

## Module 7 – BGP Route Reflector Lab

**Objective:** To implement BGP route reflectors as an alternative to fully-meshed iBGP.

**Prerequisites:** Module 1, the Scaling BGP presentation and Modules 5 & 6 (optional)

Topology:

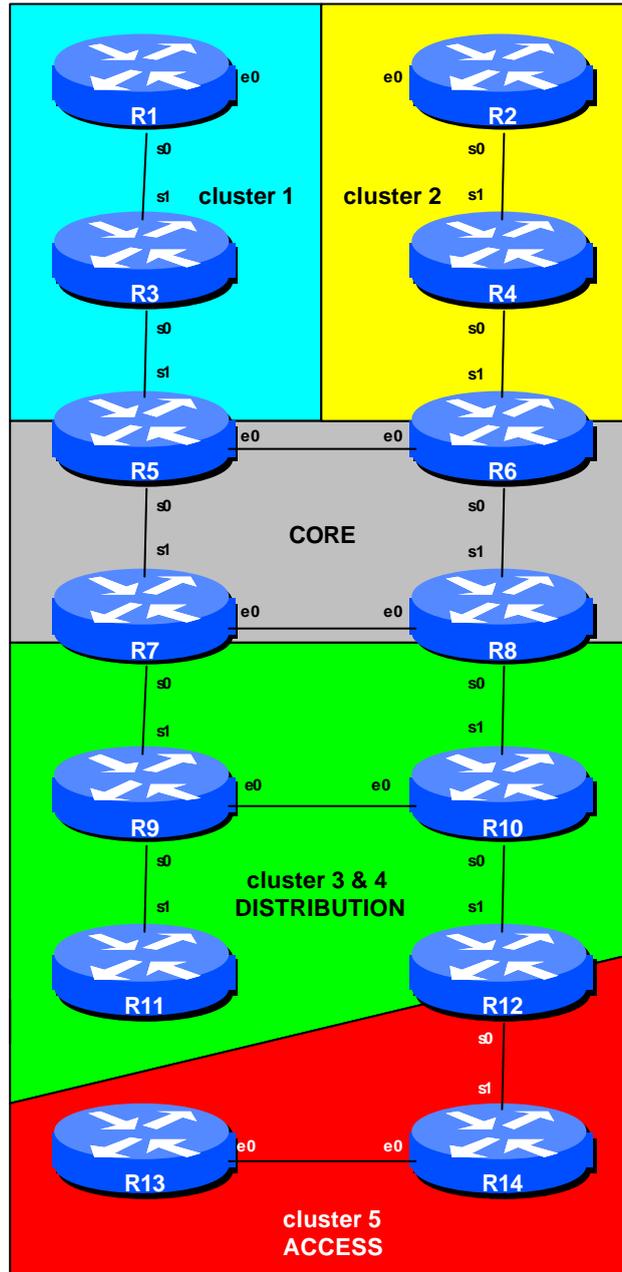


Figure 1 – Route Reflector Clusters

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## Lab Notes

A pre-requisite for this Module is the Advanced OSPF Module which includes a description of OSPF areas. The design of this route-reflector network assumes the network layout and configuration used in the Advanced OSPF Module. While it will work without the OSPF area configuration, this is a good exercise in explaining by example how many ISPs overlay route reflectors on their IGP.

Before starting, decide which routers in the network will represent the core network, and which will represent other portions of the backbone. The example given in Figure 1 allows the student to study the best combination of route reflector clusters.

Routers 5 to 8 represent the “core network” and are all route reflectors running a fully meshed iBGP. In a typical ISP backbone, these routers would carry all the routes known in the ISPs network, and possibly all the Internet routes too. Routers 1, 3 and 5 represent a cluster – say the “distribution network”, carrying out the function of aggregating customer connections. Routers 2, 4 and 6 form another cluster. Routers 7 through 12 form a pair of overlapping clusters representing a “distribution network”. And finally, Routers 12, 13 and 14 represent an “access network”.

Note that 9 to 12 are clients of the Routers 7 and 8 route reflectors in the core network. Likewise Router 5 is a route reflector for the cluster containing Routers 1, 3 and 5. Router 6 is a route reflector for the cluster containing Routers 2, 4 and 6. And Router 12 is a route reflector for the cluster containing Routers 12, 13 and 14. Note that it is quite possible and sometimes advantageous to set up **nested route-reflector clusters**.

