CCNA Routing and Switching
COMPLETE STUDY GUIDE
Second Edition

EXAM 100-105
EXAM 200-105
EXAM 200-125

Covers 100% of exam objectives, including internetworking, ethernet networking and data encapsulation, IP routing, security, NAT, enhanced switched technologies, wide area networks, and much more...

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Acknowledgments

There are many people who work to put a book together, and as an author, I dedicated an enormous amount of time to write this book, but it would have never been published without the dedicated, hard work of many other people.

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About the Author

Todd Lammle is the authority on Cisco certification and internetworking and is Cisco certified in most Cisco certification categories. He is a world-renowned author, speaker, trainer, and consultant. Todd has three decades of experience working with LANs, WANs, and large enterprise licensed and unlicensed wireless networks, and lately he’s been implementing large Cisco Firepower networks. His years of real-world experience are evident in his writing; he is not just an author but an experienced networking engineer with very practical experience working on the largest networks in the world, at such companies as Xerox, Hughes Aircraft, Texaco, AAA, Cisco, and Toshiba, among many others. Todd has published over 60 books, including the very popular CCNA: Cisco Certified Network Associate Study Guide, CCNA Wireless Study Guide, CCNA Data Center Study Guide, and SSFIPS (Firepower), all from Sybex. He runs an international consulting and training company based in Colorado, Texas, and San Francisco.

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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 you’re striving to enter the thriving, dynamic IT sector or seeking 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 markedly 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 is essential for and relevant to every networking job and is why Cisco certifications are in such high demand—even at companies with few Cisco devices!

Although it’s now common knowledge that Cisco rules routing and switching, the fact that it also rocks the security, collaboration, data center, wireless and service provider worlds is also well recognized. And Cisco certifications reach way beyond the popular but less extensive certifications like those offered by CompTIA and Microsoft to equip you with indispensable insight into today’s vastly complex networking realm. Essentially, by deciding to become Cisco certified, you’re proudly announcing that you want to become an unrivaled networking expert—a goal that this book will get you well on your way to achieving. Congratulations in advance on the beginning of your brilliant future!

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 websites and forum at www.lammle.com/ccna.

Cisco’s Network Certifications

It used to be that to secure the holy grail of Cisco certifications—the CCIE—you passed only one written test before being faced with a grueling, formidable hands-on lab. This intensely daunting, all-or-nothing approach made it nearly impossible to succeed and predictably didn’t work out too well for most people. Cisco responded to this issue by creating a series of new certifications, which not only made it easier to eventually win the highly coveted CCIE prize, it gave employers a way to accurately rate and measure the skill levels of prospective and current employees. This exciting paradigm shift in Cisco’s certification path truly opened doors that few were allowed through before!
Beginning in 1998, obtaining the Cisco Certified Network Associate (CCNA) certification was the first milestone in the Cisco certification climb, as well as 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. And then in May 2016, Cisco once again proclaimed updates to the CCENT and CCNA Routing and Switching (R/S) tests. Now the Cisco certification process looks like Figure I.1.

**FIGURE I.1** The Cisco certification path

Cisco 2013 Certification Path Announcements

<table>
<thead>
<tr>
<th>Routing/Switching</th>
<th>Data Center</th>
<th>Voice</th>
<th>Security</th>
<th>Wireless</th>
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<td>No Pre-req</td>
<td>CCENT</td>
<td>CCENT</td>
<td>CCENT</td>
</tr>
</tbody>
</table>

NOTE

I have included only the most popular tracks in Figure I.1. In addition to the ones in this image, there are also tracks for Design, Service Provider, Service Provider Operations, and Video.

The Cisco R/S path is by far the most popular and could very well remain so, but soon you’ll see the Data Center path become more and more of a focus as companies migrate to data center technologies. The Security and Collaboration tracks also actually does provide a good job opportunity, and an even newer one that is becoming more popular is the Industrial CCNA. Still, understanding the foundation of R/S before attempting any other certification track is something I highly recommend.

Even so, and as the figure shows, you only need your CCENT certification to get underway for most of the tracks. Also, note that there are a few other certification tracks you can go down that are not shown in the figure, although they’re not as popular as the ones shown.

**Cisco Certified Entry Network Technician (CCENT)**

Don’t be fooled by the oh-so-misleading name of this first certification because it absolutely isn’t entry level! Okay—maybe entry level for Cisco’s certification path, but definitely not for someone without experience trying to break into the highly lucrative yet challenging IT job market! For the uninitiated, the CompTIA A+ and Network+ certifications aren’t
official prerequisites, but know that Cisco does expect you to have that type and level of experience before embarking on your Cisco certification journey.

