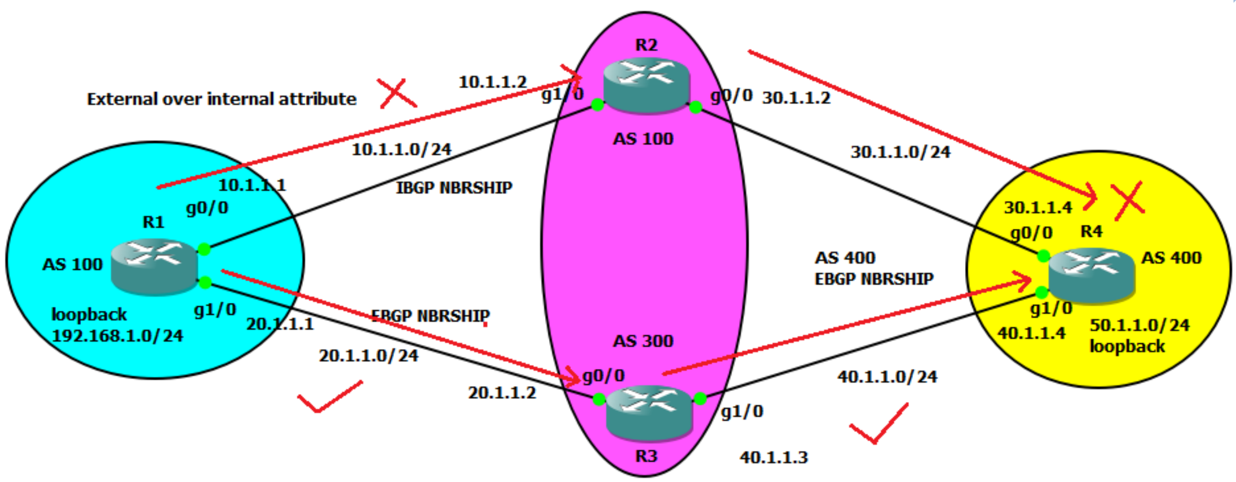
R1#traceroute

```
R1#traceroute 50.1.1.1 source loopback 1

Type escape sequence to abort.
Tracing the route to 50.1.1.1

  1 20.1.1.2 16 msec 20 msec 16 msec
  2 40.1.1.4 20 msec 40 msec 44 msec
R1#ping 50.1.1.1 source loopback 1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 50.1.1.1, timeout is 2 seconds:
Packet sent with a source address of 192.168.1.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/24/32 ms
R1#
```

Configuration –

```
R1#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 network 192.168.1.0
 neighbor 10.1.1.2 remote-as 100
 neighbor 20.1.1.2 remote-as 300
 no auto-summary
R1#
R2#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 neighbor 10.1.1.1 remote-as 100
 neighbor 30.1.1.4 remote-as 400
 no auto-summary
R2#
R3#show run | section bgp
router bgp 300
 no synchronization
 bgp router-id 3.3.3.3
 bgp log-neighbor-changes
 neighbor 20.1.1.1 remote-as 100
 neighbor 40.1.1.4 remote-as 400
 no auto-summary
R3#
```

```
R4#show run | section bgp
router bgp 400
 no synchronization
 bgp router-id 4.4.4.4
 bgp log-neighbor-changes
 network 50.1.1.0 mask 255.255.255.0
 neighbor 30.1.1.2 remote-as 100
 neighbor 40.1.1.3 remote-as 300
 no auto-summary
R4#
```



