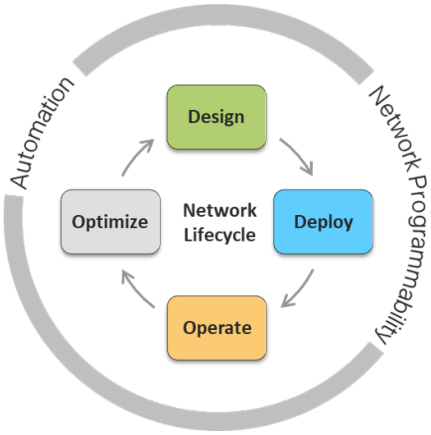
# CCIE Service Provider (v5.0) Exam Topics – Practical Exam

**Exam Description:** The Cisco CCIE Service Provider (v5.0) Practical Exam is an eight-hour, hands-on exam that requires a candidate to plan, design, implement, operate, and optimize dual stack solutions (IPv4 and IPv6) of complex Service Provider networks.




Candidates are expected to program and automate the network within their exam, as per exam topics below.

The following topics are general guidelines for the content likely to be included on the exam. Your knowledge, skills and abilities on these topics will be tested throughout the entire network lifecycle, unless explicitly specified otherwise within this document.

The exam is closed book and no outside reference materials are allowed.

## 1. Core Routing (25%)

1.1 Interior Gateway Protocol
- 1.1.a IS-IS
- 1.1.b OSPFv2 and OSPFv3
- 1.1.c Optimize IGP scale and performance
- 1.1.d IS-IS segment routing control plane for IPv4 and IPv6
- 1.1.e OSPFv2 and OSPFv3 segment routing control plane

1.2 Border Gateway Protocol
- 1.2.a IBGP, EBGP, and MP-BGP
- 1.2.b BGP route policy enforcement
- 1.2.c BGP path attribute
- 1.2.d BGP scale and performance
- 1.2.e BGP segments, BGP Labeled Unicast and Linked State

1.3 Multicast
- 1.3.a Design PIM (PIM-SM, PIM-SSM, and PIM-BIDIR)
- 1.3.b Design RP (Auto-RP, BSR, Static, Anycast RP, and MSDP)
- 1.3.c Design IGMP and MLD
- 1.3.d MLDP
- 1.3.e P2MP RSVP-TE

1.3.f Tree-sid

1.4 Multiprotocol Label Switching
- 1.4.a MPLS forwarding and control plane mechanisms
- 1.4.b LDP
- 1.4.c LDP scale and performance
- 1.4.d SR (SRGB and Max Labels Depth)
- 1.4.e LDP and SR Interworking - Segment routing mapping server

1.5 MPLS Traffic Engineering
- 1.5.a ISIS and OSPF extensions
- 1.5.b RSVP-TE
- 1.5.c MPLS TE policy enforcement
- 1.5.d MPLS LSP attributes
- 1.5.e SR-TE
- 1.5.f PCE and PCEP technology
- 1.5.g Flexible Algorithm
- 1.5.h Optimize MPLS TE scale and performance

## 2. Architectures and Services (25%)

2.1 Virtualized Infrastructure
- 2.1.a Design NFVI
- 2.1.b Design Cloud scale networking Infrastructure
- 2.1.c Design IaaS (Openstack) underlay architecture using Bare metal and Virtual Machines
- 2.1.d Design convergence, virtual scaling, network Slicing, edge distribution, in 5G Architecture

2.2 Large scale MPLS Architecture
- 2.2.a Unified MPLS
- 2.2.b Multi-domain Segment Routing with SR-PCE
- 2.2.c SLA based on IGP/TE metrics and Disjoint Paths

2.3 Carrier Ethernet
- 2.3.a E-LINE, E-LAN and E-TREE.
- 2.3.b VPWS, VPLS and H-VPLS
- 2.3.c EVPN, EVPN-VPWS, EVPN-IRB
- 2.3.d L2VPN service auto steering into segment routing policy

