



Student notes for

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Packet Tracer
Labs Course



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Remember: You will probably learn more by making notes like these and sharing them for the benefit of others.

All the best!

David Bombal

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Brief

This lab is for configuring BGP for multiple AS and having full connectivity meaning represented external networks on R1 are accessible for R4 this will be the loopbacks 1.1.1.1 and 4.4.4.4 and R2/R3's loopbacks.

Lab requirements

Configure the network as follows:

Lab: OSPF Single Area

1. Configure BGP on R1 in a single AS
 - a. Use AS 65001
 - b. Distribute all networks
2. Configure BGP on R2 in a single AS
 - a. Use AS 65002
 - b. Distribute all networks
3. Configure BGP on R3
 - a. Use AS 65003
 - b. Distribute all networks
4. Configure BGP on R4
 - a. Use AS 65004
 - b. Distribute all networks

BGP (Border Gateway Protocol)

Key Points

- BGP is a distance vector routing protocol
- BGP Routes use an administrative distance of 20
- BGP Routes come up as B
- BGP is a TCP based protocol using port 179
 - IBGP when BGP is running between one Autonomous System
 - EBGP when BGP is running between two Autonomous System's
 - BGP relies on IGP protocols for its reachability and connectivity

BGP Attributes

Mandatory: All BGP update messages to peers includes these in advertisements.

Discretionary: These may not be sent in all updates depending on the configuration.

Transitive: The transitive flag identifies if BGP should accept and advertise attributes even if not supported it is still accepted and sent in update messages.

Optional: If the transitive flag is not set then BGP can ignore the attributes and not advertise them.

1. **Weight and Local Preference** – Outgoing traffic → Inbound direction
2. **AS Path and Med** incoming traffic → Outbound direction
3. **Fake-AS (hide as)**– This is used to spoof BGP AS number for security between EBGP sessions.

Local Preference

When two ISP's are connected to 2 different routers

- by default, LP is 100

BGP Route Selection Rules

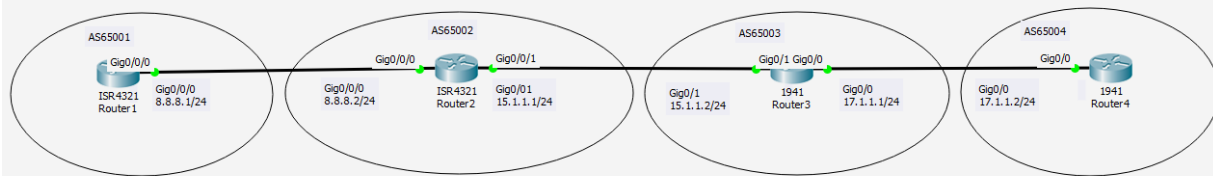
- Weight
- Local preference
- AS path
- Next hop self
- MED

BGP states

1. **Idle** – Waiting for a state event that will reset a ConnectRetry timer and then begin forming a connection with a BGP neighbor via TCP.
2. **Connect** – The TCP three-way handshake is in progress.
3. **Active** – When the TCP handshake is complete moving into the opensent state.

4. **OpenSent** – Waiting for an open message that will be checked for errors and the correct AS number. If successful keepalive messages start being sent.
5. **OpenConfirm** – When keepalive messages are received from a remote BGP neighbor moving into the established state.
6. **Established** – Completed BGP Neighbor adjacency

Lab Topology



Here we have four routers that we will configure to advertise their networks with OSPF AS 1 in a single area.