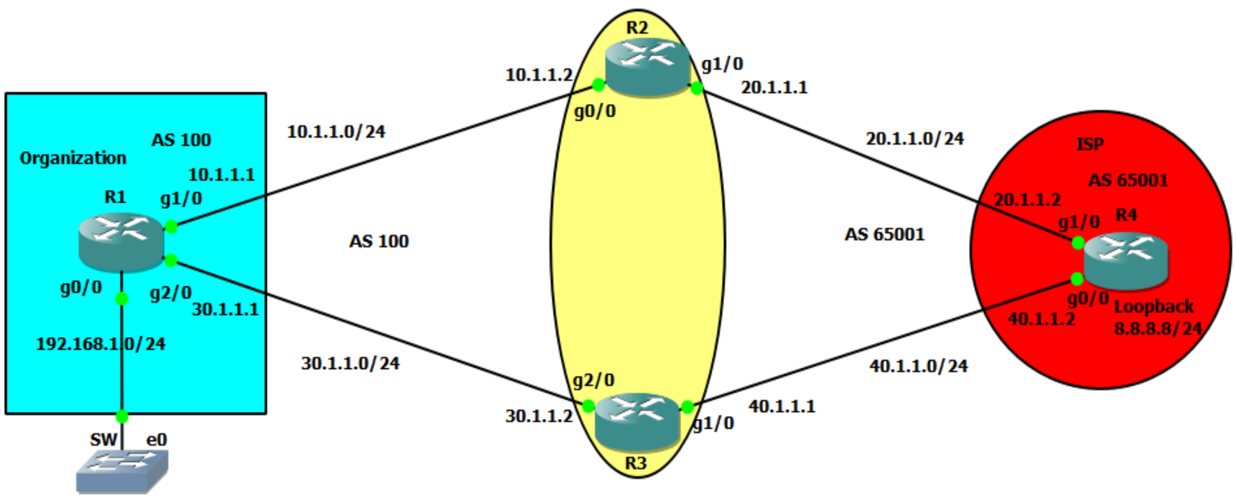

```
R4#show ip bgp
BGP table version is 4, local router ID is 4.4.4.4
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 50.1.1.0/24      0.0.0.0                  0         32768 i
*> 192.168.1.0      30.1.1.2                               0 100 i
*                   40.1.1.3                               0 300 100 i
R4#
```

3. IGP cost to reach next hop (Shortest IGP path to BGP next hop)

1. Prefer the path within the autonomous system with the lowest IGP metric to the BGP next hop.
2. If IGP configured background of bgp then bgp can use IGP cost to reach next hop address.

4. Oldest path (only for EBGP neighbors)

1. Prefer the path that we received first, in other words, the oldest path.
2. If router receiving same prefix coming from two different EBGP NBR then oldest path will be always preferred.
3. Oldest path only compared is in EBGP Neighborship, not an IBGP.
4. Prefix that will receive first will become as a best path whether lower NBR ip address or not same.



Point to be noted – Oldest path is compared in case of EBGP NBR.

```
RTR4_ISP#show ip bgp
BGP table version is 3, local router ID is 4.4.4.4
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
*> 8.8.8.0/24       0.0.0.0                  0         32768 i
*  192.168.1.0      40.1.1.1                               0 100 i
*>                  20.1.1.1      oldest received path     0 100 i
RTR4_ISP#
RTR4_ISP#
RTR4_ISP#
```

Now let's prove it how -

Right now I'm going to shutdown NBR using bgp command on RTR4_ISP –

- RTR4_ISP(config)#router bgp 65001
- RTR4_ISP(config-router)#neighbor 20.1.1.1 shutdown

Lets see now bgp table of R4 –

```
RTR4_ISP#show ip bgp
BGP table version is 4, local router ID is 4.4.4.4
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
*> 8.8.8.0/24       0.0.0.0                  0         32768 i
*> 192.168.1.0      40.1.1.1                               0 100 i
RTR4_ISP#
RTR4_ISP#
```

Going to disable this command -

- RTR4_ISP(config-router)# no neighbor 20.1.1.1 shutdown

Proved now –

```
RTR4_ISP#show ip bgp
BGP table version is 4, local router ID is 4.4.4.4
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
*> 8.8.8.0/24       0.0.0.0                  0         32768 i
*  192.168.1.0      20.1.1.1                               0 100 i
*>                  40.1.1.1                               0 100 i
RTR4_ISP#
RTR4_ISP#
RTR4_ISP#
```

