CCIE Service Provider Unified Exam Topics 4.1

Exam Description: The Cisco CCIE® Service Provider Version 4.1 exam unifies written and lab exam topics documents into a unique curriculum, while explicitly disclosing which domains pertain to which exam, and the relative weight of each domain.

The Cisco CCIE® Service Provider **Written Exam** (400-201) is a two-hour test with 90–110 questions that validate professionals who have the expertise to design, implement, diagnose, and troubleshoot complex Service Provider highly available network infrastructure and services based on dual stack solutions (IPv4 and IPv6); understand how the network and service components interoperate; and understand the functional requirements and translate into specific device configurations. The exam is closed book and no outside reference materials are allowed.

An Evolving Technologies section is included in the Written exam only. It will enable candidates to bridge their core technology expertise with knowledge of the evolving technologies that are being adopted at an accelerated pace, such as cloud, IoT, and network programmability.

The Cisco CCIE® Service Provider **Lab Exam** is an eight-hour, hands-on exam which requires a candidate to configure, diagnose, and troubleshoot a series of complex network scenarios for a given specification based on dual stack solutions (IPv4 and IPv6). Knowledge of troubleshooting is an important skill and candidates are expected to diagnose and solve issues as part of the CCIE lab exam. The candidate will not configure all end-user system; however, the candidate is responsible for all devices residing in the network.

The following 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. In order to better reflect the contents of the exam and for clarity purposes, the guidelines below may change at any time without notice.

Domain Number	Domain	Written Exam Percentage (%)	Lab Exam Percentage (%)
1.0	Core Routing	25	30
2.0	Service Provider Architecture and Services	21	22
3.0	Access and Aggregation	18	21
4.0	High Availability and Fast Convergence	14	15
5.0	Service Provider Security, Operation, and Management	12	12
6.0	Evolving Technologies	10	n/a

1.0 **Core Routing**
1.1. Interior Gateway Protocol
       1.1.a. Describe, implement, and troubleshoot IS-IS
       1.1.b. Describe, implement, and troubleshoot OSPFv2 and OSPFv3
       1.1.c. Describe and optimize IGP scale and performance
1.2. Border Gateway Protocol
       1.2.a. Describe, implement, and troubleshoot IBGP, EBGP, and MP-BGP
       1.2.b. Describe, implement, and troubleshoot BGP route policy enforcement
       1.2.c. Describe BGP path attribute
       1.2.d. Describe and optimize BGP scale and performance
       1.2.e. Describe, implement, and troubleshoot advanced BGP features
1.3. Multiprotocol Label Switching
       1.3.a. Describe MPLS forwarding and control plane mechanisms
       1.3.b. Describe, implement, and troubleshoot LDP
       1.3.c. Describe and optimize LDP scale and performance
1.4. MPLS Traffic Engineering
       1.4.a. Describe, implement, and troubleshoot RSVP
       1.4.b. Describe, implement, and troubleshoot ISIS and OSPF extensions
       1.4.c. Describe, implement, and troubleshoot MPLS TE policy enforcement
       1.4.d. Describe MPLS TE attributes
       1.4.e. Describe and optimize MPLS TE scale and performance
       1.4.f. Describe, implement, and troubleshoot MPLS advanced features, for example: Segment
            Routing and MPLS-TE Inter-AS
1.5. Multicast
       1.5.a. Describe, implement, and troubleshoot PIM (PIM-SM, PIM-SSM, and PIM-BIDIR)
       1.5.b. Describe, implement, and troubleshoot RP (Auto-RP, BSR, Static, Anycast RP, and MSDP)
       1.5.c. Describe, implement, and troubleshoot mVPN
       1.5.d. Describe and optimize multicast scale and performance
1.6. Quality of Service
       1.6.a. Describe, implement, and troubleshoot classification and marking
       1.6.b. Describe, implement, and troubleshoot congestion management and scheduling
       1.6.c. Describe, implement, and troubleshoot congestion avoidance
       1.6.d. Describe, implement, and troubleshoot MPLS QoS models (Pipe, Short Pipe, and Uniform)
       1.6.e. Describe, implement, and troubleshoot MPLS TE QoS (MAM, RDM, CBTS, PBTS, and DS-TE)

