Networking

Networking Implementation

2.2.1 - Routing Technologies

What are some different routing technologies and how do they differ?

Overview

The student will compare and contrast routing technologies and bandwidth management concepts

Grade Level(s)

10, 11, 12

Cyber Connections

- Threats & Vulnerabilities
- Networks & Internet
- Hardware & Software

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Teacher Notes:

CompTIA N10-008 Network+ Objectives

Objective 2.2

- Compare and contrast routing technologies and bandwidth management concepts
    - Routing
        - Dynamic Routing
            - Protocols [Routing Internet Protocol (RIP), Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Border Gateway Protocol (BGP)]
            - Link state vs. distance vector vs. hybrid
        - Static Routing
        - Default route
        - Administrative distance
        - Exterior vs. interior
        - Time to live

Routing Technologies

What's the Fastest Route?

Routing refers to the process of determining how a packet of data is sent from one computer or server to another. The packet starts from the source router and traverse through a series of routers across many networks until reaching its destination using a routing algorithm. This algorithm considers the packet size and header to decide the best route to the destination. When packets reach any individual router, the packet's source and destination address are used with a routing table to decide the next hop address. This process is repeated until the packet reaches its destination.

A router can be configured with either static or dynamic routing. ***Static routing*** routes packets through a network describe by fixed paths. ***Dynamic routing*** (occasionally referred to as adaptive routing) routes packets through different routes based on the current conditions of the communication circuits within a system. Dynamic routing scales well, unlike static routing, because network routes are automatically added to the routing table via the routing protocol.

Teacher Notes:

With dynamic routing, we generally separate it into two categories, ***exterior*** and ***interior***. As the names suggest, if it is outside of our network, something that we don't control, that is an exterior gateway protocol (EGP). If it is inside our network, where we control it, that is an interior gateway protocol (IGP).

Protocols

One dynamic routing protocol is called ***routing information protocol (RIP)***. RIP uses hop count as a routing metric to determine the most efficient route between the source and its destination using the Bellman-Ford algorithm. RIP has an ***AD (administrative distance)*** value of 120 and uses port number 520. The AD is used to rate the trustworthiness of routing information received on one router from its neighbor. An AD is represented by a whole number between 0 and 255, the smaller the number, the more trusted it is. There is a newer version simply titled RIPv2 (version 2) that has a few changes, the most important being scalability.

The next dynamic routing protocol is ***open shortest path first (OSPF)***. OSPF works by finding the best path from the source to the destination router according to its own shortest path first algorithm (Dijkstra). OSPF has an AD value of 110 and uses port number 89. OSPF is commonly used on some of the largest networks to offer dynamic routing because of its scalability.

Another dynamic routing protocol is ***Enhanced Interior Gateway Routing Protocol (EIGRP)***. As a replacement to IGRP, EIGRP uses the concept of an autonomous system to describe the set of contiguous routers running the same protocols and sharing the same information. EIGRP includes the subnet mask in its route updates. EIGRP has an AD value of 90 and uses port 88. EIGRP is arguably the best routing protocol for private networks because of its balance among speed, scalability, and ease of management.

The last dynamic routing protocol to look at is ***Border Gateway Protocol (BGP)***. BGP is the core routing protocol of the Internet. BGP is an external routing protocol that uses an algorithm to determine the best route. BGP has an AD value of 20 and uses port 179. BGP is an EGP because it is outside of our network.

Teacher Notes:

Link State, Distance Vector, and Hybrid

Link state protocols (also called shortest path first protocols) have routers create three separate tables: one table tracks directly attached neighbors, another table determines the topology of the entire internetwork, and the third table is the actual routing table itself. The reason for the name "link state" is because this protocol is most concerned about the state of the link. Is it up or is it down? Of the previously listed routing protocols, OSPF is a link state protocol.

Distance vector protocols determine the best path to a remote network by distance. In general, "distance" is referred to as the number of hops. The fewer the hops, the shorter the distance. RIP is a distance vector protocol (both RIPv1 and v2).

A ***hybrid*** protocol uses aspects of both link state and distance vector protocols. For former Network+ exams, we only needed to know that EIGRP is a hybrid protocol, but now BGP is included as a hybrid protocol.

Default Time to Live

Within networking, there is an IP configuration that establishes a forwarding rule for packets when no specific address of a next hop host is available via routing tables. This is referred to as the ***default route***.

The final objective for this section is ***time to live (TTL)***. TTL, or hop limit, refers to the amount of hops a packet is can take before the data is discarded. This mechanism essentially limits the lifespan of data within a computer or network.