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📘 What is the OSPF Algorithm?

OSPF (Open Shortest Path First) uses the **Dijkstra's Shortest Path First (SPF) algorithm** to determine the **best path** to each destination in a network.

🧠 Dijkstra's SPF Algorithm Explained (Used by OSPF)

- The SPF algorithm calculates the **shortest (least-cost) path** from the router (root node) to every other router in the network.
- It uses the **OSPF cost** as a metric (based on bandwidth).
- The algorithm runs every time there's a change in the network topology (e.g., link goes down).

🔁 Steps OSPF Takes Using SPF Algorithm:

1. **Build the Link-State Database (LSDB):**
   - All routers in the same OSPF area exchange **LSAs** (Link-State Advertisements).
   - These LSAs help each router build a complete **map of the network** (LSDB).
2. **Run Dijkstra's Algorithm:**
   - OSPF uses this algorithm to calculate the shortest path tree (SPT).
   - The router itself is the **root node**, and the tree contains all the shortest paths to each destination.
3. **Populate Routing Table:**
   - Based on the shortest paths, OSPF installs **best routes** into the **routing table**.

📊 Why SPF is Used in OSPF:

Feature	Benefit
Fast convergence	Quickly recalculates routes when topology changes.
Loop-free	SPF tree prevents routing loops.
Accurate path selection	Uses real-time network topology and cost values.

🎯 Real-Life Analogy:

Imagine you are using Google Maps to find the **fastest way home**:

- **Your home = Root of SPF tree**
- **Different routes = Paths with different travel times (costs)**
- Dijkstra's algorithm will calculate all possible routes and choose the one with the **least travel time**.

🛠️ Key OSPF Terms Related to SPF:

Term	Meaning
LSA	Link-State Advertisement (network info from each router)
LSDB	Link-State Database (full network map for the area)
SPT	Shortest Path Tree calculated by SPF
Metric	OSPF cost (lower = better path)