



# CCIE Routing and Switching v5.0 Configuration Practice Labs

Martin J. Duggan

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# **Cisco CCIE Routing and Switching v5.0 Configuration Practice Labs**

**Third Edition**

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Martin James Duggan

**Cisco Press**

800 East 96th Street

Indianapolis, IN 46240

# Cisco CCIE Routing and Switching v5.0 Configuration Practice Labs, Third Edition

**Martin James Duggan**

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## Dedications

I dedicate this publication to my children. Anna and James, you two are such fun to be with, and I simply cannot get enough of your time, whether we are chasing each other down a snow-covered mountain or just playing a game of Boggle at home; hanging out with you makes my life complete. Jake, welcome to the family, your thirst for milk is only comparable with Anna's and James's thirst for Apple products. I can't wait to hear your first words and to teach you how to ride a bike. All I ask when you win the Tour de France is an autograph for your old man.

Lotte, you brought me happiness, and now you have brought me Jake; I am so lucky to have you in my life. Mum and Dad, I want to thank you for all the future babysitting; Jake will be in very capable hands when he is with you.

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## Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the IOS Command Reference. The Command Reference describes these conventions as follows:

- **Boldface** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), boldface indicates commands that are manually input by the user (such as a **show** command).
- *Italic* indicates arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets ( [ ] ) indicate an optional element.
- Braces ( { } ) indicate a required choice.
- Braces within brackets ( [ { } ] ) indicate a required choice within an optional element.

## Introduction

For more than 10 years, the CCIE program has identified networking professionals with the highest level of expertise. Less than 3 percent of all Cisco certified professionals actually achieve CCIE status. The majority of candidates who take the exam fail at the first attempt because they are not fully prepared; they generally find that their study plan did not match what was expected of them in the exam. This practice exam has been designed to take you as close as possible to actually taking the actual lab exam. It can show whether you are ready to schedule your lab or if you need to reevaluate your study plan.

## Exam Overview

The CCIE qualification consists of two separate exams, a 2-hour written exam and an 8-hour hands-on lab exam that includes troubleshooting, diagnostic, and configuration sections. Written exams are computer-based, multiple-choice exams lasting 2 hours and available at hundreds of authorized testing centers worldwide. The written exam tests your theoretical knowledge to ensure that you are ready to take the lab exam; therefore, you are eligible to schedule the lab exam only after you have passed the written exam. Having purchased this publication, you have most likely already passed the written exam and are ready to practice for the lab exam. The lab exam is a 5.5-hour, hands-on exam in which you configure a series of complex scenarios in strict accordance with the questions; it is tough, but achievable. Troubleshooting is now included for 2 hours, and you also face a series of further diagnostic questions for a 30-minute period of the exam. You can find current lab blueprint content information at the following URL:

[https://learningnetwork.cisco.com/community/certifications/ccie\\_routing\\_switching/lab\\_exam\\_v5](https://learningnetwork.cisco.com/community/certifications/ccie_routing_switching/lab_exam_v5)

The diagnostic section that has been added to the lab exam focuses on the skills required to properly diagnose network issues. The time for this new section is fixed at 30 minutes. The sequence of delivery of the lab sections is fixed as follows: Troubleshooting, Diagnostics, and Configuration. Although the time constraint is an essential component of the Troubleshooting section, the system enables some flexibility by granting candidates the option of adding up to 30 minutes to complete the section. The system doesn't permit toggling between modules, however. To maintain the total exam time of 8 hours, the optional extra time used in the Troubleshooting section is automatically deducted from the time credit allotted for the Configuration section. On the other hand, if the time spent in the Troubleshooting section is less than 2 hours, the Configuration section is credited by the time gained.

## Scoring Point System

In the actual exam, a higher number of available points for certain questions would generally indicate that the required solution would take more time to achieve or that there would be multiple lines of configuration involved. If you find yourself running short on time, try to get the smaller tasks completed, and then return to the more complex questions.

## Study Roadmap

Taking the lab exam is all about experience; you cannot expect to take it and pass after just completing your written exam relying on your theoretical knowledge. You must spend countless hours of rack time configuring features and learning how protocols interact with one another. To be confident enough to schedule your lab exam, review the following outlined points.

## Assessing Your Strengths

Using the content blueprint, determine your experience and knowledge in the major topic areas. For areas of strength, practicing for speed should be your focus. For weak areas, you might need training or book study in addition to practice.

## Study Materials

Choose lab materials that provide configuration examples and take a hands-on approach. Look for materials approved or provided by Cisco and its Learning Partners.

## Hands-On Practice

Build and practice your lab scenarios on a per-topic basis. Go beyond the basics and practice additional features. Learn the **show** and **debug** commands along with each topic. If a protocol has multiple ways of configuring a feature, practice all of them.

