TOMORROW starts here.
CCIE Service Provider
BRKCCIE-9163

Vincent Zhou
Product Manager
## Agenda

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Disclaimer

- Not all the topics discussed today appear on every exam.
- For time reasons, we’re unable to discuss every feature and topic possible on the exam; rather, we will try to cover the most important ones.
Section 1: CCIE® and CCDE® Program Overview
CCIEs and CCDEs Worldwide

- Most highly respected IT certification for more than 15 years
- Industry standard for validating expert skills and experience
- More than 30,000 CCIEs / CCDEs worldwide
  —less than 3% of all professionals certified by Cisco
- Demonstrate strong commitment and investment to networking career, life-long learning, and dedication to remaining an active CCIE / CCDE
Overview: CCIE and CCDE Tracks

Routing & Switching
- Expert level knowledge of networking across LAN and WAN interfaces and variety of routers and switches
- Solve complex connectivity problems to increase bandwidth, improve response times, maximize performance, and support global operations

Security
- Expert level knowledge of security and VPN solutions
- Demonstrate in-depth understanding of Layer 2 and 3 network infrastructure; Solid understanding of Windows, Unix, Linux and HTTP, SMTP, FTP and DNS

Voice
- Expert level knowledge of Cisco Voice over IP (VoIP) products and solutions
- Capable of building and configuring complex end-to-end telephony network, troubleshooting and resolving VoIP-related problems

Design
- Expert level knowledge of network design principles for the Layer 2 and 3 network infrastructure
- Capable of assessing and translating network business requirements into technical designs

Data Center
- Expert level knowledge of Data Center Technologies, including DC infrastructure, storage, compute and virtualization
- Capable of building, configuring, and troubleshooting an end-to-end virtualized Data Center using Cisco DC technologies

Service Provider
- Expert level knowledge of IP fundamentals and technologies
- Expertise in building an extensible service provider network
- Expert level knowledge to troubleshoot and maintain complex service provider networks

SP Operations
- Expert level knowledge of SP IP NGN technologies
- Capable of troubleshooting SP networks, managing SP processes (incident, fault, change, configuration, and performance), and knowledge of NMS technology

Wireless
- Expert level knowledge of WLAN technologies
- Provides next step for individuals interested in a career in managing or working with Cisco wireless technologies
CCIEs / CCDEs must pass two exams:

- The written qualification exam has approximately 100 questions. Most items are multiple-choice.
- The lab / practical exam format is what makes CCIE / CCDE different.
  - For CCIE exams, the full-day, hands-on lab exam tests the ability to configure and troubleshoot equipment.
    - NOTE: These exams are offered at specific Cisco Lab locations. Not all lab exams are offered at all lab locations.
  - For the CCDE exam, the full-day practical situation-based exam tests the ability to design networks.
    - NOTE: These exams are offered at specific Pearson Professional Center locations on specific days.
Proactive and Holistic Candidate Feedback Process

**Input**
- Cisco Business Units
- Cisco Technology groups
- Cisco Technical Support teams (TAC, AS, ..)
- Cisco-Internal and Cisco-External Subject Matter Experts
- Customer Advisory Boards
- Customer Focus Groups
- Customer and Cisco field surveys (Marketing)
- Cisco Product Manager, Marketing Manager, Program Manager

**Feedback**
- Candidate Exam and Item Comments
- Candidate Satisfaction Surveys
- Customer Service Cases
- EAG (Exam Advisory Groups)
- Cisco Learning Network
- Blogs

**Process Flow**

1. **Input**
2. **Create or Refresh Exam Content**
3. **Launch Exam**
4. **Exam Live**
5. **Feedback**
## CCIE Information Worldwide

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Total of Worldwide CCIEs:</td>
<td>38,005*</td>
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<tr>
<td>Total of Routing and Switching CCIEs:</td>
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<td>Total of Security CCIEs:</td>
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<td>Total of Service Provider CCIEs:</td>
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<td>Total of Voice CCIEs:</td>
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<tr>
<td>Total of Wireless CCIEs:</td>
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</table>

