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TODD LAMMLE DONALD ROBB



CCNA[®] Certification

Study Guide Volume 2 Exam 200-301 v1.1 Second Edition



CCNA[®] Certification

Study Guide Volume 2 Exam 200-301 v1.1 Second Edition



Todd Lammle Donald Robb



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In this book, I enjoyed collaborating with Donald Robb from Canada. He played a crucial role in crafting the new table of contents and was instrumental in writing, editing, and thoroughly addressing the latest exam topics across various chapters. His expertise is unparalleled, and he worked tirelessly alongside me daily to bring this book to life. I'm confident you'll appreciate his contributions as much as I do. You can connect with Donald through his well-known blog at https://the-packet-thrower.com. He also serves as a leading moderator and contributor on Reddit: https://www.reddit.com/r/ccna.

About the Authors

Todd Lammle is widely regarded as one of the foremost authorities on Cisco certification and internetworking, holding certifications across nearly every Cisco certification category. With a career spanning over three decades, Todd has established himself as a globally recognized author, speaker, trainer, and consultant. His expertise extends across a broad range of technologies, including LANs, WANs, and large-scale enterprise wireless networks, both licensed and unlicensed. In recent years, he has specialized in implementing extensive Cisco security networks, particularly utilizing Firepower/FTD and ISE.

What sets Todd apart is his deep, hands-on experience, which is evident in his writing and training materials. He's not just an author; he's a seasoned networking engineer with practical knowledge gained from working on some of the largest and most complex networks in the world. His experience includes significant contributions to companies such as Xerox, Hughes Aircraft, Texaco, AAA, Cisco, and Toshiba, among many others. This real-world experience allows Todd to bring a unique, practical perspective to his work, making his books and training sessions invaluable resources for IT professionals at all levels.

Todd has authored more than 120 books, solidifying his reputation as a leading voice in the industry. Some of his most popular titles include the CCNA: Cisco Certified Network Associate Study Guide, CCNA Wireless Study Guide, CCNA Data Center Study Guide, CCNP SNCF (Firepower), and CCNP Security. All of these works are published by Sybex, a respected name in technical publishing.

In addition to his writing and speaking engagements, Todd runs an international consulting and training company based in Idaho. His company provides expert guidance and training to organizations around the world, helping them to navigate the complexities of modern networking technologies. Despite his busy professional life, Todd still finds time to enjoy the natural beauty of Idaho, often spending his free time at the lake in the mountains, where he enjoys the outdoors with his beloved golden retrievers.

For those looking to dive deeper into Todd Lammle's work, you can find his extensive range of books at https://www.lammle.com/order-our-books.Additionally,Todd is accessible to his readers and clients through his website at www.lammle.com, where you can find more resources, updates, and ways to connect with him directly.

Donald Robb, widely recognized online as the-packet-thrower, brings over two decades of experience in the IT industry. His career has spanned a diverse array of roles, beginning with help desk support and evolving into a position as one of the most respected consultants in the field. Donald has honed expert-level skills across various IT domains, including networking, security, collaboration, data center management, wireless technologies, and service providers. His depth of knowledge and technical expertise have made him a sought-after professional in the industry.

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In addition to his hands-on work in the field, Donald has made significant contributions to IT education. He has had the privilege of working alongside Todd Lammle, a legendary figure in the IT world, co-authoring several books and developing courses that have helped countless professionals advance their careers. Through his extensive experience, certifications, and educational efforts, Donald Robb has solidified his reputation as a leading authority in the IT industry.

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Introduction

Welcome to the exciting world of Cisco certification! If you've picked up this book because you want to improve yourself and your life with a better, more satisfying, and secure job, you've done the right thing. Whether your plan is to enter the thriving, dynamic IT sector or to enhance your skill set and advance your position within it, being Cisco certified can seriously stack the odds in your favor to help you attain your goals.

Cisco certifications are powerful instruments of success that also just happen to improve your grasp of all things internetworking. As you progress through this book, you'll gain a complete understanding of networking that reaches far beyond Cisco devices. By the end of this book, you'll comprehensively know how disparate network topologies and technologies work together to form the fully operational networks that are vital to today's very way of life in the developed world. The knowledge and expertise you'll gain here are essential for and relevant to every networking job. It's why Cisco certifications are in such high demand even at companies with few Cisco devices!



