Troubleshooting BGP

Interaction Between the Data Structures of a BGP and an IP Routing Table

Component of Routing Process	Description
Incoming Route Information	A BGP router receives BGP updates from a BGP neighbor. Unlike OSPF and EIGRP neighbors, BGP neighbors do not need to be directly connected. Rather, BGP neighbors can be multiple hops away from one another. Therefore, BGP neighbors are often referred to as *peers*.
Data Structure of IP Routing Protocol	BGP maintains two data structures: the neighbor table and the BGP table. The neighbor table contains status information about BGP neighbors, whereas the BGP table contains network prefixes learned from BGP neighbors.

Interaction Between the Data Structures of a BGP and an IP Routing Table

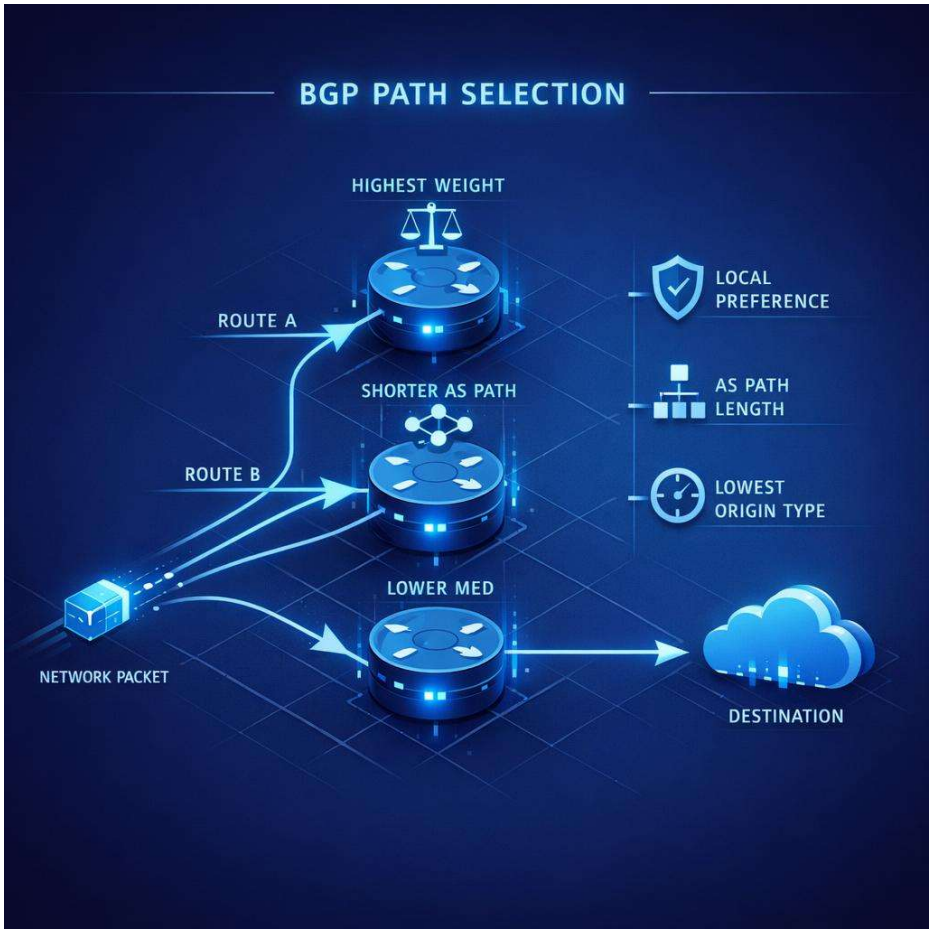
Injecting and Redistributing Routes	Routes can be inserted in the BGP table by advertisements received from BGP neighbors or by locally injected routes. For a route to be locally injected (either through a manual configuration or through a redistribution configuration), it must be present in the IP routing table.
Route Installation	Similar to OSPF and EIGRP, BGP might have more than one route to a network prefix in its BGP table. BGP then selects what it considers to be the best route to that network prefix; that best route becomes a candidate to be inserted into the IP routing table.
Outgoing Route Information	Routes in a router's BGP table that are considered the best routes to their network prefixes are advertised to the router's BGP peers. BGP offers several features to limit routes advertised to BGP peers or received from BGP peers.

