Introduction to Dynamic Routing Protocol

Routing Protocols and Concepts – Chapter 3
Dynamic Routing Protocols

- Function(s) of Dynamic Routing Protocols:
  - Dynamically share information between routers.
  - Automatically update routing table when topology changes.
  - Determine best path to a destination.

Routers Dynamically Pass Updates
Dynamic Routing Protocols

- The **purpose of a dynamic routing protocol** is to:
  - **Discover** remote networks
  - **Maintaining** up-to-date routing information
  - **Choosing the best path** to destination networks
  - **Ability to find a new best path** if the current path is no longer available
Dynamic Routing Protocols

- **Components of a routing protocol**
  - **Algorithm**
    In the case of a routing protocol algorithms are used for facilitating routing information and best path determination
  - **Routing protocol messages**
    These are messages for discovering neighbors and exchange of routing information
Dynamic Routing Protocols

- **Advantages** of **static routing**
  - It can backup multiple interfaces/networks on a router
  - Easy to configure
  - No extra resources are needed
  - More secure

- **Disadvantages** of **static routing**
  - Network changes require manual reconfiguration
  - Does not scale well in large topologies
Classifying Routing Protocols

- Dynamic routing protocols are grouped according to characteristics. Examples include:
  - RIP
  - IGRP
  - EIGRP
  - OSPF
  - IS-IS
  - BGP
Classifying Routing Protocols

- **Autonomous System** is a group of routers under the control of a single authority.

- **Types of routing protocols:**
  - **Interior Gateway Protocols** (IGP)
  - **Exterior Gateway Protocols** (EGP)
Classifying Routing Protocols

- **IGP**: Comparison of **Distance Vector & Link State** Routing Protocols

  **Distance vector**
  - routes are advertised as vectors of distance & direction.
  - incomplete view of network topology.
  - Generally, periodic updates.

  **Link state**
  - complete view of network topology is created.
  - updates are not periodic.
Classifying Routing Protocols

- **Convergence** is defined as when all routers’ routing tables are at a state of consistency.

**Comparing Convergence**

**Slow convergence: RIP**

**Fast convergence: OSPF**
Routing Protocols Metrics

**Metric**

A value used by a routing protocol to determine which routes are better than others.
Routing Protocols Metrics

- Metrics used in IP routing protocols
  - Bandwidth
  - Cost
  - Delay
  - Hop count
  - Load
  - Reliability
Routing Protocols Metrics

- The Metric Field in the Routing Table
- **Metric** used for each routing protocol
  - RIP - hop count
  - IGRP & EIGRP - Bandwidth (used by default), Delay (used by default), Load, Reliability
  - OSPF – Cost, Bandwidth (Cisco’s implementation)
Routing Protocols Metrics

- **Load balancing**

  This is the ability of a router to distribute packets among multiple same cost paths

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**Load Balancing Across Equal Cost Paths**

![Diagram of load balancing across equal cost paths]

```
R2#show ip route
<output omitted>
R 192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial1/0/0
 [120/1] via 192.168.4.1, 00:00:26, Serial1/0/1
```
Administrative Distance of a Route

- **Purpose of Administrative Distance**
  
  It’s a numeric value that specifies the preference of a particular routing protocol.

![Diagram comparing Administrative Distances](image)

- EIGRP AD = 90
- RIP AD = 120

R1 and R3 do not "speak" the same routing protocol.
Administrative Distance of a Route

- Dynamic Routing Protocols

<table>
<thead>
<tr>
<th>Route source</th>
<th>Default AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected interface</td>
<td>0</td>
</tr>
<tr>
<td>Static</td>
<td>1</td>
</tr>
<tr>
<td>EIGRP summary route</td>
<td>5</td>
</tr>
<tr>
<td>eBGP</td>
<td>20</td>
</tr>
<tr>
<td>EIGRP (Internal)</td>
<td>90</td>
</tr>
<tr>
<td>IGRP</td>
<td>100</td>
</tr>
<tr>
<td>OSPF</td>
<td>110</td>
</tr>
<tr>
<td>IS-IS</td>
<td>115</td>
</tr>
<tr>
<td>RIP</td>
<td>120</td>
</tr>
<tr>
<td>EIGRP (External)</td>
<td>170</td>
</tr>
<tr>
<td>iBGP</td>
<td>200</td>
</tr>
<tr>
<td>Unknown</td>
<td>255</td>
</tr>
</tbody>
</table>
Administrative Distance of a Route

- **Directly connected routes**
  Have a default **AD of 0**

- **Static Routes**
  Administrative distance of a static route has a default value of **AD of 1**
Administrative Distance of a Route

- Directly connected routes

- Immediately appear in the routing table as soon as the interface is configured

```
R2#show ip route
Codes: C = connected, S = static, I = IGRP, R = RIP, M = mobile, B = BGP
       D = EIGRP, EX = EIGRP external, O = OSPF, IA = OSPF inter area
       N1 = OSPF NSSA external type 1, N2 = OSPF NSSA external type 2
       E1 = OSPF external type 1, E2 = OSPF external type 2, E = EGP
       i = IS-IS, L1 = IS-IS level-1, L2 = IS-IS level-2, ia = IS-IS inter area
       * = candidate default, U = per-user static route, o = ODR
       P = periodic downloaded static route

Gateway of last resort is not set

    172.16.0.0/24 is subnetted, 3 subnets
    C 172.16.1.0 is directly connected, FastEthernet0/0
    C 172.16.2.0 is directly connected, Serial0/0/0
    S 172.16.3.0 is directly connected, Serial0/0/0
    C 192.168.1.0/24 is directly connected, Serial0/0/1
    S 192.168.2.0/24 [1/0] via 192.168.1.1
```
Summary

- **Dynamic routing protocols** fulfill the following **functions**
  - Dynamically share information between routers
  - Automatically update routing table when topology changes
  - Determine best path to a destination

- **Routing protocols are grouped as either**
  - Interior gateway protocols (IGP)
  - Exterior gateway protocols (EGP)
Summary

- **Metrics** are used by dynamic routing protocols to calculate the best path to a destination.
- **Administrative distance** is an integer value that is used to indicate a router’s “trustworthiness”
- **Components of a routing table** include:
  - Route source
  - Administrative distance
  - Metric