

Networking Basics CCNA 1 Labs and Study Guide

Shawn McReynolds

Introduction

CCNA certification (Cisco Certified Network Associate) is globally accepted as a confirmation of information networking knowledge and skills. The Cisco Networking Academy Program provides a dynamic learning environment and progressive course path designed to advance your understanding of internetworking and prepare you for CCNA certification. This learning environment includes multimedia-rich curriculum, electronic labs (e-labs), interactive study exercises, and online assessments that provide instant feedback. Four courses make up the Networking Academy CCNA course path.

Networking Basics CCNA 1 Labs and Study Guide is the official workbook for the first course in the CCNA program. This book contains exercises that will help you learn the essential information presented in the CCNA 1 Networking Basics course through hands-on labs and other activities. Key learning objectives of CCNA 1 include the following:

- Understanding networks and network components
- Identifying number systems used in networking
- Defining conceptual models
- Creating network media
- Classifying network technologies and protocols
- Understanding network addressing and subnetting
- Configuring local-area networks (LANs)

Networking Basics CCNA 1 Labs and Study Guide is a valuable learning tool designed to supplement version 3.1.1 of the CCNA 1 online curriculum and the *Networking Basics CCNA 1 Companion Guide* (ISBN: 1-58713-164-1). You are encouraged to take advantage of all of these materials to gain the maximum amount of knowledge from CCNA 1.

Goals and Methods

The main goal of this book is to provide a thorough introduction to information networking. A strong foundation of knowledge and skills is required for advanced learning and success in the networking field. You will be presented with opportunities to investigate important networking topics that must be understood before complex concepts are introduced in later courses. You will find this base of knowledge is also essential in preparing you for CCNA certification.

Each chapter in *Networking Basics CCNA 1 Labs and Study Guide* contains a Study Guide section and a Lab Exercises section. Each Study Guide section contains exercises designed to focus on crucial networking concepts presented in the corresponding portion of the CCNA 1 online course. These sections may include terminology identification,

concept questions, internet research activities, journal entries, and other exercises designed to help you learn the material.

The Lab Exercises sections focus on providing ample hands-on lab experiments that showcase technologies and concepts introduced in each chapter of the course. In these sections you will find three lab types.

Curriculum labs are step-by-step labs designed to introduce you to a new concept. These labs include detailed instructions for completing the lab and often reinforce steps through added explanations. Curriculum labs are integrated into the CCNA 1 online course.

Comprehensive labs combine the concepts learned from the course and curriculum labs into new experiments and provide minimal guidance. You are encouraged to complete the curriculum labs before moving on to a comprehensive lab.

Challenge labs are unique labs requiring a thorough understanding of the previously learned network concepts. You should complete all curriculum and comprehensive labs before attempting a challenge lab.

After completing all of the exercises and hands-on labs in this book, you will be knowledgeable of a wide-array of networking concepts and well-prepared to continue your networking education in the CCNA courses that follow.

Who Should Read This Book?

The primary audience for this book is anyone taking the CCNA 1 course in the Cisco Networking Academy Program. This book contains printed versions of the CCNA 1 curriculum labs as well as other labs and exercises exclusive to the title. Therefore, *Networking Basics CCNA 1 Labs and Study Guide* is often a required course material for Networking Academies.

The secondary audience for this book is anyone interested in learning more about networking basics through self-study or through other networking courses.

How This Book Is Organized

This book contains 11 chapters and maps directly to the organization of the CCNA 1 online course. Most chapters build off of content presented in the previous chapters so the content of the course and this book is meant to be read and worked through sequentially.

Chapters 1 through 11 cover the following topics:

Chapter 1, “Introduction to Networking”—This introductory chapter opens with information and exercises focusing on technologies and methods used to connect to the world's largest network, the Internet. Next, the importance of understanding number

systems is emphasized through conversion and logic exercises. Eight curriculum labs step you through network configuration identification, a troubleshooting process, and converting number systems. The challenge lab will test your overall understanding of number systems.

Chapter 2, “Networking Fundamentals”—This chapter will introduce you to common networking terminology, the definition of bandwidth, and the concept of networking models. Chapter exercises include identifying network devices, calculating data transfer rates, and working with network models. Two curriculum labs focus on industry-standard network models. The comprehensive lab brings these models and networking devices together.

Chapter 3, “Networking Media”—Network communication requires a method of moving data between devices. Exercises in this chapter focus on the major types of network media and are designed to increase your understanding of signaling methods and media creation. Eleven curriculum labs walk you through the processes of measuring electrical characteristics of copper cabling, creating circuits, and cable creation. You will learn an alternative method to test a cable with the comprehensive lab and learn to create a cable converter through the challenge lab.

