eBGP and iBGP

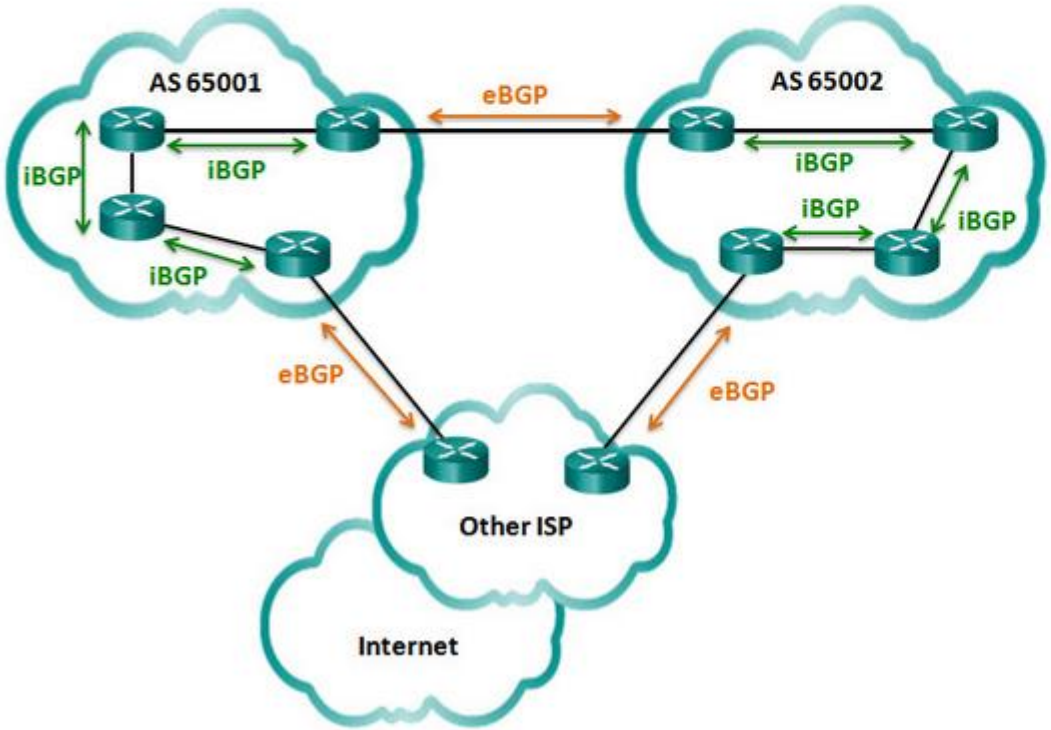
Two routers exchanging BGP routing information are known as BGP peers. As shown in Figure 1, there are two types of BGP:

- **External BGP (eBGP)** – External BGP is the routing protocol used between routers in different autonomous systems.
- **Internal BGP (iBGP)** - Internal BGP is the routing protocol used between routers in the same AS.

This course focuses on eBGP only.

Note: There are some differences in how BGP operates depending on whether the two routers are eBGP peers or iBGP peers. However, these differences are beyond the scope of this course.

