CCIE Service Provider Written Exam
Version 4.0 (400-201)

Exam Description: The Cisco CCIE® Service Provider Written Exam (400-201) version 4.0 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.

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.

10% 1.0 Service Provider Architecture and Evolution

1.1 Service Provider Architecture Concepts
- 1.1.a Describe network architecture component and Service Provider network domain, for example, PE, P, CE, Metro Ethernet Core, and Aggregation
- 1.1.b Describe platform architecture components, for example, RP, Line Cards, and Fabric Crossbar
- 1.1.c Describe Cisco IOS-XR Software architecture components, for example, System Manager and XR Kernel

1.2 Virtualization Concepts
- 1.2.a Describe basic physical router virtualization, for example, SDR and nV
- 1.2.b Describe basic network function virtualization, for example, XRv/CSR1000v

1.3 Mobility Concepts
- 1.3.a Describe basic Service Provider network mobility infrastructure, for example, RAN, Backhaul, and Core

23% 2.0 Core Routing

2.1 Interior Gateway Protocol (IGP)
- 2.1.a Describe, implement, and troubleshoot IS-IS
- 2.1.b Describe, implement, and troubleshoot OSPFv2 and OSPFv3
- 2.1.c Describe and optimize IGP scale and performance

2.2 Border Gateway Protocol (BGP)
- 2.2.a Describe, implement, and troubleshoot IBGP, EBGP, and MP-BGP
- 2.2.b Describe, implement, and troubleshoot BGP route policy enforcement
- 2.2.c Describe BGP path attribute

2.2.d Describe and optimize BGP scale and performance
2.2.e Describe, implement, and troubleshoot advanced BGP features, for example, add-path and BGP LS

2.3 Multiprotocol Label Switching (MPLS)
2.3.a Describe MPLS forwarding and control plane mechanisms
2.3.b Describe, implement, and troubleshoot LDP
2.3.c Describe and optimize LDP scale and performance

2.4 MPLS Traffic Engineering
2.4.a Describe, implement, and troubleshoot RSVP
2.4.b Describe, implement, and troubleshoot IS-IS and OSPF extensions
2.4.c Describe, implement, and troubleshoot MPLS TE policy enforcement
2.4.d Describe MPLS TE attributes
2.4.e Describe and optimize MPLS TE scale and performance
2.4.f Describe MPLS advanced features, for example, Segment Routing, G-MPLS, MPLS-TP, and MPLS-TE Inter-AS

2.5 Multicast
2.5.a Describe, implement, and troubleshoot PIM (PIM-SM, PIM-SSM, and PIM-BIDIR)
2.5.b Describe, implement, and troubleshoot RP (Auto-RP, BSR, Static, Anycast RP, and MSDP)
2.5.c Describe, implement, and troubleshoot mLDP (including mLDP profiles from 0 to 9)
2.5.d Describe P2MP TE
2.5.e Describe and optimize multicast scale and performance

2.6 Quality of Service (QoS)
2.6.a Describe, implement, and troubleshoot classification and marking
2.6.b Describe, implement, and troubleshoot congestion management and scheduling, for example, policing, shaping, and queuing
2.6.c Describe, implement, and troubleshoot congestion avoidance
2.6.d Describe, implement, and troubleshoot MPLS QoS models (MAM, RDM, Pipe, Short Pipe, and Uniform)
2.6.e Describe, implement, and troubleshoot MPLS TE QoS (CBTS, PBTS, and DS-TE)

23% 3.0 Service Provider Based Services

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

3.2 L3VPN
3.2.a Describe, implement, and troubleshoot L3VPN
3.2.b Describe, implement, and troubleshoot Inter-AS L3VPN
3.2.c Describe, implement, and troubleshoot Multicast VPN
3.2.d Describe, implement, and troubleshoot Unified MPLS and CSC

3.2.e Describe, implement, and troubleshoot shared services, for example, Extranet and Internet access

3.3 Overlay VPN
- 3.3.a Describe, implement, and troubleshoot L2TPv3
- 3.3.b Describe, implement, and troubleshoot LISP
- 3.3.c Describe, implement, and troubleshoot GRE and mGRE based VPN

3.4 Internet Service
- 3.4.a Describe, implement, and troubleshoot Internet Peering and Transit
- 3.4.b Describe, implement, and troubleshoot IPv6 transition mechanism, for example, NAT44, NAT64, 6RD, and DS Lite
- 3.4.c Describe, implement, and troubleshoot Internet peering route and transit policy enforcement

