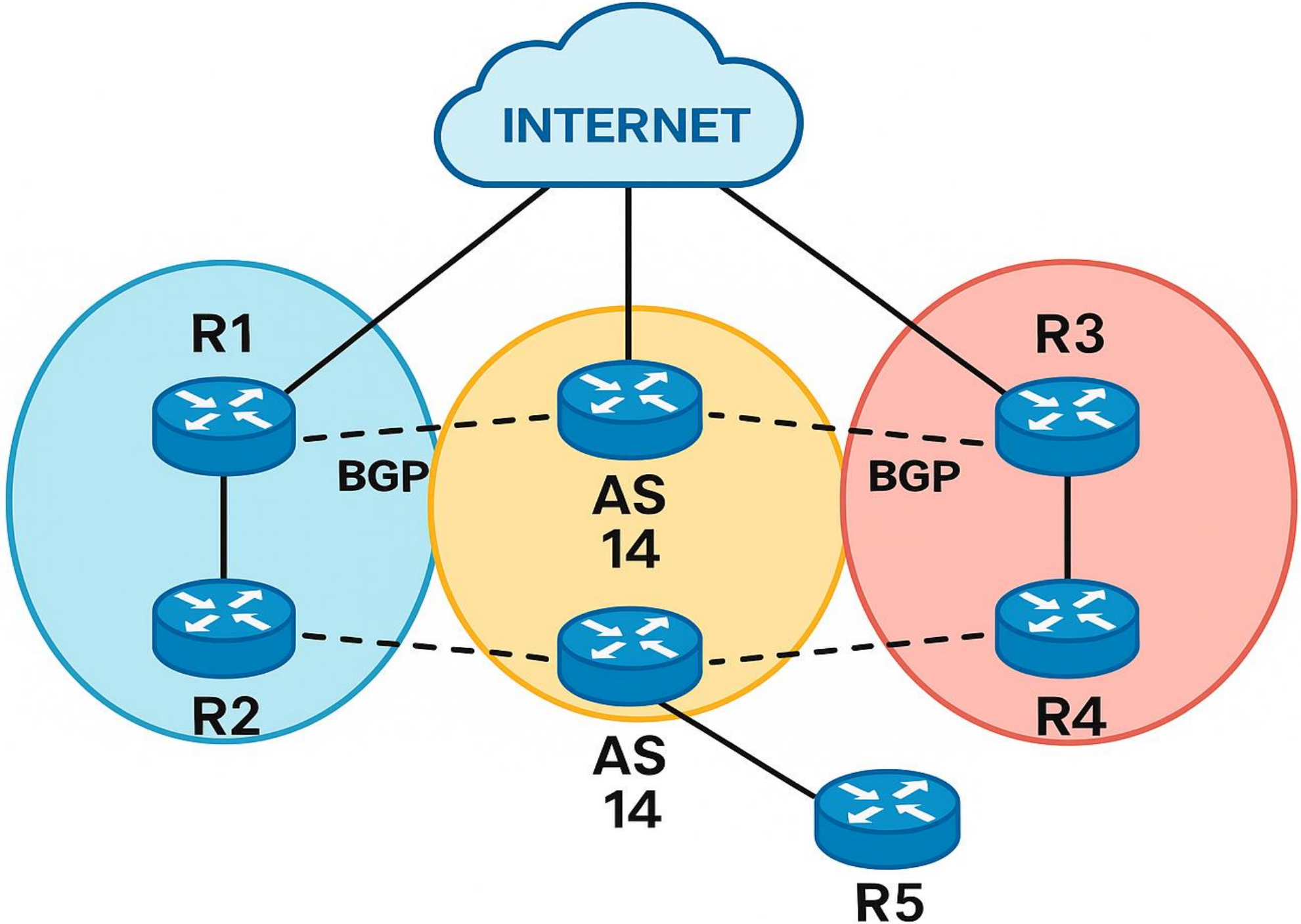

INTERNET
R1
R3
BGP
BGP
AS
14
R2
R4
AS
14
R5

Introduction

BGP is an exterior gateway Path Vector routing protocol used for sharing routing information between different autonomous systems. (BGP is an inter-autonomous system routing protocol)
-> current ver – BGPV4

It maintains a separate routing table based on shortest AS Path and various other attributes.

BGP works on TCP port no 179.
ASNs 64512 through 65535 are private ASNs in the 16-bit range.
ASNs 4.2B through 4,29,49,67,295 are private ASNs in the 32-bit range.
BGP can form neighbour adjacencies. It can also form neighbour adjacencies with routers that multihop away. (sh ip bgp summary)

ASN is 16bit or 32 bit which is typically provided by service provider or IANA.

Full mesh in BGP means that every BGP router establishes a TCP session with every other BGP router, forming a complete set of peerings.”

ARP Table

Directly connected neighbors

- BGP will use the ARP table to locate the Layer 2 address of the peer

Routing Table

Multihop neighbors

- BGP will use routing table information to find the peer's IP address

BGP PEER MESSAGES

BGP forms its peer relationships through a series of messages.

i. ***Open*** message is sent between peers to initiate the session. It contains:

- BGP Version – must be the same between BGP peers
- Local AS Number
- BGP Router ID
- Hold down timer

ii. ***KEEPALIVE*** messages are sent periodically (every 60 seconds by default) to ensure that the remote peer is still available. If a router does not receive a KEEPALIVE from a peer for a Hold-time period (by default, 180 seconds), the router declares that peer dead.

iii. ***UPDATE*** messages are used to exchange routes between peers. (NLRI)

iv. Finally***,*** ***NOTIFICATION*** messages are sent when there is a fatal error condition. If a NOTIFICATION message is sent, the BGP peer session is torn down and reset.

BGP PEER STATES

As a BGP peer session is forming, it will pass through several states. This process is known as the BGP Finite-State Machine (FSM):

i. ***Idle***: administratively down or waiting for the next retry attempt.

ii. ***Connect***: BGP waits for a TCP connection with the remote peer. If successful, an open message is sent. If unsuccessful, the session is place in an active state.
(goes active only if – routing issue, tcp port 179 is blocked, and ACL must Blocking the traffic)

iii. ***Active*** – BGP attempts to initiate a TCP connection with the remote peer. If successful, an OPEN message is sent. If unsuccessful, BGP will wait for a ConnectRetry timer to expire, and place the session back in a Connect State

iv. ***OpenSent*** – BGP has both established the TCP connection and sent an OPEN Message, and is awaiting a reply OPEN Message. Once it receives a reply OPEN Message, the BGP peer will send a KEEPALIVE message.
(BGP compares the content of OPEN messages) (bgp ver, source ip address must match that is configured for the router, as, RID)

v. ***OpenConfirm*** – If all of the opensent is goes well then it will move to openconfirm state. In openconfirm state, BGP waits for a keepalive or a notification message.

vi. ***Established*** – the BGP peer session is fully established. UPDATE messages containing routing information will now be sent.

(sh tcp brief - to check bgp state of the router)

When do you use BGP??

Multi-Homed Internet Connections (Dual/Multiple ISPs)

- **Scenario:** Your company connects to **two or more ISPs** for redundancy and load balancing.
- **Why BGP?**
  - Allows **failover** if one ISP fails.
  - Enables **traffic engineering** (e.g., prefer ISP-A for outbound, ISP-B for inbound).
  - Advertises your public IP space (**PI/PA addresses**) to the Internet.

2. Internet Exchange (IXP) & Peering

- **Scenario:** Your company/ISP connects to an **Internet Exchange Point (IXP)** to peer with other networks (e.g., Google, Netflix, Cloudflare).
- **Why BGP?**
  - Reduces latency by **directly exchanging traffic** (instead of routing through an ISP).
  - Lowers bandwidth costs (**settlement-free peering**).

3. Large Enterprise Networks with Multiple Data Centers

•**Scenario:** A global company has **multiple data centers (DCs)** in different regions (e.g., AWS, Azure, on-prem).

•**Why BGP?**

- Ensures **optimal routing** between DCs.
- Supports **SD-WAN** and hybrid cloud setups.
- Used with **MPLS** for WAN routing.

4. Cloud & Hybrid Cloud Networking (AWS, Azure, GCP)

•**Scenario:** Connecting your on-prem network to **AWS (Direct Connect), Azure (ExpressRoute), or Google Cloud**.

•**Why BGP?**

- Dynamically advertises **on-prem routes** to the cloud.
- Allows **VPN failover** (e.g., backup connection via IPSec if Direct Connect fails).

When do you use BGP??

