# CCIE Routing and Switching Written and Lab Exam Content Updates

The Written and Lab exam training and exam topics have been refreshed from version 4.0 to version 5.0. The new exam curriculum organizes the topics into six main large domains of knowledge. All exam topic domains from the version 4.0 curriculum were reorganized and restructured into six new domains. This is to improve the logical structure of the overall topics, as well as improve the alignment between the curriculum, the exam sections and the score report sections.

Exam topics are listed under each main domain. The topics are general guidelines for the content likely to be included on the exam. However, other related topics may also appear on any specific delivery of the exam. Some topics or tasks may appear on both the Written exam and Lab exam.

CCIE RSv4	CCIE RSv5	% ۱
00 Implement Layer 2 Technologies	1.0.0 Network Principles	10
0 Implement IPv4	2.0.0 Layer 2 Technologies	15
00 Implement IPv6	3.0.0 Layer 3 Technologies	40
00 Implement MPLS Layer 3 VPNs	4.0.0 VPN Technologies	15
0 Implement IP Multicast	5.0.0 Infrastructure Security	5
00 Implement Network Security	6.0.0 Infrastructure Services	15
.00 Implement Network Services		
.00 Implement Quality of Service		

A new domain covering Network Principles has been added. It includes foundational topics that will be covered only on the Written exam. It will assess expert level knowledge of these essential topics.

The Layer 2 Technologies domain predominately covers LAN switching and WAN circuit technologies.

The Layer 3 Technologies domain is the principal domain of the curriculum and covers interior and exterior routing protocols (RIP, EIGRP, OSPF, ISIS and BGP) as well as addressing, Layer 3 multicast, and fundamental routing concepts that are common across routing protocols.

As the industry continues its migration towards IPv6, the new exam revision focuses more heavily on dual-stack Layer 3 technologies, and equally treats IPv4 and IPv6 in all corresponding routing topics. There is no longer a dedicated section for IPv6. All routing protocols cover both IPv4 and IPv6.

The old Multicast Technologies domain from version 4.0 is now included in both the Layer 2 and Layer 3 Technology domains.

The **VPN Technologies** is a new stand-alone domain, including Tunneling and Encryption sub-domains. The Tunneling sub-domain includes MPLS's L2 and L3 VPNs as well as DMVPN and IPv6 Tunneling techniques. The Encryption sub-domain includes IPsec with pre-shared key for both the Written and Lab exam and GETVPN for the Written exam only.

## ...... CISCO

9.00 Troubleshoot a Network **10.00 Optimize the Network** 

11.00 Evaluate proposed changes to a Network (Written only)

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.

Learning@Cisco

# **CCIE Routing and Switching** Written and Lab Exam Content Updates

The Infrastructure Security domain includes Device Security and Network Security (both focusing on features supported on ISR routers and Catalyst 3K switches). It excludes any topic that relies on dynamic crypto (PKI) or on any remote servers.

The Infrastructure Services domain includes System Management, Network Services, Quality of Services (QoS) and Network Optimization. Layer 2 QoS topics are included in the Written exam only, supporting the Lab exam to focus on platform independent concepts.

Another notable change to the exam topics is the inclusion of weighting factors for each of the six main domains that represent the relative amount of subject knowledge and focus that can be expected in each area for either the Written or the Lab exam. The main focus of the exam is certainly the Layer 3 technologies, covering 40% of the curriculum

### **CCIE Routing and Switching v5.0 Topic Changes**

The decisions regarding which topics should be added, moved or retired were based on feedback received from key industry Subject Matter Experts (SME). These decisions reflect the evolution of the expectations of a candidate performing on the job role.

#### Topics Added to the CCIE Routing and Switching v5.0 Written Exam:

- Describe basic software architecture differences between IOS and IOS XE
- Identify Cisco Express Forwarding Concepts
- **Explain General Network Challenges**
- Explain IP, TCP and UDP Operations
- Describe Chassis Virtualization and Aggregation Technologies
- Explain PIM Snooping
- Describe WAN Rate-based Ethernet Circuits
- **Describe BGP Fast Convergence Features**
- ISIS (for IPv4 and IPv6)
- Describe Basic Layer 2 VPN Wireline
- **Describe Basic L2VPN LAN Services**
- Describe GET VPN
- Describe IPv6 Network Address Translation

#### Topics Added to the CCIE Routing and Switching v5.0 Written and Lab Exams:

- Use IOS Troubleshooting Tools
- Apply Troubleshooting Methodologies
- Interpret Packet Capture
- Implement and Troubleshoot Bidirectional Forwarding Detection
- Implement EIGRP (multi-address) Named Mode
- Implement, Troubleshoot and Optimize EIGRP and OSPF Convergence and Scalability
- Implement and Troubleshoot DMVPN (single hub)
- Implement and Troubleshoot IPsec with pre-shared key
- Implement and Troubleshoot IPv6 First Hop Security

I	1.	1		•
CI	S	C	0	ты

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.