For up-to-the-minute updates covering additions or modifications to the Cisco certification exams, as well as additional study tools, review questions, videos, and bonus materials, be sure to visit the Todd Lammle website and forum at www.lammle.com/ccna.

Cisco's Network Certifications

Way back in 1998, obtaining the Cisco Certified Network Associate (CCNA) certification was the first pitch in the Cisco certification climb. It was also the official prerequisite to each of the more advanced levels. But that changed in 2007, when Cisco announced the Cisco Certified Entry Network Technician (CCENT) certification. Then again, in May 2016, Cisco announced new updates to the CCENT and CCNA Routing and Switching (R/S) tests. Today, things have changed dramatically again.

In July 2019, Cisco switched up the certification process more than it has in the last 20 years! Cisco announced all new certifications that started in February 2020, and then again, an update and revision in the summer of 2024, which is probably why you're reading this book!

So what's changed? For starters, the CCENT course and exam (ICND1 and ICND2) no longer exist, nor do the terms Routing & Switching (rebranded to Enterprise). On top of that, the CCNA is no longer a prerequisite for any of the higher certifications at all, meaning that you'll be able to jump straight to CCNP without having to take the new CCNA exam if you have already achieved the CCNA or have enough background to skip the CCNA.

The new Cisco certification process will look like Figure I.1.

FIGURE I.1 The Cisco certification path

| Entry Starting point for individuals interested in starting a career as a networking professional. | Associate Master the essentials needed to launch a rewarding career and expand your job possibilities with the latest technologies. | Professional Select core technology track and a focused concentration exam to customize your professional-level certification. | Expert This certification is accepted worldwide as the most prestigious certification in the technology industry. |
|---|---|--|---|
| Cisco Certified Support Technician (CCST) | CCNA | CCNP Enterprise | CCIE Enterprise Infrastructure |

First, the CCST entry-level certification was added, and you can find the Wiley study guide for the CCST Network book authored by Todd Lammle and Donald Robb as well as this study guide at https://www.lammle.com/order-our-books.

If you have an entry-level network background, you will want to head directly to CCNA, using this book and the abundant resources on www.lammle.com/ccna, of course!

The Todd Lammle CCNA program, starting with this book, is a powerful tool to get you started in your CCNA studies, and it's vital to understand that material found in this book and at www.lammle.com/ccna before you go on to conquer any other certifications!

What DoesThis Book Cover?

This second book in the CCNA series covers everything you need to know to pass the new CCNA 200-301 v1.1 exam and starts right where the first book in the series left off.

But regardless of which Cisco Certification path you choose, as I've said, taking plenty of time to study and practice with routers or a router simulator is the real key to success.

You will learn the following information in this book:

Chapter 1: Enhanced Switched Technologies This chapter will start off with STP protocols and dive into the fundamentals, covering the modes as well as the various flavors of STP. VLANs, trunks, and troubleshooting are covered as well. Finally, PortFast will also be discussed.

Chapter 2: Security with ACLs This chapter covers security and access lists, which are created on routers to filter the network. IP standard, extended, and named access lists are covered in detail. Written and hands-on labs, along with review questions, will help you study for the security and access-list portion of the Cisco exams.

Chapter 3: Internet Protocol Version 6 (IPv6) This is a fun chapter chock-full of some great information. IPv6 is not the big, bad scary creature that most people think it is, and it's a really important objective on the latest exam, so study this chapter carefully—don't just skim it.

Chapter 4: Troubleshooting IP, IPv6, and VLANs This chapter will cover detailed troubleshooting, and because this is such a major focus of the Cisco CCNA objectives I'd be letting you down if I didn't make sure you've got this important topic down. So to ensure that your skills are solid, we're going to begin by diving deep into trouble-shooting with IP, IPv6, and virtual LANs (VLANs) now. You absolutely must also have the fundamentals of IP and IPv6 routing and knowledge of VLANs and trunking nailed down tight if you're going to win at this.

