



# Designing and Supporting Computer Networks, CCNA Discovery Learning Guide

By Kenneth Stewart, Aubrey Adams, Allan Reid, Jim Lorenz

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Designing and Supporting Computer Networks

CCNA Discovery Learning Guide

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Kenneth D. Stewart III • Aubrey Adams

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*Designing and Supporting Computer Networks, CCNA Discovery Learning Guide* is the official supplemental textbook for the Designing and Supporting Computer Networks course in the Cisco® Networking Academy® CCNA® Discovery curriculum version 4. In this course, the last of four in the new curriculum, you progress through a variety of case studies and role-playing exercises, which include gathering requirements, designing basic networks, establishing proof-of-concept, and performing project management tasks. In addition, within the context of a pre-sales support position, you learn lifecycle services, including upgrades, competitive analyses, and system integration.

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The *Learning Guide*, written and edited by instructors, is designed as a portable desk reference to use anytime, anywhere to reinforce the material from the course and organize your time.

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The *Learning Guide*'s features help you focus on important concepts to succeed in this course:

- Chapter Objectives—Review core concepts by answering the focus questions listed at the beginning of each chapter.
- Key Terms—Refer to the lists of networking vocabulary introduced and highlighted in context in each chapter. The Glossary defines each key term.
- Summary of Activities and Labs—Maximize your study time with this complete list of all associated exercises at the end of each chapter.
- Check Your Understanding—Evaluate your readiness with the end-of-chapter questions that match the style of questions you see in the online course quizzes. The answer key explains each answer.
- Challenge Questions and Activities—Apply a deeper understanding of the concepts with these challenging end-of-chapter questions and activities. The

answer key explains each answer.

- Hands-on Labs—Master the practical, hands-on skills of the course by performing all the tasks in the course labs included in Part II of the Learning Guide.
- Portfolio Documents—Develop a professional network design portfolio as you work through real-life case studies. All the course portfolio documents and support materials are provided for you in this Learning Guide and on the CD-ROM.

*i*

How To—Look for this icon to study the steps you need to learn to perform certain tasks.

*i*

Interactive Activities—Reinforce your understanding of topics with exercises from the online course identified throughout the book with this icon. The files for these activities are on the accompanying CD-ROM.

*i*

Packet Tracer Activities—Explore and visualize networking concepts using Packet Tracer exercises interspersed throughout some chapters. The files for these activities are on the accompanying CD-ROM. Packet Tracer v4.1 software developed by Cisco is available separately.

*i*

Hands-on Labs—Master the practical, hands-on skills of the course by working through all 71 labs in this course included in Part II of the book. The labs are an integral part of the CCNA Discovery curriculum—review the core text and the lab material to prepare for all your exams.

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Companion CD-ROM

The CD-ROM includes

- Interactive Activities
- Packet Tracer Activity files
- All Portfolio documents
- IT Career Information
- Taking Notes
- Lifelong Learning

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This book is part of the Cisco Networking Academy Series from Cisco Press®. Books in this series support and complement the Cisco Networking Academy curriculum.



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Designing and Supporting Computer Networks  
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• Kenneth D. Stewart III • Aubrey Adams

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# Introduction

The following Introduction pertains to the Learning Guide as a whole.

Cisco Networking Academy is a comprehensive e-learning program that delivers information technology skills to students around the world. The CCNA Discovery curriculum consists of four courses that provide a comprehensive overview of networking, from fundamentals to advanced applications and services. The goal of the Designing and Supporting Computer Networks course is to assist you in developing the skills necessary to design small enterprise LANs and WANs. The course provides an introduction to collecting customer requirements, translating those requirements into equipment and protocol needs, and creating a network topology that addresses the needs of the customer. It will also familiarize you with how to create and implement a design proposal for a customer. This course prepares you with the skills required for entry-level presales support and entry-level network design jobs.

