Routing Protocols in Networking (Static vs. Dynamic)

Routing protocols are crucial in networking as they determine how data packets travel from source to destination. They fall into two categories: Static and Dynamic routing.

Static Routing:

- Manually configured by a network administrator.
- Suitable for small, simple networks.
- No overhead traffic for route updates.

Example:

Router(config)# ip route 192.168.2.0 255.255.255.0 10.0.0.2

This command sets a static route to the 192.168.2.0 network via the next-hop IP 10.0.0.2.

Pros:

- Simple and secure
- No CPU/memory overhead

Cons:

- Not scalable
- Manual updates if topology changes

Dynamic Routing:

- Automatically learns and updates routes using protocols.
- Adapts to network changes in real-time.
- Uses more resources (CPU, memory).

Types of Dynamic Routing Protocols:

1. Distance Vector Protocols (e.g., RIP)
   - Shares routing tables periodically.
   - Hop count is the metric.

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- Example:

  Router(config)# router rip

  Router(config-router)# network 192.168.1.0

2. Link-State Protocols (e.g., OSPF)

- Builds a complete map of the network.
- Uses cost (bandwidth) as metric.
- Example:

  Router(config)# router ospf 1

  Router(config-router)# network 10.0.0.0 0.0.0.255 area 0

3. Hybrid Protocols (e.g., EIGRP)

- Combines features of both distance vector and link-state.
- Uses bandwidth and delay as metrics.
- Example:

  Router(config)# router eigrp 100

  Router(config-router)# network 192.168.1.0

Pros:

- Scalable
- Automatically adapts to changes

Cons:

- Requires more configuration and resources
- Potential for routing loops without proper configuration

Summary:

Type	Config	Adaptability	Best Use Case
Static	Manual	Low	Small/simple setups
Dynamic RIP	Auto	Medium	Small to medium

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Dynamic	OSPF	Auto	High	Large enterprise
Dynamic	EIGRP	Auto	High	Cisco environments