### Multiple Certifications

Many CCIEs Have Gone on to Pass the Certification Exams In Additional Tracks, Becoming a "Multiple CCIE.” Below Are Selected Statistics on CCIEs Who Are Certified in More Than One Track

<table>
<thead>
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<th>Number of Certifications</th>
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<td>4</td>
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<td>5 or More</td>
<td>25</td>
</tr>
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</table>

*Updated 2-Mar-2013
Become a Cisco Subject Matter Expert

- If you consider yourself a Subject Matter Expert AND would like to lend your expertise to the Cisco Certification Program, send your resume and tell us which Certification Exams you are interested in contributing. We’ll contact you about opportunities as they come up and based on the information you provide us!

- sme-interest@external.cisco.com

<table>
<thead>
<tr>
<th>Exam Design</th>
<th>Item Development</th>
<th>Item Review</th>
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</thead>
<tbody>
<tr>
<td>Standard Setting</td>
<td>Topics (Blueprint) Validation</td>
<td></td>
</tr>
</tbody>
</table>
Step 1: CCIE Written Exam

- Available worldwide at any Pearson VUE testing facility for ~$350 USD. Costs may vary due to exchange rates and local taxes (VAT, GST)
- Two-hour exam with around 100 multiple-choice questions
- Closed book; no outside reference materials allowed
- Pass/fail results are available immediately following the exam; the passing score is set by statistical analysis and is subject to periodic change
- Waiting period of 5 calendar days to retake the exam
- Candidates who pass a CCIE written exam must wait a minimum of 6 months before taking the same number exam
- From passing written, candidate “must” take first lab exam attempt within 18 months
- No “skip-question” functionality
Step 2: CCIE Lab Exam

- Available in select Cisco locations for $1,500 USD, adjusted for exchange rates and local taxes where applicable, not including travel and lodging
- **Eight-hour** exam requires working configurations and troubleshooting to demonstrate expertise
- Cisco documentation available via Cisco Web; no personal materials of any kind allowed in lab
- Minimum score is **around 80%** to pass
- Scores can be viewed normally online within 48 hours and failing score reports indicate areas where additional study may be useful
CCIE Service Provider Overview

- CCIE Service Provider certification recognizes experts with the highest level of technical knowledge and hands-on experience in configuring, optimizing and troubleshooting extensible Service Provider infrastructure to deliver rich services.
- There is an ever-growing demand for Service Provider experts in the industry.
- The CCIE Service provider certification was introduced in 2002.
- CCIE Service provider migrated to Version 3 from April 18th 2011.
- Around 3,000 CCIE Service Provider worldwide.
Section 2: CCIE Service Provider Written Exam
CCIE SP Written Exam (350-029): What’s new

- SP engineer job role oriented rather than technology oriented
- Emphasize on emerging widely deployed SP technology like IPv6, MPLS, Traffic Engineering, L3/L2 VPN, Multicast VPN, CSC, Carrier Ethernet, SP Security, SP QoS, etc.
- Weaken but include traditional access technology like ATM, Frame-relay, DSL, Cable, etc.
- Exclude transport and access technology which have unique essential/certification like Optical, Wireless.
# CCIE SP Written Exam: Topics

<table>
<thead>
<tr>
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<td>1.11</td>
<td>Describe, Implement, Optimize and Troubleshoot High availability</td>
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<tr>
<td>1.12</td>
<td>Describe, Implement, Optimize and Troubleshoot Convergence</td>
</tr>
<tr>
<td>1.13</td>
<td>Describe, Implement, Optimize and Troubleshoot Security in the core</td>
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<td>2.2</td>
<td>Describe, Implement, Optimize and Troubleshoot PPP connections</td>
</tr>
<tr>
<td>2.3</td>
<td>Describe, Implement, Optimize and Troubleshoot SONET/SDH connections</td>
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<tr>
<td>2.4</td>
<td>Describe, Implement, Optimize and Troubleshoot Frame-relay connections</td>
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<tr>
<td>2.5</td>
<td>Describe, Implement, Optimize and Troubleshoot ATM connections</td>
</tr>
<tr>
<td>2.6</td>
<td>Describe, Implement, Optimize and Troubleshoot T1/T3 and E1/E3 services.</td>
</tr>
</tbody>
</table>