Configurations and Verification

BGP

Router1

!

```
R1(config)#router bgp 65001
R1(config-router)#neighbor 8.8.8.2 remote-as 65002
R1(config-router)#network 8.8.8.0 mask 255.255.255.0
R1(config-router)#network 1.1.1.1 mask 255.255.255.255
!
```

Router2

!

```
R2(config)#router bgp 65002
R2(config-router)#neighbor 8.8.8.1 remote-as 65001
R2(config-router)#network 8.8.8.0 mask 255.255.255.0
R2(config-router)#network 15.1.1.0 mask 255.255.255.0
R2(config-router)#network 2.2.2.2 mask 255.255.255.255
R2(config-router)#neighbor 15.1.1.2 remote-as 65003
!
```

Router3

!

```
R2(config)#router bgp 65003
R2(config-router)#neighbor 15.1.1.1 remote-as 65002
R2(config-router)#network 15.1.1.0 mask 255.255.255.0
R2(config-router)#network 17.1.1.0 mask 255.255.255.0
R2(config-router)#network 3.3.3.3 mask 255.255.255.255
R2(config-router)#neighbor 17.1.1.2 remote-as 65004
```

```

!
Router4
!
R1(config)#router bgp 65004
R1(config-router)#neighbor 17.1.1.1 remote-as 65003
R1(config-router)#network 17.1.1.0 mask 255.255.255.0
R1(config-router)#network 4.4.4.4 mask 255.255.255.255
!

```

Verification commands and outputs

R4#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, **B - BGP**
 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
 E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
 i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
 * - candidate default, U - per-user static route, o - ODR
 P - periodic downloaded static route

Gateway of last resort is not set

```

1.0.0.0/32 is subnetted, 1 subnets
B 1.1.1.1/32 [20/0] via 17.1.1.1, 00:00:00
2.0.0.0/32 is subnetted, 1 subnets
B 2.2.2.2/32 [20/0] via 17.1.1.1, 00:00:00
3.0.0.0/32 is subnetted, 1 subnets
B 3.3.3.3/32 [20/0] via 17.1.1.1, 00:00:00
4.0.0.0/32 is subnetted, 1 subnets
C 4.4.4.4/32 is directly connected, Loopback0
8.0.0.0/24 is subnetted, 1 subnets
B 8.8.8.0/24 [20/0] via 17.1.1.1, 00:00:00
15.0.0.0/24 is subnetted, 1 subnets
B 15.1.1.0/24 [20/0] via 17.1.1.1, 00:00:00
17.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 17.1.1.0/24 is directly connected, GigabitEthernet0/0
L 17.1.1.2/32 is directly connected, GigabitEthernet0/0

```

R1#show ip protocols

```

Routing Protocol is "bgp 65001"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
IGP synchronization is disabled
Automatic route summarization is disabled
Neighbor(s):
Address FiltInFiltOutDistInDistOut Weight RouteMap
8.8.8.2
Maximum path: 1
Routing Information Sources:
Gateway Distance Last Update
8.8.8.2 20 00:00:00
Distance: external 20 internal 200 local 200

```

R1#show ipbgp summary

```

BGP router identifier 1.1.1.1, local AS number 65001
BGP table version is 9, main routing table version 6
8 network entries using 1056 bytes of memory
8 path entries using 416 bytes of memory

```

```
6/5 BGP path/bestpath attribute entries using 1012 bytes of memory
4 BGP AS-PATH entries using 96 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 1) using 32 bytes of memory
BGP using 2612 total bytes of memory
BGP activity 7/0 prefixes, 8/0 paths, scan interval 60 secs

Neighbor V AS MsgRcvdMsgSentTblVerInQOutQ Up/Down State/PfxRcd
8.8.8.2 4 65002 28 21 9 0 0 00:19:23 4

R1#traceroute 4.4.4.4
Type escape sequence to abort.
Tracing the route to 4.4.4.4

 1 8.8.8.2 1 msec 0 msec 0 msec
 2 15.1.1.2 0 msec 0 msec 0 msec
 3 17.1.1.2 0 msec 0 msec 0 msec
```

Extra Examples and Resources

Cisco BGP

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus6000/sw/unicast/6_x/cisco_n6k_layer3_ucast_cfg_rel_602_N2_1/13_bgp.html

http://docwiki.cisco.com/wiki/Border_Gateway_Protocol