

Cisco 专业技术丛书



CCNP Cisco Internetwork Troubleshooting Study Guide

(EXAM 640-440)

CCNP 学习指南:

Cisco



(英文版)

网络互连故障排除

Syngress Media 公司 著



机械工业出版社  
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OSBORNE 

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# FOREWORD

## From Global Knowledge

At Global Knowledge we strive to support the multiplicity of learning styles required by our students to achieve success as technical professionals. In this testing product, it is our intention to offer the reader a valuable tool for successful completion of the CCNP certification.

As the world's largest IT training company, Global Knowledge is uniquely positioned to offer these books. The expertise gained each year from providing instructor-led training to hundreds of thousands of students worldwide has been captured in book form to enhance your learning experience. We hope that the quality of these books demonstrates our commitment to your lifelong learning success. Whether you choose to learn through the written word, computer-based training, Web delivery, or instructor-led training, Global Knowledge is committed to providing you the very best in each of those categories. For those of you who know Global Knowledge, or those of you who have just found us for the first time, our goal is to be your lifelong competency partner.

Thank you for the opportunity to serve you. We look forward to serving your needs again in the future.

Warmest regards,

A handwritten signature in black ink, reading "Duncan Anderson". The signature is fluid and cursive, with a large initial "D" and a long, sweeping underline.

Duncan Anderson  
President and Chief Operating Officer, Global Knowledge

## **The Global Knowledge Advantage**

Global Knowledge has a global delivery system for its products and services. The company has 28 subsidiaries, and offers its programs through a total of 60+ locations. No other vendor can provide consistent services across a geographic area this large. Global Knowledge is the largest independent information technology education provider, offering programs on a variety of platforms. This enables our multi-platform and multi-national customers to obtain all of their programs from a single vendor. The company has developed the unique Competus<sup>TM</sup> Framework software tool and methodology which can quickly reconfigure courseware to the proficiency level of a student on an interactive basis. Combined with self-paced and on-line programs, this technology can reduce the time required for training by prescribing content in only the deficient skills areas. The company has fully automated every aspect of the education process, from registration and follow-up, to "just-in-time" production of courseware. Global Knowledge, through its Enterprise Services Consultancy, can customize programs and products to suit the needs of an individual customer.

## **Global Knowledge Classroom Education Programs**

The backbone of our delivery options is classroom-based education. Our modern, well-equipped facilities staffed with the finest instructors offer programs in a wide variety of information technology topics, many of which lead to professional certifications.

## **Custom Learning Solutions**

This delivery option has been created for companies and governments that value customized learning solutions. For them, our consultancy-based approach of developing targeted education solutions is most effective at helping them meet specific objectives.

## **Self-Paced and Multimedia Products**

This delivery option offers self-paced program titles in interactive CD-ROM, videotape and audio tape programs. In addition, we offer custom development of interactive multimedia courseware to customers and partners. Call us at 1 (888) 427-4228.

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Our network-based training service delivers efficient competency-based, interactive training via the World Wide Web and organizational intranets. This leading-edge delivery option provides a custom learning path and "just-in-time" training for maximum convenience to students.

## **ARG**

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- Cabling Voice and Data Networks
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- Virtual Private Networks
- ATM Essentials

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- Network Troubleshooting
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- Managing Cisco Network Security
- Windows NT 4.0 Security

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- Catalyst 5000 Series Configuration
- Cisco LAN Switch Configuration
- Managing Cisco Switched Internetworks
- Configuring, Monitoring, and Troubleshooting Dial-Up Services
- Cisco AS5200 Installation and Configuration
- Cisco Campus ATM Solutions

#### Bay Networks

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- Bay Networks Hub Connectivity
- Bay Networks Accelar 1xxx Installation and Basic Configuration
- Bay Networks Centillion Switching

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- DIGITAL UNIX TruCluster Software Configuration and Management
- UNIX Shell Programming Featuring Kornshell
- DIGITAL UNIX v4.0 Security Management
- DIGITAL UNIX v4.0 Performance Management
- DIGITAL UNIX v4.0 Intervals Overview

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- AlphaServer 4100, Troubleshooting Techniques and Problem Solving

## ABOUT THE CONTRIBUTORS

### About Syngress Media

**Syngress Media** creates books and software for Information Technology professionals seeking skill enhancement and career advancement. Its products are designed to comply with vendor and industry standard course curricula, and are optimized for certification exam preparation. You can contact Syngress via the Web at <http://www.syngress.com>.

