CCNA
Portable Command Guide
Second Edition

All the CCNA 640-802 commands in one compact, portable resource

Scott Empson
Steps to Configuring a Router

1. Create an IP plan as per your diagram.
   a. Subnetting
   b. VLSM

2. Cable your equipment as per your diagram.

3. Establish a basic router configuration.
   a. Host names
   b. Passwords:
      i. Secret
      ii. Console
      iii. Terminal—vty
      iv. Auxiliary
   c. Turn off DNS so spelling mistakes will not slow you down
   d. Banners: login or MOTD

4. Configure your interfaces.
   a. Addresses
   b. Masks
   c. Clock rates (for serial DCE interfaces)
   d. Descriptions

5. Create IP host name tables for remote access.

6. Configure routing.
   a. Static
   b. Default
   c. Dynamic—Pick the routing protocol that best suits your needs:
      i. RIP-2
      ii. OSPF
      iii. EIGRP

7. Configure access control lists (ACLs).
   a. Standard
   b. Extended
   c. Named

8. Change the WAN encapsulation type.
   a. PPP:
      i. Authentication: CHAP
      ii. Authentication: PAP
   b. HDLC, if returning to default

9. Apply advanced IP configuration as necessary.
   a. NAT/PAT
   b. DHCP

10. Save your configuration.
    a. Locally
    b. Remote
Scott Empson

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Warning and Disclaimer
This book is designed to provide information about the Certified Cisco Networking Associate (CCNA) exam and the commands needed at this level of network administration. Every effort has been made to make this book as complete and as accurate as possible, but no warranty or fitness is implied.

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Dedications
This book is dedicated to Trina, Zach, and Shae, without whom I couldn’t have made it through those long nights of writing and editing.
Acknowledgments

Anyone who has ever had anything to do with the publishing industry knows that it takes many, many people to create a book. It may be my name on the cover, but there is no way that I can take credit for all that occurred to get this book from idea to publication. Therefore, I must thank:

The team at Cisco Press—Once again, you amaze me with your professionalism and the ability to make me look good. Mary Beth, Chris, Patrick, Meg, Seth—thank you for your continued support and belief in my little engineering journal.

To my technical reviewers, Robert and Phil—thanks for keeping me on track and making sure that what I wrote was correct and relevant.

To the staff of the Cisco office here in Edmonton, especially Cesar Barrero—thanks for putting up with me and my continued requests to borrow equipment for development and validation of the concepts in this book. But, can I keep the equipment for just a little bit longer? Please?
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Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the Cisco 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).
- **Italics** indicate arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets [ ] indicate optional elements.
- Braces { } indicate a required choice.
- Braces within brackets [{ } ] indicate a required choice within an optional element.
Introduction

Welcome to CCNA! Recently Cisco Press came to me and told me, albeit very quietly, that there was going to be some changes made to the CCNA certification exam, and asked whether I would be interested in updating my CCNA Portable Command Guide for release around the time of the announcement of the new exam. I was already working on the various command guides for the new CCNP certification exams, but I felt that a revision wouldn’t take a lot of time, as hopefully there would still be a lot of concepts that hadn’t changed.

I have long been a fan of what I call the “Engineering Journal”—a small notebook that can be carried around and that contains little nuggets of information—commands that you forget, the IP addressing scheme of some remote part of the network, little reminders about how to do something you only have to do once or twice a year (but is vital to the integrity and maintenance of your network). This journal has been a constant companion by my side for the past eight years; I only teach some of these concepts every second or third year, so I constantly need to refresh commands and concepts and learn new commands and ideas as they are released by Cisco. My journals were the best way for me to review because they were written in my own words—words that I could understand. At least, I had better understand them, because if I didn’t, I had only myself to blame.

The journals that I would create for my Academy classes would always be different from the journals I would create when I was teaching from a different curriculum or if I was out in the industry working on some production network. I could understand that the Academy needed to split topics into smaller, more manageable chunks, but for me out in the real world, I needed these concepts to follow a different approach—I needed all the routing protocols together in one place in my journals, and not spread across some two-year outline of knowledge.

