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JON BUHAGIAR

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Jon Buhagiar

I dedicate this book to my wife, Teresa, and my son, Joseph.
I love you both.

—JAB

Acknowledgments

About the Author

Jon Buhagiar, BS/ITM, MCSE, CCNA, is an information technology professional with two decades of experience in higher education and the private sector.

Jon currently serves as supervisor of network operations at Pittsburgh Technical College. In this role, he manages datacenter and network infrastructure operations and IT operations and is involved in the management of projects supporting the quality of education at the College. He also serves as an adjunct instructor in the College's School of Information Technology department, where he has taught courses for Microsoft and Cisco certification. Jon has been an instructor for 20+ years with several colleges in the Pittsburgh area, since the introduction of the Windows NT MCSE in 1998.

Jon earned a bachelor of science degree in Information Technology Management from Western Governors University. He also achieved an associate degree in Business Management from Pittsburgh Technical College. He has recently become a Windows Server 2016 Microsoft Certified Solutions Expert (MCSE) and earned the Cisco Certified Network Associate (CCNA) certification. Other certifications include CompTIA Network+, CompTIA A+, and CompTIA Project+.

In addition to his professional and teaching roles, Jon has authored *CCNA Routing and Switching Practice Tests: Exam 100-105, Exam 200-105*, and *Exam 200-125; CompTIA Network+ Review Guide: Exam N10-007, 4th Edition*, and *CompTIA A+ Deluxe Study Guide: Exam 220-1002* (all Sybex, 2016). He has also served as the technical editor for the second edition of the *CompTIA Cloud+ Study*

Guide (Sybex, 2016); *CCNA Security Study Guide: Exam 210-260 (Sybex, 2018)*; *CCNA Cloud Complete Study Guide: Exam 210-451* and *Exam 210-455* (Sybex, 2018); *CCNP Enterprise Certification Study Guide: Implementing* (Sybex, 2018), and *Operating Cisco Enterprise Network Core Technologies: Exam 300-401* (Sybex, 2020). Jon has spoken at several conferences about spam and email systems. He is an active radio electronics hobbyist and has held a ham radio license for the past 16 years, KB3KGS. He experiments with electronics and has a strong focus on the Internet of Things (IoT).

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Introduction

CCNA Certification Practice Tests: Exam 200-301 is a companion volume to the *CCNA Certification Study Guide*. If you're looking to test your knowledge before you take the CCNA exam, this book will help you by providing a combination of 1,200 questions that cover the CCNA objectives.

If you're just starting to prepare for the CCNA exam, I highly recommend that you use *Understanding Cisco Networking Technologies, Volume 1* and *CCNA Certification Study Guide, Volume 2* by Todd Lammle (Sybex, 2020) to help you learn about each of the objectives covered in the CCNA exam. Once you're ready to test your knowledge, use this book to help find places where you may need to study more or to practice for the exam itself.

Since it is a companion to the *CCNA Certification Study Guide* for Exam 200-301, this book is designed to be similar to taking the CCNA certification exam. It contains scenarios and standard multiple-choice questions similar to those you may encounter in the certification exam itself. The book contains eight chapters: six objective-centric chapters with 100 to 250 questions, weighted by the objectives, and two chapters that contain 100-question practice tests to simulate taking the exam itself. The bulk of the questions are in the IP Connectivity objective.

Cisco's Network Certification

It used to be that to secure the holy grail of Cisco certifications—the Cisco Certified Internetwork Expert (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 for each of the more advanced levels. Today, the Cisco CCNA exam remains as important in the scheme of Cisco certification as it was 20+ years ago. Of course, you can imagine that what we learned two decades ago has changed significantly, and so has the current Cisco CCNA exam. The CCNA exam is less focused on routing and switching than prior exams and more focused on a wider spectrum of technologies. The technologies include virtualization, wireless, and software-defined networking, just to name a few.