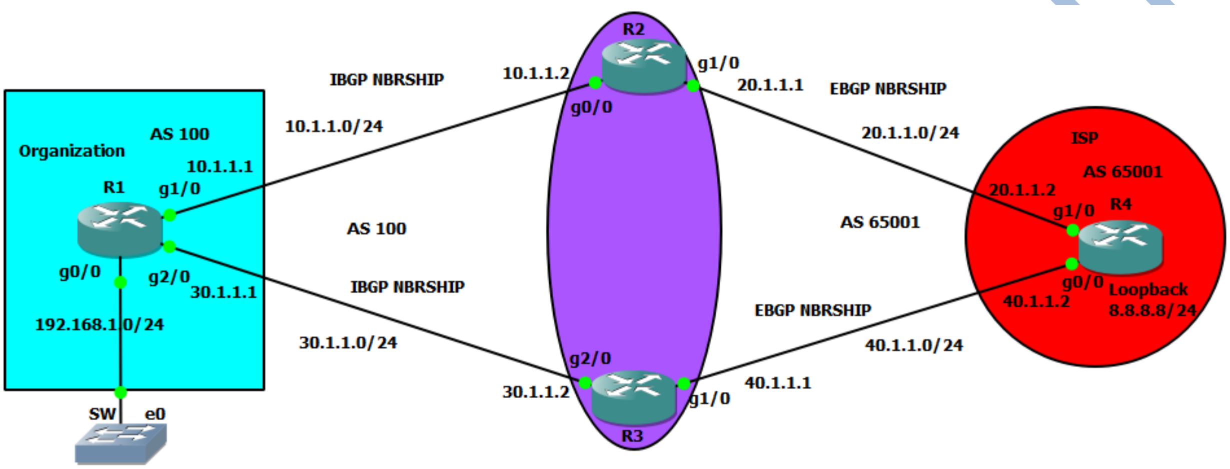
now It has been proved oldest path

- Gateway of last resort is not set
- 20.0.0.0/24 is subnetted, 1 subnets
- C 20.1.1.0 is directly connected, GigabitEthernet1/0
- 8.0.0.0/24 is subnetted, 1 subnets
- C 8.8.8.0 is directly connected, Loopback4
- 40.0.0.0/24 is subnetted, 1 subnets
- C 40.1.1.0 is directly connected, GigabitEthernet0/0
- B 192.168.1.0/24 [20/0] via 40.1.1.1, 00:05:57
- RTR4_ISP#

```
R1#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 network 192.168.1.0
 neighbor 10.1.1.2 remote-as 100
 neighbor 30.1.1.2 remote-as 100
 no auto-summary
R1#
R2#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 neighbor 10.1.1.1 remote-as 100
 neighbor 10.1.1.1 next-hop-self
 neighbor 20.1.1.2 remote-as 65001
 no auto-summary
R2#
R3#show run | section bgp
router bgp 100
 no synchronization
 bgp router-id 3.3.3.3
 bgp log-neighbor-changes
 neighbor 30.1.1.1 remote-as 100
 neighbor 30.1.1.1 next-hop-self
 neighbor 40.1.1.2 remote-as 65001
 no auto-summary
R3#
RTR4_ISP#show run | section bgp
router bgp 65001
 no synchronization
 bgp router-id 4.4.4.4
 bgp log-neighbor-changes
 network 8.8.8.0 mask 255.255.255.0
 neighbor 20.1.1.1 remote-as 100
 neighbor 40.1.1.1 remote-as 100
 no auto-summary
RTR4_ISP#

R1#traceroute 8.8.8.8 source gigabitEthernet 0/0
Type escape sequence to abort.
Tracing the route to 8.8.8.8
 1 10.1.1.2 16 msec 32 msec 20 msec
  2 20.1.1.2 44 msec 32 msec 44 msec
R1#
```

5. Lower neighbor router-id – (Compared only IBGP neighbor case)

1. Prefer the path with the lowest BGP neighbor router ID. The router ID is based on the highest IP address. If you have a loopback interface, then the IP address on the loopback will be used. The router ID can also be manually configured.
2. Router-id election criteria same as OSPF protocol
3. Lower router-id will be always preferred.
4. If router is receiving same prefix coming from two different IBGP neighbor then lower router-id of NBR will be always preferred.



Let's prove it –

```
R1#show ip bgp
BGP table version is 6, 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
                              lower NBR router-id
   Network          Next Hop            Metric LocPrf Weight Path
*>i8.8.8.0/24       10.1.1.2                 0    100      0 65001 i
* i                 30.1.1.2                 0    100      0 65001 i
*> 192.168.1.0      0.0.0.0                  0         32768 i
                              Higher NBR router-id
R1#
R1#
```

Proved –

```
R1#
R1#
R1#show ip bgp 8.8.8.0
BGP routing table entry for 8.8.8.0/24, version 6
Paths: (2 available, best #1, table Default-IP-Routing-Table)
  Not advertised to any peer
  65001
    10.1.1.2 from 10.1.1.2 (2.2.2.2)
      Origin IGP, metric 0, localpref 100, valid, internal, best
  65001
    30.1.1.2 from 30.1.1.2 (3.3.3.3)
      Origin IGP, metric 0, localpref 100, valid, internal
R1#
```

