

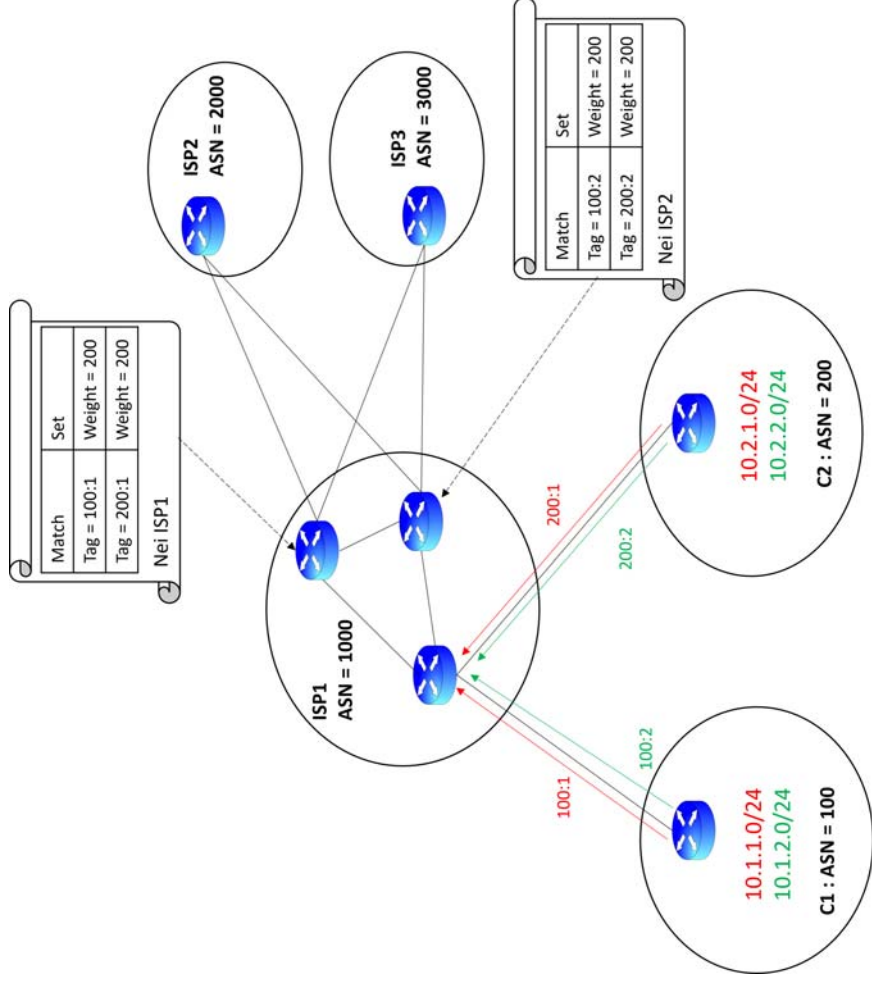
Communities

Basics

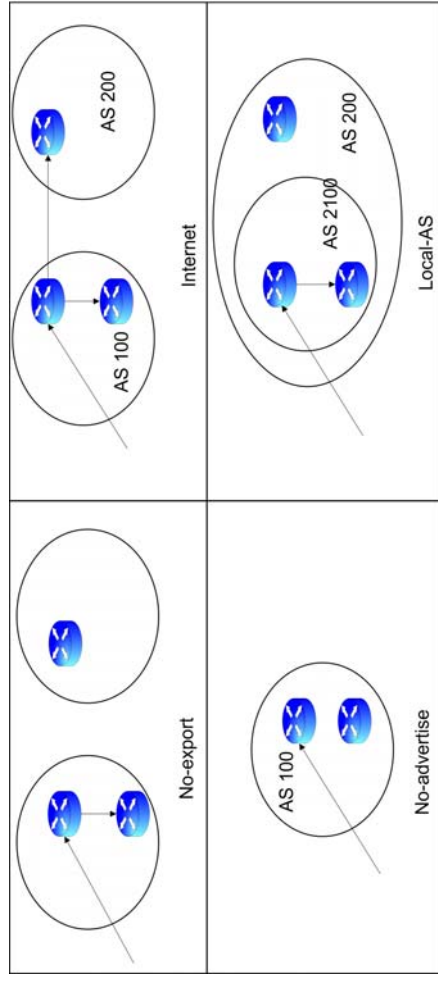
- It is a method of tagging a set of prefixes that share a common properties.
- Community is an optional transitive attribute
- It is used for tagging a route. When a BGP update carries an NLRI it also tags it with a community value, which the BGP routers along the paths uses to decide policies associated with the tag.
 - Path-manipulation (Determining exit paths).
 - Route-filtering etc.
- Any BGP router can tag a route at the time of receiving, sending or redistributing a route.
 - Path Manipulation is done by the upstream router and the downstream router will tag the advertisements.
- By default, communities are stripped in outgoing BGP updates. use **send-community** to tell the IOS to keep the communities info.

Assume the following situation, Customer 1 and 2 are connected with ISP1 which as two neighbours ISP 2 and 3. Now, ISP1 wants to steer all traffic of 10.1.1.1.0/24 and 10.2.1.1.0/24 routes from cust 1 and cust 2 respectively to ISP2 and 10.1.1.2.0/24 and 10.2.2.0/24 routes to ISP3. then the following will happen.

1. ISP will tell customer 1 and 2 to tag their respective route using BGP communities values.
2. The tags are transitive, thus they will reach the end points of ISP1
3. The end router will implement a community list to match community tags to choose the appropriate exit route using the weight attribute.