In February 2020, Cisco made some changes to its certification portfolio, as shown in Figure 1. The biggest change is that the Cisco Certified Entry Network Technician (CCENT) has been retired. You are now required to take the CCNA certification in one exam (200-301), and there are no prerequisites and no separate parts as there were in the past CCNA exams. Cisco has also added a technician-level exam called the Cisco Certified Technician (CCT). The CCT exam is aimed at entry-level technicians who support and maintain Cisco equipment. The CCT has not replaced the CCENT, and rest assured the CCNA is still the benchmark for network professionals. In addition to those changes, Cisco also added the Cisco

Certified Architect (CCAr). This accreditation distinguishes an individual who has achieved the certification of Cisco Certified Internetwork Expert (CCIE) and is versed is all of the Cisco specialized areas. This accreditation requires a candidate to develop and defend a network design before a Cisco-appointed exam committee.

Technician (CCT)	Associate (CCNA)	Professional (CCNP)	Expert (CCIE)	Architect (CCAr)
Cisco Certified Technician	Cisco Certified Network Associate	Enterprise	Enterprise	Cisco Certified Architect
		Security	Security	
		Service Provider	Service Provider	
		Collaboration	Collaboration	
		Data Center	Data Center	
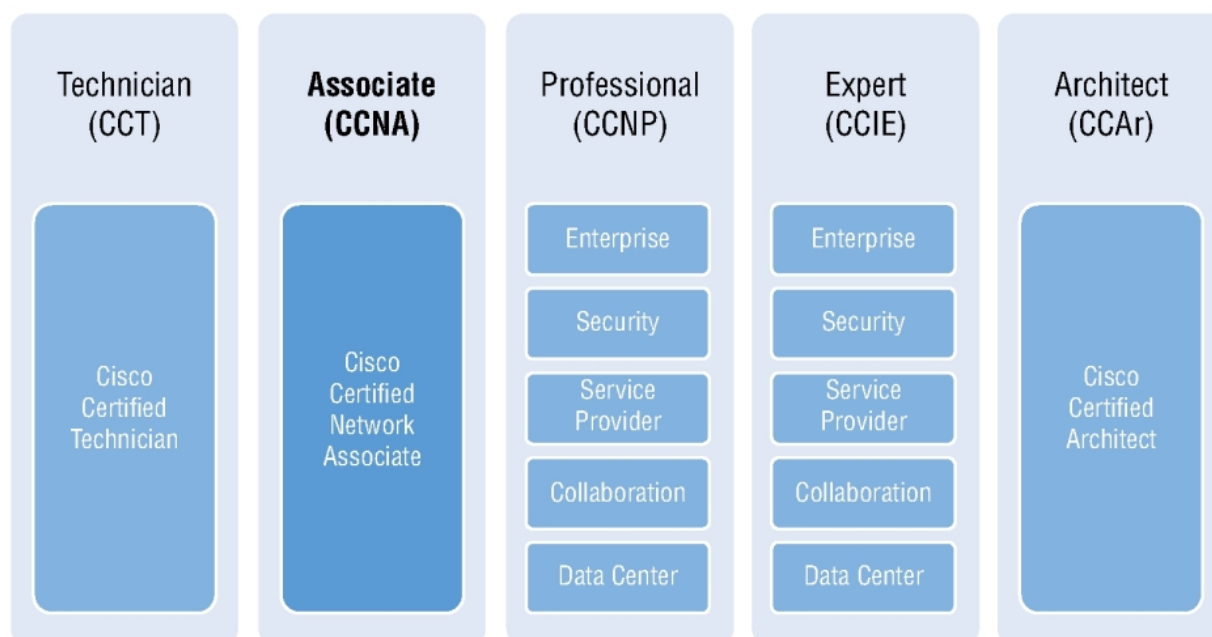
Cisco Certified Network Associate (CCNA)

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. If you are just starting out on the journey of Cisco certification and prefer to stick with Cisco-centric material, a good starting point is the book *Understanding Cisco Networking Technologies, Volume 1: Exam 200-301* by Todd Lammle (Sybex, 2020), which includes many of the introductory topics that you are expected to know by the time you start the CCNA exam process.

All of this gets us to the current day, when the climb to Cisco supremacy got much harder again. 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!

The CCNA (200-301) exam is extremely hard and covers 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! However, the CCNA certification is the most popular Cisco certification by far because it's the most sought-after certification by all employers.