2.4 L3VPN
- 2.4.a L3VPN
- 2.4.b Inter-AS L3VPN
- 2.4.c Shared services, for example: Extranet and Internet access
- 2.4.d L3VPN service auto steering into segment routing policy

2.5 Internet service
- 2.5.a IPv4 translation mechanism, for example: NAT44, CGNAT
- 2.5.b IPv6 transition mechanism, for example: NAT64, 6RD, MAP, and DS Lite
- 2.5.c Internet peering route and transit policy enforcement

2.6 Multicast VPN
- 2.6.a Rosen mVPN
- 2.6.b NG mVPN

2.7 Quality of Service for Core, Distribution and Access
- 2.7.a Classification and marking
- 2.7.b Congestion management and scheduling
- 2.7.c Congestion avoidance
- 2.7.d MPLS QoS models (Pipe, Short Pipe, and Uniform)
- 2.7.e MPLS TE QoS (MAM, RDM, CBTS, PBTS, and DS-TE)

## 3. Access Connectivity (10%)

3.1 Layer-2 Connectivity
- 3.1.a IEEE 802.1ad (Q-in-Q), IEEE 802.1ah (Mac-in-Mac), and ITU G.8032, REP
- 3.1.b Spanning-Tree Access Gateway (MST-AG and PVST-AG)
- 3.1.c Design and Operate MC-LAG

3.2 Layer-3 Connectivity
- 3.2.a PE-CE routing protocols (OSPF, ISIS, and BGP)
- 3.2.b Loop prevention techniques in multihomed environments

## 4. High Availability and Fast Convergence (10%)

4.1 High Availability
- 4.1.a (SS0/NSF, NSR, and GR)

4.2 Routing/fast convergence
- 4.2.a IGP convergence
- 4.2.b LDP convergence
- 4.2.c BGP convergence - Prefix Independent Convergence (BGP-PIC)

4.2.d BFD
4.2.e LFA-FRR (LFA, Remote LFA and TI-LFA)
4.2.f MPLS TE FRR

## 5. Security (10%)

5.1 Control plane security
- 5.1.a Control plane protection techniques (LPTS and CoPP)
- 5.1.b Routing Protocol and LDP authentication and security
- 5.1.c BGP prefix-based and attribute-based filtering
- 5.1.d BGP-RPKI (Origin AS validation)

5.2 Management plane security
- 5.2.a Implement and troubleshoot device management (MPP, SSH, and VTY)
- 5.2.b Implement and troubleshoot logging and SNMP security
- 5.2.c Implement and troubleshoot AAA

5.3 Infrastructure security
- 5.3.a ACL
- 5.3.b uRPF
- 5.3.c RTBH and Router Hardening
- 5.3.d BGP Flowspec

## 6. Assurance and Automation (20%)

6.1 Network Assurance
- 6.1.a Syslog and logging functions
- 6.1.b SNMP traps and RMON
- 6.1.c NetFlow and IPFIX
- 6.1.d Segment Routing OAM and MPLS OAM
- 6.1.e Segment Routing Data Plane monitoring
- 6.1.f IP/MPLS Performance monitoring (TCP, UDP, ICMP and SR)
- 6.1.g Ethernet OAM (Y.1564 and Y.1731)

6.2 Network Automation
- 6.2.a Design, deploy and optimize NSO service packages (Yang model, template-based, python-based, fastmap, reactive fastmap, CLI NEDs, NETCONF NEDs, NSO northbound integration using REST and RESTCONF).
- 6.2.b Design NFV orchestration (NFVO) using NSO and ESC in an ETSI NFV architecture.
- 6.2.c Design and deploy Model-driven telemetry on XR devices (Yang models,

gRPC, GPB, device configuration, collection architecture)

6.2.d Deploy and Optimize Ansible playbook scripts that interacts with NSO, IOS-XE and IOS-XR devices