*Designing and Supporting Computer Networks, CCNA Discovery Learning Guide* is the official supplemental textbook for the fourth course in v4.x of the Cisco Networking Academy CCNA Discovery online curriculum. As a textbook, this book provides a ready reference to explain the same networking concepts, technologies, protocols, and devices as the online curriculum. In addition, it contains all the interactive activities, Packet Tracer activities, and hands-on labs from the online curriculum.

This book emphasizes key topics, terms, and activities and provides many alternative explanations and examples as compared with the course. You can use the online curriculum as directed by your instructor and then also use this *Learning Guide*'s study tools to help solidify your understanding of all the topics. In addition, the book includes the following:

- Additional key Glossary terms
- Additional Check Your Understanding and Challenge questions
- Interactive activities and Packet Tracer activities (and all supplemental documents associated with them) on the CD-ROM

## Goal of This Book

First and foremost, by providing a fresh, complementary perspective of the online content, this book helps you learn all the required materials of the fourth course in the Networking Academy CCNA Discovery curriculum. As a secondary goal, individuals who do not always have Internet access can use this text as a mobile replacement for the online curriculum. In those cases, you can read the appropriate sections of this book, as directed by your instructor, and learn the topics that appear in the online curriculum.

## Audience for This Book

This book's main audience is anyone taking the fourth CCNA Discovery course of the Networking Academy curriculum. Many Networking Academies use this textbook as a required tool in the course, and other Networking Academies recommend the *Learning Guides* as an additional source of study and practice material.

## Book Features

The educational features of this book focus on supporting topic coverage, readability, and practice of the course material to facilitate your full understanding of the course material.

## Topic Coverage

The following features give you a thorough overview of the topics covered in each chapter so that you can make constructive use of your study time:

- **Objectives:** Listed at the beginning of each chapter, the objectives reference the core concepts covered in the chapter. The objectives match the objectives stated in the corresponding chapters of the online curriculum; however, the question format in the *Learning Guide* encourages you to think about finding the answers as you read the chapter.
- **"How-to" feature:** When this book covers a set of steps that you need to perform for certain tasks, the text lists the steps as a how-to list. When you are studying, the icon helps you easily refer to this feature as you skim through the book.
- **Notes, tips, cautions, and warnings:** These are short sidebars that point out interesting facts, timesaving methods, and important safety issues.
- **Chapter summaries:** At the end of each chapter is a summary of the chapter's key concepts. It provides a synopsis of the chapter and serves as a study aid.

## Readability

The authors have compiled, edited, and in some cases rewritten the material so that it has a more conversational tone that follows a consistent and accessible reading level. In addition, the following features have been updated to assist your understanding of the networking vocabulary:

- **Key terms:** Each chapter begins with a list of key terms, along with a page-number reference from inside the chapter. The terms are listed in the order in which they are explained in the chapter. This handy reference allows you to find a term, flip to the page where the term appears, and see the term used in context. The Glossary defines all the key terms.
- **Glossary:** This book contains an all-new Glossary with more than 230 computer and networking terms.

## Practice

Practice makes perfect. This new *Learning Guide* offers you ample opportunities to put what you learn into practice. You will find the following features valuable and effective in reinforcing the instruction that you receive:

- **Check Your Understanding questions and answer key:** Updated review questions are presented at the end of each chapter as a self-assessment tool. These questions match the style of questions that you see in the online course. Appendix A, "Check Your Understanding and Challenge Questions Answer Key," provides an answer key to all the questions and includes an explanation of each answer.
- **(New) Challenge questions and activities:** Additional, and more challenging, review questions and activities are presented at the end of chapters. These questions are purposefully designed to be similar to the more complex styles of questions you might see on the CCNA exam. This section might also include activities to help prepare you for the exams. Appendix A provides the answers.
- **Packet Tracer activities:** Interspersed throughout the chapters, you'll find many activities to work with the Cisco Packet Tracer tool. Packet Tracer enables you to create networks, visualize how packets flow in the network, and use basic testing tools to determine whether the network would work. When you see this icon, you can use Packet Tracer with the listed file to perform a task suggested in this book. The activity files, and any files associated with the Packet Tracer activities, are available on this book's CD-ROM; Packet Tracer software, however, is available through the Academy Connection website. Ask your instructor for access to Packet Tracer.