Learning@Cisco

# **CCIE Routing and Switching** Written and Lab Exam Content Updates

#### Topics Moved from the CCIE® RS v4.0 Lab exam to the CCIE® RS v5.0 Written Exam:

- Describe IPv6 Multicast
- Describe RIPv6 (RIPng) .
- **Describe IPv6 Tunneling Techniques**
- Describe Device Security using IOS AAA with TACACS+ and RADIUS
- Describe 802.1x
- Describe Layer 2 QoS
- Identify Performance Routing (PfR)

#### Topics Removed from the CCIE® RS v4.0 Exam:

- Flexlink, ISL, Layer 2 Protocol Tunneling
- Frame-Relay (LFI, FR Traffic Shaping)
- WCCP
- IOS Firewall and IPS
- RITE, RMON
- RGMP
- RSVP QoS, WRR/SRR

### **CCIE Routing and Switching v5.0 Exam Format**

Although the exam number is changed from 350-001 to 400-101, the new Written exam format remains essentially the same as the previous one.

The format of the Lab exam has some significant changes that you need to be aware of.



The web-based delivery infrastructure supporting the new Lab exam is actually very similar to the one used to deliver the previous version 4.0, however, the configuration portion of the exam is now delivered using virtual devices - just like the troubleshooting portion of the exam. Virtual routers and virtual switches will be used throughout the exam, supporting more realistic and bigger network topologies that improve the reliability of the test while focusing on conceptual technologies - rather than testing specific hardware platform peculiarities.

Just like with the CCIE Routing and Switching v4.0, the Troubleshooting module delivers incidents that are independent of each other, meaning that the resolution of one does not depend on the resolution of another incident.

## ...... CISCO.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.

Learning@Cisco

# **CCIE Routing and Switching** Written and Lab Exam Content Updates

This is designed in order to objectively quantify the troubleshooting skills and avoid bias of strengths and weaknesses in specific technical areas.

On the contrary, the Configuration module presents candidates with a whole scenario composed of multiple items that are meant to be inter-dependent, by nature of the infrastructure technologies. Candidates do see all items at the beginning of each exam module. They can work out the sequence that they want to address each item as well as manage the time spent to resolve each item.

A new exam module called "diagnostic module" has been added and will focus on the skills required to properly diagnose network issues. The time for this new lab module is fixed to 30 minutes, no more or no less.

The sequence of delivery of these three lab modules is fixed as follows: Troubleshooting module, then the Diagnostic module and finally the Configuration module.

Although the time constraint is an essential component of the Troubleshooting module, the system enables some flexibility by granting candidates the option to extend up to 30 minutes to complete the module. The system doesn't allow going back and forth between modules and the Diagnostic module is fixed to 30 minutes. In order to maintain the total exam time to 8 hours, the optional extra time used in the Troubleshooting module will automatically be deducted from the time credit allotted for the Configuration module. On the contrary, if the time spent in the Troubleshooting module is less than 2 hours, the Configuration module is credited by the time gained.

The web-based delivery system will display a warning message after two hours have passed within the Troubleshooting module, informing the candidate that if they proceed in the Troubleshooting module, any additional time used (up to thirty minutes) will be reduced from the Configuration time, ensuring that the total exam is a maximum eight hours.

In order to pass the lab exam, a candidate must meet two separate conditions. First, the sum of scores of each module must exceed the overall lab exam cut-score. Second, the score achieved for each module must exceed the module's minimum score. This is done to prevent from passing the lab exam while failing or even bypassing the shortest Diagnostic module. While the exact lab exam overall cut-score remains confidential, the overall pass/fail decision is made on the verification if all specific criterion for each exam item are met. The point value of each item is shown on the test and scores are granted only when all criterion are met. No partial score is granted for any items (all items are multi-point dichotomous items).

