CCNP Advanced Cisco Router Configuration Study Guide

(EXAM 640-403)

CCNP 学习指南：

Cisco

（英文版）

路由器高级配置技术

Syngress Media 公司 著

机械工业出版社
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OSBORNE

Cisco 专业技术丛书

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CCNP Advanced Cisco Router
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凡购本书，如有缺页、倒页、脱页，由本社发行部调换

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,

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.

ARG

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.

Global Knowledge Courses Available

Network Fundamentals
- Understanding Computer Networks
- Telecommunications Fundamentals I
- Telecommunications Fundamentals II
- Understanding Networking Fundamentals
- Implementing Computer Telephony Integration
- 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
- Introduction to Cisco Router Configuration
- 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 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

Pamela Forsyth (CCIE Routing & Switching, CCSI, CNX, Master CNE, MCSE) has been working in a technical capacity with digital electronics and computer systems for more than 20 years, and has been active in the networking field since 1989. She is currently a senior network engineer with Wang Global in the Enterprise Transport Group, specializing in design and integration of large-scale, routed networks and ATM networks based on Cisco WAN switching products.

Neil Lovering (CCIE) is a network consultant and Cisco-certified instructor. He has helped with many large and small network design and optimization projects throughout the United States and Canada, specializing in OSPF configuration and migration. Over the last few years, Neil has taught thousands of students how to configure Cisco routers and switches, design and troubleshoot complex networks, and earn various Cisco network certifications. He has also authored the first in a series of Cisco-oriented, computer-based training courses offered through Global Knowledge Network. He is currently working on some Web-based educational sites.

Herbert Borovansky is a consultant with the Forté Consulting Group, based in Phoenix, Arizona. He gained his bachelor's degree in Management Information Systems from the University of Arizona. He is currently leading the design and implementation of switched network infrastructures for two call centers for a large financial services company. His skills range from

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network operating systems to personal computer operating systems, as well as internetworking using switching and routing.

George Spahl (CNE, CCNA, CNX, MCSE) is a network analyst who lives in Louisville, Kentucky. He has worked in the industry for ten years and specializes in network troubleshooting and protocol analysis. He holds a B.A. in mathematics and is currently working on his CCIE.

Frank C. Drewes III (CCNA, MCSE) has worked in the network industry for eight years. He has worked in technical support for Data Stitch, and for two years worked at Microsoft as a technical support engineer. Frank is currently the network architect for i2 Technologies, the leading provider of intelligent planing and scheduling software. His current position involves designing and implementing a fast growing, 20-site, international LAN/WAN based in Dallas, Texas. Frank lives in Fort Worth, Texas with his wife and 15-month-old daughter.

Mark Powell has been a network consultant specializing in Cisco router-and-switch networking since 1994. Mark is also a Cisco instructor for Global Knowledge Network. He currently teaches the Introduction and Advanced Router Configuration Courses. Mark also teaches Cisco Internetwork Troubleshooting, Internetwork Design, Maintenance and Installation, and the Cisco SNA configuration course. He has course directorship of the Cisco Design and Troubleshooting courses. Some of his recent consulting jobs have included network design for the San Francisco Examiner, Northern Telecom, and Symbol Technologies. Mark lives in San Jose, California and can be reached at **mtpowell@ix.netcom.com**.

Michael Dyer (CCSI, CCNA) has more than 15 years' experience in distributed computer systems design, network development, and logistics systems integration—with Department of Defense agencies and commercial industries. Michael formerly directed the DOD Multi-Level Security Communications and Advanced Computer System Test bed. He was instrumental in the development of the U.S. Global Transportation Network system. As a captain in the U.S. Air Force, he led a cadre of multinational personnel providing Unisys Base Level System network and telecommunications services to remote, southern European locations. Michael holds a B.S. in computer science, and an M.A. in computer resource management. Michael can be contacted at **mdicorp@aol.com**.

Melissa Craft (CCNA, CNE-3, CNE-4, CNE-GW, MCSE, MCNE, Citrix) is a consulting engineer for MicroAge, a dynamic systems integration company in Phoenix, Arizona. She handles internetwork systems design for complex or global network projects, concentrating on infrastructure and messaging. She has a bachelor's degree from the University of Michigan. Melissa Craft is a member of the IEEE, the Society of Women Engineers, and American Mensa, Ltd.

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

James McInvaille is a network engineer and instructor for Niche Networks, LLC in Herndon Virginia. He has 12 years of experience in the communications industry, starting in the U.S. Air Force, where he was a network engineer. He is currently working toward his CCIE.