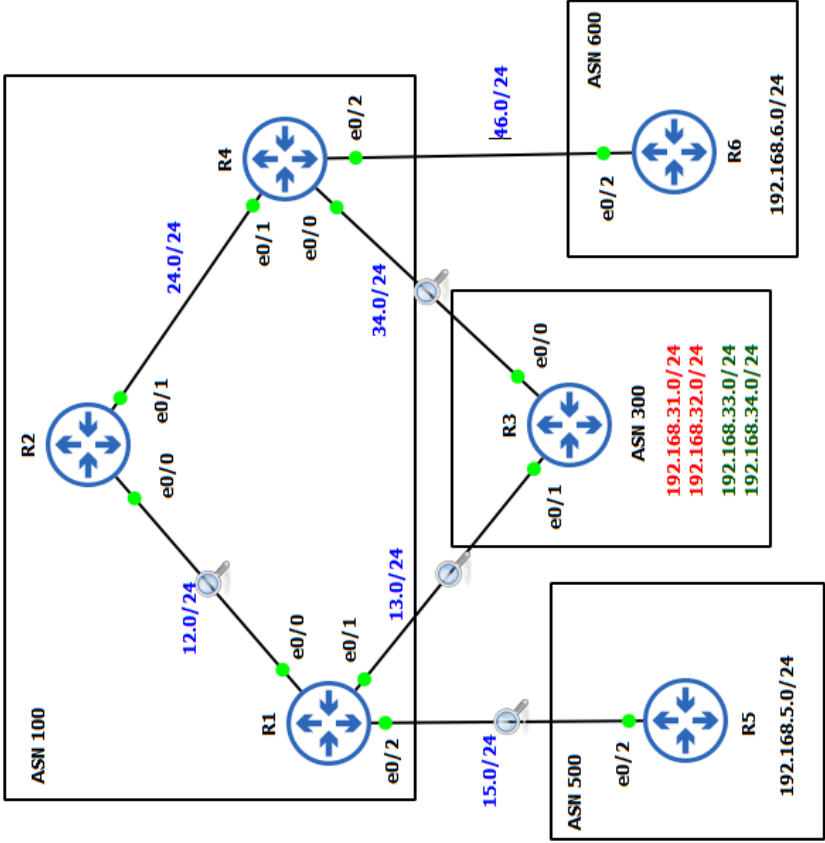
Types of Communities



- **Well Known** : Pre-defined in the BGP

- **no-export** : Does not get advertised to eBGP peers, kept in the local AS only. e.g. Routes from a customer is not advertised to another customer.
- **no-advertise** : Does not get advertised to any peers. e.g. When a customer sends routes the PE only.
- **internet** : Default tag value, routes are advertised to all neighbours.
- **local-as** : Does not get advertised outside Local-AS (Confederation)
- **Custom** : Defined by the user
 - 32 bits number. Old way (ASN:nn) 16+16 format.
 - By default the IOS internally stores the community values as the old format only. However to use the new format use the command **ip bgp community new-format** .

Base Topology Setup



r1

```
conf t
int e0/0
ip add 192.168.12.1 255.255.255.0
no sh
int e0/1
ip add 192.168.13.1 255.255.255.0
no sh
int e0/2
ip add 192.168.15.1 255.255.255.0
no sh
int l0
ip add 1.1.1.1 255.255.255.0

ip route 2.2.2.0 255.255.255.0 e0/0
ip route 3.3.3.0 255.255.255.0 e0/1
ip route 4.4.4.0 255.255.255.0 e0/0
ip route 5.5.5.0 255.255.255.0 e0/2

router bgp 100
bgp router-id 1.1.1.1

nei LOCAL peer-group
nei LOCAL remote-as 100
nei LOCAL update-source l0
nei LOCAL next-hop-self
nei LOCAL password Cisco123

nei REMOTE peer-group