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 certifications and each one focuses on a specialty area, as shown in Figure 1. The CCNP Enterprise certification is still the most popular, with the Security certification coming in at a close second. And I've got to tell you that the Data Center certification is quickly catching up. Also good to know is that anyone with a CCNP specialty certification has all the skills and knowledge needed to attempt the notoriously dreaded but coveted CCIE specialty lab. But just becoming a CCNA 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!

Why Become a CCNA?

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 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 switching and IP connectivity 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?

This CCNA exam (200-301) tests a candidate for the knowledge and skills required to successfully install, operate, and troubleshoot a small branch office network to a medium-size enterprise 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 exam also includes questions on physical and network security, network troubleshooting, and WAN technologies. We also see wireless technology added as an objective, since many networks today are composed of wired and wireless technologies.

This CCNA exam has also added an objective domain to take into consideration the expanse of virtualized networking. Both private and public cloud-based networks are included in this objective domain. The CCNA exam added the objective domain of automation and programmability to accommodate this real-world requirement. A lot of what we do today must scale and be reproducible with expected results.

How Do You Become a CCNA?

All you have to do is pass the CCNA exam (200-301). 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! Hey, it's hard, but it can be done!

Where Do You Take the Exams?

You may take the CCNA or any Cisco exam at any of the Pearson VUE authorized testing centers. For information, check https://www.pearsonvue.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 is 200-301.)

2. Register with the nearest Pearson VUE testing center. At this point, you will be asked to pay in advance for the exam. At the time of this writing, the CCNA exam is $300. The exams must be taken within one year of payment. You can schedule exams up to six weeks in advance or as late as the day you want to take it—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 50–60 questions and must be completed in about 120 minutes or less. This information can change per exam. 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, practice; do the hands-on exercises that can be found at the end of each chapter in the books *Understanding Cisco Networking Technologies, Volume 1* and *CCNA Certification Study Guide, Volume 2* by Todd Lammle (Sybex, 2020), and perform them 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 answers
- 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 double-check your answer before clicking Next since you can't change your mind.

After you complete an exam, you'll get 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 them. If you pass the exam, you'll receive confirmation from Cisco, typically within two to four weeks, sometimes a bit longer.

CCNA (200-301) Exam Objectives

Exam objectives are subject to change at any time without prior notice and at Cisco's sole discretion. Please visit Cisco's certification website, https://www.cisco.com/c/en/us/training-events.html, for the

latest information on the CCNA exam. [Tables 1–6](#) cover the CCNA (200-301) exam objectives.

Table 1 20% Network Fundamentals

Objective	Chapter
1.1 Explain the role and function of network components	1
1.1.a Routers	1
1.1.b L2 and L3 switches	1
1.1.c Next-generation firewalls and IPS	1
1.1.d Access points	1
1.1.e Controllers (Cisco DNA Center and WLC)	1
1.1.f Endpoints	1
1.1.g Servers	1
1.2 Describe characteristics of network topology architectures	1
1.2.a 2 tier	1
1.2.b 3 tier	1
1.2.c Spine-leaf	1
1.2.d WAN	1
1.2.e Small office/home office (SOHO)	1
1.2.f On-premises and cloud	1
1.3 Compare physical interface and cabling types	1
1.3.a Single-mode fiber, multimode fiber, copper	1
1.3.b Connections (Ethernet shared media and point-to-point)	1
1.3.c Concepts of PoE	1
1.4 Identify interface and cable issues (collisions, errors, mismatch duplex, and/or speed)	1
1.5 Compare TCP to UDP	1

Objective	Chapter
1.6 Configure and verify IPv4 addressing and subnetting	1
1.7 Describe the need for private IPv4 addressing	1
1.8 Configure and verify IPv6 addressing and prefix	1
1.9 Compare IPv6 address types	1
1.9.a Global unicast	1
1.9.b Unique local	1
1.9.c Link local	1
1.9.d Anycast	1
1.9.e Multicast	1
1.9.f Modified EUI 64	1
1.10 Verify IP parameters for Client OS (Windows, Mac OS, Linux)	1
1.11 Describe wireless principles	1
1.11.a Nonoverlapping Wi-Fi channels	1
1.11.b SSID	1
1.11.c RF	1
1.11.d Encryption	1
1.12 Explain virtualization fundamentals (virtual machines)	1
1.13 Describe switching concepts	1
1.13.a MAC learning and aging	1
1.13.b Frame switching	1
1.13.c Frame flooding	1
1.13.d MAC address table	1

