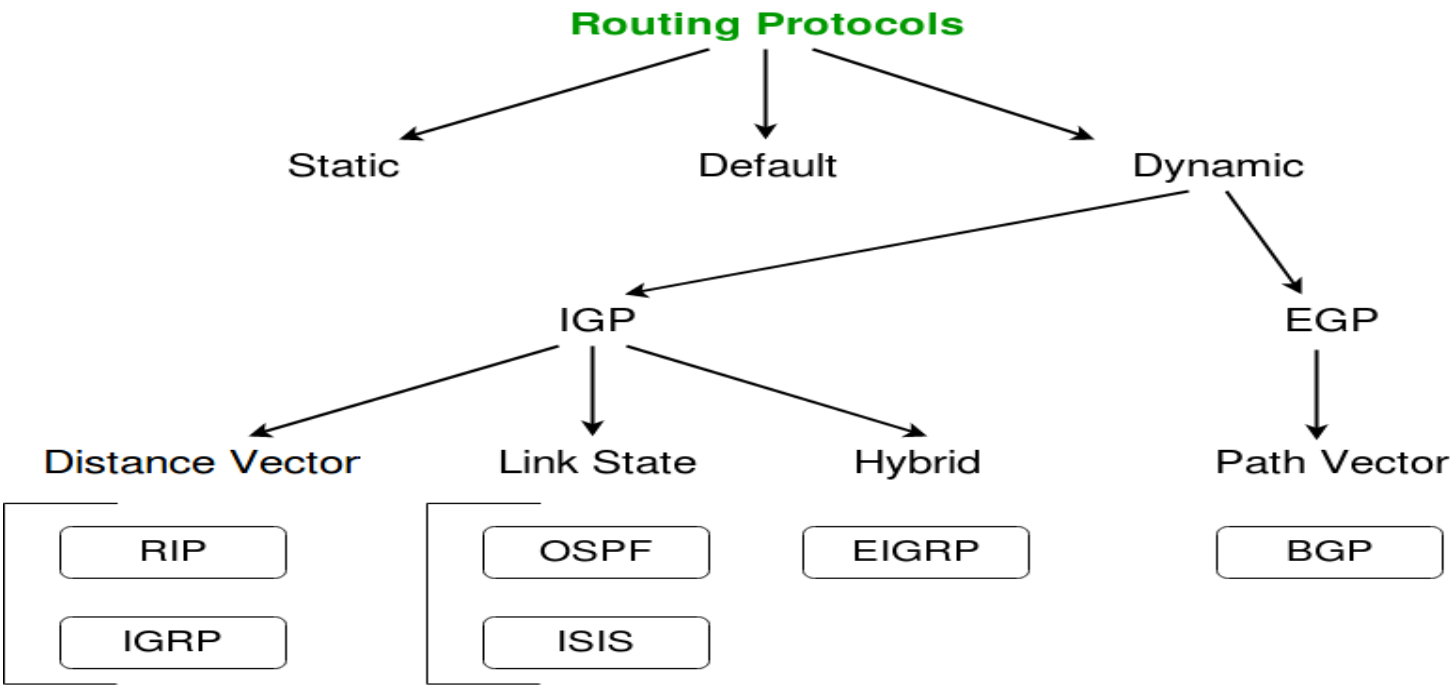

🚀 OSPF (Open Shortest Path First)(Dynamic Routing)

- **Type**: Link State (IGP)
- **Algorithm**: Dijkstra's SPF
- **Purpose**: Dynamic route learning, fast convergence. Automatically learn the route Dynamically from the other routers
- **OSPF Packets**: Hello, DBD, LSR, LSU, LSAck

Hello Packet: Discovery, DR/BDR election
DBD Packet: Summary of LSAs.
LSR / LSU / LSAck: DB sync and acknowledgments

OSPF Adjacency:

Down→Init → 2-Way → Ex Start → Exchange → Loading → Full.

Here's a breakdown of the key states:

1. **Down:** (Initial state) No **Hello packets have been received** from a neighbor.
2. **Init:** My router has received a Hello packet from a neighbor, but I don't see my own Router ID in their Hello yet. This means **one-way communication is established**.
3. **2-Way:** (Crucial state) Both routers have seen their own Router ID in the other's Hello packets. Bi-directional communication is confirmed. On multi-access networks (like Ethernet), DR/BDR election happens here. Non-DR/BDR routers will stay in 2-Way with each other.
4. **ExStart:** Routers negotiate who will be the "master" and "slave" for the LSDB exchange. The router with the higher Router ID usually becomes the master. This ensures orderly DBD packet sequencing.
5. **Exchange:** Routers exchange **DBD (Database Description) packets**, which are summaries (headers) of their Link-State Databases. They compare these to identify missing or outdated information.

6. **Loading:** Based on the DBD comparison, routers send **LSR (Link-State Request) packets** for any missing LSAs. The neighbor responds with **LSU (Link-State Update) packets** containing the requested LSAs.
7. **Full:** (Desired state) Both routers have fully synchronized LSDBs. They are now considered "fully adjacent" and can make routing decisions based on complete topological information.

OSPF Packet Types & Their Contents

Packet Type	Purpose	Key Contents
Hello	Discover & maintain neighbors	Router ID, Hello/Dead intervals, Area ID, Authentication type, Neighbor list, DR/BDR info
DBD	Exchange summary of LSAs	LSA headers (not full LSAs), MTU size, options field, sequence number
LSR	Request specific LSAs	LSA type, Link State ID, sequence number, Advertising Router ID, options field
LSU	Send full LSA information	One or more complete LSAs, including topology info (router links, metrics, etc.)
LSAck	Acknowledge received LSAs	List of acknowledged LSA headers (not the full LSA)

After Database Sync what will happen:

Use SPF algorithm to find the Shortest(Best) path based on the cost. Then exchange the route.