Chapter 4, “Cable Testing”—Exercises in this chapter are designed to increase your understanding of signaling properties and methods of testing network cables. Five curriculum labs introduce you to two pieces of cable testing equipment and the tests they can perform.

Chapter 5, “Cabling LANs and WANs”—This chapter presents exercises that focus on the cabling used to create local and wide-area networks. These exercises will challenge you to compare types of networks, identify network cables and components, and investigate types of servers. Ten curriculum labs focus on building LANs and WANs using the proper cabling and devices. You are asked to build a larger LAN in the comprehensive lab.

Chapter 6, “Ethernet Fundamentals”—Learning how Ethernet operates is required to completely understand how today's networks function. Chapter exercises include identifying technology fundamentals, understanding framing, and working with Ethernet addressing. A challenge lab tests your ability to gather MAC address information in your local network.

Chapter 7, “Ethernet Technologies”—This chapter focuses on the family of Ethernet technologies from 10 Mbps Legacy Ethernet to 10 Gbps Ethernet. Ethernet parameter identification exercises will help you learn the similarities and differences in the Ethernet technologies. Three curriculum labs provide information on waveform decoding and using software to capture and analyze Ethernet frames.

Chapter 8, “Ethernet Switching”—Exercises in this chapter are designed to help you understand different modes of switching, identify collision and broadcast domains, and

illustrate data flow. The challenge lab asks you to build a multi-switch network with redundant links and observe an anti-looping mechanism.

Chapter 9, “TCP/IP Protocol Suite and IP Addressing”—This chapter begins with exercises pertaining to the TCP/IP protocol suite before focusing on IP addressing. You will learn the multiple protocols that make up the protocol suite and the various methods used for obtaining an IP address. Three curriculum labs cover the basics of addressing, setting up a DHCP client, and a method used to learn MAC addresses. The comprehensive lab prompts you to use tools and skills learned previously to identify internetworks. The challenge lab focuses on using software to monitor network processes.

Chapter 10, “Routing Fundamentals and Subnets”—Early chapter exercises are designed to increase your understanding of routed and routing protocols. Later exercises focus on subnetting. Four of the five curriculum labs deal with subnetting. Two additional comprehensive labs also focus on subnetting and add address assignment components. Subnetting can be the most difficult concept to grasp in CCNA 1 so be sure to take your time with these exercises and labs.

Chapter 11, “TCP/IP Transport and Application Layers”—The last chapter of the book includes exercises designed to help you understand the functions of the Transport and Application layers of the TCP/IP model. A curriculum lab brings together multiple tools from other labs to investigate particular types of TCP traffic. A challenge lab focuses on client/server applications.

TABLE OF CONTENTS

CHAPTER 1 Introduction to Networking

Study Guide

- Connecting to the Internet

 - Vocabulary Exercise: Matching

 - Vocabulary Exercise: Completion

 - Vocabulary Exercise: Identifying Acronyms

 - Compare and Contrast Exercise: Internet Access Technologies

 - Concept Questions

 - Journal Entry

- Network Math

 - Vocabulary Exercise: Define

 - Concept Questions

 - Number Systems Conversion Exercise

 - Binary Logic ANDing Exercise

 - Journal Entry

Lab Exercises

- Curriculum Lab 1-1: PC Hardware

Curriculum Lab 1-2: PC Network TCP/IP Configuration
Curriculum Lab 1-3: Using ping and tracert from a Workstation
Curriculum Lab 1-4: Web Browser Basics
Curriculum Lab 1-5: Basic PC/Network Troubleshooting Process
Curriculum Lab 1-6: Decimal to Binary Conversion
Curriculum Lab 1-7: Binary to Decimal Conversion
Curriculum Lab 1-8: Hexadecimal Conversion

Challenge Lab 1-9: Understanding Number Systems

CHAPTER 2 Networking Fundamentals

Study Guide

Networking Terminology

Vocabulary Exercise: Matching
Compare and Contrast Exercise: Network Types
Concept Questions
Identify Network Devices Exercise
Understanding Physical Network Topologies Exercise
Journal Entry

Bandwidth

Vocabulary Exercise: Completion
Concept Questions
Calculating Data Transfer Rates Exercise
Measuring Bandwidth on the Internet Exercise
Journal Entry

Networking Models

Vocabulary Exercise: Define
Compare and Contrast Exercise: OSI and TCP/IP Models
Concept Questions
Identifying Encapsulation PDUs Exercise
Journal Entry

Lab Exercises

Curriculum Lab 2-1: OSI Model and TCP/IP Model
Curriculum Lab 2-2: OSI Model Characteristics and Devices