## Lab Exercise

1. **Reset the configuration** so that all routers are in the same AS (AS100 is used in this example). Also all routers should use the same OSPF process ID (100) and should be as configured in the Advanced OSPF Module.
2. **Tidy up the OSPF NSSA configuration.** BGP requires the neighbour addresses to be explicitly in the IGP before it will establish a relationship with the neighbouring router. So for those parts of the network which are in an OSPF NSSA (as configured in the OSPF module), iBGP will not be established. The following commands are required to remedy this (example is for Router5).

```
Router5(config-router)#router ospf 100
Router5(config-router)#no area 10 nssa no-redirect default-info no-summary
Router5(config-router)#area 10 nssa
```

**Checkpoint #1:** Call the lab assistant and show the router configuration and connectivity. If continuing from the Advanced OSPF module, the configuration and connectivity should be unchanged.

3. **Set the lab network's autonomous system number.** It is good practice whenever setting up BGP on a router to include the **autonomous-system** directive. Each router team should enter the configuration command:

```
Router(config)# autonomous-system 100
```

to signify the fact that this network is entirely in AS100.

4. **Configure full mesh iBGP in the core network.** The core router should be a route reflector for the distribution router in the same cluster. Core routers should have a fully meshed iBGP among themselves. The routers in a cluster do not require fully meshed iBGP among themselves – they should only peer with the route reflector.

**Example for Router 5 using peer groups (recommended):**

```
router bgp 100
  no synchronization
  network 210.210.8.0 mask 255.255.252.0
  neighbor CORE-IBGP peer-group
  neighbor CORE-IBGP description iBGP for the CORE routers
  neighbor CORE-IBGP remote-as 100
  neighbor CORE-IBGP update-source loopback0
  neighbor 210.210.19.224 peer-group CORE-IBGP      ! iBGP with Router 6
  neighbor 210.210.35.224 peer-group CORE-IBGP     ! iBGP with Router 7
  neighbor 220.220.7.224 peer-group CORE-IBGP     ! iBGP with Router 8
  . . .
```

5. **Configuring route-reflector-client peers:** On the routers that will be router-reflectors (Routers 5, 6, 7, 8 and 12), configure peers inside the cluster as **route-reflector-clients**. Each router team should announce the /22 network which has been assigned to them.

**Example for Router 5 using peer groups (recommended):**

```
router bgp 100
  no synchronization
  network 210.210.8.0 mask 255.255.252.0
  neighbor RR-CLIENT peer-group
  neighbor RR-CLIENT remote-as 100
  neighbor RR-CLIENT description iBGP route reflector client configuration
```

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```
neighbor RR-CLIENT update-source loopback0
neighbor RR-CLIENT route-reflector-client
neighbor 200.200.7.224 peer-group RR-CLIENT      ! ibgp with Router 1
neighbor 200.200.19.224 peer-group RR-CLIENT    ! ibgp with Router 3
. . .
```

Note that the clients don't require an iBGP peering between each other – the route reflector announces one client's network to another client.

**NOTE:** If a full-mesh amongst clients is required (usually due to operational conditions), then the router requires the *no bgp-client-to-client reflection* bgp command to be configured.

**Q.** What does the *no bgp client-to-client reflection* bgp command do?

**A.** By default, a router reflector will reflect all routes it hears to its clients, even the routes it hears from its clients. This command turns off the functionality so that the route reflectors don't announce client routes back to the members of the cluster.

- 6. Route-reflector clients should configure iBGP peering** to all the router reflectors inside the cluster. Note that Routers 9 to 12 are in two overlapping clusters which have two connections to the core network. So each cluster client should have an iBGP peering configured with the two core routers in the cluster.

**Example for Router 9 using peer groups (recommended):**

```
router bgp 100
no synchronization
network 220.220.8.0 mask 255.255.252.0
neighbor RR peer-group
neighbor RR remote-as 100
neighbor RR description iBGP configuration for RR clients
neighbor RR update-source loopback0
neighbor 210.210.35.224 peer-group RR
neighbor 220.220.7.224 peer-group RR
. . .
```

- 7. Nested Clusters.** Notice that Router 12 is a route reflector for cluster 5, but is a client in clusters 3 and 4. It will have iBGP peerings with Router 7 and 8 as part of cluster 30, and will have iBGP peerings with Router 13 and 14 as a route reflector in cluster 5.
- 8.** Use *'show ip bgp <address>'* to see how reflected prefixes show up on the clients. How do you explain the path choices which you see?

**Checkpoint #2:** *Call the lab instructors and show the function of your router. You should have peerings with all the routers in your cluster, and any peers/clients. You should also demonstrate the output from “show ip route” so that you can see which routes you are hearing from which routers.*

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## **CONFIGURATION NOTES**

Documentation is critical! You should record the configuration at each *Checkpoint*, as well as the configuration at the end of the module.