5. ISP & Carrier Networks

- **Scenario:** ISPs use BGP to **route traffic between their own network and other ISPs**.
- **Why BGP?**
  - The **only protocol** that scales for the entire Internet.
  - Supports **traffic engineering** (e.g., preferring certain paths).
    6. Anycast Routing (Global Load Balancing)
- **Scenario:** Services like **DNS (Cloudflare, Google DNS 8.8.8.8)** or CDNs use Anycast (same IP in multiple locations).
- **Why BGP?**
  - Advertises the **same IP prefix from multiple locations**.
  - Users connect to the **nearest server** automatically.

BGP PEERS??

There are two types of BGP neighbor relationships:

- iBGP Peers – BGP neighbors within the same autonomous system.
- eBGP Peers – BGP neighbors connecting separate autonomous systems

❑By default, BGP assumes that eBGP peers are a maximum of one hop away.

❑The administrative distance of routes learn from egbp peer (outside the autonomous system) is 20, while the AD for the ibgp and locally-originated routes is 200.

BGP ATTRIBUTES

Each BGP route (prefix) is associated with attributes. These attributes help routers **choose the best path** when multiple routes are available.

Well-known Mandatory Attributes
mut be recognized by all bgp implementation
must be included in every update message that contains NLRIs.

1. **ORIGIN** – Describes where the route originated (IGP, EGP, or Incomplete).
2. **AS_PATH** – Lists all AS numbers a route has passed through.
3. **NEXT_HOP** – IP address of the next router to reach the destination.

Well-known Discretionary Attributes

Recognized by all BGP routers, but not mandatory.

4. **LOCAL_PREF (Local Preference)** – Used within an AS to prefer one path over another.
5. **ATOMIC_AGGREGATE** – Informs that some information was lost during route aggregation.

Optional Transitive Attributes

Optional, but if a router doesn't recognize them, it still forwards them to other BGP peers.

6.AGGREGATOR –
Purpose: Identifies the router and AS that created the aggregated route
Use Case: When multiple routes are summarized into one, this attribute stores info about the origin of the summary

7.COMMUNITY – Allows tagging routes for easier filtering and control.
Purpose: Used to tag routes with extra information for grouping, filtering, or policy control.
Use Case: You might tag routes with a community value like no-export, local-AS, or custom value like 65000:100 to control routing behaviour within and across Ases.

1

Optional Transitive

Can stay with the route advertisements from one autonomous system to another

(i.e., BGP community)

2

Optional Non-transitive

Cannot be shared across autonomous systems

(i.e., MED, or multiple-exit discriminator)

BGP ATTRIBUTES

🟥 Optional Non-Transitive Attributes

Optional and **not** passed to other BGP peers if not understood.

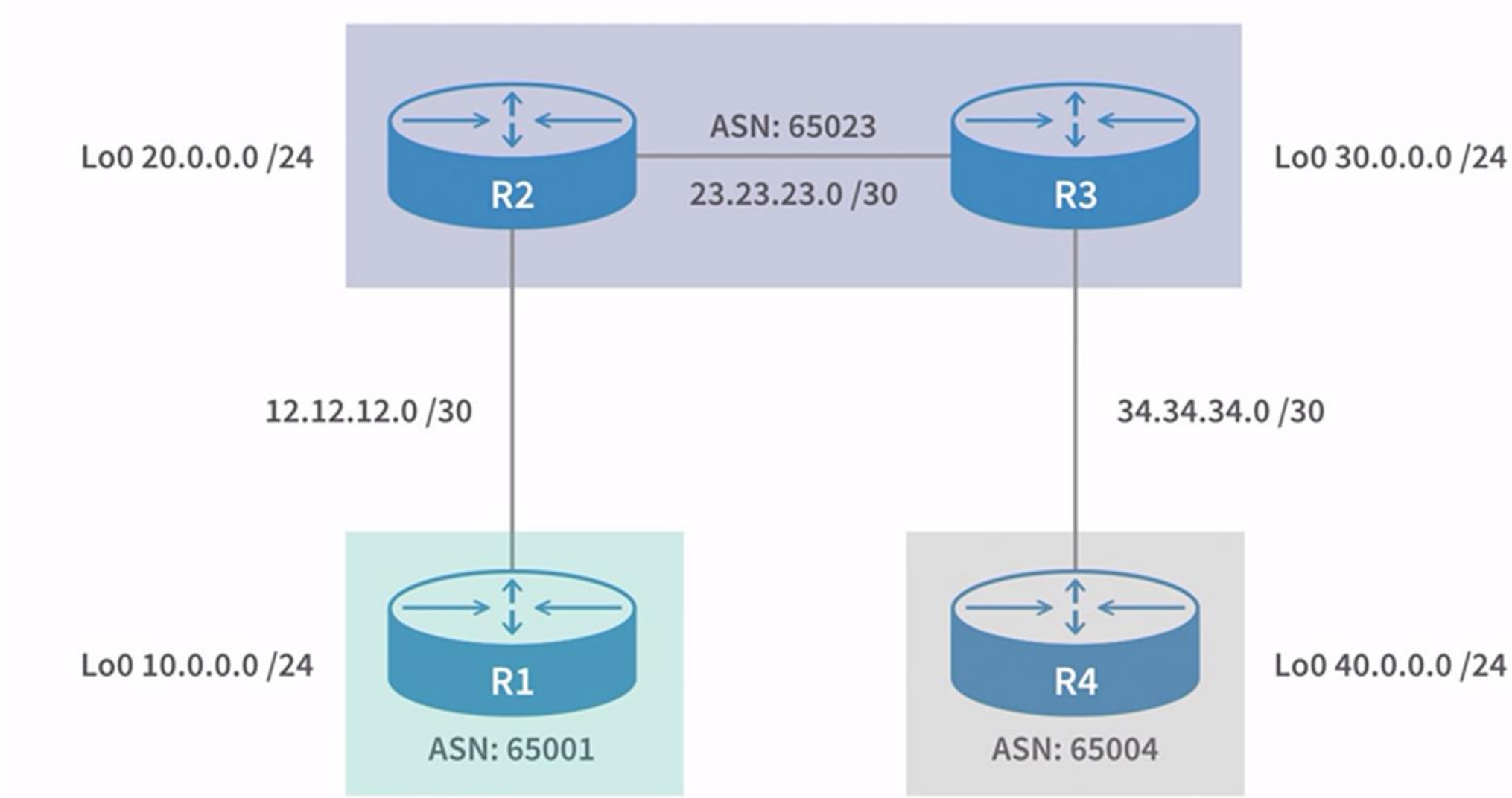
8. **MULTI_EXIT_DISC (MED)** – Suggests the preferred path into an AS when multiple links exist.
9. **ORIGINATOR_ID** – Identifies the originator of a route in BGP Route Reflector environments.
10. **CLUSTER_LIST** – Used in BGP Route Reflectors to prevent routing loops.

🔵 Additional Modern Attributes (Extended Features)

These may not be part of the core BGP-4 spec but are widely used in modern networks:

11. **BGP Confederation Attributes** – For internal AS structuring.
12. **Extended Communities** – Allow more tagging options.
13. **AIGP (Accumulated IGP Metric)** – Helps with IGP-based path selection.
14. **BGP-LS (Link-State)** – Used in SDN and IGP interworking.
15. **BGPsec_PATH** – Security extension (cryptographically signed AS_PATH).

IPV4:


Lo0 20.0.0.0 /24
R2
ASN: 65023
23.23.23.0 /30
R3
Lo0 30.0.0.0 /24
12.12.12.0 /30
34.34.34.0 /30
Lo0 10.0.0.0 /24
R1
ASN: 65001
R4
ASN: 65004
Lo0 40.0.0.0 /24

commands

router bgp <as-no>
neighbor <neighbor-ip-address> remote-as <neighbor asn>
network <network-address> mask <subnet-mask>

BGP network statement don’t identify network, instead identify the specific network installed into the routing table.

redistribute network to other routers:
redistribute <sub-command>

configure router id:
bgp router-id <router-id>

no bgp default ipv4 unicast

Disables the automatic activation of IPv4 address-family

```
Router(config-router)#address-family IPv4 unicast
Router(config-router)#neighbor [neighbor IP] activate
```

🔍 **Purpose and Use:**

Modern BGP implementations support **multiple address families**—not just IPv4. This includes IPv6, VPNv4, multicast, etc. The command tells the router:

“I want to configure BGP for sending and receiving **IPv4 unicast** routes.”