Figure 1: eBGP versus iBGP

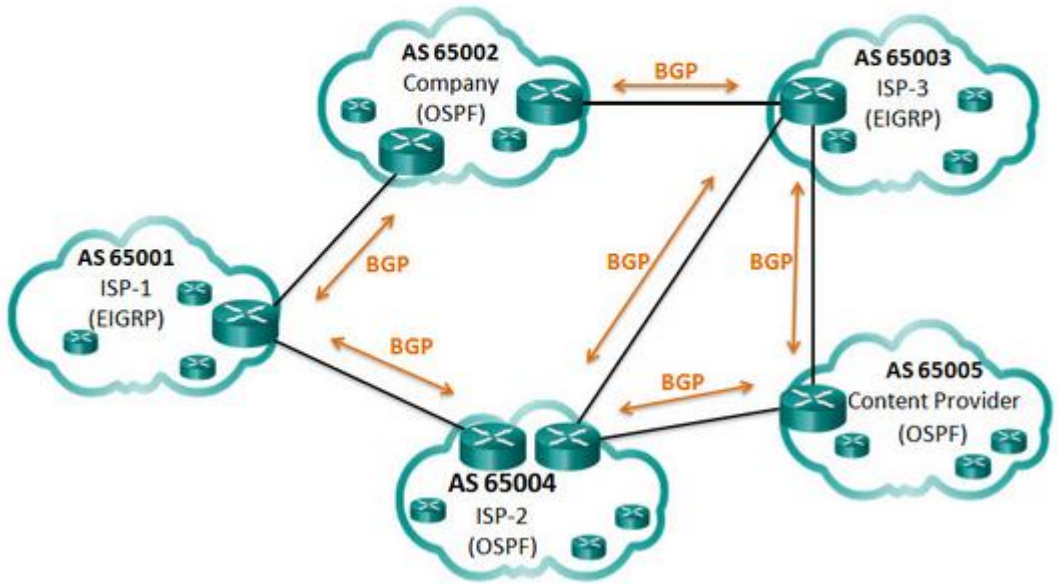


When to use BGP

The use of BGP is most appropriate when an AS has connections to multiple autonomous systems. This is known as multi-homed. Each AS in Figure 1 is multi-homed because each AS has connections to at least two other autonomous systems or BGP peers.

Before running BGP, it is important that the network administrator has a good understanding of BGP. A misconfiguration of a BGP router could have negative effects throughout the entire Internet.

Figure 1: Multi-homed AS Topology



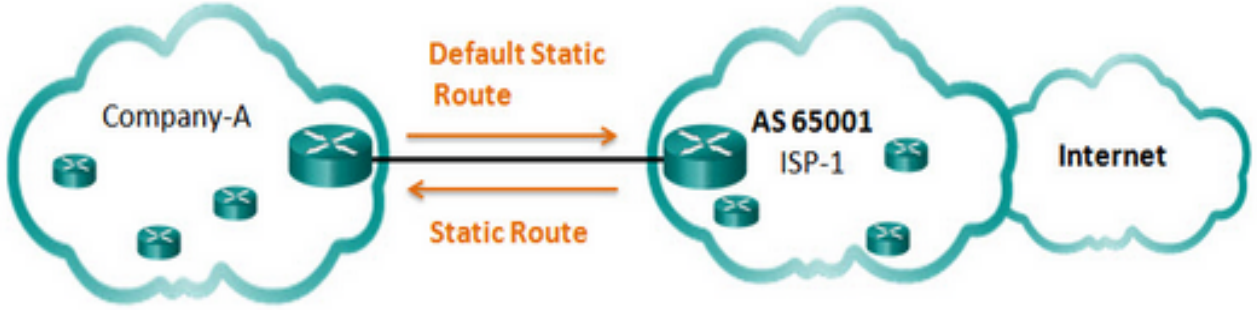
When not to use BGP

BGP should not be used when at least one of the following conditions exist:

- There is a single connection to the Internet or another AS. This is known as single-homed. In this case, Company-A may run an IGP with the ISP or, Company-A and the ISP will each use static routes, as shown in Figure 1. Although it is recommended only in unusual situations, for the purposes of this course, you will configure single-homed BGP.
- When there is a limited understanding of BGP. A misconfiguration of a BGP router can have far reaching affects beyond the local AS, negatively impacting routers throughout the Internet.

Note: There are some single-homed situations where BGP may be appropriate, such as the need for a specific routing policy. However, routing policies are beyond the scope of this course.

