CCNP Routing and Switching ROUTE 300-101 Quick Reference

Denise Donohue

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Contents at a Glance

Contents

Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the IOS Command Reference. The Command Reference describes these conventions as follows:

- **Boldface** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), boldface indicates commands that are manually input by the user (such as a **show** command).
- *Italic* indicates arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets ([ ]) indicate an optional element.
- Braces ({ }) indicate a required choice.
- Braces within brackets ([{ }]) indicate a required choice within an optional element.

How This Book Is Organized

- **Chapter 1, "Networking Overview":** This chapter provides a review of basic IP, TCP, and UDP operations, such as fragmentation and windowing. It also reviews routing fundamentals including AD, types of protocols, packet forwarding, and loop prevention.
- **Chapter 2, "IPv6 Overview":** This chapter provides an overview of IPv6 addressing, routing, and route summarization. This rather in-depth introduction to IPv6 covers the IPv6 address format, ways for hosts to acquire their addresses, and IPv6 routing. It also includes strategies for integrating IPv4 and IPv6, such as in various types of tunnels. More detailed applications of IPv6 are covered in the chapters for each routing protocol and for the various technologies.
- **Chapter 3, "RIP":** Configuring and verifying RIPv2 and RIPng for IPv6 are described in this chapter.
- **Chapter 4, "EIGRP":** This chapter contains an in-depth description of EIGRP for IPv4 and IPv6 operation and configuration, including neighbor establishment and route exchange. It covers using EIGRP with Frame Relay, Ethernet over MPLS (EoMPLS), and Layer 3 MPLS VPNs. It also includes EIGRP named mode, ways to optimize EIGRP, and securing EIGRP through authentication.
- **Chapter 5, "OSPF":** Chapter 5 describes OSPF's structure and operation. It covers OSPF design requirements, neighbor establishment, and LSA information for both OSPFv2 and OSPFv3. The configuration portion provides OSPF configuration for LAN and WAN networks. The chapter additionally covers optimizing and securing OSPF.
- **Chapter 6, "Advanced Routing Techniques":** This chapter examines various methods of controlling routing updates, such as route maps, prefix lists, and distribute lists. It describes how to configure route maps and how to use them for policy-based routing, controlling route redistribution, and tagging routes. Additionally, techniques such as IP SLA and VRF Lite are covered.
- **Chapter 7, "BGP and Internet Connectivity":** This chapter gives an overview of BGP operation and basic configuration. BGP path selection is covered, along with ways to influence the path selection and filter routes. Additionally, methods to verify BGP operation are shown. Multi-protocol BGP, using BGP with IPv6 routing, is covered.

- **Chapter 8, "Infrastructure Security":** This chapter examines ways to secure the routing infrastructure and the routers themselves, as well as the data transmitted. It looks at IPv4 and IPv6 ACLs, device access control, and various types of traffic tunneling techniques.
- **Chapter 9, "Infrastructure Services":** This chapter describes useful network management services, such as SNMP, logging, debugging, and NetFlow. It covers DHCP for both IPv4 and IPv6, NAT for both IPv4 and IPv6, and NAT virtual interface.

CHAPTER 3

RIP

RIP Version 2

Routing Information Protocol (RIP) has been in existence since 1988. It is a basic distance vector protocol that uses hop count as its metric, and thus does not pick up any differences in bandwidth between different routes. RIPv2 is a classless protocol—it carries subnet mask information in its updates, enabling you to use various subnet masks in the network. Some other characteristics of RIPv2 include the following:

- Uses UDP port 520.
- All routes advertised every 30 seconds, along with triggered updates due to topology change.
- Administrative distance is 120.
- Updates sent as multicasts to IPv4 address 224.0.0.9.
- Maximum metric (hop count) is 15. A hop count of 16 is considered infinity, poisoning the route.
- Supports plain text and MD5 authentication.
- No neighbor relationship formation process exists—all interfaces participating in RIP send route updates whether or not another RIP router is out of that interface.
- Route summarization is performed at each interface.
- Supports variable-length subnet masks but does auto-summary by default.
- Load balances across up to four equal metric paths by default.

RIP implements *split horizon* to help prevent routing loops. This does not allow a router to advertise out an interface a route learned via that interface. Split horizon typically comes into play on multiaccess interfaces where advertisements from multiple neighbors are learned via the same interface.

RIPv2 Configuration

To configure RIP, enter the RIP routing process in global configuration mode, and specify the interfaces that will run RIP by using the **network** command. The router then multicasts its routing table out all interfaces with IP addresses within the networks specified by that command. The **passive-interface** *interface* command stops RIP from sending updates out an interface. Use the **neighbor** *ip-address* command to inform RIP to send updates as unicasts to the specified neighbor.

Example 3-1 shows the configuration that enables RIP on all interfaces with IP addresses in the 10.0.0.0 range. The version of RIP is set to version 2, interface e0/1 is passive for RIP, and neighbor 10.1.1.2 is on a nonbroadcast network, thus updates are sent as unicast.

Example 3-1 RIPv2 Configuration

```
Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# no auto-summary
Router(config-router)# network 10.0.0.0
Router(config-router)# passive-interface e0/1
Router(config-router)# neighbor 10.1.1.2
```

RIPng for IPv6

RIP next generation (RIPng) is the IPv6 version of RIP and is defined in RFC 2080. Like RIPv2 for IPv4, RIPng is a distance vector routing protocol that uses a hop count for its metric and has a maximum hop count of 15. It uses UDP but on port 521 instead of 520, and still has an administrative distance of 120. RIPng also sends periodic multicast updates—every 30 seconds—to advertise routes. The multicast address is FF02::9. The source address of RIPng updates is the link-local address of the outbound interface.

Two important differences exist between the old RIP and the next-generation RIP. One is that RIPng supports multiple concurrent processes, each identified by a process name. Another is that RIPng is initialized in global configuration mode and then enabled on specific interfaces. There is no **network** command in RIPng.

RIPng Configuration

Example 3-2 shows the syntax used to apply RIPng to a configuration. Notice that the syntax is similar to traditional RIP. You must first enable IPv6 routing. The global command to enable RIPng is optional; the router creates it automatically when the first interface is enabled for RIPng. You might need the command for additional configuration, such as originating a default route, as shown in Example 3-2.

Example 3-2 RIPng Configuration

```
Router(config)# ipv6 router rip process-name
!
Router(config)# interface type number
Router(config-if)# ipv6 rip process enable
Router(config-if)# ipv6 rip process default-information originate
```

Like RIP for IPv4, troubleshoot RIPng by looking at the routing table (**show ipv6 route** [**rip**]), by reviewing the routing protocols (**show ipv6 protocols**), and by watching routing updates propagated between routers (**debug ipv6 rip**).