2.0 **Service Provider Architecture and Services**
2.1. Service provider architecture concepts
       2.1.a. Describe network architecture component and service provider network domains, for
            example: PE, P, CE, Metro Ethernet Core, Aggregation, RAN Backhaul, and eNodeB
       2.1.b. Describe Cisco IOS, Cisco IOS-XE, and Cisco IOS-XR software architecture components, for
            example: XR Kernel, System Manager, and Interprocess communication
2.2. Virtualization concepts
       2.2.a. Describe physical router virtualization, for example: SDR, Multiple-Logical-Routers, and
            Satellite Network Virtualization
       2.2.b. Describe Network Function Virtualization architecture concepts, for example: Service
            Function Chaining, ESP, EPN, and NFVI

2.3. Carrier Ethernet
      2.3.a. Describe, implement, and troubleshoot E-LINE, for example: VPWS
      2.3.b. Describe, implement, and troubleshoot E-LAN and E-TREE, for example: VPLS and H-VPLS
      2.3.c. Describe, implement, and troubleshoot EVPN
      2.3.d. Describe IEEE 802.1ad (Q-in-Q), IEEE 802.1ah (Mac-in-Mac), and ITU G.8032 (REP)

2.4. L3VPN
      2.4.a. Describe, implement, and troubleshoot L3VPN
      2.4.b. Describe, implement, and troubleshoot Inter-AS L3VPN
      2.4.c. Describe, implement, and troubleshoot multicast VPN
      2.4.d. Describe, implement, and troubleshoot unified MPLS and CSC
      2.4.e. Describe, implement, and troubleshoot shared services, for example: Extranet and
          Internet access

2.5. Overlay VPN
      2.5.a. Describe, implement, and troubleshoot L2TPv3
      2.5.b. Describe LISP

2.6. Internet service
      2.6.a. Describe, implement, and troubleshoot IPv6 transition mechanism, for example: NAT44,
          NAT64, 6RD, MAP, and DS Lite
      2.6.b. Describe, implement, and troubleshoot Internet peering route and transit policy
          enforcement

3.0 Access and Aggregation

3.1. Transport and encapsulation technologies
      3.1.a. Describe transport technologies, for example: optical, xDSL, DOCSIS, TDM, and GPON
      3.1.b. Describe Ethernet technologies
      3.1.c. Describe, implement, and troubleshoot link aggregation techniques

3.2. PE-CE connectivity
      3.2.a. Describe, implement, and troubleshoot PE-CE routing protocols, for example: static, OSPF,
          RIP, RIPng, EIGRP, ISIS, and BGP
      3.2.b. Describe, implement, and troubleshoot route redistribution
      3.2.c. Describe, implement, and troubleshoot route filtering
      3.2.d. Describe, implement, and troubleshoot loop prevention techniques in multihomed
          environments
      3.2.e. Describe, implement, and troubleshoot Multi-VRF CE

3.3. Quality of Service
      3.3.a. Describe, implement, and troubleshoot classification and marking
      3.3.b. Describe, implement, and troubleshoot congestion management and scheduling, for
          example: policing, shaping, and queuing
      3.3.c. Describe, implement, and troubleshoot congestion avoidance

3.4. Multicast
      3.4.a. Describe, implement, and troubleshoot IGMP and MLD
      3.4.b. Describe, implement, and troubleshoot PIM
      3.4.c. Describe, implement, and troubleshoot RP
      3.4.d. Describe and optimize multicast scale and performance