[https://learningnetwork.cisco.com/docs/DOC-10123](https://learningnetwork.cisco.com/docs/DOC-10123)
### CCIE SP Written Exam: Topics

**3 Describe, Implement, Optimize and Troubleshoot Remote Access Technologies**

| 3.1 | Describe, Implement, Optimize and Troubleshoot IP over DSL to the customer |
| 3.2 | Describe, Implement, Optimize and Troubleshoot IP over wire line to the customer |
| 3.3 | Describe, Implement, Optimize and Troubleshoot IP over Cable to the customer |

**4 Describe, Implement, Optimize and Troubleshoot L3VPN Technologies**

| 4.1 | Describe, Implement, Optimize and Troubleshoot Intra-AS L3VPN |
| 4.2 | Describe, Implement, Optimize and Troubleshoot Inter-AS L3VPN |
| 4.3 | Describe, Implement, Optimize and Troubleshoot Carrier Supporting Carrier (CSC) |
| 4.4 | Describe, Implement, Optimize and Troubleshoot L2TPv3 for L3VPN |
| 4.5 | Describe, Implement, Optimize and Troubleshoot VPN extranet, Internet access |
| 4.6 | Describe, Implement, Optimize and Troubleshoot VRF Service |
| 4.7 | Describe, Implement, Optimize and Troubleshoot Multicast VPN |
| 4.8 | Describe, Implement, Optimize and Troubleshoot L3VPN GRE |

**5 Describe, Implement, Optimize and Troubleshoot L2VPN Technologies**

| 5.1 | Describe, Implement, Optimize and Troubleshoot AToM |
| 5.2 | Describe, Implement, Optimize and Troubleshoot Carrier Ethernet |
| 5.3 | Describe, Implement, Optimize and Troubleshoot L2TPv3 for L2 VPN |
| 5.4 | Describe, Implement, Optimize and Troubleshoot L2VPN QoS |
| 5.5 | Describe, Implement, Optimize and Troubleshoot L2VPN GRE |
Describe, Implement, Optimize and Troubleshoot Managed Services Traversing the Core

6.1 Describe, Implement, Optimize and Troubleshoot Managed Voice/Video services
6.2 Describe, Implement, Optimize and Troubleshoot Managed Security services
6.3 Describe, Implement, Optimize and Troubleshoot Service Level Agreements for managed services traversing the core

Describe Service Provider Network implementing principle

7.1 Given a Service Provider network design change or new service, identify the success criteria
7.2 Given a Service Provider network design change or new service, identify appropriate routing protocol
7.3 Given a Service Provider network design change or new service, identify appropriate tunneling protocol
7.4 Given a Service Provider network design change or new service, identify improving convergence method
7.5 Given a Service Provider network design change or new service, identify improving scalability method
7.6 Given a Service Provider network design change or new service, identify improving reliability method
7.7 Given a Service Provider network design change or new service, identify improving management method
7.8 Given a Service Provider network design change or new service, identify improving QOS method
7.9 Given a Service Provider network design change or new service, identify improving security method
CCIE SP Written Exam: Checklist

CCIE Service Provider Written Exam Checklist v3.0 (back-up) - The Cisco Learning Network...

https://learningnetwork.cisco.com/docs/DOC-10124
Section 3: CCIE Service Provider Practical Exam
CCIE Service Provider Lab Exam

- Candidates build a service provider network to a series of supplied specifications
- The point values for each question are shown on the exam
- Some questions depend upon completion of previous parts of the network
- It’s not a design test, nor is a test of “best practices” for use in field
Service Provider Lab Exam: Locations

Eight fixed CCIE Lab Locations for Service Provider
Mobile labs happen worldwide
Service Provider Lab Exam: Changes