BGP Data Structure

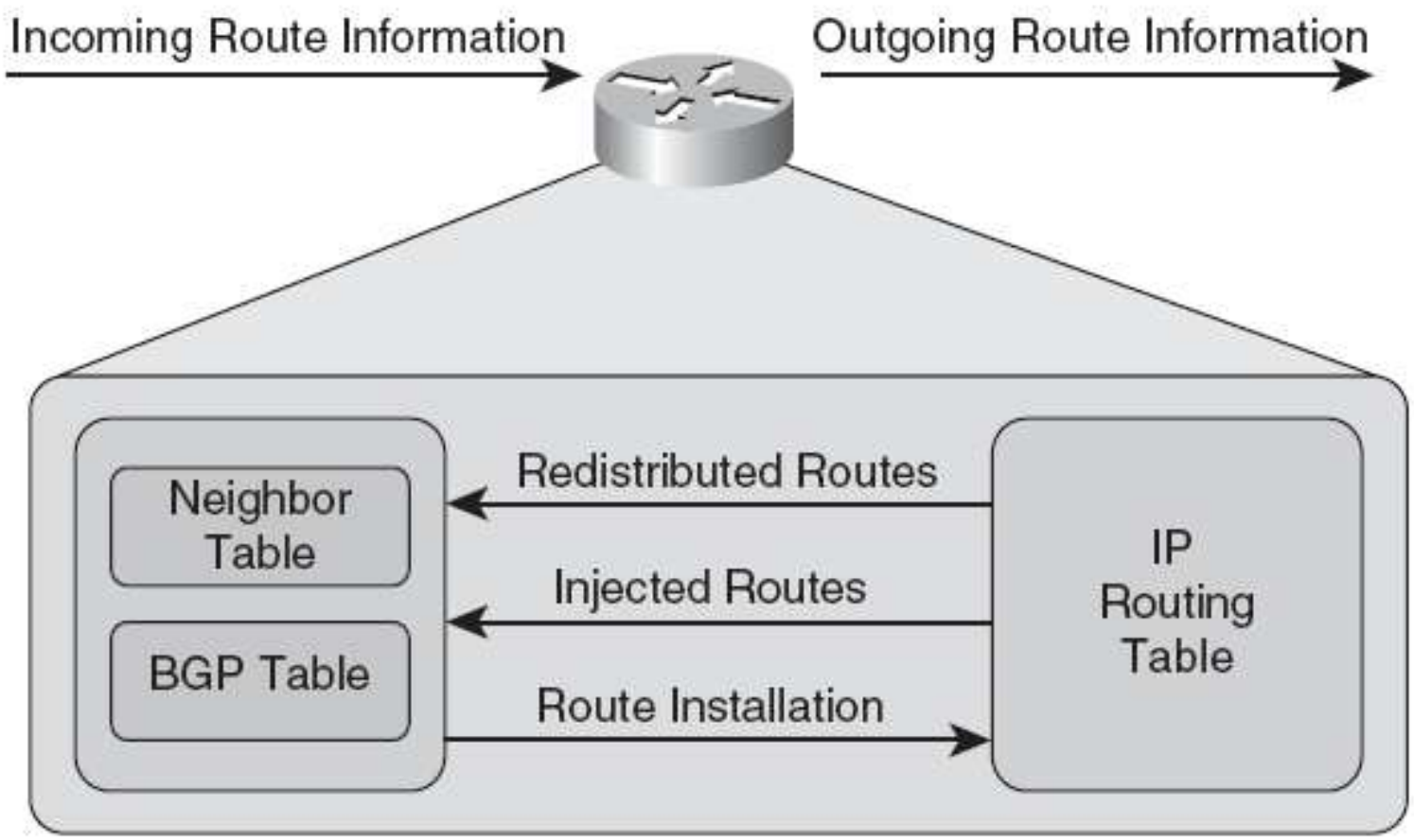
- **Neighbor table:** Lists all configured BGP neighbors, with each neighbor's IP, AS number, state of the neighborship, and key statistics.
- **BGP table:** Also called the Routing Information Base (RIB); holds routes learned from peers and routes locally injected.

BGP Operation

- Unlike OSPF and EIGRP, BGP ignores link bandwidth. Instead, it uses the following criteria to forward a packet.