Table 2 26% 2.0 Network Access

Objective	Chapter
2.1 Configure and verify VLANs (normal range) spanning multiple switches	2
2.1.a Access ports (data and voice)	2
2.1.b Default VLAN	2
2.1.c Connectivity	2
2.2 Configure and verify interswitch connectivity	2
2.2.a Trunk ports	2
2.2.b 802.1Q	2
2.2.c Native VLAN	2
2.3 Configure and verify Layer 2 discovery protocols (Cisco Discovery Protocol and LLDP)	2
2.4 Configure and verify (Layer 2/Layer 3) EtherChannel (LACP)	2
2.5 Describe the need for and basic operations of Rapid PVST+ Spanning Tree Protocol and identify basic operations	2
2.5.a Root port, root bridge (primary/secondary), and other port names	2
2.5.b Port states (forwarding/blocking)	2
2.5.c PortFast benefits	2
2.6 Compare Cisco Wireless Architectures and AP modes	2
2.7 Describe physical infrastructure connections of WLAN components (AP, WLC, access/trunk ports, and LAG)	2
2.8 Describe AP and WLC management access connections (Telnet, SSH, HTTP, HTTPS, console, and TACACS+/RADIUS)	2

2.9 Configure the components of a wireless LAN access for client connectivity using GUI only such as WLAN creation, security settings, QoS profiles, and advanced WLAN settings	2

Table 3 25% 3.0 IP Connectivity

Objective	Chapter
3.1 Interpret the components of a routing table	3
3.1.a Routing protocol code	3
3.1.b Prefix	3
3.1.c Network mask	3
3.1.d Next hop	3
3.1.e Administrative distance	3
3.1.f Metric	3
3.1.g Gateway of last resort	3
3.2 Determine how a router makes a forwarding decision by default	3
3.2.a Longest match	3
3.2.b Administrative distance	3
3.2.c Routing protocol metric	3
3.3 Configure and verify IPv4 and IPv6 static routing	3
3.3.a Default route	3
3.3.b Network route	3
3.3.c Host route	3
3.3.d Floating static	3
3.4 Configure and verify single area OSPFv2	3
3.4.a Neighbor adjacencies	3
3.4.b Point-to-point	3
3.4.c Broadcast (DR/BDR selection)	3
3.4.d Router ID	3
3.5 Describe the purpose of first hop redundancy protocol	3

Table 4 10% 4.0 IP Services

Objective	Chapter
4.1 Configure and verify inside source NAT using static and pools	4
4.2 Configure and verify NTP operating in a client and server mode	4
4.3 Explain the role of DHCP and DNS within the network	4
4.4 Explain the function of SNMP in network operations	4
4.5 Describe the use of syslog features including facilities and levels	4
4.6 Configure and verify DHCP client and relay	4
4.7 Explain the forwarding per-hop behavior (PHB) for QoS such as classification, marking, queuing, congestion, policing, shaping	4
4.8 Configure network devices for remote access using SSH	4
4.9 Describe the capabilities and function of TFTP/FTP in the network	4

Table 5 15% 5.0 Security Fundamentals

Objective	Chapter
5.1 Define key security concepts (threats, vulnerabilities, exploits, and mitigation techniques)	5
5.2 Describe security program elements (user awareness, training, and physical access control)	5
5.3 Configure device access control using local passwords	5
5.4 Describe security password policy elements, such as management, complexity, and password alternatives (multifactor authentication, certificates, and biometrics)	5
5.5 Describe remote access and site-to-site VPNs	5
5.6 Configure and verify access control lists	5
5.7 Configure Layer 2 security features (DHCP snooping, dynamic ARP inspection, and port security)	5
5.8 Differentiate authentication, authorization, and accounting concepts	5
5.9 Describe wireless security protocols (WPA, WPA2, and WPA3)	5
5.10 Configure WLAN using WPA2 PSK using the GUI	5