Chapter 5: Network Address Translation (NAT) In this chapter, we're going to dig into Network Address Translation (NAT), Dynamic NAT, and Port Address Translation (PAT), also known as NAT Overload. Of course, I'll demonstrate all the NAT commands.

Chapter 6: IP Services This chapter covers how to find neighbor device information using the proprietary Cisco Discovery Protocol (CDP) and the industry-standard Link Layer Discovery Protocol (LLDP). I'll also discuss how to make sure our times are synchronized with our devices using Network Time Protocol (NTP). After that, I'll show you the Simple Network Management Protocol (SNMP) and the type of alerts sent to the network management station (NMS). You'll learn about the oh-so-important syslog logging and configuration, and then, finally, I'll cover how to configure Secure Shell (SSH).

Chapter 7: Security Fundamentals This chapter will help you to define key security concepts (threats, vulnerabilities, exploits, and mitigation techniques) as well as describe security program elements (user awareness, training, and physical access control). We'll also cover authentication, authorization and accounting, and password policies.

Chapter 8: First Hop Redundancy Protocol (HSRP) This chapter will start off by telling you the reasons why we need a layer 3 redundancy protocol and then move into how to build redundancy and load-balancing features into your network elegantly with routers that you might even have already. You really don't need to buy some overpriced load-balancing device when you know how to configure and use Hot Standby Router Protocol (HSRP).

Chapter 9: Quality of Service (QoS) *Quality of service (QoS)* refers to the way resources are controlled so that the quality of services is maintained. In this chapter I'm going to cover how QoS solves problems by using classification and marking tools, policing, shaping and re-marking, providing congestion management and scheduling tools, and finally, link-specific tools.

Chapter 10: Wireless Technologies Because I know you've crushed all of the previous chapters, you're ready to dive into this one! If that's not exactly you, just know that the two chapters on switching provide a really nice review on switching and VLANs. So, let's start this chapter by defining a basic wireless network as well as basic wireless principles. We'll talk about different types of wireless networks, the minimum devices required to create a simple wireless network, and some basic wireless topologies as well. After that, I'll get into basic security by covering WPA, WPA2, and WPA3.

Chapter 11: Configuring Legacy Wireless Controllers After Chapter 10 you now know how wireless works, so now we're going to guide you through configuring a wireless network from beginning to end. We'll start by telling you all about how to get a Cisco Wireless LAN Controller up and running before showing you how to join access points to our new WLC. We'll also dig deep into how to configure the WLC to support wireless networks. By the end of this chapter, you'll triumph by having an actual endpoint join your wireless LAN!

Chapter 12: Configuring Modern Wireless Controllers This chapter walks you through setting up a virtual Cisco 9800 controller and using port channels. Then, we will create a simple WPA2 WLAN using PSK, just as we did with the WLC. Then, we will join our new wireless network with my test PC to confirm everything works as advertised! Finally, we will finish up the chapter by exploring how to work with cloud-managed access points.

Chapter 13: Virtualization, Containers, and VRFs In this chapter, we'll begin to address modern challenges by introducing you to virtualization basics. We'll then walk you through its common components and features to close the topic by comparing some of the virtualization products on the market as of this writing. After that, we'll explore important automation concepts and components to provide you with sure footing to jump into the SDN and configuration management chapters following this one.

Chapter 14: Software-Defined Networking (SDN) Automation has gotten popular enough to be included on the CCNA exam—it even has its own DevNet certification track! Even so, most companies still aren't keen on fully managing their network with a bunch of Python scripts on a shared drive. So a better solution is to go with something called a software-defined networking (SDN) controller to centrally manage and monitor the network instead of doing everything manually, and that is what this chapter is all about!

Chapter 15: Automation and REST APIs When preparing for the CCNA, manually configuring everything while practicing the topics in this book is a great way to gain hands-on experience and become proficient with IOS commands. However, by the time you're nearing the exam, you might find that repeating basic configurations, like add-ing VLANs over and over, becomes tedious. This is why automation is gaining traction in the workplace—it helps prevent these errors and saves time by reducing the need for repetitive tasks. In this chapter, we'll introduce the concept of automation and explore REST APIs, which are the preferred method for automating network devices today.