- The CCIE Service provider Lab exam content was revised and implemented worldwide on April 2011, to include some of the current trends and technologies in the SP industry.
- New topics and hardware and software upgrades have been introduced.
- End-of-Life devices were also removed and replaced:
  - 3700, 3600 and 2600 were removed.
  - Routers were replaced with XR12000 and Cisco7200/7600.
  - Catalyst 3550 Switches were replaced with ME3400.
SP Lab Exam: Equipment and Software Versions

- Cisco XR12000 series router running 3.9.1
- Cisco 7200/7600 series router running 12.2-33.SRE
- Cisco ME3400E series running version 12.2-54.SE

Lab May Test Any Feature That Can Be Configured on the Equipment and Cisco IOS-XR/IOS Versions Listed above, or on the CCIE Website; More Recent Versions May Be Installed in the Lab, But You Won’t Be Tested on Them

https://learningnetwork.cisco.com/docs/DOC-10121
SP Lab Exam: What’s new

- IOS-XR integrating with IOS
- IPv6 routing
- Enhanced MPLS TE: Inter-Area and Inter-AS, FRR, DS-TE
- Enhanced L3VPN: 6VPE, CSC
- Enhanced L2VPN: VPLS on IOS-XR, Inter-AS L2VPN, Redundancy
- Enhanced Multicast VPN: Inter-AS MVPN
### SP Lab Exam: Topics

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<td>2.3</td>
<td>Implement, Optimize and Troubleshoot IP over wire line to the customer</td>
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[https://learningnetwork.cisco.com/docs/DOC-9991](https://learningnetwork.cisco.com/docs/DOC-9991)
# SP Lab Exam: Topics

## 3 Implement, Optimize and Troubleshoot L3VPN Technologies

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## 4 Implement, Optimize and Troubleshoot L2VPN Technologies

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</table>
SP Lab Exam: Checklist

https://learningnetwork.cisco.com/docs/DOC-10145
SP Lab Exam: Pre-Configuration

The Routers and Switches in Your Topology Are Preconfigured With:

- Basic IPv4/IPv6 addressing, hostname, passwords
- Switching: Trunking, VTP, VLANs
- WAN: Frame Relay DLCI mappings, HDLC, PPP
- Routing Basic: IS-IS, OSPFv2/v3, RIPv2, EIGRP, BGP
- VPN Basic: VRF, MP-BGP
- All pre-configured passwords are ‘cisco’ or with username/password of ‘cisco/cisco’
- Occasionally, security devices may also have some pre-configuration. If not, candidate is required to initialize all security devices

Do Not Change Any Pre-Configuration on Any Devices Unless Explicitly Stated in a Question
The candidate PC has browsers to read lab exam content and access all devices consoles by clicking correspondent device icons.
SP Lab Exam: Lab Delivery System

- Web GUI delivering all the exam content (questions, diagrams, guidelines, access to devices, documentation)
- Transparent servers backend managing the user sessions and holding the IOU instances for each user
- Benefits:
  - Flexibility in content delivery format
  - Content updates effective globally immediately
- No printed exam workbook
Service Provider Lab Exam: Grading

- Proctors grade all lab exams
- Automatic tools aid proctors with simple grading tasks
- Automatic tools are never solely responsible for lab exam grading—proctors are
- Proctors complete grading of the exam and submits the final score within 48 hours
- No Partial credit awarded on questions
- Points are awarded for working solutions only
- Some questions have multiple solutions
Section 4: CCIE Service Provider Sample Lab
SP Sample Lab: Topology

- IS-IS IPv4/IPv6
- OSPF IPv4/IPv6
- BGP unicast IPv4/IPv6
- MPLS LDP
- MPLS TE
- MPLS TE FRR
- MP-BGP Intra-AS VPNv4
- MP-BGP Inter-AS VPNv4
- CSC
- MP-BGP VPNv6 - 6VPE
- Multicast VPN
- AToM
- VPLS
- L2TPv3
SP Sample Lab: Addressing Scheme