Table 6 10% 6.0 Automation and Programmability

Objective	Chapter
6.1 Explain how automation impacts network management	6
6.2 Compare traditional networks with controller-based networking	6
6.3 Describe controller-based and software defined architectures (overlay, underlay, and fabric)	6
6.3.a Separation of control plane and data plane	6
6.3.b North-bound and south-bound APIs	6
6.4 Compare traditional campus device management with Cisco DNA Center enabled device management	6
6.5 Describe characteristics of REST-based APIs (CRUD, HTTP verbs, and data encoding)	6
6.6 Recognize the capabilities of configuration management mechanisms Puppet, Chef, and Ansible	6
6.7 Interpret JSON encoded data	6

CCNA (200-301) Exam Delta Objectives

When studying to take a Cisco exam it takes time, lots of time! Understandably, we can find ourselves in the middle of studying for one exam, such as the prior CCNA Routing and Switching (200-125) exam, only to find out it is being retired and replaced with the CCNA (200-301). To maintain your momentum, you will find yourself frantically looking at what exactly changed from the past exam to the current exam. For this purpose, I have included the delta exam

objectives in this book. These delta objectives are the new objectives that were not present on the prior exam or were not emphasized in the prior exam. This section is only a guide for you to prepare for the transition to the current certification of CCNA (200-301). This section is not the only portion you must study in addition to the prior study material. The delta objectives do not reflect the objectives that were dropped from the prior exam, such as Enhanced Interior Gateway Routing Protocol (EIGRP), just to name a few. Knowing these objectives won't hurt you, but as per the new exam objectives, they are not required.

Exam objectives are subject to change at any time without prior notice and at Cisco's sole discretion. Please visit Cisco's certification website (https://www.cisco.com/c/en/us/training-events.html) for the latest information on the CCNA (200-301) exam. Table 7 covers the difference between the prior CCNA Routing and Switching (200-125) exam and the new CCNA (200-301) exam objectives.

Table 7 Delta Objectives

Objective	Chapter
1.1 Explain the role and function of network components	1
1.1.a Routers	1
1.1.b L2 and L3 switches	1
1.1.c Next-generation firewalls and IPS	1
1.1.d Access points	1
1.1.e Controllers (Cisco DNA Center and WLC)	1
1.1.f Endpoints	1
1.1.g Servers	1
1.2 Describe characteristics of network topology architectures	1
1.2.c Spine-leaf	1
1.2.e Small office/home office (SOHO)	1
1.2.f On-premises and cloud	1
1.10 Verify IP parameters for Client OS (Windows, Mac OS, Linux)	1
1.11 Describe wireless principles	1
1.11.a Nonoverlapping Wi-Fi channels	1
1.11.b SSID	1
1.11.c RF	1
1.11.d Encryption	1
1.12 Explain virtualization fundamentals (virtual machines)	1
2.6 Compare Cisco Wireless Architectures and AP modes	2

Objective	Chapter
2.7 Describe physical infrastructure connections of WLAN components (AP, WLC, access/trunk ports, and LAG)	2
2.8 Describe AP and WLC management access connections (Telnet, SSH, HTTP, HTTPS, console, and TACACS+/RADIUS)	2
2.9 Configure the components of a wireless LAN access for client connectivity using GUI only such as WLAN creation, security settings, QoS profiles, and advanced WLAN settings	2
3.2 Determine how a router makes a forwarding decision by default	3
3.2.a Longest match	3
3.2.c Routing protocol metric	3
4.9 Describe the capabilities and function of TFTP/FTP in the network	4
5.1 Define key security concepts (threats, vulnerabilities, exploits, and mitigation techniques)	5
5.2 Describe security program elements (user awareness, training, and physical access control)	5
5.4 Describe security password policy elements, such as management, complexity, and password alternatives (multifactor authentication, certificates, and biometrics)	5
5.8 Differentiate authentication, authorization, and accounting concepts	5
5.9 Describe wireless security protocols (WPA, WPA2, and WPA3)	5