Routing Protocols:

1. Introduction:

Static routing is the simplest form of routing, achieved by manually adding routes to the routing table through configuration settings. This method is straightforward because you, as the network administrator, precisely control the routing paths.

Advantages of Static Routing:

- Simplicity and Control: It's easy to implement in small networks and provides explicit control over routing paths.
- Resource Efficient: Consumes less bandwidth and CPU resources since routers don't exchange routing information.
- Security: Reduces the risk of incorrect routing information because routes are not advertised over the network.

Disadvantages of Static Routing:

- Scalability Issues: Not suitable for large networks as it become complex and unmanageable.
- Lack of Fault Tolerance: The network cannot automatically reroute traffic unless manually configured if a link fails.

Unlike static routing, dynamic routing uses algorithms and protocols to adjust to changes in the network automatically. Routers communicate with each other, sharing information to update and maintain routing tables dynamically.

Advantages of Dynamic Routing:

- Scalability: More suitable for larger networks; can easily handle changes and growth in network structure.
- Fault Tolerance: Automatically recalculates routes when network changes occur, providing higher resilience and fault tolerance.
- Reduced Administrative Cost: Although complex to set up initially, it reduces the need for manual intervention once operational.

Disadvantages of Dynamic Routing:

- Resource Usage: Requires more CPU power and bandwidth to send routing updates and calculations.
- Potential Security Risks: The constant exchange of routing information can be exploited if not secured properly.

Common Dynamic Routing Protocols include:

- RIP (Routing Information Protocol): Simple and widely supported but limited by hop count. (https://www.javatpoint.com/rip-protocol)
- OSPF (Open Shortest Path First): More complex, scales well, and is suitable for large heterogeneous networks. (https://www.cisco.com/c/en/us/support/docs/ip/open-shortest-path-first-ospf/7039-1.html)
- EIGRP (Enhanced Interior Gateway Routing Protocol): A Cisco proprietary protocol that efficiently combines the features of link-state and distance vector protocols. (https://networklessons.com/cisco/ccie-routing-switching-written/introduction-to-eigrp)

2. Lab Session

Network Setup:

- Three routers (R1, R2, R3)
- Two switches (S1, S2)
- Four PCs (PC0, PC1, PC2, PC3)

Network Diagram:

- R1 connects to S1 and R2
- R2 connects to S2, R2, and R3
- R3 connects to R2
- S1 connects to R1, PC0, and PC2
- S2 connects to R2, PC1, and PC3

Part 1: Configuring Static Routing

- **Step 1: Assign IP addresses to all devices.**
  Routers interface IPs (e.g., R1 interfaces: 192.168.1.1/24 and 192.168.2.1/24).
  PCs (e.g., PC0: 192.168.1.100/24, Gateway: 192.168.1.1).
- **Step 2: Configure static routing.**
  On R1, configure a static route to the network of PC1 through R2.
  On R2, configure static routes to the networks of PC0 and PC2 through R1, and to PC3 through R3.
  On R3, configure a static route to the network of PC1 through R2.
- **Step 3: Test connectivity.**
  Ensure each PC can ping every other PC. If pings fail, troubleshoot the static routes.

Part 2: Configuring Dynamic Routing using RIP

- **Step 1: Remove all static routes configured in Part 1.**
- **Step 2: Enable RIP on all routers.**
  Use router rip command followed by version 2.

Use network commands to advertise connected networks on each router.

- **Step 3: Verify RIP routing.**
  Use show ip route to verify that routes are received via RIP.
  Use debug ip rip to troubleshoot RIP updates if necessary.
- **Step 4: Test connectivity again.**
  Ensure that all PCs can still ping each other after the RIP configuration

3. Lab and Assignment:

- **Step 1: Remove all static routes configured in Part 1**

This ensures that the network is ready to be configured with dynamic routing without any conflicts from existing static routes.

- **Step 2: Enable EIGRP on all routers**

Command to start EIGRP:

`router eigrp [ASN]` where [ASN] is the Autonomous System Number you choose (e.g., 100).

Configure EIGRP for each network:

Use the network [network-address] command to advertise networks connected to each router. It's important to use the correct network addresses and wildcard masks.

For example:

```
R1(config)# router eigrp 100
R1(config-router)# network 192.168.1.0 0.0.0.255
R1(config-router)# network 192.168.2.0 0.0.0.255

R2(config)# router eigrp 100
R2(config-router)# network 192.168.2.0 0.0.0.255
R2(config-router)# network 192.168.3.0 0.0.0.255
R2(config-router)# network 192.168.4.0 0.0.0.255

R3(config)# router eigrp 100
R3(config-router)# network 192.168.4.0 0.0.0.255
```

- **Step 3: Verify EIGRP routing**
  - Use the show ip route eigrp command on each router to ensure that EIGRP routes are being advertised and received correctly.
  - Optionally, use show ip protocols to view the status of EIGRP and its parameters.

    - Use show ip eigrp neighbors to check the establishment of EIGRP adjacencies between routers.
- **Step 4: Test connectivity**
  Perform ping tests between all PCs to ensure that each device can reach the others. This tests the effectiveness of EIGRP in dynamically routing traffic across the network.

4. Second Assignment:

Please research on how can you configure this setup into OSPF.

Assignments:

For the first assignment, your deadline is 23rd of May 23:59, Thursday
For the second assignment, your deadline is 2nd of June 23:59, Sunday

Please send your video URL address of assignments as homework explaining your setup and running it. You need a running setup for full score in each assignment