Figure 1: Single-homed Topology

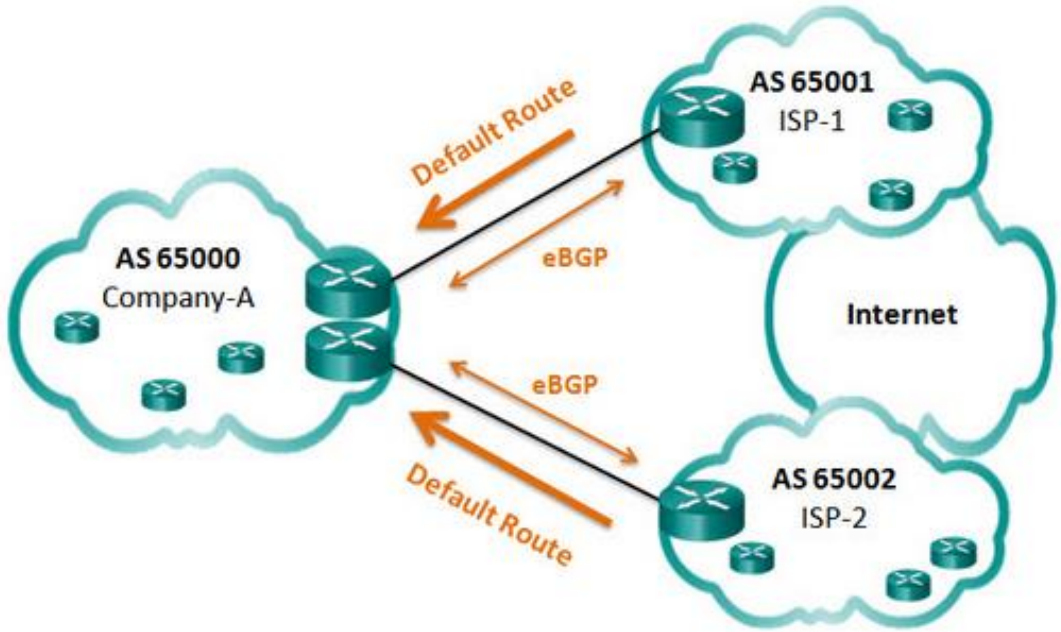


BGB Options

Default Route Only

ISPs advertise a default route to Company-A, as shown in Figure 1. The arrows indicate that the default is configured on the ISPs, not on the Company-A. This is the simplest method to implement BGP. However, because the company only receives a default route from both ISPs, sub-optimal routing may occur. For example, Company-A may choose to use ISP-1's default route when sending packets to a destination network in ISP-2's AS.