Quick Tip for Interviewng

- Emphasize that **Hello packets are used for neighbor discovery and DR/BDR election**.
- **DBD packets** are exchanged during the **Exchange state**.
- **LSR/LSU/LSAck** are used during the **Loading state** to **synchronize databases**.

These states help troubleshoot and ensure proper communication during the neighbour establishment process.

Common Reasons for Adjacency Issues (Stuck States):

Note: If routers get **stuck in states like ExStart or Loading**, it often indicates a **mismatch in parameters** that prevent a full exchange:

- **MTU Mismatch:** ***Prevents DBD packets*** from being processed correctly.
- **Authentication Mismatch:** Incorrect or missing authentication keys.
- **Area ID Mismatch:** Routers must be in the same OSPF area.
- **Hello/Dead Interval Mismatch:** Timers for neighbor detection must align.
- **Network Type Mismatch:** Especially crucial for DR/BDR election on multi-access networks.
- **Passive Interface:** If an interface is set as passive, it won't send or receive OSPF Hellos.

For example, a stuck **"Loading"** state often **indicates database exchange problems**.
Stuck in Loading? Likely **MTU mismatch** or **LSDB sync issue**.

What is OSPF, and what is its primary purpose?
OSPF (Open Shortest Path First) is a link-state routing protocol used for deter-mining the best path for routing packets within an IP network. Its main purpose is to provide efficient and dynamic routing in IP networks

What are the advantages of OSPF over distance vector protocols?
OSPF uses a link-state database and Dijkstra's algorithm for path selection, which results in faster convergence, better scalability, and loop prevention compared to distance vector protocols.

What is the purpose of OSPF Hello packets?
OSPF **Hello** packets are used for neighbor discovery, adjacency establishment, and maintaining neighbor relationships.

Explain LSDB (Link-State Database) synchronization?

LSDB synchronization ensures that OSPF routers have consistent link-state databases before exchanging routing updates, reducing the risk of transient routing loops during OSPF convergence.

What are the steps involved in OSPF convergence?

OSPF convergence involves neighbor discovery, database synchronization, route calculation using Dijkstra's algorithm, SPF tree creation, and updating the routing table.

How does OSPF perform route summarization?

OSPF summarizes routes at area boundaries, using Type 3 Summary LSAs to reduce the size of routing tables.

What is the purpose of OSPF route filtering?

OSPF route filtering allows administrators to control the exchange of routing information by applying Access Control Lists (ACLs) to OSPF processes.

What is a virtual link in OSPF?

A virtual link is used to connect an OSPF area to the backbone area (Area 0) through a non-backbone area.

Explain the concept of a stub area in OSPF?

A stub area blocks Type 5 External LSAs from entering the area, which reduces the size of the LSDB and routing table. The ABR generates Type 3 Summary LSAs for external routes.

How can OSPF be secured using authentication?

OSPF authentication is configured using plain text or MD5 authentication keys to ensure that OSPF Hello packets and LSAs are exchanged only between authenticated neighbors.

How does OSPFv3 differ from OSPFv2?

OSPFv3 is designed specifically for IPv6 networks and uses IPv6 addresses. It also simplifies OSPF operation by eliminating the need for DR/BDR elections on point-to-point links..

What commands can you use to troubleshoot OSPF?

Common troubleshooting commands include "show ip ospf," "show ip ospf neighbor," "show ip ospf database," and "debug ip ospf events."

How does OSPF interact with BGP?

OSPF can redistribute BGP routes into the OSPF routing domain, allowing BGP-learned routes to be advertised within the OSPF network.

OSPF ExStart state Stucking:

MTU mismatch is the main problem.

BGP(Border gateway protocol)

BGP Messages:

BGP communication runs over a TCP session on Port 179 and uses four main message types.
OPEN: Used to establish a session. It contains BGP version, Local ASN, Hold Time & Router ID.
UPDATE: Used to exchange routing information.
KEEPALIVE: Sent messages periodically to keep the session alive.
NOTIFICATION: Sent when an error is detected, causing the BGP session to close.

BGP Peering Process(State):

Idle, Connect, Active, Open Sent, Open Confirm, Exchange

BGP uses TCP port 179 to establish sessions. When two routers initiate peer-ing, they start in **IDLE**, attempt a TCP session in **Connect**, and send a **OPEN** message in **OPENSENT**. Once both routers receive **OPEN** and **KEEPALIVE**, they enter **ESTABLISHED** state. Routes are **Exchanged** using **UPDATE** messages, and the session is Kept alive with **KEEPALIVE** packets.

Path Attributes

1. Well-known, Mandatory: Must be included in every BGP update (e.g., AS_PATH, NEXT_HOP, ORIGIN).
2. Well-known, Discretionary: Recognized by all BGP routers, but not required in every update (e.g., LOCAL_PREF).
3. Optional, Transitive: Not necessarily supported by all routers, but if a router doesn't understand it, it should pass it along to the next peer (e.g., COMMUNITY).
4. **Optional, Non-transitive:** If a router doesn't understand this attribute, it should be discarded (e.g., MED).

1. Prefer highest Weight. (Only on cisco)
2. Prefer highest LOCAL_PREFERENCE.
3. Prefer locally originated routes.
4. Prefer shortest AS_PATH.
5. Prefer lowest ORIGIN code.
6. Prefer lowest MED.
7. Prefer eBGP over IBGP paths. Oldest routing table
8. Prefer path with the lowest IGP metric to the NEXT_HOP.
9. Use the lowest Router-ID as a tie-breaker.

BGP Path Selection Process:
Check N/W reachability
Local Pref