BGP Data Structures

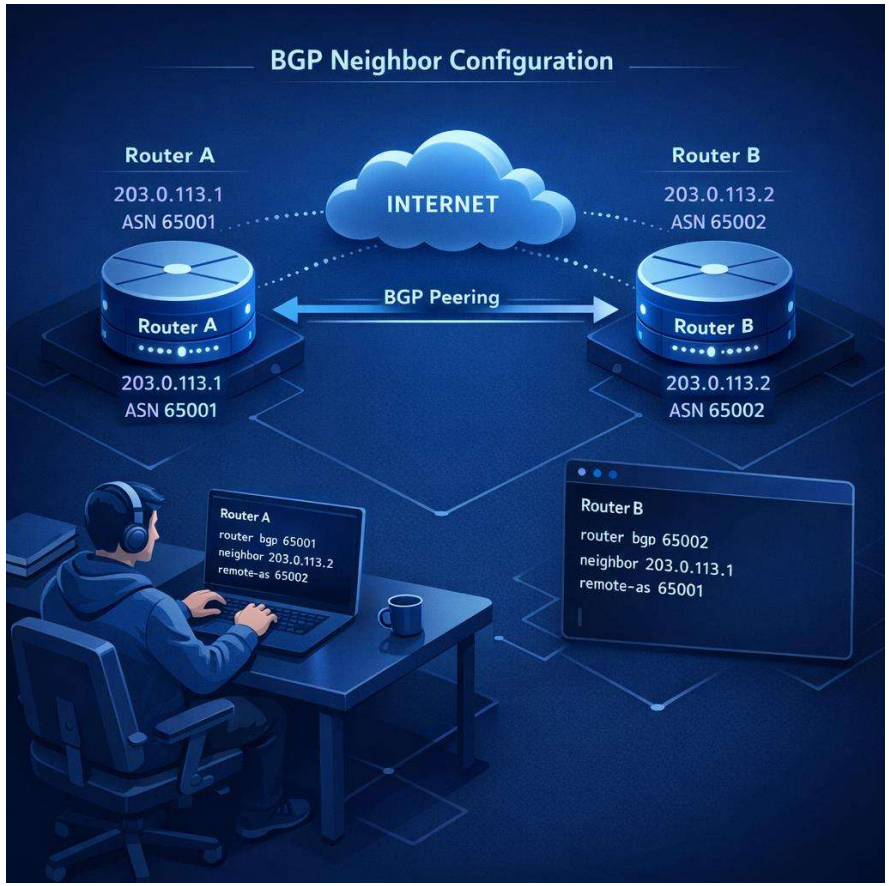


BGP Operation

1. Prefers the path with the highest weight (note: weight is Cisco-specific).
2. Prefers the highest local preference.
3. Prefers the path originated locally.
4. Prefers the shortest AS path.
5. Prefers the lowest origin type (IGP < EGP< INCOMPLETE.)
6. Prefers the lowest MED.
7. Prefers eBGP paths over iBGP paths.
8. Prefers the lowest IGP metric to the next-hop.
9. Prefers the path with the lowest BGP router ID.

BGP Operation

- A BGP router learns its neighbors through manual configuration, not dynamically.
- This makes sense since BGP neighbors don’t have to be physically adjacent.

