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Routage et Architectures Avancées

Part 1: Rounting protocols

1. What are the 2 main types of IGP routing protocol, what are their main differences and give an example of each

 Answer: The two main types of IGP are Distance Vector and Link-State protocols. Distance Vector protocols, as RIP, determine routes based on metrics such as hop count and exchange updates periodically, making them simpler but slower to converge. Link-State protocols, as OSPF, build complete network map and use the Dijkstra algorithm, offering faster convergence and better scalability but requiring more resources. The main difference lies in how they calculate and share routing information.

2. MCQ

Question: An example of a distance vector routing protocol is :

Answer: a) RIP V1 and c) IGRP

Question: Full calculation of an OSPF cost takes into account :

Answer: a) bandwith

3. Which parameters are included in routing table. Describe the purpose of each parameter

Answer: A rounting table includes these four parameters:

    - Destination Network: Specifies the target network or subnet for the route.

    - Next Hop: Indicates the IP address of the next router to reach the destination.

    - Metric/Cost: Determines the efficiency of the route (OSPF cost or RIP hop count).

    - Interface: Specifies the router interface used to forward the packet.

4. Explain what is REDISTRIBUTION. Give a concrete example. Graphic required .

Answer: Redistribution is the process of sharing routes between different routing protocols or domains. For example, Router A (running OSPF) and Router B (running EIGRP) exchange routes through redistribution, allowing seamless communication between OSPF and EIGRP networks. This ensures connectivity in mixed-protocol environments.
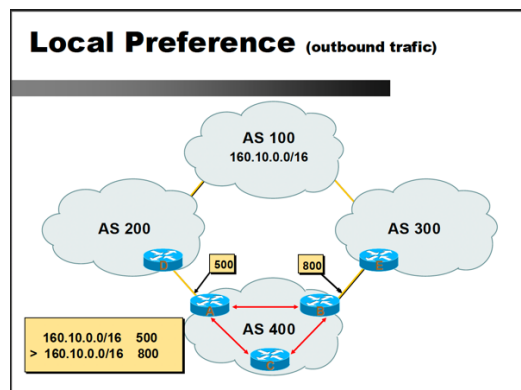
5. Why can we need multiple areas in an OSPF autonomous system ?

Answer: Multiple areas in an OSPF autonomous system reduce router resource usage by limiting SPF calculations to specific areas, minimize routing table sizes through route summarization, and contain LSA within areas, reducing network overhead and improving convergence.

6. Explain and describe three BGP attributes which permit to force the use of a preferred path (in depth answers required).

Answer: Three BGP Attributes to Enforce a Preferred Path:

1. Local Preference: Is used to determine the preferred outbound path within an AS. Higher values are preferred, allowing control over traffic exiting the AS .

Local Preference (outbound trafic)

AS 100
160.10.0.0/16

AS 200

AS 300

500   800

AS 400

160.10.0.0/16   500
> 160.10.0.0/16   800

2. MED (Multi-Exit Discriminator): It influences the preferred inbound path between two AS. Routes with the lowest MED value are chosen, helping control incoming traffic.

Multi-Exit Discriminator (MED)
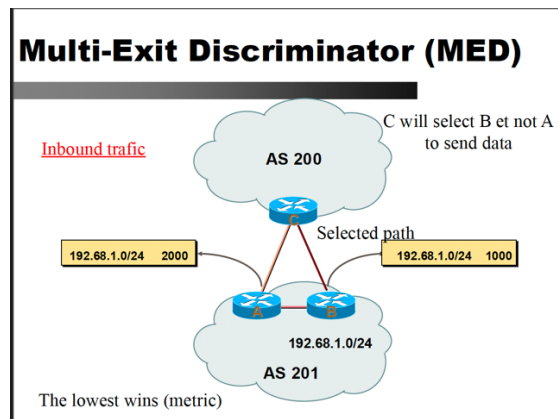
3.   AS-Path Prepend: It modifies the AS-Path length to make a route less desirable. By artificially adding the same AS number multiple times, the path appears longer and is less preferred by other AS .

7. What are the benefits and possible issues of Internet peering between 2 telecom operators?

Answer:

Benefits: Internet peering reduces latency, improves data transfer speed, and lowers costs by bypassing third-party transit providers.

Issues: Peering can lead to disputes over traffic imbalance, lack of scalability, and potential security vulnerabilities if not properly managed.

Part 2: Local loop and Core networks

1. What are the 2 main different types of FTTH? Give a short description of each type (advantages ad drawbacks)

Answer: The 2 main types of FTTH are Active Optical Network (AON) and Passive Optical Network (PON).

AON relies on active electronic devices, like switches and routers, to manage the distribution of signals, offering each user dedicated bandwidth and supporting longer distances. But, this approach is more expensive and complex due to the need for power and maintenance of the active components.

PON uses optical splitters to distribute signals without any active components between the provider and the user. This makes PON cost-effective, energy-efficient, and easy to deploy. But, the drawback is that bandwidth is shared among users, which can

lead to reduced performance in high-demand scenarios, and it is less scalable compared to AON.

2. QOS : Explain what is Differentiated Service (main principle). For which types of traffic, can you usually assign some specific classes of service and why ?

Answer: Differentiated Service is a QoS model that marks packets using the DSCP field in the IP header, ensuring each packet is handled based on its priority. High-priority traffic, as voice, is marked for low latency and minimal jitter. Video traffic is marked for consistent bandwidth using Assured Forwarding. Non-critical traffic, like file downloads, is treated as Best Effort. This approach optimizes resource allocation and reduces congestion for critical applications .

3. Explain the meaning of 'label switching' (in MPLS). Explain shortly the use of each of the 2 labels

Answer: In MPLS, label switching enables packets to be forwarded based on labels rather than IP addresses, ensuring faster and more efficient routing. Each packet is assigned two labels by the ingress PE router:

• First Label: Identifies the egress PE router and is used by P routers to forward the packet along the Label Switched Path. This label is swapped at each hop and removed by the penultimate router before reaching the egress PE.

• Second Label: Identifies the destination VRF at the egress PE router. It remains unchanged throughout the backbone and ensures the packet is directed to the correct VPN endpoint.

4. Define what a VRF is. What is the difference between VRF and VPN. Give an example

Answer: A VRF (Virtual Routing and Forwarding) is a technology that creates multiple virtual routing tables on a single router, isolating traffic for different customers or applications on shared infrastructure.

Difference Between VRF and VPN

• VRF: Manages routing separation within the provider's network.

• VPN: Defines the end-to-end secure connection, often using VRF for routing isolation.

To conclude, A VRF isolates routing tables within a provider's network, enabling traffic separation while a VPN provides end-to-end secure connectivity between customer sites, often relying on VRF for routing isolation .

For example: In an MPLS network, two companies with overlapping IP addresses can use separate VRFs on the same PE router to isolate and route their traffic within their respective VPN .