Figure 1: Default Route Only

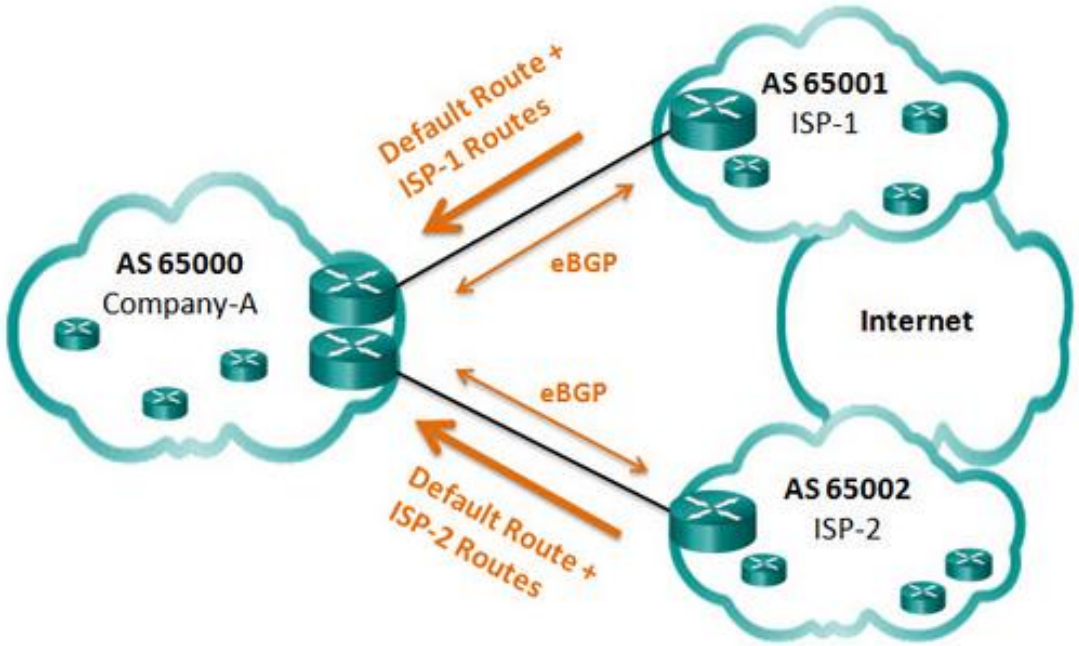


BGB Options

Default Route and ISP Routes

ISPs advertise their default route and their network to Company-A, as shown in Figure 2. This option allows Company-A to forward traffic to the appropriate ISP for networks advertised by that ISP. For example, Company-A would choose ISP-1 for networks advertised by ISP-1. For all other networks, one of the two default routes can be used, which means sub-optimal routing may still occur for all other Internet routes.

Figure 2: Default Route and ISP Routes

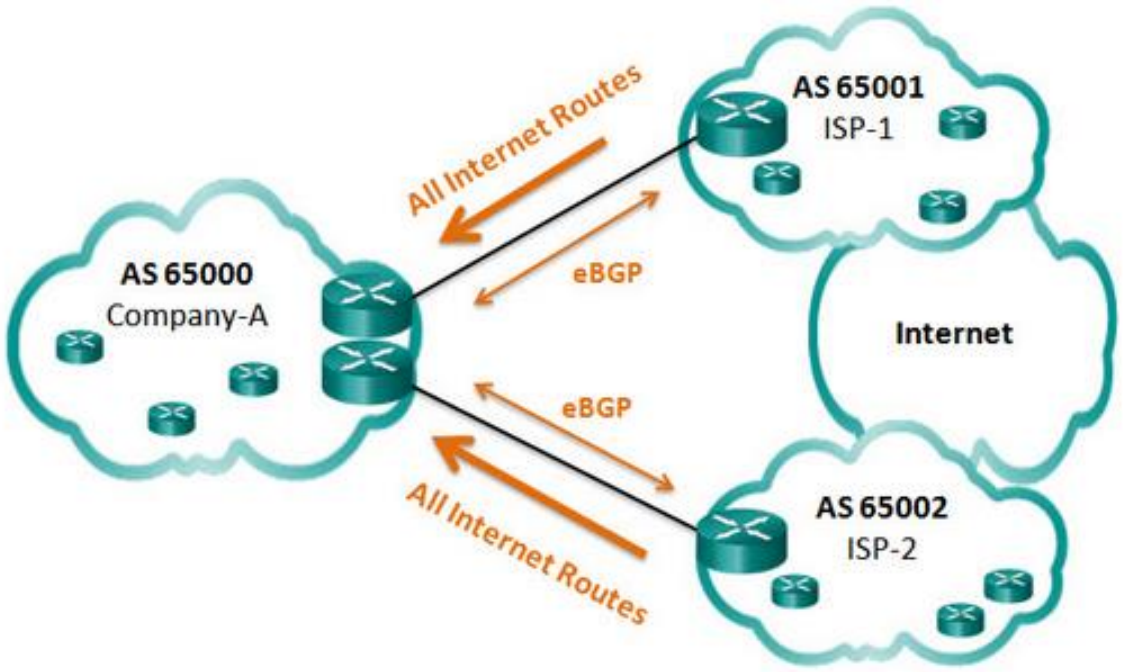


BGB Options

All Internet Routes

ISPs advertise all Internet routes to Company-A, as shown in Figure 3. Because Company-A receives all Internet routes from both ISPs, Company-A can determine which ISP to use as the best path to forward traffic for any network. Although this solves the issue of sub-optimal routing, the Company-A's BGP router must contain all Internet routes, which would currently include routes to over 550,000 networks.