Proved on the basis of lower NBR router -id

Note – you can also verify lower NBR router-id using below command –

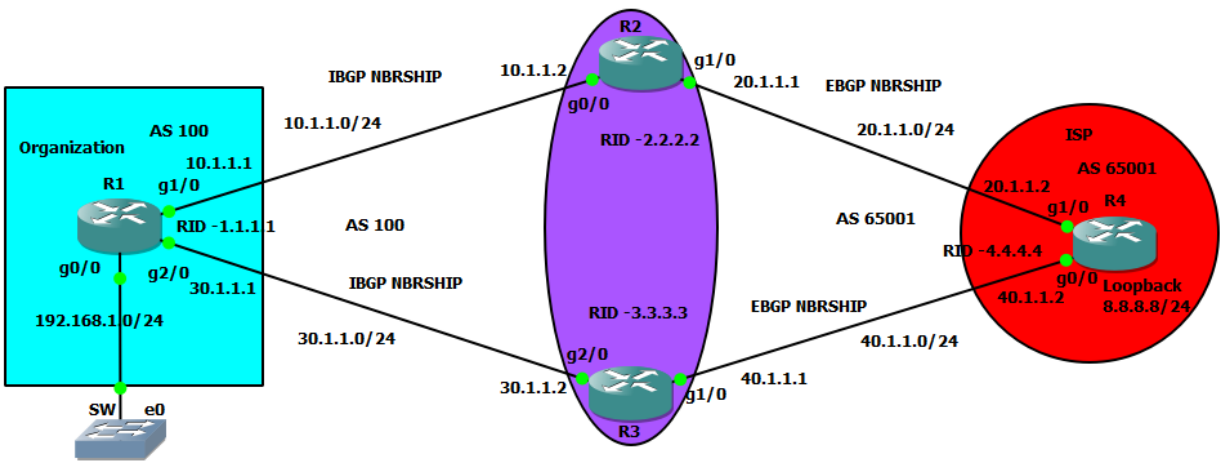
R1#show ip bgp neighbors

Point to be noted –

If NBR router-id will be same then it will compare next attribute that is called – Lower neighbor ip address**.**

6. Lower neighbor ip address –

1. Prefer the path with the lowest neighbor IP address. If you have two eBGP routers and two links in between then the router ID will be the same. In this case, the neighbor IP address is the tiebreaker.
2. If router is receiving same prefix coming from two NBR which router-id has same then lower NBR router ip address will be preferred.




```
R1#  show ip bgp
BGP table version is 6, 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
*>i8.8.8.0/24       10.1.1.2                 0    100      0 65001 i
* i                 30.1.1.2                 0    100      0 65001 i
*> 192.168.1.0      0.0.0.0                  0         32768 i
R1#
R1#              so far it has been preffred this path
R1#
```

Proved in the below snapshot –

```
R1#show ip bgp 8.8.8.0 255.255.255.0
BGP routing table entry for 8.8.8.0/24, version 8
Paths: (2 available, best #1, table Default-IP-Routing-Table)
Flag: 0x840
  Not advertised to any peer
  65001
    10.1.1.2 from 10.1.1.2 (3.3.3.3)
      Origin IGP, metric 0, localpref 100, valid, internal, best
  65001
    30.1.1.2 from 30.1.1.2 (3.3.3.3)
      Origin IGP, metric 0, localpref 100, valid, internal
R1#
```

here router-id is same then election will be done the basis of lowe NBR ip address

```
R1#show ip bgp
BGP table version is 8, 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
*>i8.8.8.0/24       10.1.1.2                 0    100      0 65001 i
* i                 30.1.1.2                 0    100      0 65001 i
*> 192.168.1.0      0.0.0.0                  0         32768 i
R1#
```

Note –

BGP support equal cost load balancing but up to IGP cost to reach next hop attribute must be same .

Next hop rule –

1. Whenever any routers give update to its ebgp neighbor, it will advertise update after modifying their next-hop address.
2. whenever any router give update to its ibgp neighbor, it will advertise update without Modifying their next-hop address

Note – According to my Skills I have demonstrated BGP attributed and let me know if there is any single mistake has been done by me, please write here – umesh1123@gmail.com

In order to I can enhance my skills. BGP full notes will be uploaded soon. One more things please broadcast this notes with your friends & group, comment as well.