Comprehensive Lab 2-3: Networking Device Identification and Association

CHAPTER 3 Networking Media

Study Guide

Copper Media

Vocabulary Exercise: Matching
Vocabulary Exercise: Identifying Acronyms
Compare and Contrast Exercise: Copper Cable Types
Concept Questions

Understanding Ohm's Law Exercise
Choosing the Correct Network Cable Type Exercise
Identifying Network Cable Pinouts Exercise
Journal Entry

Optical Media

Vocabulary Exercise: Matching
Compare and Contrast Exercise: Single-mode and Multimode Fiber Optic Cable
Concept Questions
Electromagnetic Spectrum Chart Exercise
Journal Entry

Wireless Signals

Vocabulary Exercise: Completion
Compare and Contrast Exercise: Wireless Networking Standards
Concept Questions
Locating Wi-Fi Hotspots Using the Internet Exercise
Journal Entry

Lab Exercises

Curriculum Lab 3-1: Safe Handling and Use of a Multimeter (3.1.1)
Curriculum Lab 3-2 Voltage Measurement (3.1.2)
Curriculum Lab 3-3: Resistance Measurement (3.1.3)
Curriculum Lab 3-4: Series Circuits (3.1.5)
Curriculum Lab 3-5: Communications Circuits (3.1.9)
Curriculum Lab 3-6: Fluke 620 Basic Cable Testing (3.1.9)
Curriculum Lab 3-7: Straight-Through Cable Construction (3.1.9)
Curriculum Lab 3-8: Rollover Cable Construction (3.1.9)
Curriculum Lab 3-9: Crossover Cable Construction (3.1.9)
Curriculum Lab 3-10: UTP Cable Purchase (3.1.9)
Curriculum Lab 3-11: Fiber-Optic Cable Purchase (3.1.9)

Comprehensive Lab 3-12: Testing a Crossover Cable

Challenge Lab 3-13: Creating a Cable Converter

CHAPTER 4 Cable Testing

Study Guide

Frequency-Based Cable Testing
Vocabulary Exercise: Completion
Concept Questions
Signal Types Exercise
Calculating Power Loss or Gain Exercise
Journal Entry

Signals and Noise

Vocabulary Exercise: Matching
Concept Questions

Wiring Fault Identification Exercise
Journal Entry

Lab Exercises

Curriculum Lab 4-1: Fluke 620 Cable Tester – Wire Map (4.2.9)
Curriculum Lab 4-2: Fluke 620 Cable Tester – Faults (4.2.9)
Curriculum Lab 4-3: Fluke 620 Cable Tester – Length (4.2.9)
Curriculum Lab 4-4: Fluke LinkRunner – LAN Tests (4.2.9)
Curriculum Lab 4-5: Fluke LinkRunner – Cable and NIC Tests (4.2.9)

CHAPTER 5 Cabling LANs and WANs

Study Guide

Cabling LANs

Vocabulary Exercise: Completion
Compare and Contrast Exercise: Peer-to-Peer and Client/Server Networks
Concept Questions
Identifying LAN Cables and Components Exercise
Investigate Types of Servers Exercise
Journal Entry

Cabling WANs

Vocabulary Exercise: Identifying Acronyms
Concept Questions
Journal Entry

Lab Exercises

Curriculum Lab 5-1: RJ-45 Jack Punch Down (5.1.5)
Curriculum Lab 5-2: Hub and NIC Purchase (5.1.7)
Curriculum Lab 5-3: Purchasing LAN Switches (5.1.10)
Curriculum Lab 5-4: Building a Peer-to-Peer Network (5.1.12)
Curriculum Lab 5-5: Building a Hub-based Network (5.1.13)
Curriculum Lab 5-6: Building a Switch-based Network (5.1.13)
Curriculum Lab 5-7: Connecting Router LAN Interfaces (5.2.3)
Curriculum Lab 5-8: Building a Basic Routed WAN (5.2.3)
Curriculum Lab 5-9: Troubleshooting Interconnected Devices (5.2.3)
Curriculum Lab 5-10: Establishing a Console Connection to a Router or Switch (5.2.7)

Comprehensive Lab 5-11: Building a Multi-Switch Network

CHAPTER 6 Ethernet Fundamentals

Study Guide

Ethernet Fundamentals

Vocabulary Exercise: Matching
Compare and Contrast Exercise: Layer 1 and Layer 2 Functions
Concept Questions
Identifying Frame Types Exercise

- Understanding MAC Addresses Exercise
- Journal Entry
- Ethernet Operation
 - Vocabulary Exercise: Completion
 - Compare and Contrast Exercise: Deterministic and Non-Deterministic
- MAC Protocols
 - Concept Questions
 - Identifying Collision Domains Exercise
 - Journal Entry