Figure 3: All Internet Routes



Steps to Configure eBGP

To implement eBGP for this course, you will need to complete the following tasks:

Step 1: Enable BGP routing.

Step 2: Configure BGP neighbor(s) (peering).

Step 3: Advertise network(s) originating from this AS.

Table 1 lists the command syntax and a description for basic eBGP configuration.

Table 1: BGP Configuration Commands

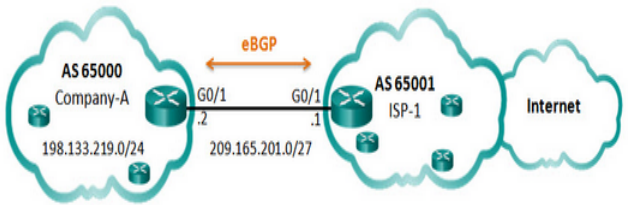
Command	Description
`Router(config)# router bgp as-number`	Enables a BGP routing process, and places the router in router configuration mode.
`Router(config-router)# neighbor ip-address remote-as as-number`	Specifies a BGP neighbor. The *as-number* is the neighbor's AS number.
`Router(config-router)# network network-address [mask network-mask]`	Advertises a network address to an eBGP neighbor as being originated by this AS. The *network-mask* is the subnet mask of the network.

Configurations

Figure 1 shows a single-homed BGP topology. Using eBGP, Company-A in AS 65000 will advertise its 198.133.219.0/24 network to ISP-1 at AS 65001. ISP-1 will advertise a default route in its eBGP updates to Company-A.

Note: BGP is usually not necessary in single-homed AS. It is used here to provide a simple configuration example.

Figure 1: eBGP Configuration Topology



Example 1 shows the BGP configuration for Company-A. Customers will typically use private IPv4 address space for internal devices within their own network. Using NAT, the Company-A router would then translate these private IPv4 addresses to one of its public IPv4 addresses, advertised by BGP to the ISP.

Example 1: eBGP Configuration for Company-A

```
Company-A(config)# router bgp 65000

Company-A(config-router)# neighbor 209.165.201.1 remote-as 65001

Company-A(config-router)# network 198.133.219.0 mask 255.255.255.0
```

The **router bgp** command enables BGP and identifies the AS number for Company-A. A router can belong to only a single AS, so only a single BGP process can run on a router.

The **neighbor** command identifies the BGP peer and its AS number. Notice that the ISP AS number is different than the Company-A AS number. This informs the BGP process that the neighbor is in a different AS and is therefore, an external BGP neighbor.

The **mask** option must be used when the network being advertised is different than its classful equivalent. In this example, the 198.133.219.0/24 is equivalent to a class C network. Class C networks have a /24 subnet mask, so in this case the **mask** option is not required. If Customer-A was advertising the 198.133.0.0/16 network, then the **mask** option would be required. Otherwise BGP would advertise the network with a /24 classful mask.

The **network** command enters the *network-address* into the local BGP table. The BGP table contains all routes learned via BGP or advertised using BGP. eBGP will then advertise the *network-address* to its eBGP neighbors.

Note: In contrast to an IGP protocol, the *network-address* used in the **network** command does not have to be a directly connected network. The router only needs to have a route to this network in its routing table.

Example 2: eBGP Configuration on ISP-1

```
ISP-1(config)# router bgp 65001

ISP-1(config-router)# neighbor 209.165.201.2 remote-as 65000

ISP-1(config-router)# network 0.0.0.0
```

The eBGP commands on the ISP-1 router are similar to the configuration on Company-A. Notice how the **network 0.0.0.0** command is used to advertise a default network to Company-A.