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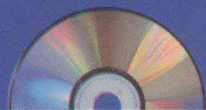


CCNP Cisco Internetwork Troubleshooting Study Guide

(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
China Machine Press

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CCNP 学习指南

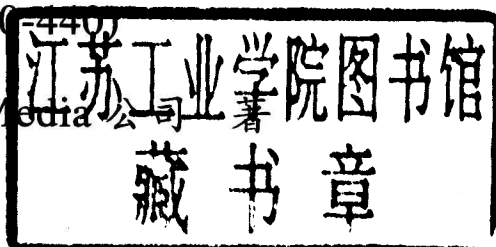
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Osborne
McGraw-Hill

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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™ 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.

Electronic Delivery of Training

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.

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American Research Group (ARG), a wholly-owned subsidiary of Global Knowledge, one of the largest worldwide training partners of Cisco Systems, offers a wide range of internetworking, LAN/WAN, Bay Networks, FORE Systems, IBM, and UNIX courses. ARG offers hands on network training in both instructor-led classes and self-paced PC-based training.

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- Introduction to Voice Over IP
- Introduction to Wide Area Networking
- Cabling Voice and Data Networks
- Introduction to LAN/WAN protocols
- Virtual Private Networks
- ATM Essentials

Network Security & Management

- Troubleshooting TCP/IP Networks
- Network Management
- Network Troubleshooting
- IP Address Management
- Network Security Administration
- Web Security
- Implementing UNIX Security
- Managing Cisco Network Security
- Windows NT 4.0 Security

IT Professional Skills

- Project Management for IT Professionals
- Advanced Project Management for IT Professionals
- Survival Skills for the New IT Manager
- Making IT Teams Work

LAN/WAN Internetworking

- Frame Relay Internetworking
- Implementing T1/T3 Services
- Understanding Digital Subscriber Line (xDSL)
- Internetworking with Routers and Switches
- Advanced Routing and Switching
- Multi-Layer Switching and Wire-Speed Routing
- Internetworking with TCP/IP
- ATM Internetworking
- OSPF Design and Configuration
- Border Gateway Protocol (BGP) Configuration

Authorized Vendor Training

Cisco Systems

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- Advanced Cisco Router Configuration
- Installation and Maintenance of Cisco Routers
- Cisco Internetwork Troubleshooting
- Cisco Internetwork Design
- Cisco Routers and LAN Switches
- 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

- Bay Networks Accelerated Router Configuration
- Bay Networks Advanced IP Routing
- Bay Networks Hub Connectivity
- Bay Networks Accelar 1xxx Installation and Basic Configuration
- Bay Networks Centillion Switching

FORE Systems

- FORE ATM Enterprise Core Products
- FORE ATM Enterprise Edge Products
- FORE ATM Theory
- FORE LAN Certification

Operating Systems & Programming

Microsoft

- Introduction to Windows NT
- Microsoft Networking Essentials
- Windows NT 4.0 Workstation
- Windows NT 4.0 Server
- Advanced Windows NT 4.0 Server
- Windows NT Networking with TCP/IP
- Introduction to Microsoft Web Tools
- Windows NT Troubleshooting
- Windows Registry Configuration

UNIX

- UNIX Level I
- UNIX Level II
- Essentials of UNIX and NT Integration

Programming

- Introduction to JavaScript
- Java Programming
- PERL Programming
- Advanced PERL with CGI for the Web

Web Site Management & Development

- Building a Web Site
- Web Site Management and Performance
- Web Development Fundamentals

High Speed Networking

- Essentials of Wide Area Networking
- Integrating ISDN
- Fiber Optic Network Design
- Fiber Optic Network Installation
- Migrating to High Performance Ethernet

DIGITAL UNIX

- UNIX Utilities and Commands
- DIGITAL UNIX v4.0 System Administration
- DIGITAL UNIX v4.0 (TCP/IP) Network Management
- AdvFS, LSM, and RAID Configuration and Management
- 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

DIGITAL OpenVMS

- OpenVMS Skills for Users
- OpenVMS System and Network Node Management I
- OpenVMS System and Network Node Management II
- OpenVMS System and Network Node Management III
- OpenVMS System and Network Node Operations
- OpenVMS for Programmers
- OpenVMS System Troubleshooting for Systems Managers
- Configuring and Managing Complex VMScluster Systems
- Utilizing OpenVMS Features from C
- OpenVMS Performance Management
- Managing DEC TCP/IP Services for OpenVMS
- Programming in C

Hardware Courses

- AlphaServer 1000/1000A Installation, Configuration and Maintenance
- AlphaServer 2100 Server Maintenance
- 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.

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

We would like to thank the following people:

- Bridget Robeson at Niche Networks, for all her help.
- Richard Kristof of Global Knowledge for championing the series and providing us access to some great people and information. And to Shelley Everett and Chuck Terrien for all their cooperation.
- Imran Qureshi and Tina Dupart at Cisco for their time and insight.
- To all the incredibly hard-working folks at Osborne/McGraw-Hill: Brandon Nordin, Scott Rogers, Gareth Hancock, and Jody McKenzie for their help in launching a great series and being solid team players.

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 objective 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

on the

Job

- **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** 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	TFTP	69
Domain Name Service	DNS	53
Time Service	-	37
NetBIOS Name Server	-	137
NetBIOS Datagram Server	-	138
Boot Protocol (Client and Server)	BOOTP	67 and 68
TACACS	TACACS	49

- **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