17% 4.0 Access and Aggregation

4.1 Transport and Encapsulation Technologies
- 4.1.a Describe transport technologies, for example, optical, DSL, DOCSIS, TDM, and GPON
- 4.1.b Describe, implement, and troubleshoot Ethernet technologies
- 4.1.c Describe link aggregation techniques

4.2 PE-CE Connectivity
- 4.2.a Describe, implement, and troubleshoot PE-CE routing protocols, for example, static, OSPF, and BGP
- 4.2.b Describe, implement, and troubleshoot route redistribution
- 4.2.c Describe, implement, and troubleshoot route filtering
- 4.2.d Describe, implement, and troubleshoot loop prevention techniques in Multihomed environments
- 4.2.e Describe, implement, and troubleshoot end-to-end fast convergence
- 4.2.f Describe, implement, and troubleshoot Multi-VRF CE
- 4.2.g Describe Broadband Forum TR-101, for example, Trunk N:1 and Trunk 1:1

4.3 Quality of Service
- 4.3.a Describe, implement, and troubleshoot classification and marking
- 4.3.b Describe, implement, and troubleshoot congestion management and scheduling, for example, policing, shaping, and queuing
- 4.3.c Describe, implement, and troubleshoot congestion avoidance
- 4.3.d Describe Link Fragmentation (LFI), cRTP, and RTP

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

10% 5.0 High Availability and Fast Convergence

5.1 System Level HA

5.1.a Describe Multichassis/clustering HA
5.1.b Describe, implement, and troubleshoot SS0/NSF, NSR, and GR
5.1.c Describe, implement, and troubleshoot IGP-LDP Sync
5.1.d Describe, implement, and troubleshoot LDP Session Protection

5.2 Layer 1/2/3 Failure Detection Techniques
5.2.a Describe Layer 1 failure detection
5.2.b Describe, implement, and troubleshoot Layer 2 failure detection
5.2.c Describe, implement, and troubleshoot Layer 3 failure detection

5.3 Routing/Fast Convergence
5.3.a Describe, implement, and optimize IGP convergence
5.3.b Describe, implement, and optimize BGP convergence
5.3.c Describe, implement, and optimize IP FRR and MPLS TE FRR

17% 6.0 Service Provider Security, Service Provider Operation and Management

6.1 Control Plane Security
6.1.a Describe, implement, and troubleshoot control plane protection techniques (LPTS and CoPP)
6.1.b Describe, implement, and troubleshoot routing protocol security, for example, BGP-TTL security and protocol authentication
6.1.c Describe, implement and troubleshoot BGP prefix suppression
6.1.d Describe, implement and troubleshoot LDP security, for example, authentication and label allocation filtering
6.1.e Describe, implement, and troubleshoot BGP prefix based filtering
6.1.f Describe BGPsec

6.2 Management Plane Security
6.2.a Describe, implement, and troubleshoot device management, for example, MPP, SSH, and VTY
6.2.b Describe, implement, and troubleshoot logging and SNMP security
6.2.c Describe backscatter Traceback

6.3 Infrastructure Security
6.3.a Describe, implement, and troubleshoot uRPF
6.3.b Describe Lawful-intercept
6.3.c Describe, implement, and troubleshoot iACL
6.3.d Describe, implement, and troubleshoot RTBH
6.3.e Describe BGP Flowspec
6.4.f Describe DDoS mitigation techniques

6.4 Timing and Synchronization
6.4.a Describe, implement, and troubleshoot timing protocol, for example, NTP, 1588v2, and SyncE

6.5 Network Monitoring and Troubleshooting
6.5.a Describe, implement, and troubleshoot syslog and logging functions
6.5.b Describe, implement, and troubleshoot SNMP traps, RMON, EEM, and EPC

- 6.5.c Describe, implement, and troubleshoot port mirroring protocols, for example, SPAN, RSPAN, and ERSPAN
- 6.5.d Describe, implement and troubleshoot NetFlow and IPFIX
- 6.5.e Describe, implement, and troubleshoot IP SLA
- 6.5.f Describe, implement, and troubleshoot MPLS OAM and Ethernet OAM
- 6.5.g Describe network event and fault management
- 6.5.h Describe performance management and capacity procedures

6.6 Network Configuration and Change Management

- 6.6.a Describe maintenance, operational procedures
- 6.6.b Describe network inventory management process
- 6.6.c Describe network change, implementation, and rollback
- 6.6.d Describe incident management process based on ITILv3 framework