## Cisco Documentation

Familiarize yourself with content from the following URL, but note that access to this URL likely will be restricted in the real exam:

<http://www.cisco.com/cisco/web/psa/configure.html>

## Home Labs

Although acquiring a personal home lab is ideal, it can be costly to gather all the equipment you will need.

## Cisco 360 Program

The Cisco 360 Learning Program encompasses six stages of activity to support successful learning for students:

1. **Assessment:** Students take a diagnostic preassessment lab to benchmark their knowledge of various networking topics.
2. **Planning:** Based on the preassessment, students create a learning plan that uses a mix of learning components to focus their study.
3. **Learning:** Students learn by participating in lessons and lectures, reading materials, and working with peers and instructors.
4. **Practice:** Students use the practice exercises to apply learning on actual network equipment.
5. **Mastery:** Students measure their understanding by completing assessments of knowledge and skill for various approaches to solving network problems.
6. **Review:** Students review their work with a mentor or instructor and tune their skills with tips and best practices.

You can find detailed information about the 360 program at the following URL:  
[https://learningnetwork.cisco.com/community/learning\\_center/cisco\\_360/360-rs](https://learningnetwork.cisco.com/community/learning_center/cisco_360/360-rs)

## Equipment List and IOS Requirements

The lab exam tests any feature that can be configured on the equipment and the IOS versions indicated here:

- 3925 series routers - IOS 15.3(T) – Advanced Enterprise Services
- Catalyst 3560X series switches running IOS Version 15.0S – Advanced IP Services

## Chapter Overview

Each chapter consists of questions related to the v5.0 Blueprint within the following sections:

Chapter Topic Sections	v5.0 Topic Section
LAN Switching	Layer 2 Technologies
IGPs	Layer 3 Technologies
Redistribution	
BGP	
Multicast	
IPv6	
MPLS, Tunneling, DMVPN	VPN Technologies
QoS	Infrastructure Services
Security	Infrastructure Security

Chapters 1 and 2 follow a similar format but without questions about Multiprotocol Label Switching (MPLS), whereas Chapter 3 emphasizes virtual private networks (VPN) and questions specifically related to MPLS.

Each chapter begins with an overview of the required equipment and topology and provides general guidelines to follow while taking the practice exam. The actual practice lab exam is then presented, which should be undertaken in an advised 8-hour window. An “Ask the Proctor” section is included at the end of the question section to provide some clues as to how to answer the question (which you might find helpful if you cannot immediately solve a particular question). A full lab debrief is then provided that explains the optimal solution for each question, along with the associated **show** commands to provide full verification of the working solution. Each chapter then closes with a brief summary offering tips and advice.

The appendixes provide initial and final configurations for each router and switch per chapter to enable you to preconfigure and check your final working configurations at the beginning and end of each practice lab exam.

The appendixes are provided to you online from the book’s registered product page in .txt format, to make it easier for you to copy/paste them into your own lab gear. To access these files, see the “Where Are the Companion Files?” page at the end of this eBook document.

# Practice Lab 1

The CCIE exam commences with 2 hours of troubleshooting followed by 5 1/2 hours of configuration and a final 30 minutes of additional questions. This lab consists of 100 points and has been timed to last for 8 hours of configuration and self-troubleshooting, so aim to complete the lab within this period. Then either score yourself at this point or continue until you believe you have met all the objectives. You will now be guided through the equipment requirements and pre-lab tasks in preparation for taking this practice lab.

If you do not own six routers and four switches, consider using the equipment available and additional lab exercises and training facilities available within the CCIE R&S 360 program. You can find detailed information on the 360 program and CCIE R&S exam on the following URLs, respectively:

[https://learningnetwork.cisco.com/community/learning\\_center/cisco\\_360/360-rs](https://learningnetwork.cisco.com/community/learning_center/cisco_360/360-rs)

[https://learningnetwork.cisco.com/community/certifications/ccie\\_routing\\_switching](https://learningnetwork.cisco.com/community/certifications/ccie_routing_switching)

## Equipment List

You need the following hardware and software components to begin this practice lab:

- Six routers loaded with Cisco IOS Software Release 15.3T Advanced Enterprise image and the minimum interface configuration, as documented in Table 1-1
- Four 3560X switches with IOS 15.0S IP Services

**Table 1-1** *Hardware Required per Router*

Router	Model	Ethernet I/F	Serial I/F
R1	3925	2	—
R2	3925	2	1
R3	3925	2	—
R4	3925	2	—
R5	3925	2	1
R6	3925	2	—

## Setting Up the Lab

You can use any combination of routers as long as you fulfill the requirements within the topology diagram, as shown in Figure 1-1. However, you should use the same model of routers because this can make life easier if you load configurations directly from those supplied with your own devices. If your router interface speeds do not match those used in this lab, consider reconfiguring the bandwidth statement accordingly to provide symmetry with the routing protocol metrics.