This book is my “Industry” edition of the Engineering Journal. It contains a different logical flow to the topics, one more suited to someone working in the field. Like topics are grouped together: routing protocols, switches, troubleshooting. More-complex examples are given. New topics have been added, such as IPv6, wireless, and the Security Device Manager (SDM). The popular “Create Your Own Journal” appendix is still here—blank pages for you to add in your own commands that you need in your specific job. We all recognize the fact that no network administrator’s job can be so easily pigeonholed as to being just working with CCNA topics—you all have your own specific jobs and duties assigned to you. That is why you will find those blank pages at the end of the book—make this book your own; personalize it with what you need to make it more effective. That way your journal will not look like mine.

The Cisco Networking Academy Program and This Guide

The first book that I ever published for Cisco Press was a command guide that was specially designed to follow the Cisco Networking Academy Program curriculum. The CCNA Command Quick Reference was released in 2005 and was organized in such a way that if you were working on CCNA 3, Chapter 8 in the online curriculum, the commands for that chapter were in Part 3, Chapter 8 of that book. However, the Cisco Networking Academy Program has now released two different flavors of the Academy curriculum: CCNA
Discovery and CCNA Exploration. The two courses take decidedly different paths in their delivery of content, but they both end up at the same destination—a place where a student completing either set of courses is ready to take the CCNA certification exam. Because there is such a variety in how the courses teach content, Cisco Press believed that creating two books for the Cisco Academy would not be viable, because most of the content would be the same, just in a different order. Therefore, this book can be used with either CCNA Discovery or CCNA Exploration. A quick perusal of the table of contents, or the inside back cover (where I have my “What Do You Want to Do?” list of the more commonly asked questions), should take you to the section with the command(s) that you are looking for. There is even a section in Chapter 15, “Implementing a Wireless LAN,” that deals with topics that are only presented in the Academy curriculum—provisioning a Linksys wireless access point and wireless client card. This topic is not covered on the certification exam, but it is part of the Academy courseware, so I have included it in this book, too.

Networking Devices Used in the Preparation of This Book
To verify the commands in this book, I had to try them out on a few different devices. The following is a list of the equipment I used when writing this book:

- C2620 router running Cisco IOS Software Release 12.3(7)T, with a fixed Fast Ethernet interface, a WIC-2A/S serial interface card, and an NM-1E Ethernet interface
- C2821 ISR with PVDM2, CMME, a WIC-2T, FXS and FXO VICs, running 12.4(10a) IPBase IOS
- WS-C2960-24TT-L Catalyst Switch, running 12.2(25)SE IOS
- WS-C2950-12 Catalyst switch, running version C2950-C3.0(5.3)WC(1) Enterprise Edition software

These devices were not running the latest and greatest versions of Cisco IOS Software. Some of it is quite old.

Those of you familiar with Cisco devices will recognize that a majority of these commands work across the entire range of the Cisco product line. These commands are not limited to the platforms and Cisco IOS Software versions listed. In fact, these devices are in most cases adequate for someone to continue his or her studies into the CCNP level, too.

Private Addressing Used in this Book
This book makes use of RFC 1918 addressing throughout. Because I do not have permission to use public addresses in my examples, I have done everything with private addressing. Private addressing is perfect for use in a lab environment or in a testing situation, because it works exactly like public addressing, with the exception that it cannot be routed across a public network. That is why you will see private addresses in my WAN links between two routers using serial connections, or in my Frame Relay cloud.

Who Should Read This Book
This book is for those people preparing for the CCNA exam, whether through self-study, on-the-job training and practice, or even through study within the Cisco Networking
Academy Program. There are also some handy hints and tips along the way to hopefully make life a bit easier for you in this endeavor. It is small enough that you will find it easy to carry around with you. Big, heavy textbooks might look impressive on your bookshelf in your office, but can you really carry them all around with you when you are working in some server room or equipment closet somewhere?