As briefly mentioned above, the objective of the new Diagnostic module is to further assess the skills required to properly diagnose network issues. These skills include "analyzing, correlating and discerning multiple sources of documentation" such as email threads, network topology diagrams, console outputs, syslogs and even traffic captures. These activities are naturally part of the overall Troubleshooting activities. They were designed as a separate lab module because the format of the items is significantly different. The Troubleshooting incidents require candidates to resolve networking issues by configuring possible solutions (while not breaking any explicit constraints) and verifying that the symptoms are fixed, using terminal sessions to the console port of actual devices.

In contrast, the Diagnostic module tickets require candidates to make a choice between pre-defined options in order to:

- indicate what the root cause of an issue is
- or where is the issue located in a diagram
- or what is the critical piece of information leading to identifying the root cause
- or what piece of information is missing to make a judgment about the root cause

### ...... **CISCO**

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.

## **CCIE Routing and Switching** Written and Lab Exam Content Updates

The Diagnostic module doesn't require using terminal sessions to actual devices. It provides candidates with a set of documentation that represent a snapshot of a realistic situation, at a point in time in the investigation process that a network engineer might be confronted with. For instance, a support engineer might need to provide the root cause analysis to a customer, or might need to help a colleague who is stuck on a problem, or might have to summarize the previous investigations steps...

Within the Diagnostic module, the format of some of the tickets presented is similar to the format of the Written exam. It includes multiple-choice (single answer or multiple answers), Drag and Drop, or even Point and Click on diagrams. The biggest difference with the Written exam is that tickets will contain a set of documentation that candidates must consult in order to understand the issue. Then in turn, analyze and correlate information (after discerning between valuable and worthless pieces) in order to make a choice among pre-defined options.

Tickets will not require candidates to write anything in order to provide the answer to a ticket. All tickets will be closeended (as opposed to open-ended) so that the grading will be deterministic, ensuring a fair and consistent scoring. This approach also helps to grant credit and scores for accurately identifying the root cause of a networking issue but failing to resolve it within the defined constraints – which the Troubleshooting module doesn't offer.

Real-life experience is certainly the best training to prepare for the module. However, it is also naturally embedded when training for the Troubleshooting module. Candidates with limited experience should focus on discovering, practicing and applying efficient and effective troubleshooting methodologies that can be applied for any realistic networking challenge.

We trust that this new Diagnostic module greatly improves the overall value of the certification by focusing on valuable skills unique to experienced and talented engineers.



Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.

**CISCO** 

# CCIE Routing and Switching Written and Lab Exam Content Updates

### CCIE® Routing and Switching v5.0 Recommended Hardware and Software Equipment

This latest revision assesses knowledge of platform-independent concepts that are applicable across the portfolio of routers and switches. They are based on functionalities available in Cisco IOS Software Release 15 running within a 100% virtual environment.

In order to become familiar with the virtualized IOS lab environment, training is available through the Cisco 360 Learning Program. The product offerings include Pre-assessment Labs, Practice Lab Workbooks, and all labs associated with the CIERS1 and CIERS2 Instructor Led Trainings.

Candidates who want to prepare using hardware based labs can use the following equipment and Cisco IOS Software Releases:

- Cisco ISR 2900 Series routers running IOS version 15.3T Universal Software release
- Catalyst 3560X Series switches running IOS version 15.0SE Universal (IP Services) Software release

Any other hardware platform that can run equivalent Cisco IOS Software version 15 may be used as well.

Note that older equipment platforms and Cisco IOS Software Releases may be used to learn and practice a significant portion of the exam curriculum. Refer to the Cisco Feature Navigator (www.cisco.com/go/fn) to compare Cisco IOS Software Releases.

### **CCIE Routing and Switching v5.0 Resources**

Along with the changes to the version 5.0 curriculum, new material will be released in the Cisco 360 Learning Program beginning in January 2014. The material is being revised to include new virtual rack rentals, videos on demand, new workbook labs, full scale graded assessment labs, as well as new classes. The most exciting part of this program is the new release of the virtual equipment rental that is needed to perform the workbook and technology specific labs using an efficient and scalable delivery environment.

As you certainly know, the Cisco Learning Network is a social learning network designed for networking professionals across the globe. It hosts all official information regarding Cisco Certifications, including the exam Topics. Please visit learningnetwork.cisco.com for more information regarding the CCIE Routing and Switching v5.0.

## ...... CISCO.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: 12/13 http://www.cisco.com/go/trademarks.