

Course Name: CCIE Routing & Switching

Version: v4.0

Course Time: 100 Hrs.

Course Prerequisites: CCNP Routing & Switching

Course Outline:

➤ **Implement Layer 2 Technologies**

- ❖ Implement Spanning Tree Protocol (STP)
 - 802.1d
 - 802.1w
 - 801.1s
 - Loop guard
 - Root guard
 - Bridge protocol data unit (BPDU) guard
 - Storm control
 - Unicast flooding
 - Port roles, failure propagation, and loop guard operation
- ❖ Implement VLAN and VLAN Trunking Protocol (VTP)
- ❖ Implement trunk and trunk protocols, EtherChannel, and load-balance
- ❖ Implement Ethernet technologies
 - Speed and duplex
 - Ethernet, Fast Ethernet, and Gigabit Ethernet
 - PPP over Ethernet (PPPoE)
- ❖ Implement Switched Port Analyzer (SPAN), Remote Switched Port Analyzer (RSPAN), and flow control
- ❖ Implement Frame Relay
 - Local Management Interface (LMI)
 - Traffic shaping
 - Full mesh
 - Hub and spoke
 - Discard eligible (DE)
- ❖ Implement High-Level Data Link Control (HDLC) and PPP

➤ **Implement IPv4**

- ❖ Implement IP version 4 (IPv4) addressing, subnetting, and variable-length subnet masking (VLSM)
- ❖ Implement IPv4 tunneling and Generic Routing Encapsulation (GRE)
- ❖ Implement IPv4 RIP version 2 (RIPv2)
- ❖ Implement IPv4 Open Shortest Path First (OSPF)
 - Standard OSPF areas
 - Stub area
 - Totally stubby area
 - Not-so-stubby-area (NSSA)
 - Totally NSSA
 - Link-state advertisement (LSA) types
 - Adjacency on a point-to-point and on a multi-access network
 - OSPF graceful restart
- ❖ Implement IPv4 Enhanced Interior Gateway Routing Protocol (EIGRP)
 - Best path
 - Loop-free paths
 - EIGRP operations when alternate loop-free paths are available, and when they are not available
 - EIGRP queries

- Manual summarization and autosummarization
- EIGRP stubs
- ❖ Implement IPv4 Border Gateway Protocol (BGP)
 - Next hop
 - Peering
 - Internal Border Gateway Protocol (IBGP) and External Border Gateway Protocol (EBGP)
- ❖ Implement policy routing
- ❖ Implement Performance Routing (PfR) and Cisco Optimized Edge Routing (OER)
- ❖ Implement filtering, route redistribution, summarization, synchronization, attributes, and other advanced Features
- **Implement IPv6**
 - ❖ Implement IP version 6 (IPv6) addressing and different addressing types
 - ❖ Implement IPv6 neighbor discovery
 - ❖ Implement basic IPv6 functionality protocols
 - ❖ Implement tunneling techniques
 - ❖ Implement OSPF version 3 (OSPFv3)
 - ❖ Implement EIGRP version 6 (EIGRPv6)
 - ❖ Implement filtering and route redistribution
- **Implement MPLS Layer 3 VPNs**
 - ❖ Implement Multiprotocol Label Switching (MPLS)
 - ❖ Implement Layer 3 virtual private networks (VPNs) on provider edge (PE), provider (P), and customer edge (CE) routers
 - ❖ Implement virtual routing and forwarding (VRF) and Multi-VRF Customer Edge (VRF-Lite)
- **Implement IP Multicast**
 - ❖ Implement Protocol Independent Multicast (PIM) sparse mode
 - ❖ Implement Multicast Source Discovery Protocol (MSDP)
 - ❖ Implement interdomain multicast routing
 - ❖ Implement PIM Auto-Rendezvous Point (Auto-RP), unicast rendezvous point (RP), and bootstrap router (BSR)
 - ❖ Implement multicast tools, features, and source-specific multicast
 - ❖ Implement IPv6 multicast, PIM, and related multicast protocols, such as Multicast Listener Discovery (MLD)
- **Implement Network Security**
 - ❖ Implement access lists
 - ❖ Implement Zone Based Firewall
 - ❖ Implement Unicast Reverse Path Forwarding (uRPF)
 - ❖ Implement IP Source Guard
 - ❖ Implement authentication, authorization, and accounting (AAA) (configuring the AAA server is not required, only the client-side (IOS) is configured)
 - ❖ Implement Control Plane Policing (CoPP)
 - ❖ Implement Cisco IOS Firewall
 - ❖ Implement Cisco IOS Intrusion Prevention System (IPS)
 - ❖ Implement Secure Shell (SSH)
 - ❖ Implement 802.1x
 - ❖ Implement NAT
 - ❖ Implement routing protocol authentication
 - ❖ Implement device access control
 - ❖ Implement security features

➤ **Implement Network Services**

- ❖ Implement Hot Standby Router Protocol (HSRP)
- ❖ Implement Gateway Load Balancing Protocol (GLBP)
- ❖ Implement Virtual Router Redundancy Protocol (VRRP)
- ❖ Implement Network Time Protocol (NTP)
- ❖ Implement DHCP
- ❖ Implement Web Cache Communication Protocol (WCCP)

➤ **Implement Quality of Service (QoS)**

- ❖ Implement Modular QoS CLI (MQC)
 - Network-Based Application Recognition (NBAR)
 - Class-based weighted fair queuing (CBWFQ), modified deficit round robin (MDRR), and low latency queuing (LLQ)
 - Classification
 - Policing
 - Shaping
 - Marking
 - Weighted random early detection (WRED) and random early detection (RED)
 - Compression
- ❖ Implement Layer 2 QoS: weighted round robin (WRR), shaped round robin (SRR), and policies
- ❖ Implement link fragmentation and interleaving (LFI) for Frame Relay
- ❖ Implement generic traffic shaping
- ❖ Implement Resource Reservation Protocol (RSVP)
- ❖ Implement Cisco AutoQoS

➤ **Troubleshoot a Network**

- ❖ Troubleshoot complex Layer 2 network issues
- ❖ Troubleshoot complex Layer 3 network issues
- ❖ Troubleshoot a network in response to application problems
- ❖ Troubleshoot network services
- ❖ Troubleshoot network security

➤ **Optimize the Network**

- ❖ Implement syslog and local logging
- ❖ Implement IP Service Level Agreement SLA
- ❖ Implement NetFlow
- ❖ Implement SPAN, RSPAN, and router IP traffic export (RITE)
- ❖ Implement Simple Network Management Protocol (SNMP)
- ❖ Implement Cisco IOS Embedded Event Manager (EEM)
- ❖ Implement Remote Monitoring (RMON)
- ❖ Implement FTP
- ❖ Implement TFTP
- ❖ Implement TFTP server on router
- ❖ Implement Secure Copy Protocol (SCP)
- ❖ Implement HTTP and HTTPS
- ❖ Implement Telnet

➤ **Evaluate proposed changes to a Network**

- ❖ Evaluate interoperability of proposed technologies against deployed technologies
 - Changes to routing protocol parameters

- Migrate parts of a network to IPv6
- Routing Protocol migration
- Adding multicast support
- Migrate spanning tree protocol
- Evaluate impact of new traffic on existing QoS design
- ❖ Determine operational impact of proposed changes to an existing network
 - Downtime of network or portions of network
 - Performance degradation
 - Introducing security breaches
- ❖ Suggest Alternative solutions when incompatible changes are proposed to an existing network
 - Hardware/Software upgrades
 - Topology shifts
 - Reconfigurations

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