Chapter 16: Configuration Management In this chapter we're going to take things to a whole new level, diving deeper into configuration management tools like Ansible, Puppet, and Terraform. These great features make it possible to automate almost everything in your infrastructure!

Appendix A: Answers to the Written Labs This appendix provides the answers to the end-of-chapter written lab.

Appendix B: Answers to the Review Questions This appendix provides the answers to the end-of-chapter review questions.

Interactive Online Learning Environment and Test Bank

The interactive online learning environment that accompanies the CCNA Certification Study Guide: Exam 200-301 v1.1 provides a test bank with study tools to help you prepare for the certification exams and increase your chances of passing them the first time! The test bank includes the following elements:

Sample tests All of the questions in this book are provided, including the assessment test, which you'll find at the end of this introduction, and the review questions at the end of each chapter. In addition, you'll find a practice exam for each book in the series. Use these questions to test your knowledge of the study guide material. The online test bank runs on multiple devices.

Electronic flashcards The flashcards are included for quick reference and are great tools for learning quick facts. You can even consider these additional simple practice questions, which is essentially what they are.

PDF of glossary of terms There is a glossary included that covers the key terms used in this book.



The Sybex Interactive Online Test Bank, flashcards, and glossary can be accessed at http://www.wiley.com/go/Sybextestprep.

Todd Lammle Bonus Material and Labs Be sure to check www.lammle.com/ccna for directions on how to download all the latest bonus materials created specifically to help you study for your CCNA exam.

Todd Lammle Videos I have created a full CCNA series of videos that can be purchased at www.lammle.com/ccna.



Like all exams, the CCNA certification from Cisco is updated periodically and may eventually be retired or replaced. At some point after Cisco is no longer offering this exam, the old editions of our books and online tools will be retired. If you have purchased this book after the exam was retired or are attempting to register in the Sybex online learning environment after the exam was retired, please know that we make no guarantees that this exam's online Sybex tools will be available once the exam is no longer available.

CCNA Exam Overview

Cisco has designed the new CCNA program to prepare you for today's associate-level job roles in IT technologies. The CCNA 200-301 v1.1 exam now includes security and automation and programmability, and there is even a new CCNA DevNet certification. The new CCNA program has one certification that covers a broad range of fundamentals for IT careers.

The new CCNA certification covers a huge amount of topics, including

- Network fundamentals
- Network access
- IP connectivity
- IP services
- Security fundamentals
- Wireless
- Automation and programmability

Are There Any Prerequisites for Taking the CCNA Exam?

Not really, but having experience is really helpful. Cisco has no formal prerequisites for CCNA certification, but you should have an understanding of the exam topics before taking the exam.

CCNA candidates often also have

- One or more years of experience implementing and administering Cisco solutions
- Knowledge of basic IP addressing
- A good understanding of network fundamentals

How to Use This Book

If you want a solid foundation for the serious effort of preparing for the new CCNA exam, then look no further. I've spent hundreds of hours putting together this book with the sole intention of helping you to pass the Cisco exams as well as really learning how to correctly configure Cisco routers and switches!

This book is loaded with valuable information, and you will get the most out of your study time if you understand the way in which this book is organized.

So to maximize your benefit from this book, I recommend the following study method:

1. Take the assessment test that's provided at the end of this introduction. (The answers are at the end of the test.) It's okay if you don't know any of the answers; that's why you bought this book! Carefully read over the explanations for any questions you get wrong and note the chapters in which the relevant material is covered. This information should help you plan your study strategy.