nei REMOTE update-source l0
nei REMOTE ebgp-multi 2
nei REMOTE password Cisco123

nei 2.2.2.2 peer-group LOCAL
nei 4.4.4.4 peer-group LOCAL

nei 3.3.3.3 remote-as 300
nei 3.3.3.3 peer-group REMOTE

nei 5.5.5.5 remote-as 500
nei 5.5.5.5 peer-group REMOTE

net 192.168.12.0
net 192.168.13.0
net 192.168.15.0

exit
end
```

r2

```
conf t
int e0/0
ip add 192.168.12.2 255.255.255.0
no sh
int e0/1
ip add 192.168.24.2 255.255.255.0
no sh
int l0
ip add 2.2.2.2 255.255.255.0

ip route 1.1.1.0 255.255.255.0 e0/0
ip route 4.4.4.0 255.255.255.0 e0/1

router bgp 100
bgp router-id 2.2.2.2

nei LOCAL peer-group
nei LOCAL remote-as 100
nei LOCAL update-source l0
nei LOCAL next-hop-self
nei LOCAL password Cisco123

nei 1.1.1.1 peer-group LOCAL
nei 4.4.4.4 peer-group LOCAL

net 192.168.12.0
net 192.168.24.0

exit

end
```

r3

```
conf t
int e0/0
ip add 192.168.34.3 255.255.255.0
no sh
int e0/1
ip add 192.168.13.3 255.255.255.0
no sh
int l0
ip add 3.3.3.3 255.255.255.0

ip route 1.1.1.0 255.255.255.0 e0/1
ip route 4.4.4.0 255.255.255.0 e0/0

router bgp 300
bgp router-id 3.3.3.3

nei REMOTE peer-group
nei REMOTE update-source l0
nei REMOTE ebgp-multi 2
nei REMOTE password Cisco123

nei 1.1.1.1 remote-as 100
nei 1.1.1.1 peer-group REMOTE

nei 4.4.4.4 remote-as 100
nei 4.4.4.4 peer-group REMOTE

net 192.168.13.0
net 192.168.34.0

exit

end
```