**Note** The CCIE Assessor topology version B is used for this lab. Additional interfaces available on the Assessor that are not required for this lab were omitted from Figure 1-1. If you are not using the CCIE Assessor, use Figure 1-1 and Figure 1-4 to determine how many interfaces you need to complete your own topology.

**Note** Notice in the initial configurations supplied that some interfaces will not have IP address preconfigured. This is because you either will not be using that interface or you need to configure this interface from default within the exercise. The initial configurations supplied should be used to preconfigure your routers and switch before the lab starts.

If your routers have different interface speeds than those used within this book, adjust the bandwidth statements on the relevant interfaces to keep all interface speeds in line. This can ensure that you do not get unwanted behavior due to differing IGP metrics.

## Lab Topology

This practice lab uses the topology outlined in Figure 1-1, which you must re-create with your own equipment or by simply using the CCIE Assessor.

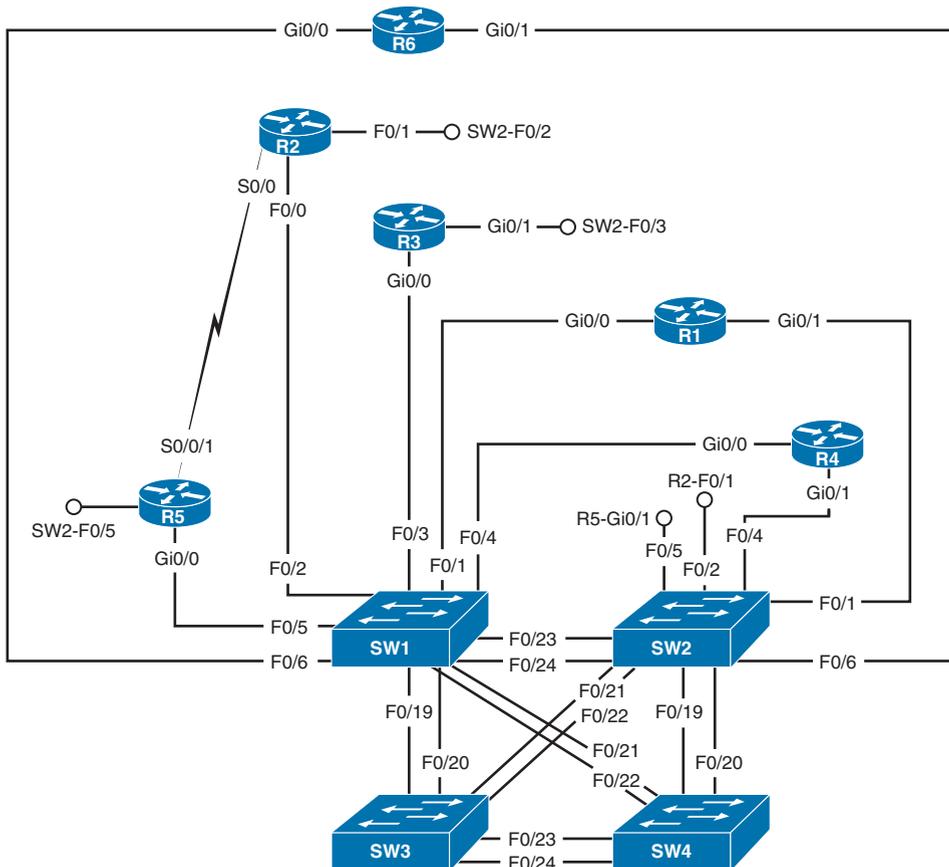


Figure 1-1 Lab Topology

## Switch Instructions

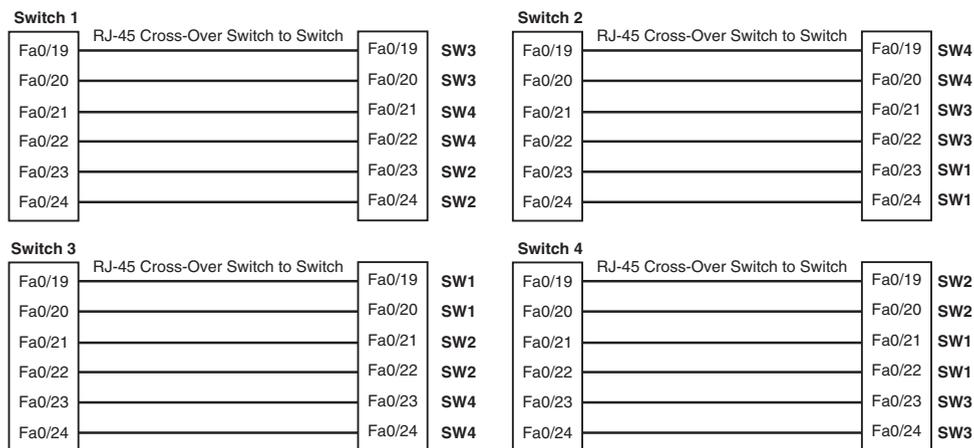
Configure VLAN assignments from the configurations supplied or from Table 1-2, with the exception of Switch2 Fa0/4 (which will be configured during the lab).