Optional Sections
A few sections in this book have been marked as “Optional.” These sections cover topics that are not on the CCNA certification exam, but they are valuable topics that I believe should be known by someone at a CCNA level. Some of the optional topics might also be concepts that are covered in the Cisco Networking Academy Program courses, either the CCNA Discovery or the CCNA Exploration segments.

Organization of This Book
This book follows what I think is a logical approach to configuring a small to mid-size network. It is an approach that I give to my students when they invariably ask for some sort of outline to plan and then configure a network. Specifically, this approach is as follows:

- Part I: TCP/IP Version 4
  - Chapter 1, “How to Subnet”—An overview of how to subnet, examples of subnetting (both a Class B and a Class C address), the use of the binary AND operation, the Enhanced Bob Maneuver to Subnetting
  - Chapter 2, “VLSM”—An overview of VLSM, an example of using VLSM to make your IP plan more efficient
  - Chapter 3, “Route Summarization”—Using route summarization to make your routing updates more efficient, an example of how to summarize a network, necessary requirements for summarizing your network

- Part II: Introduction to Cisco Devices
  - Chapter 4, “Cables and Connections”—An overview of how to connect to Cisco devices, which cables to use for which interfaces, and the differences between the TIA/EIA 568A and 568B wiring standards for UTP
  - Chapter 5, “The Command-Line Interface”—How to navigate through Cisco IOS Software: editing commands, keyboard shortcuts, and help commands

- Part III: Configuring a Router
  - Chapter 6, “Configuring a Single Cisco Router”—Commands needed to configure a single router: names, passwords, configuring interfaces, MOTD and login banners, IP host tables, saving and erasing your configurations
• Part IV: Routing
  — Chapter 7, “Static Routing”—Configuring static routes in your internetwork
  — Chapter 8, “RIP”—Configuring and verifying RIPv2, how to see and clear your routing table
  — Chapter 9, “EIGRP”—Configuring and verifying EIGRP
  — Chapter 10, “Single Area OSPF”—Configuring and verifying Single Area OSPF
• Part V: Switching
  — Chapter 11, “Configuring a Switch”—Commands to configure Catalyst 2960 switches: names, passwords, IP addresses, default gateways, port speed and duplex; configuring static MAC addresses; managing the MAC address table; port security
  — Chapter 12, “VLANs”—Configuring static VLANs, troubleshooting VLANs, saving and deleting VLAN information.
  — Chapter 13, “VLAN Trunking Protocol and Inter-VLAN Communication”—Configuring a VLAN trunk link, configuring VTP, verifying VTP, inter-VLAN communication, router-on-a-stick, and subinterfaces
  — Chapter 14, “STP and EtherChannel”—Verifying STP, setting switch priorities, and creating and verifying EtherChannel groups between switches
• Part VI: Extending the LAN
  — Chapter 15, “Implementing a Wireless LAN”—Configuring a Linksys wireless access point, configuring a Linksys wireless client card
• Part VII: Network Administration and Troubleshooting
  — Chapter 16, “Backing Up and Restoring Cisco IOS Software and Configurations”—Boot commands for Cisco IOS Software, backing up and restoring Cisco IOS Software using TFTP, Xmodem, and ROMmon environmental variables
  — Chapter 17, “Password-Recovery Procedures and the Configuration Register”—The configuration register, password-recovery procedure for routers and switches
  — Chapter 18, “Cisco Discovery Protocol (CDP)”—Customizing and verifying CDP
  — Chapter 19, “Telnet and SSH”—Commands used for Telnet and SSH to remotely connect to other devices
  — Chapter 20, “The ping and traceroute Commands”—Commands for both ping and extended ping; the traceroute command
  — Chapter 21, “SNMP and Syslog”—Configuring SNMP, working with syslog
— Chapter 22, “Basic Troubleshooting”—Various show commands used to view the routing table; interpreting the show interface command; verifying your IP settings using different operating systems