- **Interactive activities:** These activities provide an interactive learning experience to reinforce the material presented in the chapter.
- **Labs:** This book contains all the hands-on labs from the curriculum. Part I includes references to the hands-on labs, as denoted by the lab icon, and Part II contains each lab in full. You may perform each lab as you see each lab referenced in the chapter or wait until you have completed the chapter.

## A Word About Packet Tracer Software and Activities

Packet Tracer is a self-paced, visual, interactive teaching and learning tool developed by Cisco. Lab activities are an important part of networking education. However, lab equipment can be a scarce resource. Packet Tracer provides a visual simulation of equipment and network processes to offset the challenge of limited equipment. Students can spend as much time as they like completing standard lab exercises through Packet Tracer, and have the option to work from home. Although Packet Tracer is not a substitute for real equipment, it allows students to practice using a command-line interface. This "e-doing" capability is a fundamental component of learning how to configure routers and switches from the command line.

Packet Tracer 4.1 is available only to Cisco Networking Academies through the Academy Connection website. Ask your instructor for access to Packet Tracer.

## How This Book Is Organized

This book covers the major topics in the same sequence as the online curriculum for the CCNA Discovery Designing and Supporting Computer Networks course. The online curriculum has ten chapters for this course, so this book has ten chapters with the same names and numbers as the online course chapters.

To make it easier to use this book as a companion to the course, the major topic headings in each chapter match, with just a few exceptions, the major sections of the online course chapters. However, the *Learning Guide* presents many topics in slightly different order inside each major heading where necessary. In addition, the book occasionally uses different examples than the course. As a result, students get more detailed explanations, a second set of examples, and different sequences of individual topics, all to aid the learning process. This new design, based on research into the needs of the Networking Academies, helps typical students lock in their understanding of all the course topics.

## Chapters and Topics

Part I of this book has ten chapters, as follows:

- **Chapter 1, "Introducing Network Design Concepts,"** discusses how network designers ensure communications networks can adjust and scale to the demands for new services. Topics include a network design overview, the benefits of a hierarchical network design, and network design methodologies.
- **Chapter 2, "Gathering Network Requirements,"** introduces the StadiumCompany and FilmCompany case studies. The StadiumCompany design project is used in the main text, media, and Packet Tracer activities. The FilmCompany design project is completed in the hands-on labs. Students are introduced to the six phases of the Cisco lifecycle, the proper way to respond to a Request For Proposal or Request For Quote, and the roles of a network partner team. How constraints and trade-offs affect the network design is also covered.
- **Chapter 3, "Characterizing the Existing Network,"** emphasizes how characterizing the network to identify strengths and weaknesses assists in the network design process and how to select the appropriate hardware and software to meet client needs. How to conduct a wireless site survey and the creation of a network Design Requirements document are used to solidify the students' understanding of the material in

this chapter.

- **Chapter 4, "Identifying Application Impacts on Network Design,"** describes how the network designer determines the success criteria for a project. Students learn how the characteristics of various applications affect the design of a network. Students also learn how the network requirements of various common applications, such as voice and video, impact the network. Students are also introduced to quality of service mechanisms and how to diagram the application traffic flows to determine bandwidth requirements of a network design.
- **Chapter 5, "Creating the Network Design,"** introduces how to properly analyze the business goals and technical requirements to create an efficient network design. Students learn how to design the application, distribution, and core layer for a campus design; how to design for the WAN connectivity module with remote worker support; and how to design a wireless topology while incorporating security features.
- **Chapter 6, "Using IP Addressing in the Network Design,"** describes how a network designer selects the appropriate hierarchical IP addressing scheme to meet the physical and logical network requirements. Students also learn to choose a routing protocol and design a route summarization strategy. Additional topics include how to create a logical naming structure for network devices, what IPv6 is, methods to implement IPv6 on a network, and how to implement IPv6 on a Cisco device.
- **Chapter 7, "Prototyping the Campus Network,"** has the student identify the purpose of creating proof-of-concept test. Students also learn how to create a test plan to perform simulated or prototype tests of a network upgrade, and how to identify risks and weaknesses in the design based on the proof-of-concept test conclusions.
- **Chapter 8, "Prototyping the WAN,"** discusses the components and technologies used for WAN connectivity. The components and configuration of Frame Relay connections are covered with regard to configuring a VPN client. Students are also introduced to a proof-of-concept test used to check WAN and remote worker connectivity.
- **Chapter 9, "Preparing the Proposal,"** is a summary activity in which students use what they have learned about designing a network to create a bill of materials, plan an implementation schedule, support contracts, and present a network upgrade proposal as a culminating activity.
- **Chapter 10, "Putting It All Together,"** guides students through the resources available to help their career search, including books, websites, classes, and consultants. Students write résumés, find job openings, and practice interviewing as they prepare to enter the workforce.