**Table 1-2** VLAN Assignment

VLAN	Switch 1	Switch 2	Switch 3	Switch 4
34	Fa0/3, Fa0/4	—	—	—
45	Fa0/5	See questions	—	—
46	Fa0/6	See questions	—	—
100	—	Fa0/1	—	—
132	Fa0/1, Fa0/2	Fa0/3	—	—
200	—	Fa0/2	—	—
300	I/F VLAN 300	Fa0/5, Fa0/6, I/F VLAN 300	I/F VLAN 300	I/F VLAN 300

**Note** Switch 2 will be configured during the actual lab questions for VLAN 45 and 46 interface Fa0/4.

Connect your switches with RJ-45 Ethernet cross-over cables, as shown in Figure 1-2.

**Figure 1-2** Switch Cabling

## Serial Link

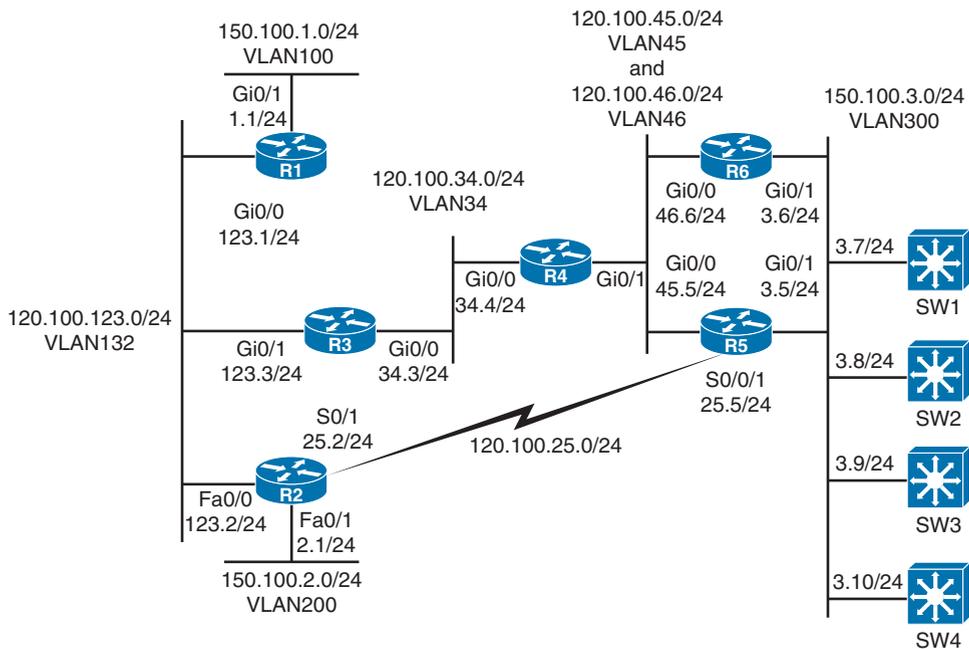
A preconfigured PPP back-to-back serial link exists between R2 and R5, and R2 has been configured to provide the clocking for the connection in the initial configuration files.

Therefore, R2 should have the DCE serial cable and R5 the DTE serial cable for the back-to-back connectivity.

## IP Address Instructions

In the real CCIE lab, the majority of your IP addresses will be preconfigured. For this exercise, however, you are required to configure your IP addresses, as shown in Figure 1-3, or load the initial router configurations supplied. If you are manually configuring your equipment, ensure that you include the following loopback addresses:

R1 Lo0 120.100.1.1/24	R6 Lo0 120.100.6.1/24
R2 Lo0 120.100.2.1/24	SW1 Lo0 120.100.7.1/24
R3 Lo0 120.100.3.1/24	SW2 Lo0 120.100.8.1/24
R4 Lo0 120.100.4.1/24	SW3 Lo0 120.100.9.1/24
R5 Lo0 120.100.5.1/24	SW4 Lo0 120.100.10.1/24



**Figure 1-3** IP Addressing Diagram