- **2.** Study each chapter carefully, making sure you fully understand the information and the test objectives listed at the beginning of each one. Pay extra-close attention to any chapter that includes material covered in questions you missed.
- **3.** Answer all of the questions related to each chapter. (The answers appear in Appendix A and Appendix B.) Note the questions that confuse you and study the topics they cover again until the concepts are crystal clear. And again—do not just skim these questions! Make sure you fully comprehend the reason for each correct answer. Remember, these will not be the exact questions you will find on the exam, but they're written to help you understand the chapter material and ultimately pass the exam!
- 4. Try your hand at the practice questions that are exclusive to this book. The questions can be found only at http://www.wiley.com/go/sybextestprep. Don't forget to check out www.lammle.com/ccna for the most up-to-date Cisco exam prep questions, videos, hands-on labs, and Todd Lammle boot camps.
- **5.** Test yourself using all the flashcards, which are also found on the download link listed in the Sybex downloads. These are brand-new and updated flashcards to help you prepare for the CCNA exam and a wonderful study tool!

To learn every bit of the material covered in this book, you'll have to apply yourself regularly and with discipline. Try to set aside the same time period every day to study, and select a comfortable and quiet place to do so. I'm confident that if you work hard, you'll be surprised at how quickly you learn this material!

If you follow these steps and really study—*doing hands-on labs every single day* in addition to using the review questions, the practice exams, the Todd Lammle video sections, and the electronic flashcards, as well as all the written labs—it would actually be hard to fail the Cisco exams. But understand that studying for the Cisco exams is a lot like getting in shape—if you do not go to the gym every day, it's not going to happen!

Where Do You Take the Exam?

You may take the CCNA Composite or any Cisco exam at any of the Pearson VUE authorized testing centers. For information, check www.vue.com or call 877-404-EXAM (3926). To register for a Cisco exam, follow these steps:

- 1. Determine the number of the exam you want to take. (The CCNA exam number is 200-301.)
- 2. Register with the nearest Pearson VUE testing center. At this point, you will be asked to pay for the exam in advance. You can schedule exams up to six weeks in advance or as late as the day you want to take them—but if you fail a Cisco exam, you must wait five days before you will be allowed to retake it. If something comes up and you need to cancel or reschedule your exam appointment, contact Pearson VUE at least 24 hours in advance.
- **3.** When you schedule the exam, you'll get instructions regarding all appointment and cancellation procedures, the ID requirements, and information about the testing center location.

Tips for Taking Your Cisco Exams

The Cisco exams contain about 50 or more questions and must be completed in about 90 minutes or so. It's hard to write this information down today because it changes so often. You must get a score of about 85 percent to pass this exam, but again, each exam can be different.

Many questions on the exam have answer choices that at first glance look identical especially the syntax questions! So remember to read through the choices carefully because close just doesn't cut it. If you get commands in the wrong order or forget one measly character, you'll get the question wrong. So, to practice, do the hands-on exercises at the end of this book's chapters over and over again until they feel natural to you.

Also, never forget that the right answer is the Cisco answer. In many cases, more than one appropriate answer is presented, but the *correct* answer is the one that Cisco recommends. On the exam, you will always be told to pick one, two, or three options, never "choose all that apply." The Cisco exam may include the following test formats:

- Multiple-choice single answer
- Multiple-choice multiple answer
- Drag-and-drop
- Router simulations

Cisco proctored exams will not show the steps to follow in completing a router interface configuration, but they do allow partial command responses. For example, show run, sho running, or sh running-config would be acceptable.

Here are some general tips for exam success:

- Arrive early at the exam center so you can relax and review your study materials.
- Read the questions *carefully*. Don't jump to conclusions. Make sure you're clear about *exactly* what each question asks. "Read twice, answer once," is what I always tell my students.
- When answering multiple-choice questions that you're not sure about, use the process of elimination to get rid of the obviously incorrect answers first. Doing this greatly improves your odds if you need to make an educated guess.
- You can no longer move forward and backward through the Cisco exams, so doublecheck your answer before clicking Next because you can't change your mind.

After you complete an exam, you'll get an immediate, online notification of your pass or fail status, a printed examination score report that indicates your pass or fail status, and your exam results by section. (The test administrator will give you the printed score report.)

Test scores are automatically forwarded to Cisco within five working days after you take the test, so you don't need to send your score to the company. If you pass the exam, you'll receive confirmation from Cisco, typically within two to four weeks, sometimes a bit longer.