- Backbone Carrier SP network Prefix: 2.2.0.0/24, 2002:2:2::/64
- Backbone Carrier SP router Loopback0: 2.2.0.Z/32, 2002:2:2::Z/128
- Customer Carrier SP/VPN network Prefix: 172.2.0.0/24, 2002:172:2::/64
- Customer Carrier SP/VPN router Loopback0: 172.2.0.Z/32, 2002:172:2::Z/128
- End Customer VPN network Prefix: 192.2.0.0/24
- End Customer VPN router Loopback0: 192.2.0.Z/32
- L2 VPN Customer network Prefix: 172.2.0.0/24
- L2 VPN Customer router Loopback0: 172.2.0.Z/32

- “Z” is router number, for example “Z” value for R12 is “12”
SP Sample Lab: Setup

- **Hardware**
  - Two XR-12404 with two GigabitEthernet interfaces or equivalent
  - Thirteen Cisco 7200 series routers with Ethernet interfaces or equivalent
  - Three Cisco 3560G series or equivalent

- **Software Operating System**
  - XR12000-iosxr-k9-3.9.1.tar
  - c7200-spservices-mz.122-33.SRE3.bin
  - c3560-advipservicesk9-mz.122-46.SE.bin
Configure IS-IS on above routers into area of 47.0002 and put all routers into level-1.

Ensure all routers have IS-IS IPv4 and IPv6 routes and can ping each other.
- Configure OSPFv2 and OSPFv3 on above routers in area 0
- Ensure all routers have OSPF IPv4 and IPv6 routes and can ping each other
- Configure IBGP IPv4/IPv6 unicast between R7 and R9
- Configure EBGP IPv4/IPv6 unicast between R6 and R9
- Ensure Loopback0 IPv4/IPv6 network is seen as BGP routes and they can ping each other
- Enable MPLS LDP on above routers, use loopback 0 IP address as router-id
- IS-IS is acting as unicast routing protocol
Configure MPLS TE tunnel 89 on R8, the tunnel path follows through R7 and R2 to reach R9

Configure Tunnel bandwidth of 2Mbps

Configure static route so that traffic from R8 to R9 loopback0 follow the tunnel 89
- The Primary tunnel 89 on R8 has configured in last question
- Configure Backup tunnel 279 on R2 to protect the Ethernet link between R2 and R9. Tunnel 279 is from R2 to R9 through R7. If R2 Eth0/2 detect link problem, it switches Tunnel 89 traffic into tunnel 279
Configure BGP VPNv4 on R2, R7, R8 and R9, configure R9 as VPNv4 Route Reflector for R2, R7 and R8

Configure ABC VPN sites 1, 2, 3 and 4, ensure the four sites can reach each other.
Configure Inter-AS BGP VPNv4 unicast on R6 and R9, ensure they can exchange VPNv4 unicast information.

Configure VPN site 2, 3, 4 and 5. Ensure these sites have full reachability between each other.

You are permitted to define static host route on R9.
CSC Sub Topology
R2, R7, R8 and R9 form Backbone Provider at AS 2. R6 is another Backbone Provider at AS 1002

Configure EBGPv4+labels on R8 and R3 at ABC site 2

Configure IGP+LDP on R7 and R1 at ABC site 3

Configure R1 and R3 to establish IBGP VPNv4 to distribute VRF QAZ VPN information

Ensure R16 and R18 can ping each other

Configure IGP+LDP on R6 and R12 at ABC site 5

Configure R3 and R12 to establish EBGP VPNv4 to distribute VRF QAZ VPN information, R1 and R12 are not be permitted to establish EBGP VPNv4 session

Ensure R16, R17 and R18 can ping each other
MP-BGP VPNv6 6VPE Question

- Configure R2, R7, R8 and R9 to support MP-BGP intra AS VPNv6 (6VPE) information exchange. R9 is VPNv6 route-reflector to R2, R7 and R8.
- Ensure R1, R3 and R5 can ping each other via IPv6

- Configure MP-BGP Inter-AS VPNv6 (6VPE) on R6 and R9
- Ensure R1, R3, R5 and R12 can ping each other via IPv6.
Multicast VPN Question