• Part VIII: Managing IP Services
  — Chapter 23, “Network Address Translation”—Configuring and verifying NAT and PAT
  — Chapter 24, “DHCP”—Configuring and verifying DHCP
  — Chapter 25, “IPv6”—Transitioning to IPv6; format of IPv6 addresses; configuring IPv6 (interfaces, tunneling, routing with RIPng)

• Part IX: WANs
  — Chapter 26, “HDLC and PPP”—Configuring PPP, authentication of PPP using PAP or CHAP, compression in PPP; multilink in PPP, troubleshooting PPP, returning to HDLC encapsulation
  — Chapter 27, “Frame Relay”—Configuring basic Frame Relay, Frame Relay and subinterfaces, DLCIs, verifying and troubleshooting Frame Relay

• Part X: Network Security
  — Chapter 28, “IP Access Control List Security”—Configuring standard ACLs, wildcard masking, creating extended ACLs, creating named ACLs, using sequence numbers in named ACLs, verifying and troubleshooting ACLs
  — Chapter 29, “Security Device Manager”—Connecting to a router using SDM, SDM user interfaces, SDM wizards, using SDM to configure a router as a DHCP server (or an interface as a DHCP client), using SDM to configure NAT

• Part XI: Appendixes
  — Appendix A, “Binary/Hex/Decimal Conversion Chart”—A chart showing numbers 0 through 255 in the three numbering systems of binary, hexadecimal, and decimal
  — Appendix B, “Create Your Own Journal Here”—Some blank pages for you to add in your own specific commands that might not be in this book

Did I Miss Anything?
I am always interested to hear how my students, and now readers of my books, do on both certification exams and future studies. If you would like to contact me and let me know how this book helped you in your certification goals, please do so. Did I miss anything? Let me know. My e-mail address is ccnaguide@empson.ca.
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CHAPTER 25
IPv6

This chapter provides information and commands concerning the following topics:

- Assigning IPv6 addresses to interfaces
- IPv6 and RIPng
- Configuration example: IPv6 RIP
- IPv6 tunnels: manual overlay tunnel
- Static routes in IPv6
- Floating static routes in IPv6
- Verifying and troubleshooting IPv6
- IPv6 ping


Assigning IPv6 Addresses to Interfaces

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Router(config)#ipv6 unicast-routing</code></td>
<td>Enables the forwarding of IPv6 unicast datagrams globally on the router.</td>
</tr>
<tr>
<td><code>Router(config)#interface fastethernet 0/0</code></td>
<td>Moves to interface configuration mode.</td>
</tr>
<tr>
<td><code>Router(config-if)#ipv6 enable</code></td>
<td>Automatically configures an IPv6 link-local address on the interface and enables IPv6 processing on the interface.</td>
</tr>
<tr>
<td><code>Router(config-if)#ipv6 address 3000::1/64</code></td>
<td>Configures a global IPv6 address on the interface and enables IPv6 processing on the interface.</td>
</tr>
<tr>
<td><code>Router(config-if)#ipv6 address 2001:db8:0:1::/64 eui-64</code></td>
<td>Configures a global IPv6 address with an interface identifier in the low-order 64 bits of the IPv6 address.</td>
</tr>
</tbody>
</table>
Router(config-if)#ipv6 address fe80::260:3eff:fe47:1530/64 link-local

Configure a specific link-local IPv6 address on the interface instead of the one that is automatically configured when IPv6 is enabled on the interface.

Router(config-if)#ipv6 unnumbered type/number

Specify an unnumbered interface and enables IPv6 processing on the interface. The global IPv6 address of the interface specified by type/number will be used as the source address.