IOS XR CONFIG:

Router differen ios: ios, ios xe, ios xr, nx-os

IOS NX-OS

```
S1# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
S1(config)# router bgp 65001
S1(config-router)# router-id 1.1.1.1
S1(config-router)# address-family ipv4 unicast
S1(config-router-af)# exit
S1(config-router)# neighbor 12.12.12.2 remote-as 65023
S1(config-router-neighbor)# address-family ipv4 unicast
S1(config-router-neighbor-af)# end
S1# show ip bgp neighbors
```

AS PATH

AS_PATH is a well-known mandatory attribute. This attribute identifies the autonomous systems through which routing information carried in this UPDATE message has passed. The components of this list can be AS_SETS or AS_SEQUENCES.

When a BGP speaker propagates a route, it learned from another BGP speaker's UPDATE message, it modifies the route's AS_PATH attribute based on the location of the BGP speaker to which the route will be sent:

a) When a given BGP speaker advertises the route to an internal peer, the advertising speaker SHALL NOT modify the AS_PATH attribute associated with the route.

b) When a given BGP speaker advertises the route to an external peer, the advertising speaker updates the AS_PATH attribute as follows:

Simply understand, when a router advertises routes to an iBGP peer (within the same autonomous system), it advertises the routes learned from eBGP with the same next-hop IP address. This creates a problem because other iBGP peers might not have reachability to that next hop.

Solution advertise IBGP learned networks:
R2 - network 12.12.12.0 mask 255.255.255.0 (route redistribution)
R3 – network 34.34.34.0 mask 255.255.255.0
or
R2 - neighbor 23.23.23.3 next-hop-self (next-hop-self feature)
R3 - neighbor 23.23.23.3 next-hop-self

Next-Hop-Self Feature

Modify the next-hop address in all external NLRIs using the IP address of the BGP neighbor.

```
Router(config-router)#neighbor [ip address] next-hop-self all
```

All BGP routers within a single autonomous system must be fully meshed.

Alternative Solutions

Route reflectors and confederations

BGP TABLES:

i. Loc – RIB

ii. Adj – RIB – in

iii. Adj – RIB – out

📦 **1. Adj-RIB-In (Adjacency RIB-In)**

📥 What it stores: All routes received from BGP neighbors

🔍 Use: Before any filtering or policy is applied.

⚙️ Next Step: Routes are filtered and passed to Loc-RIB.

📘 **2. Loc-RIB (Local RIB) (BGP Table) (sh ip bgp or sh bgp ipv4 unicast)**

🧠 What it stores: Best routes selected by BGP after applying policies and comparing paths

📜 This is the main BGP routing table

✅ Routes from here are installed in the main routing table (RIB/FIB) if chosen

📤 **3. Adj-RIB-Out (Adjacency RIB-Out) (sh ip bgp neighbor <ip-address> advertised-routes)**

📦 What it stores: Routes that are ready to be sent to BGP neighbors

🧰 These may be influenced by outbound route-maps, filters, etc

📡 Sent to each neighbor based on their policies

1

Connected Network

- Next-hop: 0.0.0.0
- Origin: I (for IGP)
- Weight: 32,768

2

Static Routes or from a Routing Protocol

- Next-hop: next-hop IP (per routing table)
- Origin: I (for IGP)
- Weight: 32,768
- MED: IGP metric

Show bgp ipv4 unicast

Router#show bgp [AFI] [SAFI]

- Uses the AFI and SAFI syntax

Address Family Identifier (AFI)

- IPv4
- IPv6
- VRF

Subsequent Address Family Identifier (SAFI)

- Unicast
- Multicast
- MVPN

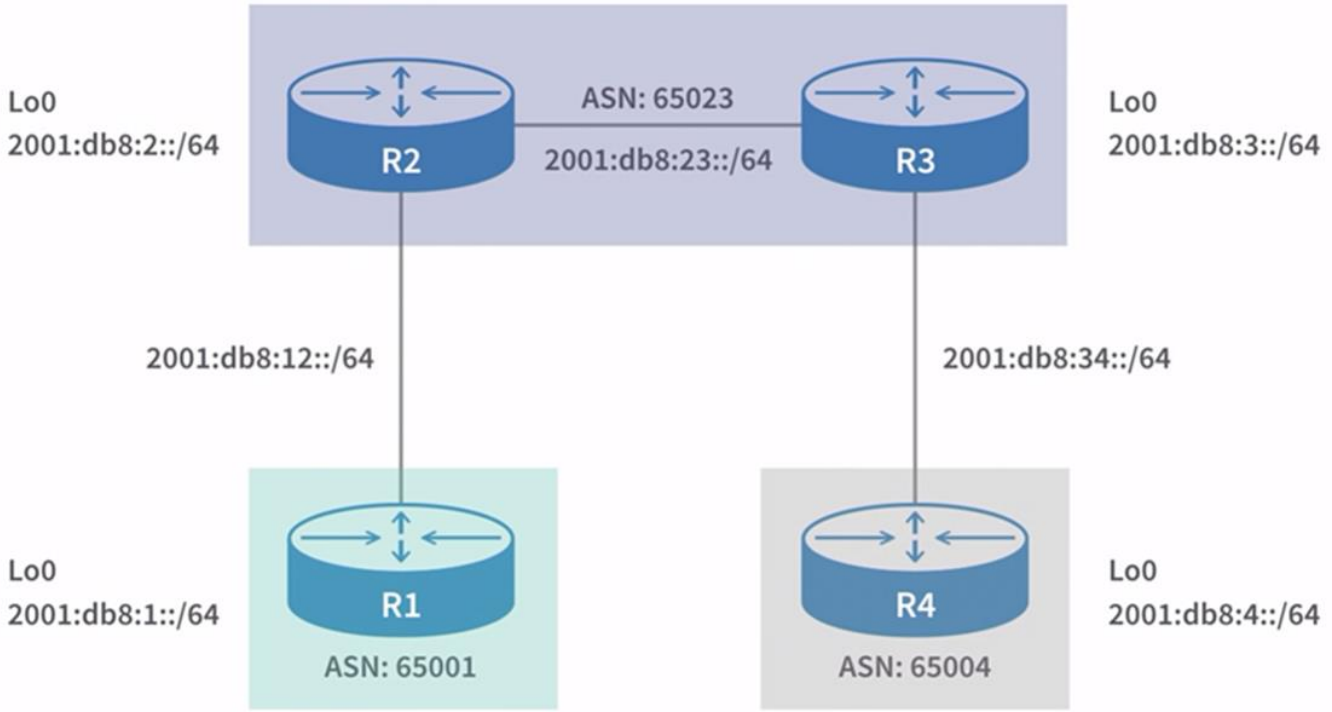
Origin Codes

Code	Meaning	Comments
i	IGP	Routes advertised via network statement
e	EGP	No longer used
?	Incomplete	Also for redistributed routes

When bgp route is learned from a ibgp peer, it sets the next-hop 0.0.0.0

if it learns from ebgp peer or anyother protocol: next-hop <next-hop-ip>

IPV6:



Router-ID must be configured for routers using IPv6-only addressing.

```
1#conf t
nter configuration commands, one per line.  End with CNTL/Z.
1(config)#ipv6 unicast
1(config)#ipv6 unicast-routing
1(config)#router bgp 65001
1(config-router)#bgp router
1(config-router)#bgp router-id 1.1.1.1
1(config-router)#neigh
1(config-router)#neighbor 2001:db8:12::2 remote
1(config-router)#neighbor 2001:db8:12::2 remote-as 65023
```

It is recommended to use **unique global unicast addressing**.

