Atributes:

Well-known Mandatory	AS-Path
(Optional bit 0)	Next Hop
	Origin Type (Junos only "I")
Well-known Discretionary	Localpref (def 100, only in AS)
(Optional bit 0)	Atomic Aggregate (marks that ASs were dropped in aggreg.)
	If using AS_SET, NO Atom_aggr
Optional Transitive - Tbit 1	Aggregator
(marked as partial if unsup.)	Community
	Ext-Community
Option Non-Transitive Tbit0	Cluster List - RR
(deleted if unsupported)	Originator ID - RR
	MED (def. compare same AS, 0)
AFI: IPv4,IPv6,MPLS_VPN	MP_REACH_NLRI
SAFI: unicast,mcast	MP_UNREACH_NLRI

Best Path Algorithm - WLLA OMNI

0. Ignore ASPathLoop, !NextHop, not synchronized
1. Weigth `Cisco`
2. Local Pref.
3. Locally Orig. or redistr. (netw.+redist > aggr) `Cisco`
4. AS-PATH (AS-SET = 1, AS_CONFED_SEQUENCE and AS_CONFED_SET ignored)
5. Origin type (lowest): IGP < EGP < Incomplete
6. MED (if same first AS / any preceding AS_CONFED_SEQUENCE is ignored)
7. Neighbor: eBGP > iBGP (confed treat as iBGP)
8. IGP metric to NH (lowest)
9. Multipath check (if Yes, skip RID,PeerIR)
10. Oldest path for external paths for stability `Cisco`
11. Lowest RID (originator ID if RR) `JunOS`
12. Minimum cluster list (in RR environment)
13. Lowest peer address (if here then multipath)

Private ASs: 64512 - 65535 (1024)
BGP Link BW feature: advert. link bandwidth in iBGP for multipath over links with unequal BW
NoExport (only to neigh AS) / **NoAdvertise** (only to neigh)
NoExportSubConf (only in Sub_AS)

Graceful Restart: (new capability negot + AFI/SAFI). After restart, estab. peer & set "restart-bit" ro resume (FW-bit "I can still fwd"). Routes marked stale (used). Routes adv by peer. **End-of-RIB** used to mark end of Updates. (empty **Update** packet). Restart def. **120sec**.

BGP Header:
- **Marker** 16B - all 1s/auth
- **Length** 2B
- **Type** 1B:
  - 1 - OPEN
  - 2 - Update
  - 3 - Notification
  - 4 - Keepalive
  - 5 - RRefresh

BGP Open Message:
- **Version**
- **AS**
- **HoldTime** (lowest, 90s/3 = KA)
- **RID**
- **Optional Capabill**. & params. (RRefresh, Auth, NLRIs, .. TLVs)

BGP Update Message:
- Unfeasable routes len
- Withdrawn routes
- Total Path Attrs Len
- Path Attrs.
- NLRIs

Attrs:
- **Optional** Bit
- **Trazitive** Bit
- **Partial** Bit

BGP States:
1. **Idle** (after Start, SYN)
2. **Connect** (waitTCP, bad->Act)
3. **Active** (Send SYN->Conn)
4. **OpenSent** (TCP OK, -> open)
5. **OpenConfirm** (->KeepA.)
6. **Established** (when keepA. received in OpenConfirm)

- dual connections => the one established by high RID **OK**
- "passive" can be used
- generally problem means flap between **Connect** and **Active**.

BGP Keepalive: **19** bytes header and no data (replaceable by Update)
BGP Notification: Error Code + Subcode + Data (6 - Cease, 4 Hold expired)
BGP Route Refresh: AFI + reserved + SAFI - request readvertisement of Adj-RIB-Out

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RRs
- Only advertise Best Routes
- do not change Attrs
- **cluster list + originator ID**
- **origID**: 1st router that sent route to RR
- CL > RR > CL + NONCL
- NONCL > RR > CL
  - All except NONCL to NONCL
RRs operation
- on reflect, if no Originator ID, add RID of originator router in local AS
- add clusID to clusList or create clusList
Loop detection:
If Orig recv. = RID, ignore update.
If ClusterID in Cluster-list recv, ignore

MED

Non-Deterministic (Cisco def., not rec)
- meds chosen in order of arrival
Deterministic-MED
- group by AS then choose
Always compare MEDs
- compare MEDs from any source

Confederations:
- adds AS_CONFED_SEQ, CBGP
- CBGP does not modify Attrs.
IPv6 requires multiprotocol extensions capability in the OPEN + MP_REACH_NLRI attr.
Dampening
- 1000p for Adv/Wdraw
- 500p for Attrib Change

- 3000 - suppress
- 750 - reuse
- 15 min - decay
ORF - Outbound Route Filter