IPv6 and RIPng

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router(config)#interface serial 0/0</td>
<td>Moves to interface configuration mode.</td>
</tr>
<tr>
<td>Router(config-if)#ipv6 rip tower enable</td>
<td>Creates the RIPng process named tower and enables RIPng on the interface.</td>
</tr>
<tr>
<td><strong>NOTE</strong>: Unlike RIPv1 and RIPv2, where you needed to create the RIP routing process with the router rip command and then use the network command to specify the interfaces on which to run RIP, the RIPng process is created automatically when RIPng is enabled on an interface with the ipv6 rip name enable command.</td>
<td></td>
</tr>
<tr>
<td><strong>NOTE</strong>: Cisco IOS Software automatically creates an entry in the configuration for the RIPng routing process when it is enabled on an interface.</td>
<td></td>
</tr>
<tr>
<td><strong>NOTE</strong>: The ipv6 router rip process-name command is still needed when configuring optional features of RIPng.</td>
<td></td>
</tr>
<tr>
<td>Router(config)#ipv6 router rip tower</td>
<td>Creates the RIPng process named tower if it has not already been created, and moves to router configuration mode</td>
</tr>
<tr>
<td>Router(config-router)#maximum-paths 2</td>
<td>Defines the maximum number of equal-cost routes that RIPng can support.</td>
</tr>
<tr>
<td><strong>NOTE</strong>: The number of paths that can be used is a number from 1 to 64. The default is 4.</td>
<td></td>
</tr>
</tbody>
</table>
Configuration Example: IPv6 RIP

Figure 25-1 illustrates the network topology for the configuration that follows, which shows how to configure IPv6 and RIPng using the commands covered in this chapter.

**Figure 25-1  Network Topology for IPv6/RIPng Configuration Example**

Austin Router

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router&gt;<strong>enable</strong></td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td>Router#<strong>configure terminal</strong></td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td>Router(config)#<strong>hostname</strong> Austin</td>
<td>Assigns a host name to the router</td>
</tr>
<tr>
<td>Austin(config)#<strong>ipv6 unicast-routing</strong></td>
<td>Enables the forwarding of IPv6 unicast datagrams globally on the router</td>
</tr>
<tr>
<td>Austin(config)#<strong>interface</strong> fastethernet 0/0</td>
<td>Enters interface configuration mode</td>
</tr>
<tr>
<td>Austin(config-if)#<strong>ipv6 enable</strong></td>
<td>Automatically configures an IPv6 link-local address on the interface and enables IPv6 processing on the interface</td>
</tr>
<tr>
<td>Austin(config-if)#<strong>ipv6 address</strong> 2001:db8:c18:2::/64 eui-64</td>
<td>Configures a global IPv6 address with an interface identifier in the low-order 64 bits of the IPv6 address</td>
</tr>
</tbody>
</table>
### Configuration Example: IPv6 RIP

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Austin(config-if)#ipv6 rip tower enable</code></td>
<td>Creates the RIPng process named tower and enables RIPng on the interface</td>
</tr>
<tr>
<td><code>Austin(config-if)#no shutdown</code></td>
<td>Activates the interface</td>
</tr>
<tr>
<td><code>Austin(config-if)#interface fastethernet 0/1</code></td>
<td>Enters interface configuration mode</td>
</tr>
<tr>
<td><code>Austin(config-if)#ipv6 enable</code></td>
<td>Automatically configures an IPv6 link-local address on the interface and enables IPv6 processing on the interface</td>
</tr>
<tr>
<td><code>Austin(config-if)#ipv6 address 2001:db8:c18:1::/64 eui-64</code></td>
<td>Configures a global IPv6 address with an interface identifier in the low-order 64 bits of the IPv6 address</td>
</tr>
<tr>
<td><code>Austin(config-if)#ipv6 rip tower enable</code></td>
<td>Creates the RIPng process named tower and enables RIPng on the interface</td>
</tr>
<tr>
<td><code>Austin(config-if)#no shutdown</code></td>
<td>Activates the interface</td>
</tr>
<tr>
<td><code>Austin(config-if)#exit</code></td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td><code>Austin(config)#exit</code></td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td><code>Austin#copy running-config startup-config</code></td>
<td>Saves the configuration to NVRAM</td>
</tr>
</tbody>
</table>