Configure the Neighbor

```
Router(config-router)#
neighbor [neighbor ip
address] remote-as
[neighbor ASN]
```

Activate the Neighbor via IPv6 Address-Family

```
Router(config-router)#
address-family IPv6

Router(config-router-af)#
neighbor [neighbor ip
address] activate
```

redistribute connected

```
Router(config)# ipv6 unicast-routing
Router(config)#router bgp [as-number]
Router(config-router)# bgp router-id [router ID]
Router(config-router)#neighbor [neighbor ip address] remote-as [neighbor ASN]
Router(config-router)# address-family IPv6
Router(config-router-af)# neighbor [neighbor ip address] activate
Router(config-router-af)#redistribute connected
```

Reminders

- Configure the router ID if the routers only have IPv6 addressing
- Neighbors need to be activated under the IPv6 address-family configuration mode
- Use unique global addresses
- Use the redistribute command

BGP Path Attributes

- Weight
- Local_pref
- Originate
- AS_path
- Origin type
- MED
- Path
- IGP Metric
- Multipath
- Age
- Router-ID
- Cluster list length
- Neighbor address

BGP Path Attributes

BGP Route Manipulation

Via prefix-list and route-map

Mnemonic	First Letter	BGP Path Attribute	Preference
We	W	Weight	↑ Higher
Love	L	Local_pref	↑ Higher
Orange	O	Originate	Local vs. aggregate
As	A	AS_path	↓ Lower
Orange	O	Origin type	IGP vs. EGP vs. ?
Mean	M	MED	↓ Lower
Pure	P	Paths	eBGP vs. iBGP
Refreshment	R	Router-ID	↓ Lower

WEIGHT

- Cisco-specific parameter
- Local to the router
- Preference: highest weight

LOCAL_PREFERNCE

- Default value of 100
- Preference: highest Local_pref

ORIGINATE

- How a path is sourced
- Preference: local paths from network or redistribute commands are preferred versus local aggregates via aggregate-address command

AS PATH

- The number of autonomous systems in the path
- Preference: shortest AS_path

ORIGIN TYPE

- **Preference: lowest origin type**
  1. IGP
  2. EGP
  3. ? Incomplete

MED (MULTI EXIT DISCRIMINATOR)

- Optional non-transitive attribute
- A hint to external neighbors about the preferred path into an autonomous system (AS) that has multiple entry points
- Preference: lowest MED

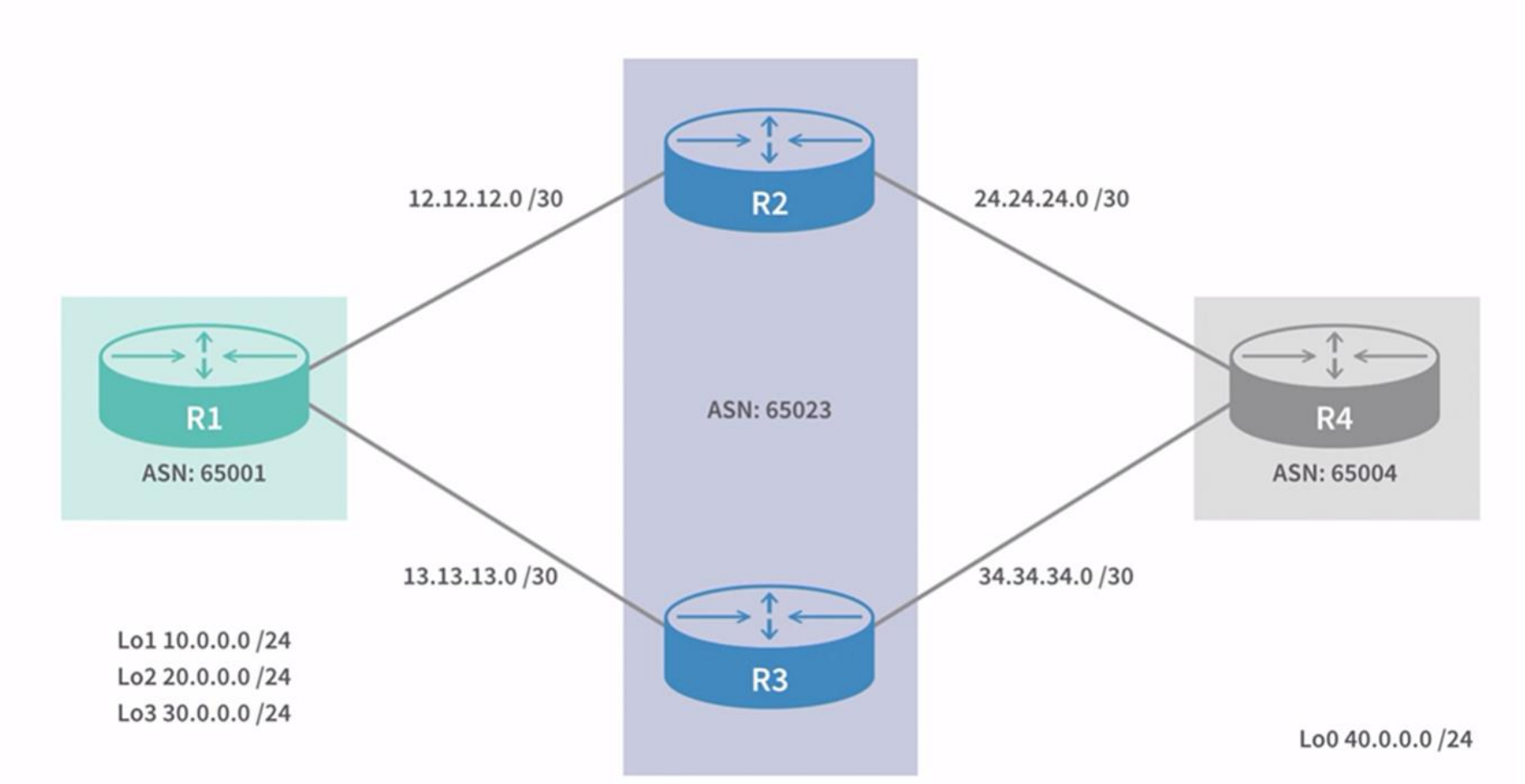
PATH

eBGP	iBGP
Administrative distance:	Administrative distance
20	200

PREFERENCE

- Preference: route from the lowest router ID

PATH CHANGING




```
R4(config)#ip prefix-list PREF20 permit 20.0.0.0/24
R4(config)#route-
R4(config)#route-map MAP20 permit 10
R4(config-route-map)#match ip addre
R4(config-route-map)#match ip address pref
R4(config-route-map)#match ip address prefix-list PREF20
```

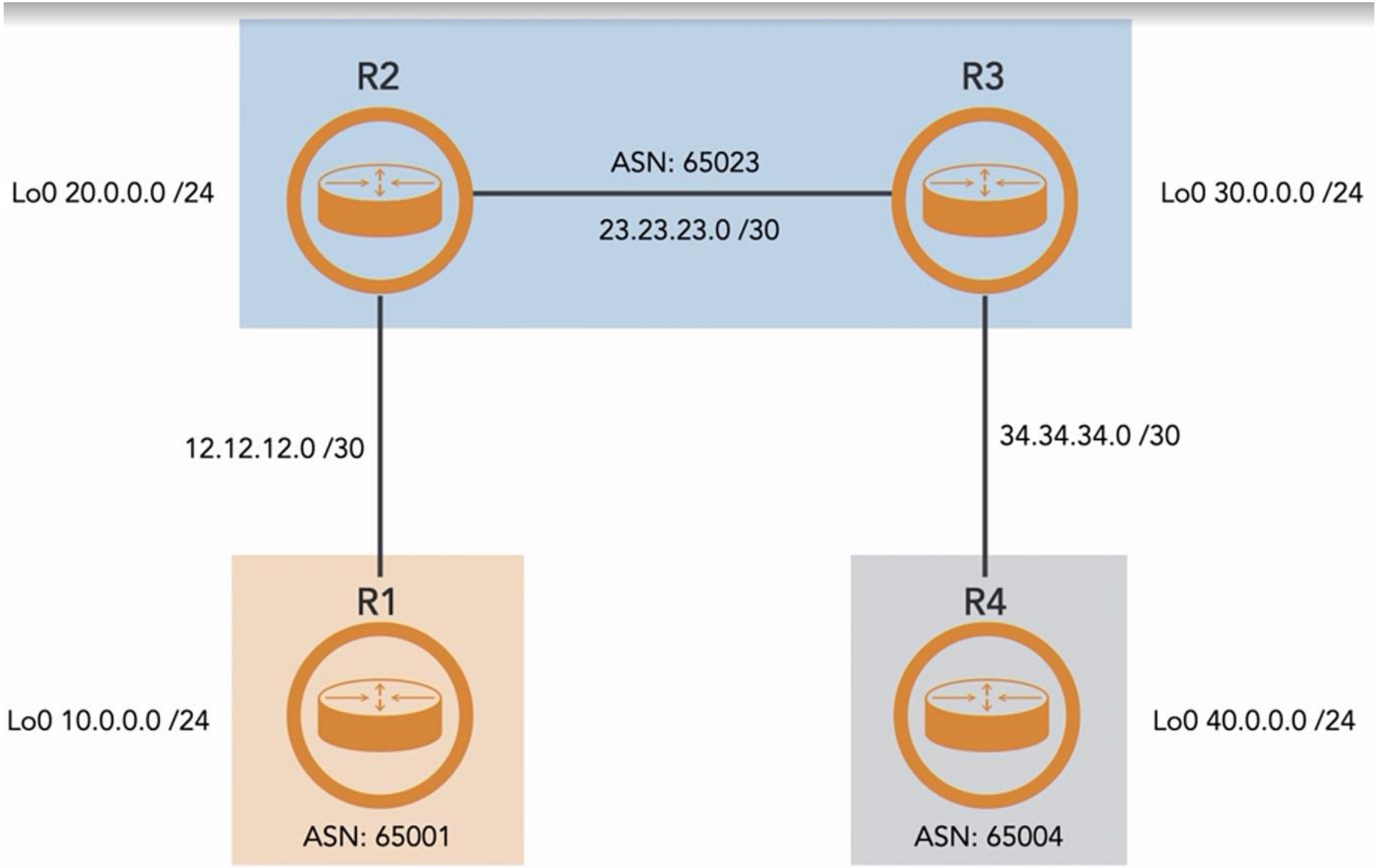
```
R4(config-route-map)#set weight 9999
R4(config-route-map)#exit
R4(config)#route
R4(config)#route-map MAP20 permit 20
R4(config-route-map)#exit
R4(config)#router bgp 65004
R4(config-router)#neigh
R4(config-router)#neighbor 34.34.34.1 route-map MAP20 in
R4(config-router)#end
R4#clear ip bgp *
```