4.0 High Availability and Fast Convergence

4.1. System level HA

      4.1.a. Describe Multichassis/clustering HA

      4.1.b. Describe, implement, and troubleshoot SS0/NSF, NSR, and GR

      4.1.c. Describe, implement, and troubleshoot IGP-LDP Sync

      4.1.d. Describe, implement, and troubleshoot LDP Session Protection

4.2. Layer 1/2/3 failure detection techniques

      4.2.a. Describe Layer 1 failure detection

      4.2.b. Describe, implement, and troubleshoot Layer 2 failure detection

      4.2.c. Describe, implement, and troubleshoot Layer 3 failure detection

4.3. Routing/fast convergence

      4.3.a. Describe, implement, and optimize IGP convergence

      4.3.b. Describe, implement, and optimize BGP convergence

      4.3.c. Describe, implement, and optimize IP FRR and MPLS TE FRR

5.0 Service Provider Security, Operation, and Management

5.1. Control plane security

      5.1.a. Describe, implement, and troubleshoot control plane protection techniques, for example: LPTS and CoPP

      5.1.b. Describe, implement, and troubleshoot routing protocol security, for example: BGP-TTL security and protocol authentication

      5.1.c. Describe, implement, and troubleshoot BGP prefix suppression

      5.1.d. Describe, implement, and troubleshoot LDP security, for example: authentication and label allocation filtering

      5.1.e. Describe, implement, and troubleshoot BGP prefix based filtering

      5.1.f. Describe, implement, and troubleshoot BGPsec

5.2. Management plane security

      5.2.a. Describe, implement, and troubleshoot device management, for example: MPP, SSH, VTY

      5.2.b. Describe, implement, and troubleshoot logging and SNMP security

      5.2.c. Describe backscatter Traceback

5.3. Infrastructure security

      5.3.a. Describe, implement, and troubleshoot uRPF

      5.3.b. Describe Lawful-intercept

      5.3.c. Describe, implement, and troubleshoot iACL

      5.3.d. Describe, implement, and troubleshoot RTBH

      5.3.e. Describe, implement, and troubleshoot BGP Flowspec

      5.3.f. Describe DDoS mitigation techniques

5.4. Timing and synchronization

      5.4.a. Describe timing protocol, for example: NTP, 1588v2, and SyncE

5.5. Network monitoring and troubleshooting

      5.5.a. Describe, implement, and troubleshoot syslog and logging functions

      5.5.b. Describe, implement, and troubleshoot SNMP traps, RMON, EEM, and EPC

      5.5.c. Describe, implement, and troubleshoot NetFlow and IPFIX

      5.5.d. Describe, implement, and troubleshoot IP SLA

      5.5.e. Describe, implement, and troubleshoot MPLS OAM and Ethernet OAM

5.6. Network configuration and change management

      5.6.a. Describe configuration change, implementation, and rollback

6.0 Evolving Technologies

6.1 Cloud

      6.1.a Compare and contrast Cloud deployment models

            6.1.a [i] Infrastructure, platform, and software services (XaaS)

            6.1.a [ii] Performance and reliability

            6.1.a [iii] Security and privacy

            6.1.a [iv] Scalability and interoperability

      6.1.b Describe Cloud implementations and operations

            6.1.b [i] Automation and orchestration

            6.1.b [ii] Workload mobility

            6.1.b [iii] Troubleshooting and management

            6.1.b [iv] OpenStack components

6.2 Network Programmability (SDN)

      6.2.a Describe functional elements of network programmability (SDN) and how they interact

            6.2.a [i] Controllers

            6.2.a [ii] APIs

            6.2.a [iii] Scripting

             6.2.a [iv] Agents

            6.2.a [v] Northbound vs. Southbound protocols

      6.2.b Describe aspects of virtualization and automation in network environments

            6.2.b [i] DevOps methodologies, tools and workflows

            6.2.b [ii] Network/application function virtualization (NFV, AFV)

            6.2.b [iii] Service function chaining

            6.2.b [iv] Performance, availability, and scaling considerations

6.3 Internet of Things (IoT)

      6.3.a Describe architectural framework and deployment considerations for Internet of Things

            6.3.a [i] Performance, reliability and scalability

            6.3.a [ii] Mobility

            6.3.a [iii] Security and privacy

            6.3.a [iv] Standards and compliance

            6.3.a [v] Migration

            6.3.a [vi] Environmental impacts on the network