
# Border Gateway Protocol (BGP) Background:

BGP is the routing protocol that is used to route traffic over the internet. It is a very large and complex protocol that has lots of customizability for those that implement it. BGP is mainly used by ISPs and very large companies that connect directly to the internet. Rarely will you see BGP being used inside a small to medium sized network.

BGP is unique in that it uses Autonomous System (AS) numbers for peering between routers. An AS number is used to summarize a group of IP address into a single “area”. For example, RIT has registered AS number 4385 and we own the IP address space of 129.21.X.X. So if you were in California and wanted to route traffic to RIT, the routers running BGP would see the 129.21.X.X address in their routing table corresponds to AS number 4385. It would then find the shortest and fastest path to reach AS number 4385. That path will be through other autonomous systems, think of it as AS hop count.

Another interesting aspect of BGP is that router peering is not automatic like it is with OSPF and EIGRP that use multicast. With BGP, you must initiate a connection from both sides, meaning that router A must be setup to peer with router B and router B must be setup to peer with router A. This configuration, and establishing the connection between two different autonomous systems is called peering. For example, RIT (AS 4385) is currently peered with Level 3 (AS 3356), Cogent (AS 174), TW Telecom (AS 4323), and NYSERnet (AS 3754). That means that the RIT edge routers have been configured to connect to those AS numbers. By doing so, they receive all the routes that Level 3 and Cogent’s routers know about. So, RIT has routing tables out to the internet and knows how to reach all the different autonomous systems. Additionally, because RIT is peered with these ISPs, they share RIT’s AS information to the internet so everyone else knows how to reach RIT’s AS.

To see a cool 3D visualization of BGP peers, check out this site: http://as2914.net/.

# Lab Notes:

**NOTE:** It is *very important* that you follow all the routers, ports, IP addresses and AS numbers that are on the diagram. Because we are all interconnected in this lab, one mistake could cause a routing loop or error.
**NOTE:** You will not need to do any configuration on the router labeled central, this will be done for you.
**NOTE:** Use the '?' in the console when you need to know how to format a command.
**NOTE:** When using ping to test connectivity, only ping the router's loopback addresses.

# BGP Lab Instructions & Questions:

1. Using the three computers, plug each computer into the console port of the routers so you can configure all 3 routers at once.

2. Using the 'hostname [NAME]' command, label each router with the corresponding router letter so it is easy to tell what router you are configuring.

3. Connect routers B and C and configure the interfaces and loopbacks shown in the diagram. Ensure they can ping one another on their interface IP's.

4. Connect routers A and B and configure the interfaces and loopbacks shown in the diagram. Ensure that they can ping one another on their interface IP's. Can router A ping router C? Explain why or why not. How can you prove it?

5. Enable BGP on router C, advertise router C's loopback network and configure router C to accept router B as a neighbor.

6. Enable BGP on router B, advertise router B's loopback network and configure router B to accept router C as a neighbor. Check the routing table on both routers to ensure the BGP peer is up. What do you see in the BGP routing table? How is it different from the 'show ip route' routing table? Can you see the path your router takes to reach each different network?

7. Using the 'ping [IP ADDRESS] interface loopback 0' command ping between router B and C's loopback addresses.

8. Configure router B to accept router A as a neighbor.

9. Enable BGP on router A, advertise router A's loopback network and configure router A to accept router B as a neighbor. Check the routing table on both routers to ensure the BGP peer is up.

10. At this point, you should be able to ping between all three of the router's loopback addresses. You will need to use the command 'ping [IP ADDRESS] interface loopback 0' for this to work properly.

11. Take a look at the BGP routing table on router C. Do you notice anything different after you connected to central?

12. Configure router A to accept central as a neighbor.

13. Try pinging one of the other pods loopback addresses you see in the routing table. Remember to ping using the loopback as the source.

14. Try running 'traceroute [IP ADDRESS] source loopback 0'.

## Hartpence Appendix

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