r4

```
conf t
int e0/0
ip add 192.168.34.4 255.255.255.0
no sh
int e0/1
ip add 192.168.24.4 255.255.255.0
no sh
int e0/2
ip add 192.168.46.4 255.255.255.0
no sh
int l0
ip add 4.4.4.4 255.255.255.0

ip route 2.2.2.0 255.255.255.0 e0/1
ip route 3.3.3.0 255.255.255.0 e0/0
ip route 1.1.1.0 255.255.255.0 e0/1
ip route 6.6.6.0 255.255.255.0 e0/2

router bgp 100
bgp router-id 4.4.4.4

nei LOCAL peer-group
nei LOCAL remote-as 100
nei LOCAL update-source l0
nei LOCAL next-hop-self
nei LOCAL password Cisco123

nei REMOTE peer-group
nei REMOTE update-source l0
nei REMOTE ebgp-multi 2
nei REMOTE password Cisco123

nei 1.1.1.1 peer-group LOCAL
nei 2.2.2.2 peer-group LOCAL

nei 3.3.3.3 remote-as 300
nei 3.3.3.3 peer-group REMOTE

nei 6.6.6.6 remote-as 600
nei 6.6.6.6 peer-group REMOTE

net 192.168.24.0
net 192.168.34.0
net 192.168.46.0

exit
```

end

r5

```
conf t
int e0/2
ip add 192.168.15.5 255.255.255.0
no sh
int l0
ip add 5.5.5.5 255.255.255.0

ip route 1.1.1.0 255.255.255.0 e0/2

router bgp 500
bgp router-id 5.5.5.5

nei 1.1.1.1 remote-as 100
nei 1.1.1.1 update-source l0
nei 1.1.1.1 ebgp-multihop 2
nei 1.1.1.1 password Cisco123

net 192.168.15.0

exit

end

r6

conf t
int e0/2
ip add 192.168.46.6 255.255.255.0
no sh
int l0
ip add 6.6.6.6 255.255.255.0

ip route 4.4.4.0 255.255.255.0 e0/2

router bgp 600
bgp router-id 6.6.6.6

nei 4.4.4.4 remote-as 100
nei 4.4.4.4 update-source l0
nei 4.4.4.4 ebgp-multihop 2
nei 4.4.4.4 password Cisco123

net 192.168.46.0

exit

end
```

Task 1 : no-advertise community

1. Add an interface Loopback-1 with 192.168.5.0/24 at R5.
2. Advertise the network to its BGP neighbour only.

Solution

- the advertisement must not be advertise to R1 only, not to any of its neighbours, i.e. the community type is no_advertise
- the configuration can be done using either of two ways
 - R5 as outbound (preferred) or
 - R1 as inbound

R5

```
conf t
ip access stand ACL_COMM
 permit 192.168.5.0 0.0.0.255 !match the route
exit

route-map RM_COMM permit 10
 match ip address ACL_COMM
 set community no-advertise !set the community value
exit

router bgp
 net 1.1.1.1 send-community !activaye community
 nei 1.1.1.1 route-map RM_COMM out !apply outbound community tagging
exit

clear ip bgp * soft
```

Verification

- Packet capture

> Frame 46: 228 bytes on wire (1824 bits), 228 bytes captured (1824 bits) on interface -, id 0

> Ethernet II, Src: aa:bb:cc:00:05:20 (aa:bb:cc:00:05:20), Dst: aa:bb:cc:00:01:20 (aa:bb:cc:00:01:20)

> Internet Protocol Version 4, Src: 5.5.5.5, Dst: 1.1.1.1

> Transmission Control Protocol, Src Port: 179, Dst Port: 22807, Seq: 162, Ack: 253, Len: 154

> Border Gateway Protocol - UPDATE Message

> Border Gateway Protocol - UPDATE Message

> Border Gateway Protocol - UPDATE Message

> Border Gateway Protocol - UPDATE Message

Marker: ffffffff...