### Contributors

**Ryan Russell** (CCNA, CCNP) has been employed in the networking field for more than ten years, including more than five years working with Cisco equipment. He has held IT positions ranging from help-desk support to network design, providing him with a good perspective on the challenges that face a network manager. Recently, Ryan has been contributing to information security projects involving network security and firewalls.

**Eric Dean** (CCIE#2708) has been employed with Global One since 1994 in the Internetwork Engineering department designing and developing enterprise, Internet, and Dial solutions for the Global One marketplace. Eric holds a master's degree in telecommunications from the University of Maryland, and a bachelor's degree in electrical engineering from George Mason University. He dedicates this book to his extremely patient wife, Lynn Ann, and their soon-to-be-born baby girl.

**Vernon Hall** graduated with a bachelor of science degree in computer science from James Madison University in 1992 and has been working as a consultant and network engineer for the past six years. He designs, installs, and supports large Novell NetWare networks. His experience includes support for file servers, peripherals, and infrastructure components from manufacturers such as Cisco, Bay Networks, and 3Com. Currently he is Director of MIS for M.C. Dean, Inc., in Chantilly, Virginia.

**Ken Peterson (CCIE)** is the President of KapNet Technologies, Inc., in Raleigh, North Carolina, a firm specializing in voice/data integration using Cisco routers and Selsius Ethernet phones. Ken has been teaching Cisco voice, Cisco router, and UNIX classes for two years. He holds a bachelor of science degree in electrical engineering from Georgia Tech. Ken's expertise includes Ethernet phones, IP PBXs, voice-over IP/Frame Relay, and Cisco ISDN dial services. Ken is currently developing the Global Knowledge ECRC computer-based training CD-ROMs that complement the Cisco ACRC course.

**Natashia Maull** is a network engineer in a large telecommunications corporation on the East Coast, specializing in high-speed networking, installation, and troubleshooting. She has experience in Cisco router configuration, ATM technology, the Catalyst 5000 product series, and Cisco internetwork troubleshooting. She is currently implementing an ATM backbone infrastructure using Cisco Products.

**Kevin E. Greene** works in the telecommunications industry as a Network Security Professional. He holds a master of science degree in information systems and a bachelor of science degree in management information systems from the New Jersey Institute of Technology. In addition, he has attained CheckPoint Firewall-1 certification as a System Engineer and System Administrator.

**Shawn H Costigan** is a Senior Network Analyst and the Technical Supervisor for BBN's (now GTE Internetworking) Dial Access Group. The network is a 300,000 modem access network and one of the largest EIGRP router networks in the world. He also serves as technical trainer to and mentors the Dialinx Controller Group. Shawn has also served four years of enlisted duty in the USAF, where he was part of the 621st Mobility Squadron that, during contingencies, set up mobile networking communications via WANs to provide encrypted transmissions to various strategic points and back to the United States.

**Richard D. Hornbaker (CCIE, CNX, MCSE, Master CNE)** is an architect with the Forté Consulting Group, a Phoenix-based firm specializing in strategic network design. With more than 15 years in the industry, Richard holds several certifications including Cisco CCIE, Network General CNX, Microsoft MCSE, and Novell Master CNE. His



skills are diverse, ranging from operating systems and software to telephony systems and data networks. Richard has just completed the overhaul of a 12,000-node campus network and is designing a 20,000-site WAN for a major corporate merger. He is a participant in the Internet Engineering Task Force (IETF) and a member of the Institute of Electrical and Electronics Engineers (IEEE). He can be reached at [Richard@Hornbaker.com](mailto:Richard@Hornbaker.com).

### **From the Classroom Sidebars**

**Glenn Lepore** is a senior network engineer with Niche Networks, LLC, in Herndon, Virginia. He has more than 13 years experience in LAN and WAN design, installation, and troubleshooting. His background includes Frame Relay, X.25, TCP/IP, IPX, and SNA. His experience includes Novell and UNIX administration, Web page design, and Internet Service Provider network operations. He is working toward his CCIE and MCSE certifications.

### **Technical Review**

**Tony Costa** (CCIE #4140, MCSE, CNE) started his networking career in 1979 installing Gandalf synchronous modems. Since then he has worked extensively in TCP/IP and IBM SNA networks. He installed some of the earliest Banyan Vines LANs in the U.S. Department of Defense, and now occasionally assists in replacing them with Microsoft Windows NT networks. Tony spends his weekends at his home in New Mexico. During the week, he teaches Cisco technology to Cisco's engineers and delivers Cisco IOS router and Cisco Catalyst switch classes to the public through Chesapeake Computer Consultants, Inc.