Dr. Dmitri Krioukov is an internetworking engineer for Dimension Enterprises, Inc., in Herndon, Virginia. His education and work experience have focused on network design, development, and integration. He has demonstrated his expertise in both high-tech companies and academia, where his knowledge has been essential to various networking processes. Dr. Krioukov holds his doctorate in physics from Old Dominion University in Norfolk, Virginia.

James H. Mapp is an internetworking engineer for Dimension Enterprises, Inc., in Herndon, Virginia. He is an experienced wide-area networking specialist, skilled in understanding networking trends and in providing engineering solutions and their implementations. He also offers proficiency in network management, enterprise projects, and emerging technologies programs. Mr. Mapp holds bachelor's degree in computer and electronics engineering from George Mason University in Fairfax, Virginia.

James Ewing (CCNA, CNA, CNE, MCSE, MCP+Internet) is an internetworking engineer for Dimension Enterprises, Inc., in Herndon, Virginia. He has a wide range of experience in the communications

industry, including designing high-speed LAN switching solutions and diagnosing advanced LAN and WAN access problems. Mr. Ewing will soon be a Cisco Certified Internetworking Expert.

Nicholas Giancola is a network engineer with Dimension Enterprises, Inc., in Herndon, Virginia. He recently completed seven years of military service, where he exhibited leadership in network design, deployment, operations, and management. He is known for administrative and technical expertise in the areas of local- and wide-area networking, troubleshooting, configuration, and network design.

Scott Paletar is an internetworking engineer for Dimension Enterprises, Inc. in Herndon, Virginia. He recently completed ten years of military service, where he exhibited strengths in enterprise technology services, customer support, and in-depth troubleshooting. He has extensive technical and management experience in information systems and wide-area networking. Scott was a senior administrator for the Network Operations Center for the U.S. Marine Corps.

Troy Corbin (CCNA) is an internetworking engineer for Dimension Enterprises, Inc. in Herndon, Virginia. His experience in the communications industry includes designing, testing, and implementing an infrastructure upgrade of a network topology, utilizing Cisco routers and Catalyst 5000 SmartSwitches coupled with various Ethernet and Fast Ethernet cabling systems. He has also been involved in network component research and development, and network and server configuration. In addition, he offers knowledge on a wide range of operating systems and network devices.

Chris Ackerman (CCDA, Cisco Support Pro) is an internetworking engineer for Dimension Enterprises, Inc. in Herndon, Virginia. He has extensive experience in systems integration and networking in the information technology industry including design and installation of LAN/WAN infrastructures. Chris has also served as Project Manager for Winframe System testing and development, for Novell application launcher testing and deployment, and for Phamis Phase II application deployment with 2,000 PCs requiring upgrades or new installation. Chris holds a bachelor's degree from Virginia Polytechnic Institute and has completed post-graduate work in Management Information Systems.

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 the one of the largest EIGRP router networks in the world. He also serves as technical trainer and mentors the Dialinx Controller Group. Shawn has also served four years of enlisted duty in the U.S. Air Force, 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.

"From the Classroom" Examples by:

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 ISP network operations. He is working toward his CCIE and MCSE certifications.

Wayne Periman is currently a senior network engineer for Niche Networks, LLC in Herndon, Virginia. He has 17 years of experience in data communications, many of which were for the U. S. Air Force. Wayne designed several Air Force bases' IP network infrastructures using a variety of schemes, including EIGRP heterogeneous backbones, and OSPF and IGRP homogeneous backbones. He was the primary advisor in setting up access control lists on distribution and access routers to facilitate the new prototype unit's mission. Wayne's expertise is in the area of routing and switching.

Technical Review by:

Series editor Mark Buchmann (CCIE, CCSI) is the owner of MAB Enterprises, Inc, a company providing consulting, network support, training, and various other services. Mark is also a co-owner of www.CertáNet.com, a company providing online certification assistance for a variety of network career paths, including all the various Cisco certifications. In his free time, he enjoys spending time with his family and boating. He lives in Raleigh, North Carolina.

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- A final, very special thanks to the typesetting and design staff in the Osborne Production Department. Their hard work and grace under pressure are much appreciated.

This book's primary objective is to help you prepare for and pass the required ACRC 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 ACRC 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.

■ 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

■ 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.

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

■ Q & A sections lay out problems and solutions in a quick-read format:

QUESTIONS AND ANSWERS

I entered a static route that I want to use as a last resort. We are using OSPF, but currently my route takes precedence over OSPF entries. How do I change the configuration?	Change the administrative distance for your static route to any number above 110, which is OSPF's default.
I am running RIP across a 64-Kbps WAN link. The updates are taking up too much bandwidth. What should I do?	Change the update period to a slower amount than the default 30 seconds.

- The **Certification Summary** is a succinct review of the chapter and a restatement 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.

- 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.

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