Length: 61

Type: UPDATE Message (2)

Withdrawn Routes Length: 0

Total Path Attribute Length: 34

> Path Attributes

> Path Attribute - ORIGIN: IGP

> Path Attribute - AS_PATH: 500

> Path Attribute - NEXT_HOP: 5.5.5.5

> Path Attribute - MULTI_EXIT_DISC: 0

> Path Attribute - COMMUNITIES: NO_ADVERTISE

> Flags: 0xc0, Optional, Transitive, Complete

Type Code: COMMUNITIES (8)

Length: 4

> Communities: NO_ADVERTISE

Community Well-known: NO_ADVERTISE (0xfffff02)

> Network Layer Reachability Information (NLRI)

> 192.168.5.0/24

- From R1 sh ip bgp 192.168.5.0

BGP routing table entry for 192.168.5.0/24, version 10

Paths: (1 available, best #1, table default, not advertised to any peer)

Not advertised to any peer

Refresh Epoch 2

500

5.5.5.5 from 5.5.5.5 (5.5.5.5)

Origin IGP, metric 0, localpref 100, valid, external, best

Community: no-advertise

rx pathid: 0, tx pathid: 0x0

- From R2 sh ip route bgp

B 192.168.13.0/24 [200/0] via 1.1.1.1, 00:25:34

B 192.168.15.0/24 [200/0] via 1.1.1.1, 00:25:30

B 192.168.34.0/24 [200/0] via 4.4.4.4, 00:24:30

B 192.168.46.0/24 [200/0] via 4.4.4.4, 00:24:29

Task 2: no-export community

- Add an intiface Loopback-1 with 192.168.6.1/24 at R6.
- Advertise the route to the local next AS (AS100) only

Solution

- Advertisement propagation is limited to ASN100
- R4 will advertise the routes to its iBGP peer but no ebgp peer.
- Community type = no-export

```
conf t
  access-list 5 permit 192.168.6.0 0.0.0.255
  route-map Rm_COMM permit 10
    match ip add 5
    set community no-export
  exit
router bgp
  net 192.168.6.0
  nei 4.4.4.4 send-community
  net 4.4.4.4 route-map RM_COMM out
exit
clear ip bgp * soft
```

Verification

1. BGP table entry from R4, sh ip bgp 192.168.6.0

BGP routing table entry for 192.168.6.0/24, version 14
Paths: (1 available, best #1, table default, not advertised to EBGp peer)
Advertised to update-groups:

```
1
600
Refresh Epoch 1
6.6.6.6 from 6.6.6.6 (6.6.6.6)
Origin IGP, metric 0, localpref 100, valid, external, best
Community: no-export
rx pathid: 0, tx pathid: 0x0
```

2. Routing table at R1, sh ip route bgp

```
B 192.168.5.0/24 [20/0] via 5.5.5.5, 00:26:24
B 192.168.6.0/24 [200/0] via 4.4.4.4, 00:00:21
B 192.168.24.0/24 [200/0] via 2.2.2.2, 00:38:20
B 192.168.34.0/24 [200/0] via 4.4.4.4, 00:37:46
B 192.168.46.0/24 [200/0] via 4.4.4.4, 00:37:45
```

3. BGP table at R3, the network 192.168.6.0 is advertised by R1 only, R4 is not advertising.

```
Network Next Hop Metric LocPrf Weight Path
*> 192.168.6.0 1.1.1.1 0 100 600 i
```

To solve the issue that R3 still gets the 192.168.6.0/24 routes, R4 can pass-on the community information to R1 that it receives from R6. You might need to the LOCAL peer group with net LOCAL send-community command. otherwise,

```
!r4
conf t
  router bgp 100
    nei 1.1.1.1 send-community
  end
  clear ip bgp * soft
```

Task 3: Custom community tagging

1. Add 4 new interfaces to R3 192.168.[30-33].0/24 .
2. R3 is multi-homed with ASN100 by R1 and R4. Configure R3 in a way, such that, 192.168.[30,31].0/24 are reachable from ISP-100 via R1 and 192.168.[32,33].0/24 are via R4.

solution

- Match network id, tag with community-id and Advertise communities to the eBGP peers.

network id community-tag	
192.168.30.0	300:10
192.168.31.0	
192.168.32.0	300:20
192.168.33.0	