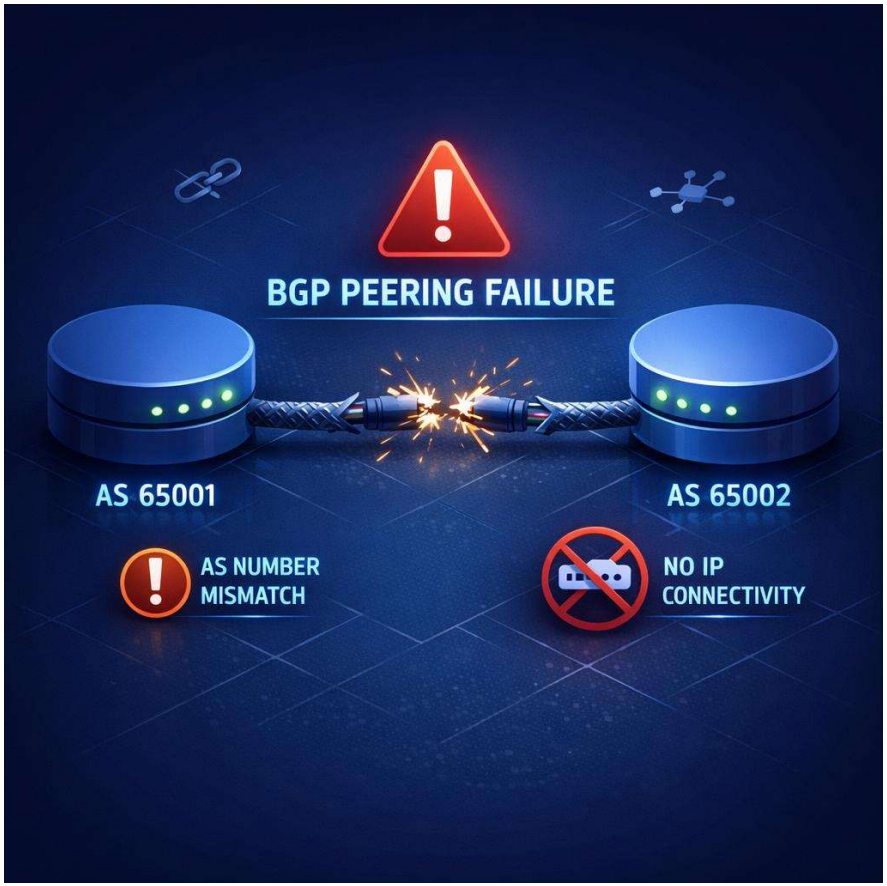


BGP Operation

- A BGP router opens sessions with configured neighbors over TCP port 179.
- Once established, BGP OPEN messages exchange each neighbor's BGP characteristics.

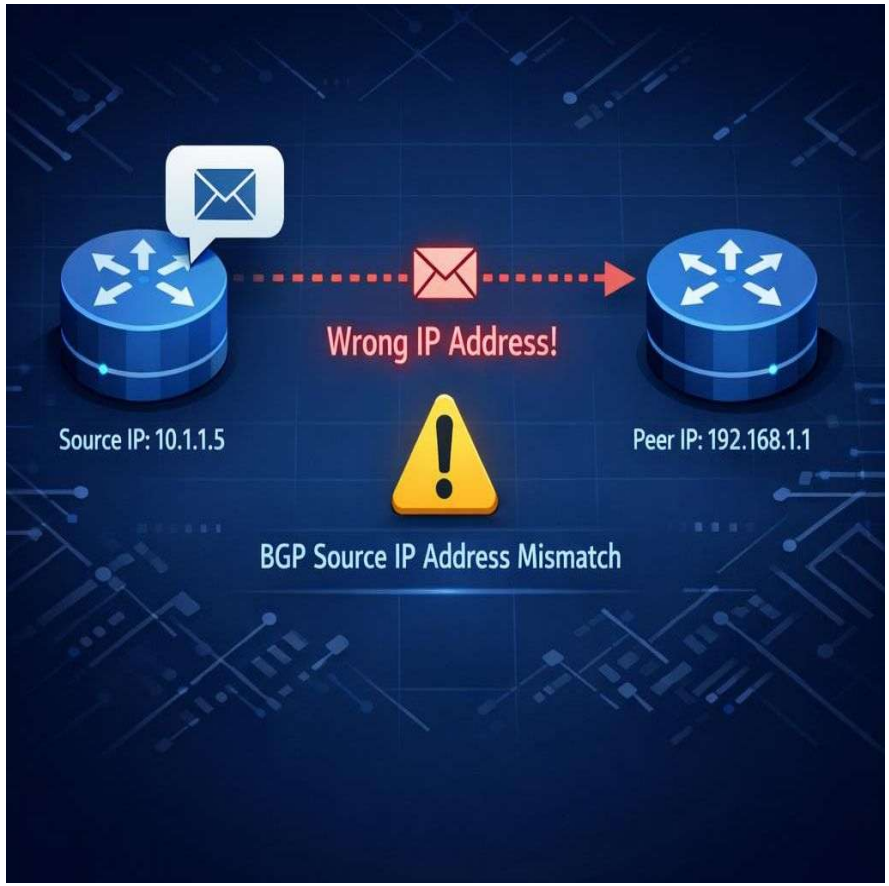
BGP Operation

- Reasons BGP peering may fail:
  - AS number in received messages must match the AS number configured for the neighbor; a mismatch resets the session.
  - BGP sessions run over TCP, so a lack of IP connectivity between routers prevents peering.