- Configure default MDT address 239.255.13.27
- Configure R2 loopback 0 as RP for AS 2, use BSR method to distribute RP. Configure R6 loopback 0 as RP for AS 1002
- Configure MSDP between R2 and R6, use loopback 0 IP address as source IP
- Configure R1 loopback 0 as RP for ABC site 2, 3, 4 and 5. Use static method to define RP
- Configure R1, R3, R5 and R12 loopback 0 to join multicast group of 239.255.X.X (X is router number). Ensure R1, R3, R5 and R12 can ping these multicast group

- Configure MP-BGP IPv4 MDT between R2, R7, R8 and R9, R9 is route-reflector
- Configure MP-BGP IPv4 MDT between R6 and R9
- Ensure multicast VPN source and group information be distributed among R2, R7, R8, R9 and R6
- Configure R7 and R8 to support VLAN and Frame-Relay interworking of AToM
- Ensure R11 and VLAN 178 can ping each other
- Configure R8 and R9 to provide VPLS service to connect VLAN 98
- Change VLAN spanning tree priority on Sw2 so that Sw2 is root for VLAN 98

Note: VPLS on IOS-XR supports only Bridge group mode on current version
Configure R6 and R8 to establish an L2TPv3 session
Configure L2TPv3 to support ipv4 interworking
Ensure VLAN 158 on R15 connects with PPP on R13 and they can ping each other
Refer to below URL for configuration and verification

- https://learningnetwork.cisco.com/thread/30106
- https://learningnetwork.cisco.com/thread/30107
- https://learningnetwork.cisco.com/thread/30108
- https://learningnetwork.cisco.com/thread/30109
- https://learningnetwork.cisco.com/thread/30110
- https://learningnetwork.cisco.com/thread/30111
- https://learningnetwork.cisco.com/thread/30112
Section 5: Preparation Resources and Test-Taking Tips
Planning Resources

- There is an abundance of material available to prepare for the CCIE certification. However, you have to be very selective of the material you choose to use.
- Choose materials that offer configuration examples and take a “hands-on” approach.
- Look for materials approved or provided by Cisco and its Learning Partners.
- Customize your study plan to reflect your own personal strengths and weaknesses.
Assessing Strengths

- Evaluate your experience and knowledge in the major topic areas listed on blueprint
- Using the content **blueprint**, determine your experience and knowledge level in the major topic areas
- For areas of **strength**: practice for speed
- For **weaker** areas: boost knowledge with training or book study first, then practice
Books

https://learningnetwork.cisco.com/docs/DOC-10002
On-line Resources

https://learningnetwork.cisco.com/docs/DOC-10144
CCIE Service Provider Suggested Training v3.0 - The Cisco Learning Network - Windows In...

https://learningnetwork.cisco.com/docs/DOC-10088
SP Study Group

https://learningnetwork.cisco.com/groups/ccie-sp-study-group
Practice Labs

- Practice lab exercises with a high level of complexity will assist you in making improvements in your exam strategy and identifying areas requiring extra study. Practice labs can be used to gauge your readiness and help identify your strengths and weaknesses. This will help you refocus and revise your study plan and adjust it according to your findings.

- Technical skill is not the only thing you need to work on; time management and your exam-taking strategy is also important to succeed in the CCIE exam. Practice labs also assist you in improving your time management and test-taking approach.
Lab Exam Tips

- Reduce stress—arrive early
- Leave yourself time—exam can run over
- Read entire exam
- Redraw topology to clarify scenario
- Manage your time
- Make no assumptions
- Keep a list
- Work questions as a unit
- Test your work
- Save configurations often
- Minimize last-minute changes
Lab Exam Proctors

- Proctor’s role is to keep exam fair
- Talk to proctor if you don’t understand a question
- Ask the proctor clarifying questions
- Report any equipment or technical problems to the proctor as soon as it occurs
For More Information

- **Beware of Rumors**
- Visit the Cisco Learning Network for more on CCIE Service Provider certification and interaction with other candidates
  
  www.cisco.com/go/learningnetwork

- **Contact support:**
  
  www.cisco.com/go/certsupport

- **Report cheating:**
  
  ccie-nda-enforcement@cisco.com
Recommended Reading

Source: Cisco Press
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