This book also includes the following:

- **Appendix A, "Check Your Understanding and Challenge Questions Answer Key,"** provides the answers to the Check Your Understanding questions that you find at the end of each chapter. It also includes answers for the Challenge questions and activities that conclude most chapters.
- **Appendix B, "StadiumCompany Story,"** provides the case study of the fictional StadiumCompany, which needs to upgrade its existing computer network to provide state-of-the-art services. You encounter the StadiumCompany design project in the main text of the chapters and in the interactive activities and Packet Tracer activities.
- **Appendix C, "FilmCompany Story,"** provides the case study of the fictional FilmCompany, which is performing contracted services for the StadiumCompany. The FilmCompany needs network upgrades similar to the StadiumCompany, and you encounter the FilmCompany design project primarily in the hands-on labs found in Part II.
- The **Glossary** provides a compiled list of all the key terms that appear throughout this book plus additional computer and networking terms.

Part II of this book includes the labs that correspond to each chapter. In addition, Part II provides the two case studies and an additional appendix, Appendix C, "Lab Equipment Interfaces and Initial Configuration Restoration," which provides a reference for router interface designations and instructions for restoring

routers and switches to their default configurations.

## About the CD-ROM

The CD-ROM included with this book provides many useful tools and information to support your education:

- **Packet Tracer activity files:** These are files to work through the Packet Tracer activities referenced throughout the book, as indicated by the Packet Tracer activity icon. Some Packet Tracer activities also have PDF files associated with them, particularly for the activities in Chapters 7 and 8. These PDF files are also included on the CD-ROM.
- **Interactive activities:** The CD-ROM contains the interactive activities referenced throughout the book.
- **Network design portfolio documents:** To help you create a network design portfolio as you work through the labs in Part II of this book, the CD provides the following files:
  - Example Test Plan (in Microsoft Word format)
  - Prototype Network Installation Checklist (in PDF format)
  - LAN Design Test Plan (in PDF and Microsoft Word format)
  - Server Farm Design Test Plan (in PDF and Microsoft Word format)
  - WAN Design Test Plan (in PDF and Microsoft Word format)
  - VPN Design Test Plan (in PDF and Microsoft Word format)
- **Taking Notes:** This section includes a TXT file of the chapter objectives to serve as a general outline of the key topics of which you need to take note. The practice of taking clear, consistent notes is an important skill for not only learning and studying the material, but for on-the-job success, too. Also included in this section is "A Guide to Using a Networker's Journal" PDF booklet providing important insight into the value of the practice of using a journal, how to organize a professional journal, and some best practices on what, and what not, to take note of in your journal.
- **IT Career Information:** This section includes a Student Guide to applying the toolkit approach to your career development. Learn more about entering the world of information technology as a career by reading two informational chapters excerpted from *The IT Career Builder's Toolkit*: "The Job Search" and "The Interview."
- **Lifelong Learning in Networking:** As you embark on a technology career, you will notice that it is ever changing and evolving. This career path provides new and exciting opportunities to learn new technologies and their applications. Cisco Press is one of the key resources to plug into on your quest for knowledge. This section of the CD-ROM provides an orientation to the information available to you and tips on how to tap into these resources for lifelong learning.

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