PATH CHANGING

Create a prefix list	**Router(config)#ip prefix-list [list name] permit [network IP]**
Create a route map	**Router(config)#route-map [map name] permit [#]** **Router(config-route-map)# match ip address prefix-list [list name]** **Router(config-route-map)# set weight [value]**
Apply the route map to BGP configuration	**Router(config-router)#neighbor [neighbor ip address] route-map [map] [in/out]**

```
Router(config-router)#neighbor [neighbor ip address]
                      update-source [i.e. loopback 0]
```

ADVANCED BGP

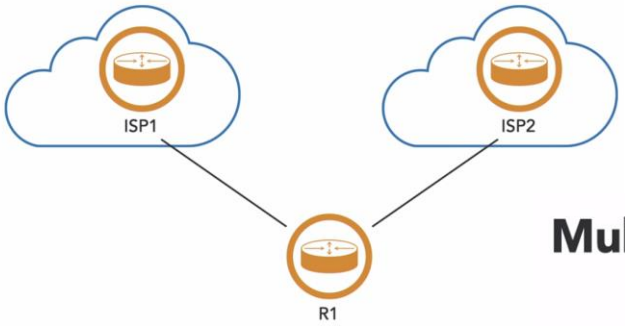


If IPV4 DEACTIVATED

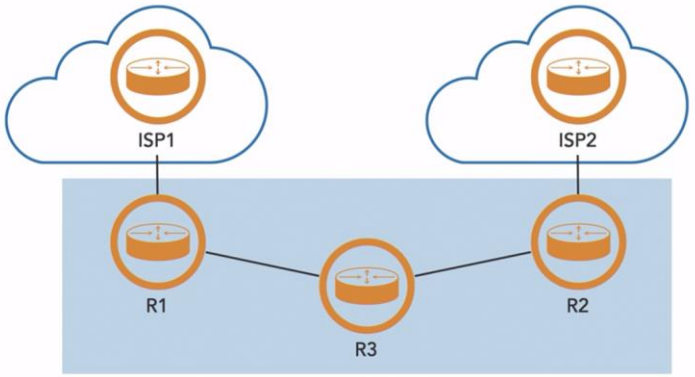
```
Router(config-router)#address-family IPv4 unicast
Router(config-router)#neighbor [neighbor IP] activate
```

BGP MULTI HOMING AND MULTIPATHING

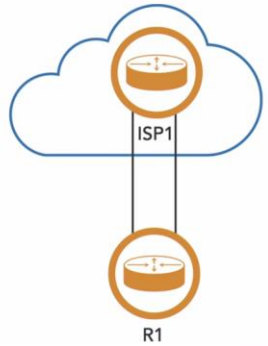
Multihoming: Single Router



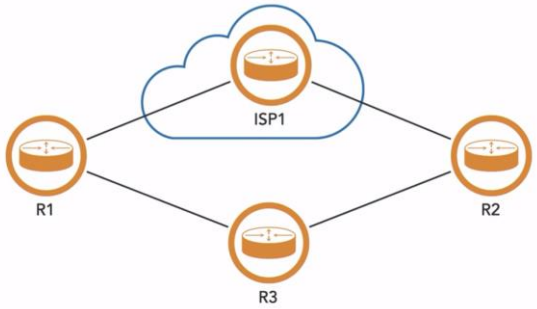
Multihoming: Multiple Routers



Multipathing | Single Router



Multipathing | Multiple Routers



MULTIHOMING AND MULTIPATHING

Multihoming means connecting your network to **two or more ISPs** (or BGP peers) for **redundancy** or **load balancing**.
Multipathing allows **installing and using multiple BGP routes** to the **same destination** — even if one is not the "best" path.

Feature	BGP Multihoming	BGP Multipathing
Connects to	Multiple ISPs or external ASes	Multiple paths to the **same destination**
Goal	Redundancy & availability	Load sharing / bandwidth balancing
Route use	Chooses best route by default	Can install/use **multiple equal-cost routes**
Common Use	Enterprise-ISP setups	Data centers / ISPs with redundant links

```
Router(config)# router bgp [AS number]
Router(config-router)# address-family ipv4 unicast
Router(config-router-af)# maximum-paths [# of paths]
```

```
Router(config-router-af)#maximum-paths ibgp
[# of paths]
```

```
Router(config)#router bgp [AS number]
Router(config-router)#address-family ipv4 unicast
Router(config)#maximum-paths [ebgp | ibgp]  [# of paths]
```

1

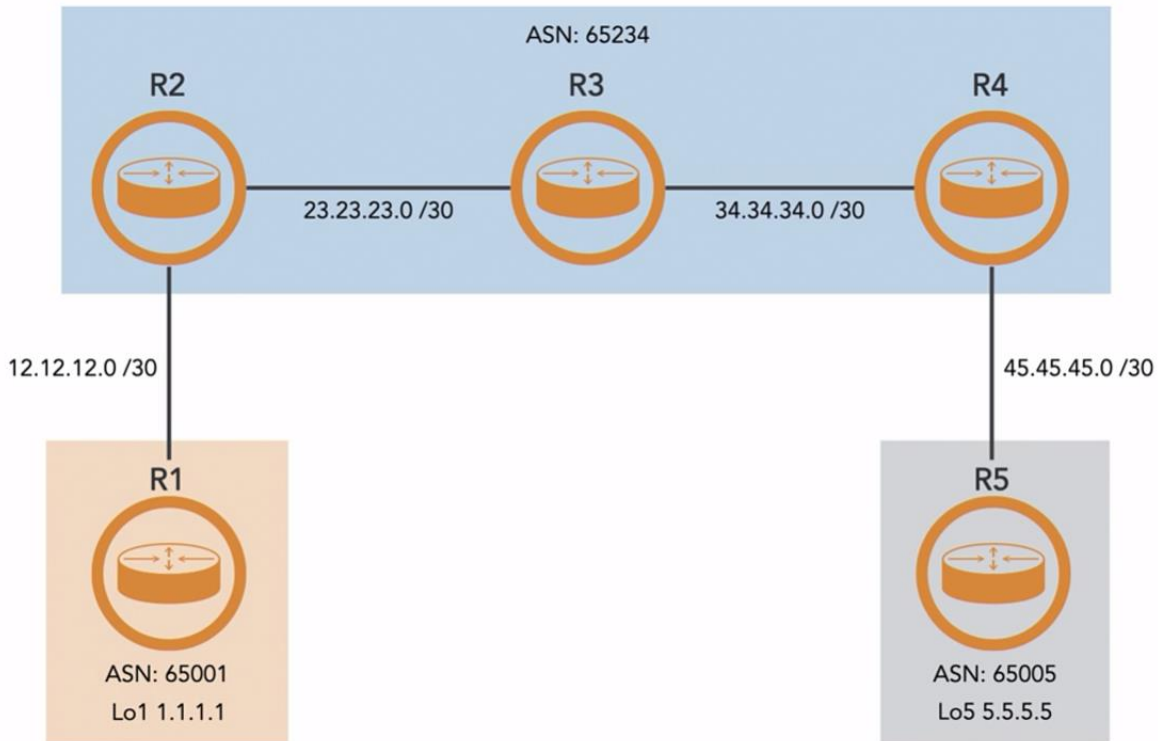
Multipathing

BGP will attempt to load balance the traffic dynamically.

2

Multihoming

To balance the load, we need to configure it.