- ISP routers will match the communities using community list
- Match the community list and

Community list	matches
10 permit 300:10	
20 permit 300:20	

- loca-pref above default(100) for appropriate community list at the corresponding routers

router	matching comm_list	set local pref
R1	10	200
	default	100
R2	20	200
	default	100

- Apply route map to nei R3

R3

```
conf t
ip access-list stand ACL_10
    permit 192.168.30.0 0.0.0.255
    permit 192.168.31.0 0.0.0.255
exit

ip access-list stand ACL_20
    permit 192.168.32.0 0.0.0.255
    permit 192.168.33.0 0.0.0.255
exit

route-map RM_COMM permit 10
    match ip address ACL_10
    set community 300:10
exit

route-map RM_COMM permit 20
    match ip address ACL_20
    set community 300:20
exit

ip bgp-community new-format !activate aa:nn format at IOS

router bgp 300
    ! apply policy to the REMOTE community
    nei REMOTE send-community
    net REMOTE route-map RM_COMM out
exit

end
clear ip bgp* soft
```

R1

```
conf t
ip bgp-community new-format

!create a Community-list to match tags
ip community-list 10 permit 300:10
ip community list 20 permit 300:20

!Set local_pref based on community list
route-map RM_LOCP permit 10
    match community 10 ! for 300:10
    set local-pref 200 ! set LP=200
exit

route-map RM_LOCP permit 20
    ! for rest use default (100)
exit

router bgp 100
    nei 3.3.3.3 route-map RM_LOCP in ! apply RM locally
exit

clear ip bgp * soft
```

R4

```
conf t
ip bgp-community new-format

!create a Community-list to match tags
ip community-list 10 permit 300:10
ip community list 20 permit 300:20

!Set local_pref based on community list
route-map RM_LOCP permit 10
    match community 20 ! for 300:20
    set local-pref 200 ! set LP=200
exit

route-map RM_LOCP permit 20
    ! for rest use default (100)
exit

router bgp 100
    nei 3.3.3.3 route-map RM_LOCP in ! apply RM locally
exit

end
clear ip bgp * soft
```

Verification

- 1. Packet capture

```
> Frame 8: 227 bytes on wire (1816 bits), 227 bytes captured (1816 bits) on interface --, id 0
> Ethernet II, Src: aa:bb:cc:00:03:00 (aa:bb:cc:00:03:00), Dst: aa:bb:cc:00:04:00 (aa:bb:cc:00:04:00)
> Internet Protocol Version 4, Src: 3.3.3.3, Dst: 4.4.4.4
> Transmission Control Protocol, Src Port: 179, Dst Port: 179, Seq: 43, Ack: 1, Len: 153
> Border Gateway Protocol - UPDATE Message
  Marker: ffffffff
  Length: 65
  Type: UPDATE Message (2)
  Withdrawn Routes Length: 0
  Total Path Attribute Length: 34
  > Path Attributes
    > Path Attribute - ORIGIN: IGP
    > Path Attribute - AS_PATH: 300
    > Path Attribute - NEXT_HOP: 3.3.3.3
    > Path Attribute - MULTI_EXIT_DISC: 0
    > Path Attribute - COMMUNITIES: 300:20
  > Network Layer Reachability Information (NLRI)
    > 192.168.32.0/24
    > 192.168.33.0/24
  > Border Gateway Protocol - UPDATE Message
  Marker: ffffffff
  Length: 65
  Type: UPDATE Message (2)
  Withdrawn Routes Length: 0
  Total Path Attribute Length: 34
  > Path Attributes
    > Path Attribute - ORIGIN: IGP
    > Path Attribute - AS_PATH: 300
    > Path Attribute - NEXT_HOP: 3.3.3.3
    > Path Attribute - MULTI_EXIT_DISC: 0
    > Path Attribute - COMMUNITIES: 300:10
  > Network Layer Reachability Information (NLRI)
    > 192.168.30.0/24
    > 192.168.31.0/24
  > Border Gateway Protocol - ROUTE-REFRESH Message
```