All of this gets us to 2016, when the climb to Cisco supremacy just got much harder again. The innocuous-sounding siren’s call of the CCENT can lure you to some serious trouble if you’re not prepared, because it’s actually much harder than the old CCNA ever was. This will rapidly become apparent once you start studying, but be encouraged! The fact that the certification process is getting harder really works better for you in the long run, because that which is harder to obtain only becomes that much more valuable when you finally do, right? Yes, indeed!

Another important factor to keep in mind is that the Interconnection Cisco Network Devices Part 1 (ICND1) exam, which is the required exam for the CCENT certification, costs $150 per attempt and it’s anything but easy to pass! The good news is that Part 1 of this book (Chapters 1-14) will guide you step-by-step in building a strong foundation in routing and switching technologies. You really need to build on a strong technical foundation and stay away from exam cram type books, suspicious online material, and the like. They can help somewhat, but understand that you’ll pass the Cisco certification exams only if you have a strong foundation and that you’ll get that solid foundation only by reading as much as you can, performing the written labs and review questions in this book, and practicing lots and lots of hands-on labs. Additional practice exam questions, videos, and labs are offered on my website, and what seems like a million other sites offer additional material that can help you study.

However, there is one way to skip the CCENT exam and still meet the prerequisite before moving on to any other certification track, and that path is through the CCNA R/S Composite exam. First, I’ll discuss the Interconnecting Cisco Network Devices Part 2 (ICND2) exam, and then I’ll tell you about the CCNA Composite exam, which will provide you, when successful, with both the CCENT and the CCNA R/S certification.

**Cisco Certified Network Associate Routing and Switching (CCNA R/S)**

Once you have achieved your CCENT certification, you can take the ICND2 (200-105) exam in order to achieve your CCNA R/S certification, which is the most popular certification Cisco has by far because it’s the most sought-after certification of all employers.

As with the CCENT, the ICND2 exam is also $150 per attempt—although thinking you can just skim a book and pass any of these exams would probably be a really expensive mistake! The CCENT/CCNA exams are extremely hard and cover a lot of material, so you have to really know your stuff. Taking a Cisco class or spending months with hands-on experience is definitely a requirement to succeed when faced with this monster!

And once you have your CCNA, you don’t have to stop there—you can choose to continue and achieve an even higher certification, called the Cisco Certified Network Professional (CCNP). There are various ones, as shown in Figure NaN.1. The CCNP R/S is still the most popular, with Voice certifications coming in at a close second. And I’ve got to tell you that the Data Center certification will be catching up fast. Also good to know is
that anyone with a CCNP R/S has all the skills and knowledge needed to attempt the notoriously dreaded but coveted CCIE R/S lab. But just becoming a CCNA R/S can land you that job you’ve dreamed about and that’s what this book is all about: helping you to get and keep a great job!

Still, why take two exams to get your CCNA if you don’t have to? Cisco still has the CCNA Composite (200-125) exam that, if passed, will land you with your CCENT and your CCNA R/S via only one test priced at only $250. Some people like the one-test approach, and some people like the two-test approach. Part 2 of this book (Chapters 15-22) covers the ICND2 exam topics.

Why Become a CCENT and CCNA R/S?

Cisco, like Microsoft and other vendors that provide certification, has created the certification process to give administrators a set of skills and to equip prospective employers with a way to measure those skills or match certain criteria. And as you probably know, becoming a CCNA R/S is certainly the initial, key step on a successful journey toward a new, highly rewarding, and sustainable networking career.

The CCNA program was created to provide a solid introduction not only to the Cisco Internetwork Operating System (IOS) and Cisco hardware but also to internetworking in general, making it helpful to you in areas that are not exclusively Cisco’s. And regarding today’s certification process, it’s not unrealistic that network managers—even those without Cisco equipment—require Cisco certifications for their job applicants.

Rest assured that if you make it through the CCNA and are still interested in Cisco and internetworking, you’re headed down a path to certain success!

What Skills Do You Need to Become a CCNA R/S?

This ICND1 exam (100-105) tests a candidate for the knowledge and skills required to successfully install, operate, and troubleshoot a small branch office network. The exam includes questions on the operation of IP data networks, LAN switching technologies, IPv6, IP routing technologies, IP services, network device security, and basic troubleshooting. The ICND2 exam (exam 200-105) tests a candidate for the knowledge and skills required to successfully install, operate, and troubleshoot a small- to medium-size enterprise branch network. The exam includes questions on LAN switching technologies, IP routing technologies, security, troubleshooting, and WAN technologies.

How Do You Become a CCNA R/S

If you want to go straight for our CCNA R/S and take only one exam, all you have to do is pass the CCNA Composite exam (200-125). Oh, but don’t you wish it were that easy? True, it’s just one test, but it’s a whopper, and to pass it you must possess enough knowledge to understand what the test writers are saying, and you need to know everything I mentioned previously, in the sections on the ICND1 and ICND2 exams! Hey, it’s hard, but it can be done!