🧠 Why All BGP Routers Within a Single AS Must Be Fully Meshed (in iBGP):

📌 Because of the iBGP Split-Horizon Rule:

An iBGP router will never advertise routes learned from one iBGP peer to another iBGP peer.

✅ Solution Options:

Option Description

🔁 Full Mesh: Every iBGP router forms a session with every other iBGP router.

🌐 Route Reflector (RR): A central router reflects iBGP routes to clients.

🧱 Confederation: Split AS into sub-ASes to reduce session count.

BGP Route Reflector

✅ A **Route Reflector (RR)** allows an iBGP router to **reflect BGP routes** to other iBGP peers, removing the full mesh requirement. (Full Mesh means tcp connection between two routers)

📤 Route Reflector Behavior

Routes learned from	Sent to
Client	Other clients + non-clients
Non-client	Only to clients
eBGP peer	To everyone (clients + non-clients)

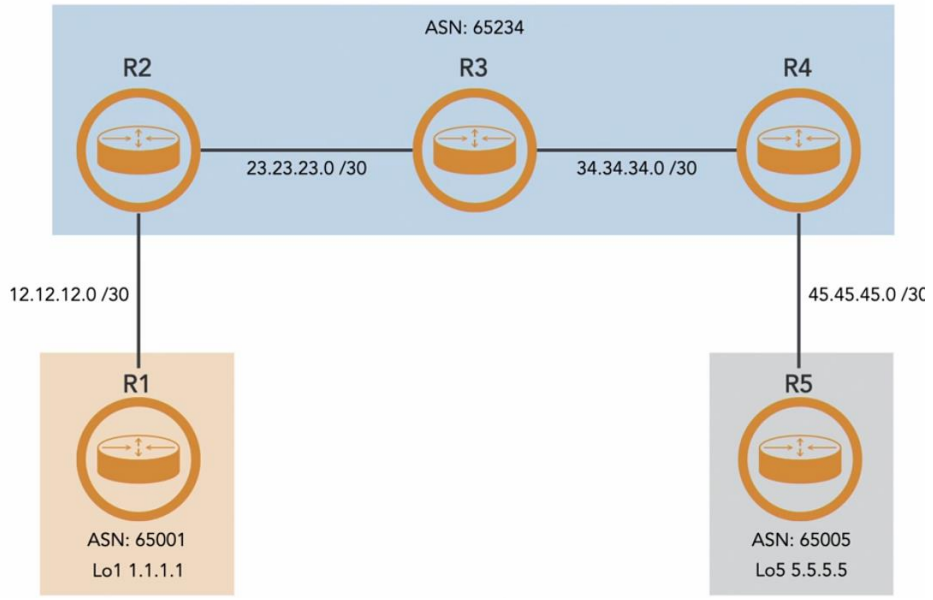
📘 Key Roles

Term	Role
Route Reflector (RR)	Central router that reflects routes.
Client	Router that peers with the RR.
Non-Client	Other routers that peer with RR but are not clients.

-The Route Reflector clients will have full adjacency only with the Route Reflector Server
- A Router Reflector Client will not have full adjacency with other Route Reflector Client

Why route reflector

When we use full mesh between IBGP peers, then the total TCP session will be n*(n-1)/2
to solve this; router reflector is used.




```
Router(config-router)#neighbor [neighbor IP]
route-reflector-client
```

Normally, **iBGP peers** don't advertise routes to other iBGP peers (split-horizon rule).

1

Rule #1

If an NLRI is received from a non-route-reflector client, then the route reflector will send this only to a client.

2

Rule #2

If an NLRI is received from a route-reflector client or from an EBGP peer, then the route reflector will send it to both the client and non-clients.

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router bgp 65234
R3(config-router)#neigh
R3(config-router)#neighbor 23.23.23.1 route-ref
R3(config-router)#neighbor 23.23.23.1 route-reflector-client
R3(config-router)#neigh
R3(config-router)#neighbor 34.34.34.2 rou
R3(config-router)#neighbor 34.34.34.2 route-ref
R3(config-router)#neighbor 34.34.34.2 route-reflector-client
R3(config-router)#
```

BGP Confederation

✅ BGP Confederation Explained (Simplified)

A BGP confederation is a method used in large networks to scale iBGP by dividing a single AS (Autonomous System) into multiple sub-ASes, while still presenting itself as one AS to the outside world.

Or

Confederation is consists of member autonomous that then combine into a large autonomous system. The member As will use AS numbers from the private ASN range.

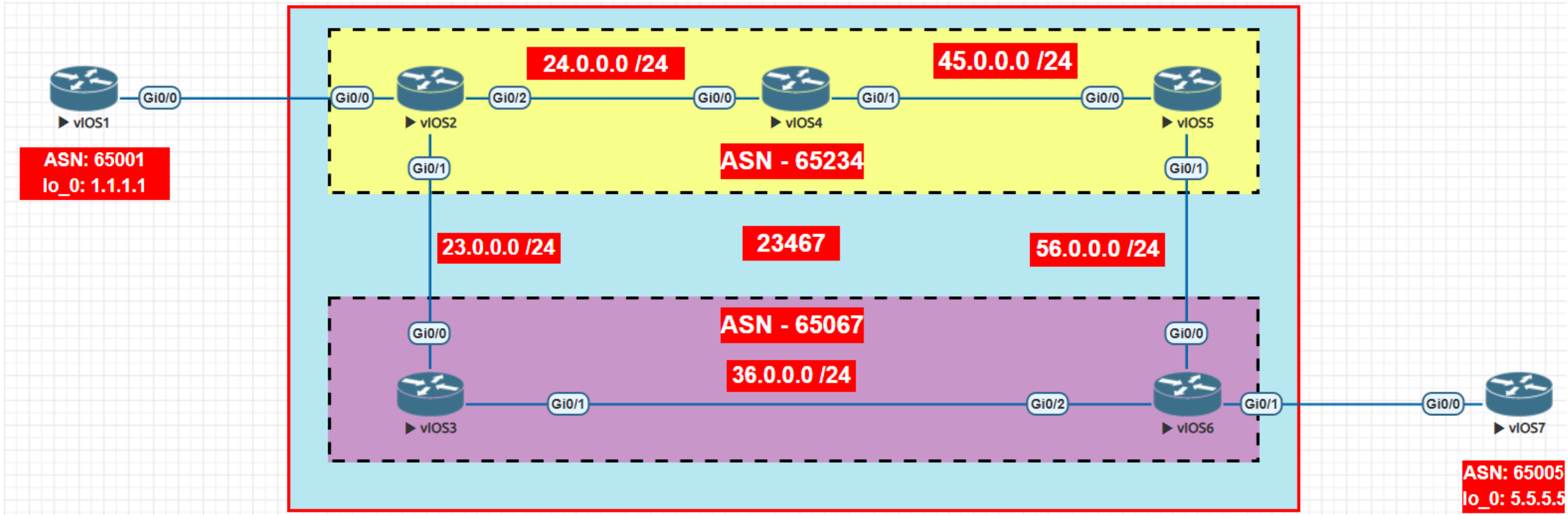
📌 Why Use BGP Confederation?

Avoid full mesh iBGP requirement.

Easier route reflectors or hierarchical BGP design.

Better administrative control within large ASes.

Keeps internal complexity hidden from external ASes.



R2:

router bgp 65234

bgp confederation identifier 23457 (router bgp confederation <outer-autonomous-system>)

bgp confederation peers 65067

BGP COMMUNITY

- A BGP community is a special tag that can be added to a route. It helps routers group certain routes together so they can be treated in a specific way, like choosing a faster path or blocking some traffic.
- It is 32-bit value colon mark in new format and decimal mark in old format.

To change to the new-format, which is in colon notation:

```
Router(config)# ip bgp-community new-format
```

```
Router(config-router)# address-family ipv4 unicast

Router(config-router-af)# neighbor [neighbor IP]
send-community [standard | extended | both]
```

** For IOS and IOS-XE routers*

From the neighbor address-family config mode:

For advertising BGP communities:

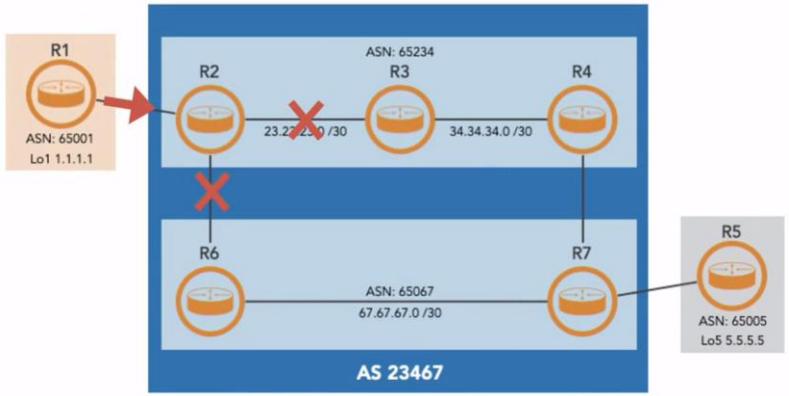
- Send-community-ebgp

To advertise extended BGP communities:

- Send-extended-community-ebgp

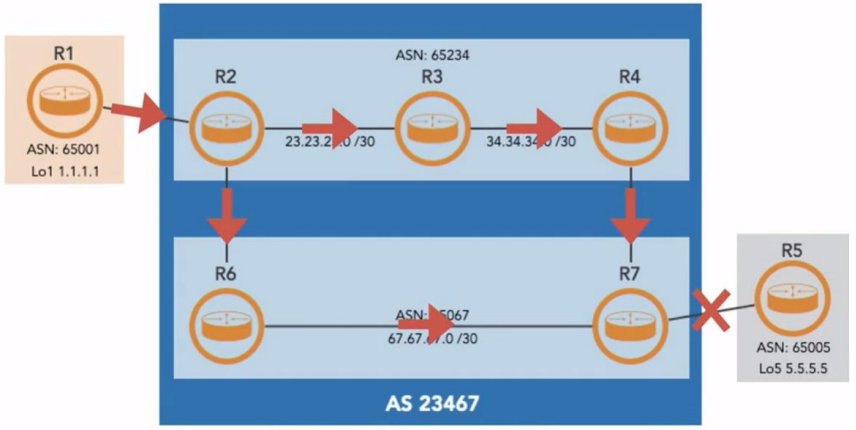
For IOS-XR routers

No_advertise Communities



In this, when a router receives a advertise route, it doesn't advertise to anyone else.

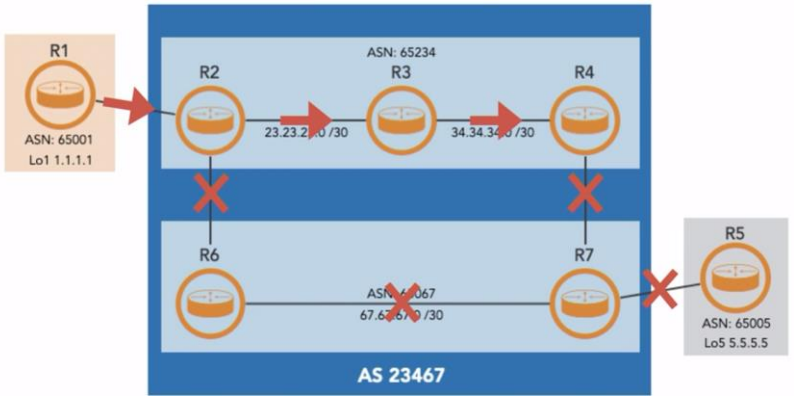
No_export Communities



In this, when a router receives a advertise route, it advertises that route to routers in the same public as.

Private BGP communities are used for conditional matching for a route policy.

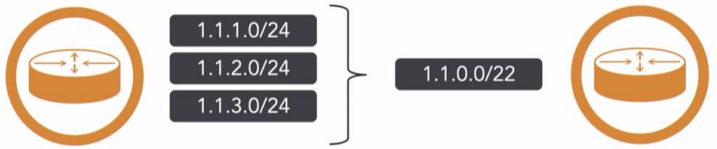
Local_AS Communities



In this, when a router receives advertised routes, it advertises those routes to routers within the same member AS. It does not advertise the routes to BGP confederation peers.

Dynamic Route Summarization With Aggregation Tag

A route summary is a consolidation of multiple routes to single-route advertisement.



router bgp 1
address-family ipv4 unicast
aggregate-address 1.1.0.0 255.255.252.0

```
 1.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
    1.1.0.0/22 [200/0] via 12.0.0.1, 00:16:28
    1.1.1.0/24 [200/0] via 12.0.0.1, 00:16:28
    1.1.2.0/24 [200/0] via 12.0.0.1, 00:16:28
    1.1.3.0/24 [200/0] via 12.0.0.1, 00:16:26
 12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
    12.0.0.0/24 is directly connected, GigabitEthernet0/0
    12.0.0.2/32 is directly connected, GigabitEthernet0/0
```

(the above command advertises the summary route in addition to the original networks)

aggregate-address 1.1.0.0 255.255.252.0 summary-only

```
1.0.0.0/22 is subnetted, 1 subnets
   1.1.0.0 [200/0] via 12.0.0.1, 00:17:30
12.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
   12.0.0.0/24 is directly connected, GigabitEthernet0/0
   12.0.0.2/32 is directly connected, GigabitEthernet0/0
```

BGP Atomic Aggregate

It is used to summarize the routes after receiving from a router. So, the router will advertise a single route to other routers.

router bgp 1
address-family ipv4 unicast
aggregate-address 1.1.0.0 255.255.252.0 summary-only

To check the advertised routes got from bgp peers:
sh ip bgp ipv4 unicast
sh ip bgp

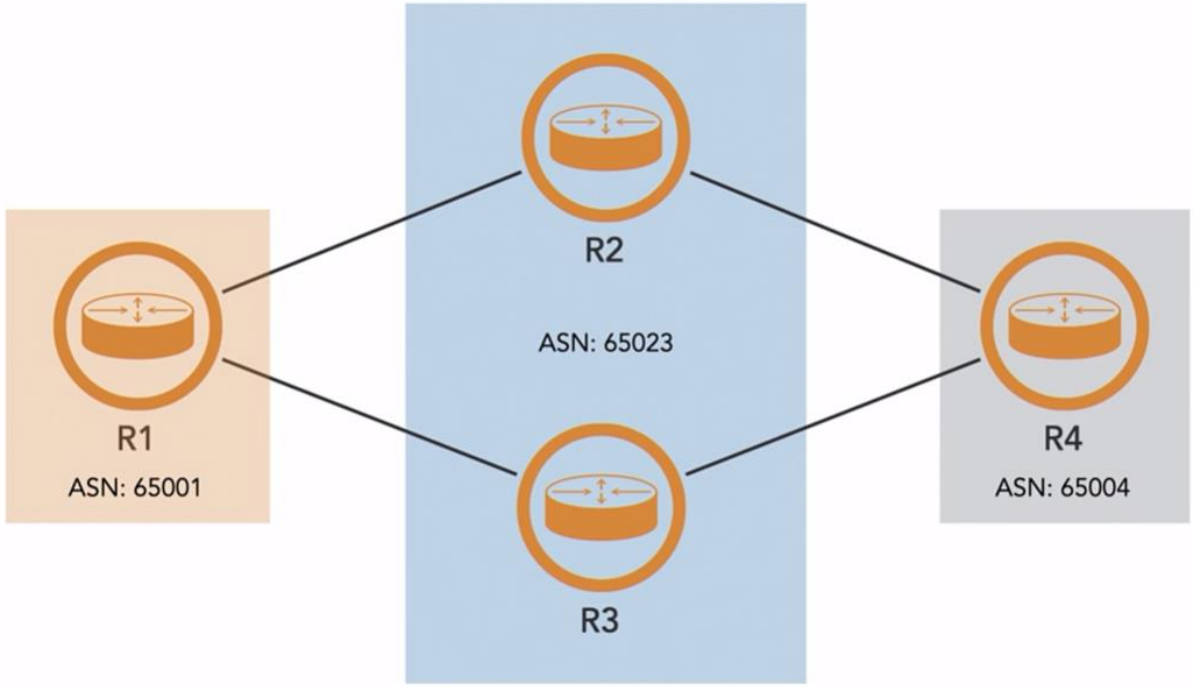
check atomic aggregate routes:
sh bgp ipv4 unicast 1.1.0.0 (<summary-ip>)

if we want to keep the as number in the history

