

A test prep guide and on-the-job reference

CCNA Certification

ROUTING BASICS FOR CISCO CERTIFIED
NETWORK ASSOCIATES EXAM 640-407



*Jumpstart your career
in networking!*

- Master the Basics of Cisco Router Configuration
- Includes Lab Exercises and Practice Exam Questions
- All Material Class-tested in CCNA Prep Course

ROBERT N. MYHRE

Contents

Introduction xiii

Acknowledgments xvii

About the Author xix

Chapter 1 Introduction to Networking and the OSI Model 1

Introduction to Networking 1

The OSI Model 2

 Why Use a Layered Model? 3

 How Does a Model Work? 4

 Application Layer (Layer 7) 6

 Presentation Layer (Layer 6) 6

 Session Layer (Layer 5) 7

 Transport Layer (Layer 4) 8

 Network Layer (Layer 3) 9

 Data Link Layer (Layer 2) 11

 Physical Layer (Layer 1) 12

 Data Encapsulation Using the OSI Model 13

Chapter 2 LAN Technologies 23

- Ethernet 23**
 - CSMA/CD 24
 - Physical Layer 25
 - Data Link Layer 25
 - Types of Ethernet 27
- Token Ring 28**
 - Physical Layer 28
 - Data Link Layer 28
 - Fault Tolerance 29
- FDDI 30**
 - Physical and Data Link Layers 30
- ATM 32**
 - Physical and Data Link Layers 33
 - LAN Emulation (LANE) 33

Chapter 3 Repeaters, Switches, Bridges, and Routers 41

- LAN Segmentation 41
- Repeaters 42
- Bridges 43
- Routers 48
- Switches 49
 - Virtual LANs, or VLANs 50

Chapter 4 TCP/IP 59

- The OSI Model versus the TCP/IP Model 59
- Internet Protocol (IP) 61
- Address Resolution Protocol (ARP) 62
- Internet Control Message Protocol (ICMP) 64
- Transmission Control Protocol (TCP) 64
- User Datagram Protocol (UDP) 65
- Application Layer Protocols 66
 - File Transfer Protocol (FTP) 66
 - Trivial File Transfer Protocol (TFTP) 66
 - Telnet 66
 - Simple Network Management Protocol (SNMP) 67
 - Other Protocols and Applications 67

Chapter 5 Introduction to Cisco Routers 75

Cisco Products Overview 75

Switches—Catalyst 1900 Series 76

Switches—Catalyst 2820 Series 76

Switches—Catalyst 2900 Series 76

Switches—Catalyst 5000 Series 76

Routers—Cisco 700 Series 77

Routers—Cisco 1600 Series 77

Routers—Cisco 2600 Series 77

Routers—Cisco 3600 Series 77

Routers—Cisco 4000 Series 78

Routers—Cisco 7000 Series 78

Learning More 78

Cisco 2500 Series Access Routers 78

Router Architecture 81

IOS 82

Configuring the Cisco Router 83

Configuration Script Install 85

Manual Configuration Using CLI 91

Connecting Routers to Each Other 103

Chapter 6 TCP/IP Addressing 121

Binary Counting 121

Addressing Principles 124

Classes of Addresses 125

Class A 125

Class B 126

Class C 127

Class D and Class E 127

Class Summary 128

Subnet Masks 128

Assigning TCP/IP Addresses 130

Setting Up Cisco Routers 133

Chapter 7 TCP/IP Subnetting 159

What Is Subnetting? 159

Why Subnet? 161

Finding the Subnet Mask	162
Step #1	162
Step #2	162
Step #3	163
Step #4	163
Finding the Number of Hosts/Subnets	166
Finding the Number of Subnets	166
Finding the Number of Hosts per Subnet	167
Populating the Subnets	168
Calculating the Subnet Addresses	168
Calculating the Host IDs	171
Supernetting	173
Configuring IC, Inc.	173
Step #1	174
Step #2	175
Step #3	175
Router 1	176
Router 2	177
Router 3	178

Chapter 8 **Static TCP/IP Routing** **195**

Static Routing Concepts	195
Configuring Routers for Static Routes	199
Router 1	201
Router 2	203
Router 3	204
Troubleshooting	206
Default Routing	209

Chapter 9 **Dynamic Routing** **225**

Routed versus Routing Protocols	225
Interior versus Exterior Routing Protocols	226
Differences Among Interior Gateway Protocols	227
Distance Vector	227
Link State	228
Classful versus Classless	229
Routing Information Protocol	229
Additional RIP Knowledge	244

Interior Gateway Routing Protocol 247
Multiprotocol Routing (MPR) 255

Chapter 10 Managing the Cisco Router 269
Disasters Can Occur 269
The Boot Process 270
Working with the IOS Image 271
Working with the Configuration Files 276
Lost Passwords 282

Chapter 11 IPX/SPX 297
IPX/SPX Model 298
Network Addressing 298
Encapsulation 299
Configuring Cisco Routers 301
Service Advertisement Protocol 309
Get Nearest Server 311

Chapter 12 AppleTalk 323
AppleTalk Model 323
Network Addressing 325
 Putting It All Together 326
Configuring Cisco Routers 327

Chapter 13 Security with Access Lists 343
Basics of Access Lists 343
AppleTalk Access Lists 345
IPX Access Lists 349
 Standard Access Lists 350
 Extended Access Lists 354
 Sap Filters 355
IP Access Lists 357
 Standard Access Lists 359
 Extended Access Lists 363

Chapter 14	WAN Technologies	383
	How Serial Links Work	383
	HDLC	384
	PPP	385
	ISDN	389
	BRI	390
	PRI	392
	Frame Relay	393
	Configuring Frame Relay on Cisco Routers	393
	Subinterfaces	399
Chapter 15	Extra Features of the Cisco Router	411
	Cisco Discovery Protocol	411
	Show Commands	414
	Debugging	421
	Telnet	423
	Logging	427
	Usernames	429
Appendix A		433
Appendix B		481
Appendix C		497
Index		503