### Houston Router

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Router&gt;enable</code></td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td><code>Router#configure terminal</code></td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td><code>Router(config)#hostname Houston</code></td>
<td>Assigns a host name to the router</td>
</tr>
<tr>
<td><code>Houston(config)#ipv6 unicast-routing</code></td>
<td>Enables the forwarding of IPv6 unicast datagrams globally on the router</td>
</tr>
<tr>
<td><code>Houston(config)#interface fastethernet 0/0</code></td>
<td>Enters interface configuration mode</td>
</tr>
<tr>
<td><code>Houston(config-if)#ipv6 enable</code></td>
<td>Automatically configures an IPv6 link-local address on the interface and enables IPv6 processing on the interface</td>
</tr>
<tr>
<td><code>Houston(config-if)#ipv6 address 2001:db8:c18:2::/64 eui-64</code></td>
<td>Configures a global IPv6 address with an interface identifier in the low-order 64 bits of the IPv6 address</td>
</tr>
<tr>
<td><code>Houston(config-if)#ipv6 rip tower enable</code></td>
<td>Creates the RIPng process named tower and enables RIPng on the interface</td>
</tr>
</tbody>
</table>
IPv6 Tunnels: Manual Overlay Tunnel

**NOTE:** Although not part of the official CCNA exam objectives, the concept of IPv6 tunnels is one that network administrators dealing with IPv6 need to be comfortable with.

Figure 25-2 illustrates the network topology for the configuration that follows, which shows how IPv6 tunnels are created.

**Figure 25-2  Network Topology for IPv6 Tunnel Creation**
IPv6 Tunnels: Manual Overlay Tunnel

### Juneau Router

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router&gt;<strong>enable</strong></td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td>Router<strong>configure terminal</strong></td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td>Router(config)#<strong>hostname Juneau</strong></td>
<td>Sets the host name of the router</td>
</tr>
<tr>
<td>Juneau(config)#<strong>ipv6 unicast-routing</strong></td>
<td>Enables the forwarding of IPv6 unicast datagrams globally on the router</td>
</tr>
<tr>
<td>Juneau(config)#<strong>interface tunnel0</strong></td>
<td>Moves to tunnel interface configuration mode</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>ipv6 address 2001:db8:c003:1104::1/64</strong></td>
<td>Assigns an IPv6 address to this interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>tunnel source serial 0/0</strong></td>
<td>Specifies the source interface type and number for the tunnel interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>tunnel destination 10.1.1.2</strong></td>
<td>Specifies the destination IPv4 address for the tunnel interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>tunnel mode ipv6ip</strong></td>
<td>Defines a manual IPv6 tunnel; specifically, that IPv6 is the passenger protocol and IPv4 is both the encapsulation and protocol for the IPv6 tunnel</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>interface fastethernet 0/0</strong></td>
<td>Moves to interface configuration mode</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>ipv6 address 2001:db8:c003:111e::1/64</strong></td>
<td>Assigns an IPv6 address to this interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>no shutdown</strong></td>
<td>Activates the interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>interface serial 0/0</strong></td>
<td>Moves to interface configuration mode</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>ip address 10.1.1.1 255.255.255.252</strong></td>
<td>Assigns an IPv4 address and netmask</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>clock rate 56000</strong></td>
<td>Sets the clock rate on interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>no shutdown</strong></td>
<td>Starts the interface</td>
</tr>
<tr>
<td>Juneau(config-if)#<strong>exit</strong></td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td>Juneau(config)#<strong>exit</strong></td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td>Juneau#<strong>copy running-config startup-config</strong></td>
<td>Saves the configuration to NVRAM</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Router&gt;enable</td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td>Router#configure terminal</td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td>Router(config)#hostname Fairbanks</td>
<td>Sets the host name of the router</td>
</tr>
<tr>
<td>Fairbanks(config)#interface tunnel0</td>
<td>Moves to tunnel interface configuration mode</td>
</tr>
<tr>
<td>Fairbanks(config-if)#ipv6 address 2001:db8:c003:1104::2/64</td>
<td>Assigns an IPv6 address to this interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#tunnel source serial 0/0</td>
<td>Specifies the source interface type and number for the tunnel interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#tunnel destination 10.1.1.1</td>
<td>Specifies the destination IPv4 address for the tunnel interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#tunnel mode ipv6ip</td>
<td>Defines a manual IPv6 tunnel; specifically, that IPv6 is the passenger protocol and IPv4 is both the encapsulation and protocol for the IPv6 tunnel</td>
</tr>
<tr>
<td>Fairbanks(config-if)#interface fastethernet 0/0</td>
<td>Moves to interface configuration mode</td>
</tr>
<tr>
<td>Fairbanks(config-if)#ipv6 address 2001:db8:c003:111f:1/64</td>
<td>Assigns an IPv6 address to this interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#no shutdown</td>
<td>Activates the interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#interface serial 0/0</td>
<td>Moves to interface configuration mode</td>
</tr>
<tr>
<td>Fairbanks(config-if)#ip address 10.1.1.2 255.255.255.252</td>
<td>Assigns an IPv4 address and netmask</td>
</tr>
<tr>
<td>Fairbanks(config-if)#no shutdown</td>
<td>Starts the interface</td>
</tr>
<tr>
<td>Fairbanks(config-if)#exit</td>
<td>Moves to global configuration mode</td>
</tr>
<tr>
<td>Fairbanks(config)#exit</td>
<td>Moves to privileged mode</td>
</tr>
<tr>
<td>Fairbanks#copy running-config startup-config</td>
<td>Saves the configuration to NVRAM</td>
</tr>
</tbody>
</table>
Static Routes in IPv6