## Acknowledgments

**W**

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- Bridget Robeson at Niche Networks, for all her help.
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## PREFACE

This book's primary objective is to help you prepare for and pass the required CIT exam so you can begin to reap the career benefits of CCNP certification. We believe that the only way to do this is to help you increase your knowledge and build your skills. After completing this book, you should feel confident that you have thoroughly reviewed all of the objectives that Cisco has established for the exam.

### In This Book

This book is organized around the topics covered within the Cisco exam administered at Sylvan Testing Centers. Cisco has specific objectives for the CIT exam: we've followed their list carefully, so you can be assured you're not missing anything.

### In Every Chapter

We've created a set of chapter components that call your attention to important items, reinforce important points, and provide helpful exam-taking hints. Take a look at what you'll find in every chapter:

- Every chapter begins with the **Certification Objectives**—what you need to know in order to pass the section on the exam dealing with the chapter topic. The Certification Objective headings identify the objectives within the chapter, so you'll always know an objective when you see it!
- **Certification Exercises** are interspersed throughout the chapters. These are step-by-step exercises that mirror vendor-recommended labs. They help you master skills that are likely to be an area of focus on the exam. Don't just read through the exercises; they are hands-on practice that you should be comfortable completing. Learning by doing is an effective way to increase your competency with a product.

exam

**Watch**

- **Exam Watch** notes call attention to information that is critical knowledge for the CCNP exams. These helpful hints are written by Cisco-certified professionals.

on the

**Job**

- **On the Job** notes point out procedures and techniques important for coding actual applications for employers or contract jobs.
- **From the Classroom** sidebars describe the issues that come up most often in the training classroom setting. These sidebars give you a valuable perspective into certification- and product-related topics. They point out common mistakes and address questions that have arisen from classroom discussions.
- **Q & A** sections lay out problems and solutions in a quick-read format:

## QUESTIONS AND ANSWERS

What are some helpful general troubleshooting tools?

Ping is the most useful general-help tool. It will tell you whether a device is reachable by sending ICMP echo request and waiting for a reply. If no reply comes back, you know there's a problem with that device. A protocol analyzer is also a good troubleshooting tool. A traceroute is also helpful.

How can I connect two dissimilar LANs?

You can achieve this by way of encapsulation. *Translational encapsulation* is a method of transparently bridging LANs that have dissimilar Physical and Data Link architecture (MAC sublayer protocols), such as Token Ring to Ethernet.

- The **Certification Summary** is a succinct review of the chapter and a re-statement of salient points regarding the exam.
- The **Two-Minute Drill** at the end of every chapter is a checklist of the main points of the chapter. It can be used for last-minute review.

- **Tables** are liberally sprinkled throughout the chapters. You'll find that these provide an easy way to look up information and show material you may find worthy of memorization:

Protocol	Familiar Name	Port
Trivial File Transfer Protocol	<b>TFTP</b>	<b>69</b>
Domain Name Service	<b>DNS</b>	<b>53</b>
Time Service	-	<b>37</b>
NetBIOS Name Server	-	<b>137</b>
NetBIOS Datagram Server	-	<b>138</b>
Boot Protocol (Client and Server)	<b>BOOTP</b>	<b>67 and 68</b>
TACACS	<b>TACACS</b>	<b>49</b>

- The **Self Test** offers questions similar to those found on the certification exams. The answers to these questions, as well as explanations of the answers, can be found in Appendix A. By taking the Self Test after completing each chapter, you'll reinforce what you've learned from that chapter, while becoming familiar with the structure of the exam questions.

## Some Pointers

Once you've finished reading this book, set aside some time to do a thorough review. You might want to return to the book several times and make use of all the methods it offers for reviewing the material:

1. *Re-read all the Two-Minute Drills*, or have someone quiz you. You also can use the drills as a way to do a quick cram before the exam.
2. *Review all the Q & A scenarios* for quick problem solving.
3. *Re-take the Self Tests*. Taking the tests right after you've read the chapter is a good idea, because it helps reinforce what you've just learned. However, it's an even better idea to go back later and do all the questions in the book in one sitting. Pretend you're taking the

exam. (For this reason, you should mark your answers on a separate piece of paper when you go through the questions the first time.)

4. *Complete the exercises.* Did you do the exercises when you read through each chapter? If not, do them! These exercises are designed to cover exam topics, and there's no better way to get to know this material than by practicing.
5. *Check out the Web site.* Global Knowledge invites you to become an active member of the Access Global Web site. This site is an online mall and an information repository that you'll find invaluable. You can access many types of products to assist you in your preparation for the exams, and you'll be able to participate in forums, on-line discussions, and threaded discussions. No other book brings you unlimited access to such a resource. You'll find more information about this site in Appendix C.