```
Router(config-router-af)# aggregate-address [aggregate
address] [aggregate mask] as-set [summary-only]
```

BGP PEER Group

Peer groups are used to apply the same policy to multiple routers that have the same AS.
We create one object and apply the same object for multiple routes.
Or
Reduces BGP router's cpu load by creating an update once per group, rather than one per neighbor.

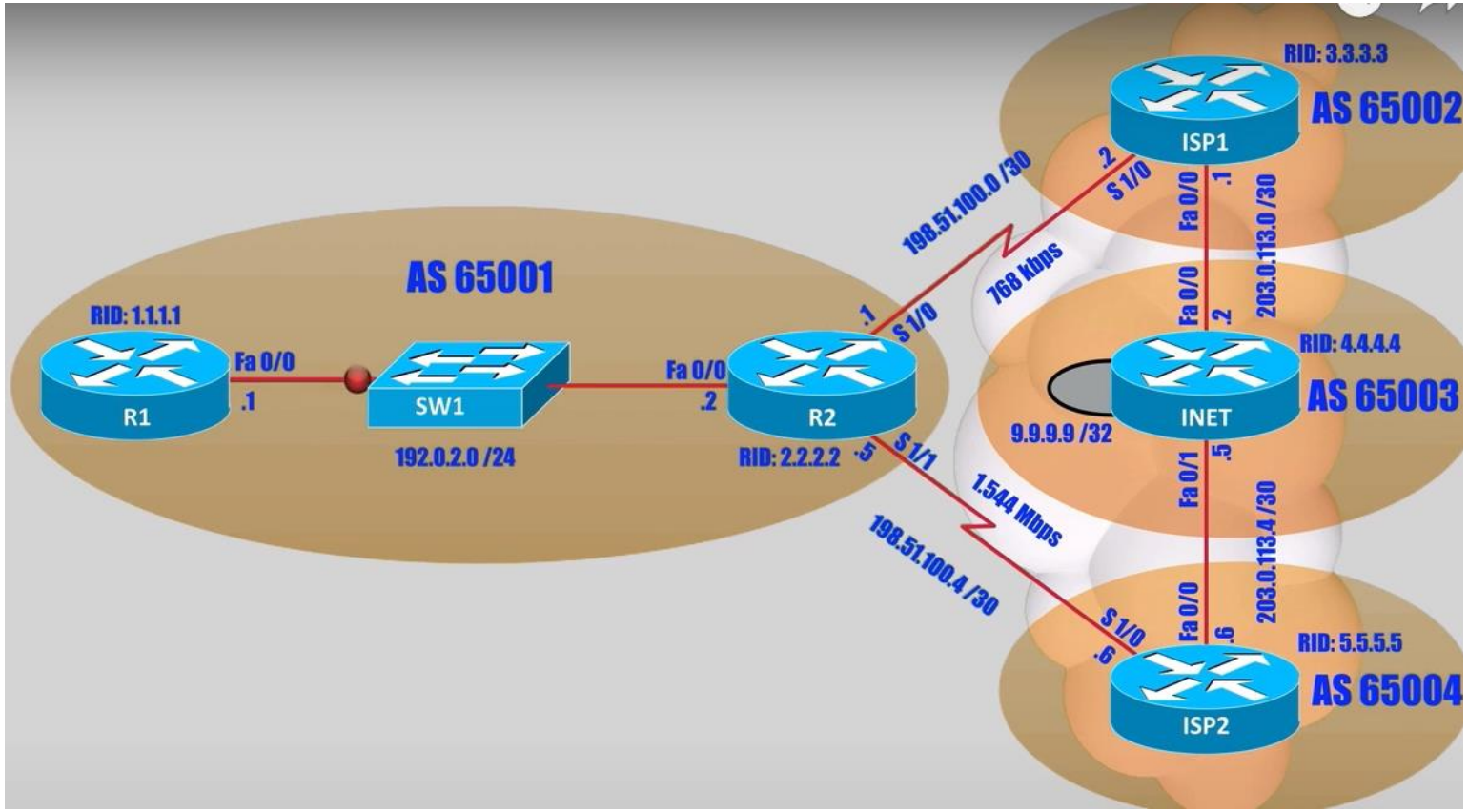



```
router bgp 65001
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 network 10.0.0.0 mask 255.255.255.0
 network 20.0.0.0 mask 255.255.255.0
 network 30.0.0.0 mask 255.255.255.0
R1(config-router)#neigh
R1(config-router)#neighbor PG-23 peer-group
R1(config-router)#neigh
R1(config-router)#neighbor PG-23 remote
R1(config-router)#neighbor PG-23 remote-as 65023
R1(config-router)#neigh
R1(config-router)#neighbor 12.12.12.2 peer-group PG-23
R1(config-router)#neigh
R1(config-router)#neighbor 13.13.13.2 peer
R1(config-router)#neighbor 13.13.13.2 peer-group PG-23
R1(config-router)#neigh
R1(config-router)#neighbor PG-23 pref
R1(config-router)#neighbor PG-23 prefix-list PL-GROUP in
R1(config-router)#end
```

i. create the peer-group
ii. Add the addresses in the peer-group

BGP PEER GROUP

We can also apply common attributes to peer group (e.g: AS number)



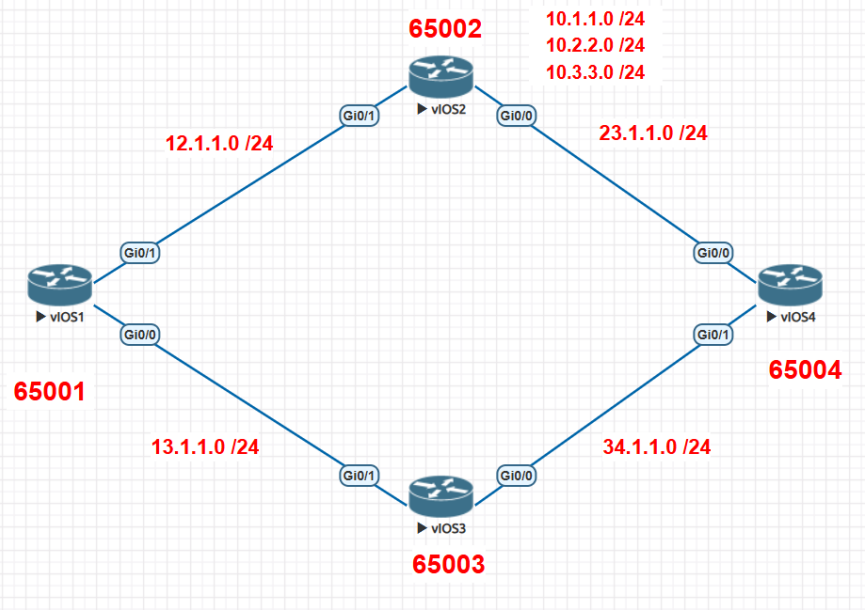
Conditional Route Selection

The method of selectively identifying which prefixes should receive or advertise from peers to what we refer as conditional route selection.

1. Distribute List – uses access-list to filter prefixes on neighbor-by-neighbor basis. (ACL)
2. Prefix List - same
3. Route Maps –
4. As-Path filtering – regular epressions
5. BGP community

We cannot use a distribution list and prefix list at the same time for receiving or advertising routes.

ACCESS-LIST



I want 10.1.1.0 traffic should not come through 12.1.1.0 network , it should come by 13.1.1.0 network

Clear bgp session - clear ip bgp * soft

access-list 10 deny 10.1.1.0 0.255.255.255
access-list 10 permit any
router bgp 65001
neighbor 12.1.1.2 remote-as 65002
neighbor 12.1.1.2 distribute-list 10 in
neighbor 13.1.1.3 remote-as 65003

BGP QUESTIONS

1. Do bgp advertise the received route from ebgp neighbor peer which is not routable by a router??
ANS: No, a route that is not considered valid/routable will not be advertised to other peers, even within iBGP or eBGP.

2. Does route reflector advertises the routes received from neighbor?
ANS: Yes, a route reflector does advertise routes received from its clients. However, it does not modify the next-hop IP address by default; the next-hop remains as advertised by the original router.

3. When does a RIB failure occur in BGP?
ANS: The rib failure tells us that a route is present which is better than advertised route.

Protocol	Admin Distance default
Connected	0
Static	1
eBGP	20
OSPF	110
IS-IS	115
RIP	120
iBGP	200

BGP ERRORS MAY COME

When there is neighbor mismatch, typed wrong autonomous system

*May 29 14:10:53.069: %BGP-3-NOTIFICATION: sent to neighbor 12.0.0.2 active 2/2 (peer in wrong AS) 2 bytes FFFE

*May 29 14:10:53.069: %BGP-4-MSGDUMP: unsupported or mal-formatted message received from 12.0.0.2:

FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF 0039 0104 FFFE 00B4 1700 0002 1C02 0601

0400 0100 0102 0280 0002 0202 0002 0246 0002 0641 0400 00FF FE

*May 29 14:10:58.159: %BGP-5-NBR_RESET: Neighbor 12.0.0.2 active reset (BGP Notification sent)