**NOTE:** Although not part of the CCNA exam objectives, the concept of static routes in IPv6 is one that network administrators dealing with IPv6 need to be comfortable with.

**NOTE:** To create a static route in IPv6, you use the same format as creating a static route in IPv4.

Figure 25-3 illustrates the network topology for the configuration that follows, which shows how to configure static routes with IPv6. Note that only the static routes on the Austin router are displayed.

**Figure 25-3  Network Topology for IPv6 Static Route Configuration**
Floating Static Routes in IPv6

**NOTE:** Although not part of the CCNA exam objectives, the concept of floating static routes in IPv6 is one that network administrators dealing with IPv6 need to be comfortable with.

To create a static route with an administrative distance (AD) set to 200, as opposed the default AD of one (1), enter the following command, for example:

```
Austin(config)# ipv6 route 2001:db8:c18:3::/64 fastethernet 0/0 200
```

The default ADs used in IPv4 are the same for IPv6.

Verifying and Troubleshooting IPv6

**CAUTION:** Using the `debug` command may severely affect router performance and might even cause the router to reboot. Always exercise caution when using the `debug` command. Do not leave `debug` on. Use it long enough to gather needed information, and then disable debugging with the `undebug all` command.

**TIP:** Send your `debug` output to a syslog server to ensure you have a copy of it in case your router is overloaded and needs to reboot.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router#clear ipv6 rip</td>
<td>Deletes routes from the IPv6 RIP routing table and, if installed, routes in the IPv6 routing table.</td>
</tr>
<tr>
<td>Router#clear ipv6 route *</td>
<td>Deletes all routes from the IPv6 routing table.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> Clearing all routes from the routing table will cause high CPU utilization rates as the routing table is rebuilt.</td>
</tr>
<tr>
<td>Router#clear ipv6 route 2001:db8:c18:3::/64</td>
<td>Clears this specific route from the IPv6 routing table.</td>
</tr>
<tr>
<td>Router#clear ipv6 traffic</td>
<td>Resets IPv6 traffic counters.</td>
</tr>
<tr>
<td>Router#debug ipv6 packet</td>
<td>Displays debug messages for IPv6 packets.</td>
</tr>
<tr>
<td>Router#debug ipv6 rip</td>
<td>Displays debug messages for IPv6 RIP routing transactions.</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>debug ipv6 routing</code></td>
<td>Displays debug messages for IPv6 routing table updates and route cache updates.</td>
</tr>
<tr>
<td><code>show ipv6 interface</code></td>
<td>Displays the status of interfaces configured for IPv6.</td>
</tr>
<tr>
