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TOPIC :   ROUTING PROTOCOLS

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ROUTER PROTOCOLS.

DEFINATION OF ROUTER PROTOCOLS.

Routing protocols are essential in computer networks as they determine the most efficient path for data packets to travel across interconnected networks. They are responsible for exchanging routing information, maintaining routing tables, and ensuring network reliability and efficiency.
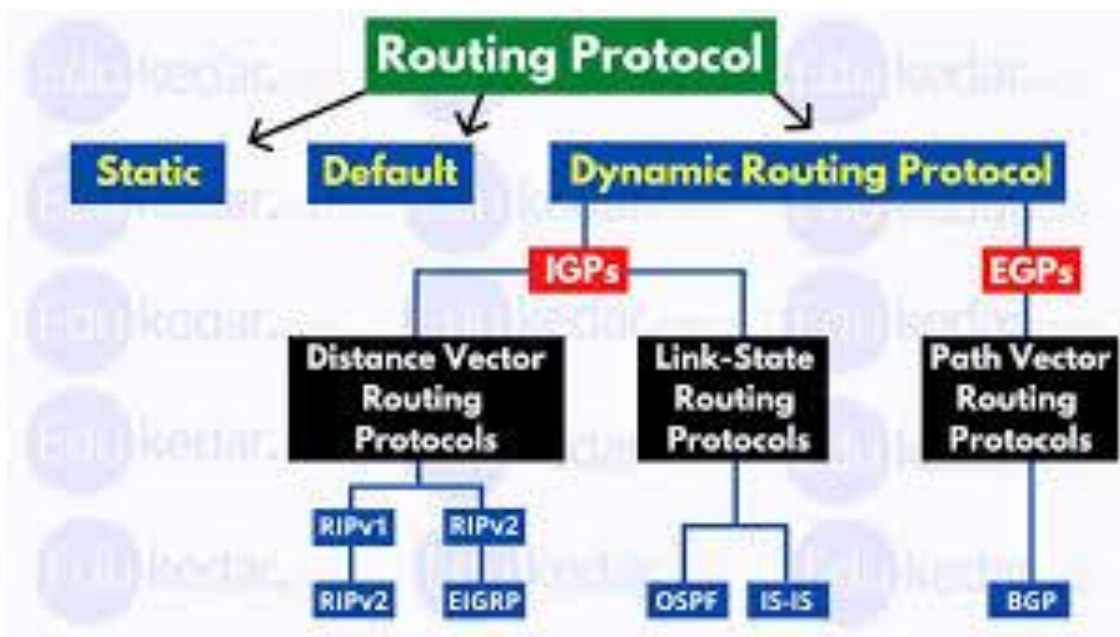
Classification of Routing Protocols:

BASED ON OPERATION

Static Routing: Routes are manually configured and do not change unless manually updated.

Example: No specific protocol; manual configuration.

Dynamic Routing: Routes are automatically updated based on network changes.

Example: RIP, OSPF.

2. Based on Behavior:

Distance Vector Routing Protocols: Calculate routes based on distance metrics.

Example: RIP, EIGRP.

Link-State Routing Protocols: Use a complete view of the network topology for routing decisions.

Example: OSPF, IS-IS.

3. Based on Protocol Types:

Interior Gateway Protocols (IGPs): Used within an organization's network.

Example: RIP, OSPF.

Exterior Gateway Protocols (EGPs): Operate between different networks.

Example: BGP.

Overview of Distance Vector Routing Protocols .

Definition and Characteristics:

Distance vector routing protocols determine the best path to a destination based on distance metrics, such as hop count. Each router periodically shares its routing table with its neighbors, which helps in discovering and maintaining routes.

Operation:

The protocol operates using the Bellman-Ford algorithm. Each router begins with knowledge of its immediate neighbors and iteratively updates its routing table based on the information received. A metric, such as hop count, is used to measure the cost of a route. The protocol can suffer from issues like routing loops, which are mitigated by techniques such as split horizon and hold-down timers.

Examples:

1. RIP (Routing Information Protocol): Uses hop count as its metric, with a maximum allowable hop count of 15, making it suitable for small networks.

2. EIGRP (Enhanced Interior Gateway Routing Protocol): Combines distance vector and link-state features. It uses advanced metrics like bandwidth and delay, providing faster convergence and scalability.

Overview of Link-State Routing Protocols

Definition and Characteristics:

Link-state routing protocols construct a complete map of the network's topology and calculate the shortest path to each destination. They are highly scalable, reliable, and support hierarchical network designs.

Operation:

Link-state protocols use Dijkstra's algorithm to compute the shortest path tree for all destinations. Routers broadcast link-state advertisements (LSAs) to all routers in the

network, which contain information about directly connected neighbors and their costs. This ensures that every router has an identical topology database.

Examples:

1. OSPF (Open Shortest Path First): An open standard protocol supporting multiple areas for scalability and uses cost as its metric.

2. IS-IS (Intermediate System to Intermediate System): Similar to OSPF but commonly used in large-scale service provider networks due to its flexibility and simplicity.

Hybrid Routing Protocols

Definition and Characteristics:

Hybrid routing protocols combine features of distance vector and link-state protocols to provide scalability, fast convergence, and reduced overhead. They adapt dynamically to network changes and maintain high reliability.

Advantages:

Hybrid protocols offer the simplicity of distance vector protocols and the efficiency of link-state protocols. They address the limitations of traditional routing protocols, such as routing loops and slow convergence.

Examples:

1. EIGRP (Enhanced Interior Gateway Routing Protocol): Includes advanced distance vector features with efficient route computation and rapid convergence.

2. BGP (Border Gateway Protocol): Operates between autonomous systems and uses policies rather than metrics for route selection.

Comparison of Routing Protocols

Comparison Criteria:

1. Characteristics:

Distance vector protocols are simple but prone to loops.

Link-state protocols are robust and scalable but resource-intensive.

Hybrid protocols combine simplicity and efficiency.

2. Operation:

Distance vector protocols rely on periodic updates.

Link-state protocols use a complete network topology for decision-making.

Hybrid protocols adapt dynamically to network changes.

3. Scalability:

Distance vector protocols are suitable for small networks.

Link-state protocols handle large networks well.

Hybrid protocols scale effectively across diverse network sizes.

4. Convergence Time:

Distance vector protocols may converge slowly.

Link-state protocols converge quickly.

Hybrid protocols offer rapid convergence.

5. Overhead:

Distance vector protocols have low computational overhead.

Link-state protocols demand higher processing and memory.

Hybrid protocols balance overhead efficiently.

Best Use Cases:

Distance vector: Small, simple networks.

Link-state: Large, dynamic networks with complex topologies.

Hybrid: Large, multi-homed networks requiring robust and scalable solutions.

Conclusion

Routing protocols are integral to efficient network design and management, enabling the seamless flow of data across diverse networks. Distance vector protocols emphasize simplicity, link-state protocols prioritize precision and scalability, and hybrid protocols blend their strengths. Understanding these protocols allows network administrators to select and implement the most appropriate solution for a given network environment, ensuring optimal performance and reliability. As networks grow in complexity, the significance of advanced routing protocols continues to expand, emphasizing their role in maintaining efficient and resilient communication systems.

References

1. Kurose, J., & Ross, K. (2021). Computer Networking: A Top-Down Approach. Pearson.

2. Tanenbaum, A. S., & Wetherall, D. J. (2020). Computer Networks. Pearson.

3. Cisco Systems. (2024). Routing Protocols Overview. Retrieved from www.cisco.com

4. RFC 2453: RIP Version 2.

5. RFC 2328: OSPF Version 2.