Lab Exercises

- Challenge Lab 6-1: Identifying MAC Addresses in a LAN

CHAPTER 7 Ethernet Technologies

Study Guide

- 10-Mbps and 100-Mbps Ethernet
 - Vocabulary Exercise: Completion
 - Compare and Contrast Exercise: Legacy Ethernet
 - Concept Questions
 - Identifying Legacy and Fast Ethernet Parameters Exercise
 - Journal Entry
- Gigabit and 10-Gigabit Ethernet
 - Vocabulary Exercise: Identifying Acronyms
 - Concept Questions
 - Identifying Legacy and Fast Ethernet Parameters Exercise
 - Journal Entry

Lab Exercises

- Curriculum Lab 7-1: Waveform Decoding (7.1.2)
- Curriculum Lab 7-2: Introduction to Fluke Network Inspector (7.1.9)
- Curriculum Lab 7-3: Introduction to Fluke Protocol Inspector (7.1.9)

CHAPTER 8 Ethernet Switching

Study Guide

- Ethernet Switching
 - Vocabulary Exercise: Matching
 - Compare and Contrast Exercise: Switch Modes
 - Concept Questions
 - Journal Entry
- Collision Domains and Broadcast Domains Exercise
 - Vocabulary Exercise: Completion
 - Concept Questions
 - Identifying Collision and Broadcast Domains Exercise
 - Illustrating Data Flow Exercise
 - Journal Entry

Lab Exercises

Challenge Lab 8-1: Building a Multi-Switch Network with Redundant Links

CHAPTER 9 TCP/IP Protocol Suite and IP Addressing

Study Guide

Introduction to TCP/IP

Vocabulary Exercise: Completion

Compare and Contrast Exercise: Reference Models

Concept Questions

Journal Entry

Internet Addresses

Vocabulary Exercise: Matching

Concept Questions

IP Address Identification Exercise

Journal Entry

Obtaining an IP Address

Vocabulary Exercise: Define

Concept Questions

Journal Entry

Lab Exercises

Curriculum Lab 9-1: IP Addressing Basics (9.2.7)

Curriculum Lab 9-2: DHCP Client Setup (9.3.5)

Curriculum Lab 9-3: Workstation ARP (9.3.7)

Comprehensive Lab 9-4: Identifying Internetworks

Challenge Lab 9-5: Using Fluke Protocol Inspector to Monitor ARP

CHAPTER 10 Routing Fundamentals and Subnets

Study Guide

Routed Protocol

Vocabulary Exercise: Completion

Compare and Contrast Exercise: Routed and Routing Protocols

Concept Questions

Journal Entry

IP Routing Protocols

Vocabulary Exercise: Matching

Compare and Contrast Exercise: Distance-Vector and Link-State Routing Protocols

Concept Questions

Creating Routing Tables Exercise

Journal Entry

The Mechanics of Subnetting
Vocabulary Exercise: Completion
Concept Questions
Subnetting Practice Exercise
Journal Entry

Lab Exercises

Curriculum Lab 10-1: Small Router Purchase (10.2.9)
Curriculum Lab 10-2: Basic Subnetting (10.3.5)
Curriculum Lab 10-3: Subnetting a Class A Network (10.3.5)
Curriculum Lab 10-4: Subnetting a Class B Network (10.3.5)
Curriculum Lab 10-5: Subnetting a Class C Network (10.3.5)

Comprehensive Lab 10-6: Subnetting a Network Using a Class C Address (1)
Comprehensive Lab 10-7: Subnetting a Network Using a Class C Address (2)

CHAPTER 11 TCP/IP Transport and Application Layers

Study Guide

TCP/IP Transport Layer
Vocabulary Exercise: Completion
Compare and Contrast Exercise: Transport Layer Protocols
Concept Questions
Understanding TCP Synchronization and Windowing Exercise
Journal Entry
The Application Layer
Vocabulary Exercise: Identifying Acronyms
Concept Questions
Journal Entry

Lab Exercises

Curriculum Lab 11-1: Protocol Inspector, TCP, and HTTP

Challenge Lab 11-2: Accessing FTP and Telnet Servers

About the Author

Shawn McReynolds is the director of the Cisco Networking Academy at Southwest Virginia Community College. He has been a member of SwVCC's Cisco Area Training Center for Sponsored Curriculum (CATC-SC) since 1999 where he teaches CCNA, CCNP, FNS, and PNIE courses. He is one of the original contributors to the IT Essentials 1 curriculum and served as a technical editor for the second edition of the IT 1 Companion Guide. Shawn has a BS in business engineering from Bluefield College and a master's degree in information networking and telecommunications from Fort Hays State University. Shawn resides in Tazewell, VA with his lovely wife, Stephanie.

**NOTE: Separate Instructor Edition with Answer Key available.
PDF format / ISBN: 1-58713-187-0**