<td><code>show ipv6 interface brief</code></td>
<td>Displays a summarized status of interfaces configured for IPv6.</td>
</tr>
<tr>
<td><code>show ipv6 neighbors</code></td>
<td>Displays IPv6 neighbor discovery cache information.</td>
</tr>
<tr>
<td><code>show ipv6 protocols</code></td>
<td>Displays the parameters and current state of the active IPv6 routing protocol processes.</td>
</tr>
<tr>
<td><code>show ipv6 rip</code></td>
<td>Displays information about the current IPv6 RIP process.</td>
</tr>
<tr>
<td><code>show ipv6 route</code></td>
<td>Displays the current IPv6 routing table.</td>
</tr>
<tr>
<td><code>show ipv6 route summary</code></td>
<td>Displays a summarized form of the current IPv6 routing table.</td>
</tr>
<tr>
<td><code>show ipv6 routers</code></td>
<td>Displays IPv6 router advertisement information received from other routers.</td>
</tr>
<tr>
<td><code>show ipv6 static</code></td>
<td>Displays only static IPv6 routes installed in the routing table.</td>
</tr>
<tr>
<td><code>show ipv6 static 2001:db8:5555:0/16</code></td>
<td>Displays only static route information about the specific address given.</td>
</tr>
<tr>
<td><code>show ipv6 static interface serial 0/0</code></td>
<td>Displays only static route information with the specified interface as the outgoing interface.</td>
</tr>
<tr>
<td><code>show ipv6 static detail</code></td>
<td>Displays a more detailed entry for IPv6 static routes.</td>
</tr>
<tr>
<td><code>show ipv6 traffic</code></td>
<td>Displays statistics about IPv6 traffic.</td>
</tr>
<tr>
<td><code>show ipv6 tunnel</code></td>
<td>Displays IPv6 tunnel information.</td>
</tr>
</tbody>
</table>
**IPv6 Ping**

To diagnose basic network connectivity using IPv6 to the specified address, enter the following command:

```
Router#ping ipv6 2001:db8::3/64
```

The following characters can be displayed as output when using PING in IPv6.

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Each exclamation point indicates receipt of a reply.</td>
</tr>
<tr>
<td>.</td>
<td>Each period indicates that the network server timed out while waiting for a reply.</td>
</tr>
<tr>
<td>?</td>
<td>Unknown error.</td>
</tr>
<tr>
<td>@</td>
<td>Unreachable for unknown reason.</td>
</tr>
<tr>
<td>A</td>
<td>Administratively unreachable. Usually means that an access control list (ACL) is blocking traffic.</td>
</tr>
<tr>
<td>B</td>
<td>Packet too big.</td>
</tr>
<tr>
<td>H</td>
<td>Host unreachable.</td>
</tr>
<tr>
<td>N</td>
<td>Network unreachable (beyond scope).</td>
</tr>
<tr>
<td>P</td>
<td>Port unreachable.</td>
</tr>
<tr>
<td>R</td>
<td>Parameter problem.</td>
</tr>
<tr>
<td>T</td>
<td>Time exceeded.</td>
</tr>
<tr>
<td>U</td>
<td>No route to host.</td>
</tr>
</tbody>
</table>
This page intentionally left blank