BGP Operation

- A BGP router may have multiple active IPs across its interfaces.A router may send a BGP message from an IP that doesn’t match what the peer has configured. If the peer doesn’t recognize the source IP, peering fails.



BGP Troubleshooting Commands

Command	Routing Component or Data Structure	Description
show ip bgp summary	Neighbor table	This command displays a router's BGP router ID, AS number, information about the BGP's memory usage, and summary information about BGP neighbors.
show ip bgp neighbors	Neighbor table	This command displays the detailed information about all the BGP neighbors of a router.
show ip bgp	BGP table	This command displays the network prefixes present in the BGP table.
debug ip routing	IP routing table	This command displays updates that occur in a router's IP routing table. Therefore, this command is not specific to BGP.

BGP Troubleshooting Commands

show ip route bgp	IP routing table	This command shows routes known to a router's IP routing table that were learned via BGP.
debug ip bgp	Exchanging BGP information with neighbors	Although this command does not show the contents of BGP updates, the output does provide real-time information about BGP events, such as the establishment of a peering relationship.
debug ip bgp updates	Exchanging BGP information with neighbors	This command shows real-time information about BGP updates sent and received by a BGP router.

BGP Troubleshooting Commands

```
R2#show ip bgp summary
 BGP router identifier 10.2.2.2, local AS number 65001
BGP table version is 11, main routing table version 11
 10 network entries using 1170 bytes of memory
14 path entries using 728 bytes of memory
6/5 BGP path/bestpath attribute entries using 744 bytes of memory
2 BGP AS-PATH entries using 48 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
BGP using 2690 total bytes of memory
BGP activity 10/0 prefixes, 14/0 paths, scan interval 60 secs

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
172.16.1.1      4        65002      11      15       11    0    0 00:07:45        4
172.16.2.2      4        65003       8      12       11    0    0 00:03:19        4
```

BGP Troubleshooting Commands

```
R2#show ip bgp neighbors
BGP neighbor is 172.16.1.1,  remote AS 65002, external link
  BGP version 4, remote router ID 10.3.3.3
  BGP state = Established, up for 00:10:05
  Last read 00:00:04, last write 00:00:05, hold time is 180, keepalive interval
```

```
  Connections established 1; dropped 0
  Last reset never
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled, Minimum incoming TTL 0, Outgoing TTL 1
Local host: 172.16.1.2, Local port: 52907
Foreign host: 172.16.1.1, Foreign port: 179
Enqueued packets for retransmit: 0, input: 0  mis-ordered: 0 (0 bytes)
```

BGP Troubleshooting Commands

```
R2#show ip bgp
BGP table version is 11, local router ID is 10.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight  Path
*> 10.1.1.1/32      192.168.0.11            11          32768  ?
*  10.1.2.0/24      172.16.2.2               0              0  65003 i
*>                  172.16.1.1               0              0  65002 i
*  10.1.3.0/30      172.16.2.2               0              0  65003 i
```

BGP Troubleshooting Commands

```
R2#show ip route bgp
      10.0.0.0/8 is variably subnetted, 6 subnets, 3 masks
B        10.1.3.0/30 [20/0] via 172.16.1.1, 00:11:26
B        10.3.3.3/32 [20/0] via 172.16.1.1, 00:00:34
B        10.1.2.0/24 [20/0] via 172.16.1.1, 00:11:26
B       10.4.4.4/32 [20/0] via 172.16.2.2, 00:07:35
```

BGP Troubleshooting Commands

```
R2#debug ip bgp
BGP debugging is on for address family: IPv4 Unicast
*Mar  1 00:23:26.535: BGP: 172.16.1.1 remote close, state CLOSEWAIT
*Mar  1 00:23:26.535: BGP: 172.16.1.1 -reset the session
*Mar  1 00:23:26.543: BGPNSF state: 172.16.1.1 went from nsf_not_active to
  nsf_not_active
*Mar  1 00:23:26.547: BGP: 172.16.1.1 went from Established to Idle
*Mar  1 00:23:26.547: %BGP-5-ADJCHANGE: neighbor 172.16.1.1 Down Peer closed the
  session
*Mar  1 00:23:26.547: BGP: 172.16.1.1 closing
*Mar  1 00:23:26.651: BGP: 172.16.1.1 went from Idle to Active
*Mar  1 00:23:26.663: BGP: 172.16.1.1 open active delayed 30162ms (35000ms max,
  28% jitter)
```