2. BGP table from R1, sh ip bgp

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 192.168.5.0	5.5.5.5	0	0	500	i
*>i 192.168.6.0	4.4.4.4	0	100	0	600 i
* i 192.168.12.0	2.2.2.2	0	100	0	i
*>	0.0.0.0	0		32768	i
*> 192.168.13.0	0.0.0.0	0		32768	i
*> 192.168.15.0	0.0.0.0	0		32768	i
* i 192.168.24.0	4.4.4.4	0	100	0	i
*>i	2.2.2.2	0	100	0	i
*> 192.168.30.0	3.3.3.3	0	200	0	300 i
*> 192.168.31.0	3.3.3.3	0	200	0	300 i
*> 192.168.32.0	3.3.3.3	0		0	300 i
*> 192.168.33.0	3.3.3.3	0		0	300 i
*>i 192.168.34.0	4.4.4.4	0	100	0	i
*>i 192.168.46.0	4.4.4.4	0	100	0	i

2. BGP table from R3, sh ip bgp

```
*> 192.168.6.0 6.6.6.6 0 0 600 i
* i 192.168.12.0 2.2.2.2 0 100 0 i
*>i 1.1.1.1 0 100 0 i
*>i 192.168.13.0 1.1.1.1 0 100 0 i
*> 192.168.15.0 1.1.1.1 0 100 0 i
*> 192.168.24.0 0.0.0.0 0 32768 i
* i 2.2.2.2 0 100 0 i
* 192.168.30.0 3.3.3.3 0 0 300 i
*>i 1.1.1.1 0 200 0 300 i
* 192.168.31.0 3.3.3.3 0 0 300 i
*>i 1.1.1.1 0 200 0 300 i
*> 192.168.32.0 3.3.3.3 0 200 0 300 i
*> 192.168.33.0 3.3.3.3 0 200 0 300 i
*> 192.168.34.0 0.0.0.0 0 32768 i
*> 192.168.46.0 0.0.0.0 0 32768 i
```

3. Verigy community tags from R1/R4 sh ip bgp {NET} | in Community

```
R4#sh ip bgp 192.168.30.0 | in Community
Community: 300:10
R4#sh ip bgp 192.168.31.0 | in Community
Community: 300:10
R4#sh ip bgp 192.168.32.0 | in Community
Community: 300:20
R4#sh ip bgp 192.168.33.0 | in Community
Community: 300:20
```

4. Verify path when ping 192.168.[30-33].0/24 from R6


```
R6#trace 192.168.30.1
Type escape sequence to abort.
Tracing the route to 192.168.30.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.46.4 0 msec 0 msec 0 msec
 2 192.168.24.2 [AS 100] 1 msec 1 msec 1 msec
 3 192.168.12.1 [AS 100] 1 msec 0 msec 1 msec
 4 192.168.13.3 [AS 100] 2 msec 1 msec 1 msec
```

```
R6#trace 192.168.31.1
Type escape sequence to abort.
Tracing the route to 192.168.31.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.46.4 1 msec 1 msec 0 msec
 2 192.168.24.2 [AS 100] 1 msec 1 msec 1 msec
 3 192.168.12.1 [AS 100] 1 msec 1 msec 1 msec
 4 192.168.13.3 [AS 100] 1 msec 1 msec 1 msec
```

```
R6#trace 192.168.32.1
Type escape sequence to abort.
Tracing the route to 192.168.32.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.46.4 0 msec 0 msec 0 msec
 2 192.168.34.3 [AS 100] 1 msec 1 msec 1 msec
```

```
R6#trace 192.168.33.1
Type escape sequence to abort.
Tracing the route to 192.168.33.1
VRF info: (vrf in name/id, vrf out name/id)
 1 192.168.46.4 0 msec 1 msec 0 msec
 2 192.168.34.3 [AS 100] 2 msec 1 msec 1 msec
```