## INTRODUCTION

# How to Take a Cisco Certification Examination

**by Richard D. Hornbaker (CCIE, CNX, MCSE, MCNE),  
Forté Consulting Group**

This section covers the importance of your CCNP certification and prepares you for taking the actual examination. It gives you a few pointers on methods of preparing for the exam, including how to study register, what to expect, and what to do on exam day.

## Catch the Wave!

Congratulations on your pursuit of Cisco certification! In this fast-paced world of networking, few certifications compare to the value of Cisco's program.

The networking industry has virtually exploded in recent years, accelerated by non-stop innovation and the Internet's popularity. Cisco has stayed at the forefront of this tidal wave, maintaining a dominant role in the industry.

Since the networking industry is highly competitive, and evolving technology only increases in its complexity, the rapid growth of the networking industry has created a vacuum of qualified people. There simply aren't enough skilled networking people to meet the demand. Even the most experienced professionals must keep current with the latest technology in order to provide the skills that the industry demands. That's where Cisco certification programs can help networking professionals succeed as they pursue their career.

Cisco started its certification program many years ago, offering only the designation of Cisco Certified Internetwork Expert, or CCIE. Through the CCIE program, Cisco provided a means to meet the growing demand for experts in the field of networking. However, the CCIE tests are brutal, with

a failure rate of more than 80 percent. (Fewer than five percent of candidates pass on their first attempt.) As you might imagine, very few people ever attain CCIE status.

In early 1998, Cisco recognized the need for intermediate certifications, and several new programs were created. Four intermediate certifications were added: CCNA (Cisco Certified Network Associate), CCNP (Cisco Certified Network Professional), CCDA (Cisco Certified Design Associate), and CCDP (Cisco Certified Design Professional). Two specialties were also created for the CCIE program: WAN Switching and ISP Dial-up.



***I would encourage you to take beta tests when they are available. Not only are the beta exams less than the cost of the final exams (some are even free!), but also, if you pass the beta, you will receive credit for passing the exam. If you don't pass the beta, you will have seen every question in the pool of available questions, and can use this information when preparing to take the exam for the second time. Remember to jot down important information immediately after the exam, if you didn't pass. You will have to do this after leaving the exam area, since materials written during the exam are retained by the testing center. This information can be helpful when you need to determine which areas of the exam were most challenging for you as you study for the subsequent test.***

## Why Vendor Certification?

Over the years, vendors have created their own certification programs because of industry demand. This demand arises when the marketplace needs skilled professionals and an easy way to identify them. Vendors benefit because it promotes people skilled in their product. Professionals benefit because it boosts their career. Employers benefit because it helps them identify qualified people.

In the networking industry, technology changes too often and too quickly to rely on traditional means of certification, such as universities and trade associations. Because of the investment and effort required to keep network certification programs current, vendors are the only organizations suited to keep pace with the changes. In general, such vendor certification



programs are excellent, with most of them requiring a solid foundation in the essentials, as well as their particular product line.

Corporate America has come to appreciate these vendor certification programs and the value they provide. Employers recognize that certifications, like university degrees, do not guarantee a level of knowledge, experience or performance; rather, they establish a baseline for comparison. By seeking to hire vendor-certified employees, a company can assure itself that not only has it found a person skilled in networking, but it has also hired a person skilled in the specific products the company uses.

Technical professionals have also begun to realize the value of certification and the impact it can have on their careers. By completing a certification program, professionals gain an endorsement of their skills from a major industry source. This endorsement can boost their current position, and it makes finding the next job even easier. Often, a certification determines whether a first interview is even granted.

Today, a certification may place you ahead of the pack. Tomorrow, it will be a necessity to keep from being left in the dust.



***Signing up for an exam has become more effortless with the new Web-based test registration system. To sign up for any of CCNP exams, access <http://www.2test.com>, and register for the Cisco Career Certification path. You will need to get an Internet account and password, if you do not already have one for 2test.com. Just select the option for first time registration, and the Web site will walk you through that process. The registration wizard even provides maps to the testing centers, something that is not available when calling Sylvan Prometric on the telephone.***

## Cisco's Certification Program

As mentioned previously, Cisco now has six certifications for the Routing and Switching career track, and four certifications for the WAN Switching career track. While Cisco recommends a series of courses for each of these certifications, they are not required. Ultimately, certification is dependent