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Second Edition

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Authorized Self-Study Guide
**Interconnecting Cisco
Network Devices,
Part 1 (ICND1)**
Second Edition

**Steve McQuerry,
CCIE No. 6108**

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Steve McQuerry, CCIE No. 6108

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Dedication

This work is dedicated to my family. Becky, as the years go by, I love you more. Thank you for your support and understanding. Katie, your work ethic has always amazed me. As you prepare to move into the next phase of your life, remember your goals and keep working hard and you can achieve anything. Logan, you have never believed there was anything you couldn't do. Keep that drive and spirit and there will be no limit to what you can accomplish. Cameron, you have a keen sense of curiosity that reminds me of myself as a child. Use that thirst for understanding and learning, and you will be successful in all your endeavors.

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Icons Used in This Book



Router



Switch



Bridge



IP Telephony Router



IP Phone



DSU/CSU



uBR910
Cable DSU



Hub



100BaseT Hub



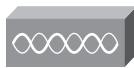
Repeater



Network Cloud



Access Server



Access Point



Database



Modem



Server



Host



PC



Laptop



Printer



Headquarters



Branch Office



Home Office

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).
- *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.

Foreword

Cisco Certification Self-Study Guides are excellent self-study resources for networking professionals to maintain and increase internetworking skills and to prepare for Cisco Career Certification exams. Cisco Career Certifications are recognized worldwide and provide valuable, measurable rewards to networking professionals and their employers.

Cisco Press exam certification guides and preparation materials offer exceptional—and flexible—access to the knowledge and information required to stay current in one's field of expertise, or to gain new skills. Whether used to increase internetworking skills or as a supplement to a formal certification preparation course, these materials offer networking professionals the information and knowledge required to perform on-the-job tasks proficiently.

Developed in conjunction with the Cisco certifications and training team, Cisco Press books are the only self-study books authorized by Cisco. They offer students a series of exam practice tools and resource materials to help ensure that learners fully grasp the concepts and information presented.

Additional authorized Cisco instructor-led courses, e-learning, labs, and simulations are available exclusively from Cisco Learning Solutions Partners worldwide. To learn more, visit <http://www.cisco.com/go/training/>.

I hope you will find this guide to be an essential part of your exam preparation and professional development, as well as a valuable addition to your personal library.

Drew Rosen
Manager, Learning and Development
Learning@Cisco
November 2007

Introduction

Since the introduction of the personal computer in the early 1970s, businesses have found more uses and applications for technology in the workplace. With the introduction of local-area networks, file sharing, and print sharing in the 1980s, it became obvious that distributed computing was no longer a passing fad. By the 1990s, computers became less expensive, and innovations such as the Internet enabled everyone to connect to computer services worldwide. Computing services have become large and distributed. The days of punch cards and green-bar paper are behind us, and a new generation of computing experts is being asked to keep this distributed technology operational. These experts are destined to have a new set of issues and problems to deal with, the most complex of them being connectivity and compatibility between differing systems and devices.

The primary challenge with data networking today is to link multiple devices' protocols and sites with maximum effectiveness and ease of use for end users. Of course, this must all be accomplished in a cost-effective way. Cisco offers a variety of products to give network managers and analysts the ability to face and solve the challenges of internetworking.

In an effort to ensure that these networking professionals have the knowledge to perform these arduous tasks, Cisco has developed a series of courses and certifications that act as benchmarks for internetworking professionals. These courses help internetworking professionals learn the fundamentals of internetworking technologies along with skills in configuring and installing Cisco products. The certification exams are designed to be a litmus test for the skills required to perform at various levels of internetworking. The Cisco certifications range from the associate level (CCNA), through the professional level (CCNP), to the expert level (CCIE).

The Interconnecting Cisco Network Devices 1 (ICND1) course is one of two recommended training classes for CCNA preparation. As a self-study complement to the course, this book helps to ground individuals in the fundamentals of switches and routed internetworks. It presents the concepts, commands, and practices required to configure Cisco switches and routers to operate in corporate internetworks. You will be introduced to all the basic concepts and configuration procedures required to build a multiswitch, multirouter, and multigroup internetwork that uses LAN and WAN interfaces for the most commonly used routing and routed protocols. ICND1 provides the installation and configuration information that network administrators require to install and configure Cisco products.

This book is the first part of a two-part, introductory-level series and is recommended for individuals who have one to three years of internetworking experience, are familiar with basic internetworking concepts, and have basic experience with TCP/IP. While this self-study book is designed for those who are pursuing the CCNA certification, it is also useful for network administrators responsible for implementing and managing small- and

medium-sized business networks. Network support staff who perform a help-desk role in a medium- or enterprise-sized company will find this a valuable resource. Finally, Cisco customers or channel resellers and network technicians entering the internetworking industry who are new to Cisco products can benefit from the contents of this book.

Goals

The goals of this book are twofold. First, it is intended as a self-study resource that covers the subjects on the 640-822 (ICND1) exam as well as the ICND1 material of the 640-802 (CCNA) exam. Second, like the certification itself, the book should help you become literate in the use of switches, routers, and the associated protocols and technologies. Using these skills, someone who completes the book and the CCNA certification should be able to select, connect, and configure Cisco devices in an internetworking environment. In particular, the book covers the basic steps and processes involved with moving data through the network using routing and Layer 2 switching.

NOTE To become CCNA certified, you must pass separate ICND1 and ICND2 exams or pass a single CCNA exam that tests on the topics from both ICND1 and ICND2.

Readers interested in more information about the CCNA certification should consult the Cisco website at <http://www.cisco.com/web/learning/index.html>. To schedule a Cisco certification test, contact Pearson Vue on the web at <http://www.pearsonvue.com/cisco/>.

Chapter Organization

This book is divided into six chapters and is designed to be read in order because many chapters build on content from previous chapters.

- Chapter 1, “Building a Simple Network,” describes the principles on which basic networks operate. This chapter helps build a foundational understanding that is used throughout the other chapters of the book.
- Chapter 2, “Ethernet LANs,” explores the operation and configuration of LANs, including the challenges associated with these networks, and describes how network devices are used to eliminate these problems focusing on Layer 2 switching.
- Chapter 3, “Wireless LANs,” describes how to extend the boundaries of network connectivity through wireless connectivity. It describes the business drivers and standards that affect wireless LAN implementation. It also discusses WLAN security issues and threat mitigation.

- Chapter 4, “LAN Connections,” looks at how a router provides connectivity between the different networks in an internetwork. This chapter also describes IP addressing number conversion and basic routing configuration skills.
- Chapter 5, “WAN Connections,” discusses the connectivity required for sites that are across wide geographic areas. It discusses interconnectivity using point-to-point links as well as DSL and cable services. The chapter also discusses how to configure Network Address Translation (NAT).
- Chapter 6, “Network Environment Management,” discusses how to use Cisco IOS commands to determine the layout of a Cisco network topology. It also describes how to manage the router startup as well as how to work with IOS configuration files and Cisco IOS images.
- Appendix, “Answers to Chapter Review Questions,” provides answers to the review questions at the end of each chapter.

Features

This book features actual router and switch output to aid in the discussion of the configuration of these devices. Many examples, illustrations, and notes are spread throughout the text. In addition, you can find many references to standards, documents, books, and websites to help you understand networking concepts. At the end of each chapter, your comprehension and knowledge are tested by review questions prepared by a certified Cisco Systems instructor.

NOTE The operating system used in this book is Cisco IOS Software Release 12.4 for the routers, and Cisco Catalyst 2960 is based on Cisco IOS Software Release 12.2.