# Cisco CCNP Implementing Cisco IP Routing



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IIC, and EC-Council. He has designed and customized courses for private and public

sectors, including college curriculums, and has worked as a lead consultant engineer

in corporate Cyber security and Information Assurance training since 2001.

As a certified Microsoft Instructor, Ken has focused his career on various security aspects of computer and network technology since the early 1980s. He has offered a wide variety of IT training and high level consulting projects for Fortune 500 companies globally. Through the course of his extensive career, he has taught a full line of Microsoft, CompTIA, Cisco, and other high level IT Security curricula.

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**Course description:** The Implementing Cisco IP Routing is a qualifying exam for the Cisco Certified Network Professional CCNP®, Cisco Certified Internetwork Professional CCIP®, and Cisco Certified Design Professional CCDP® certifications. The ROUTE exam will certify that the successful candidate has the knowledge and skills necessary to use advanced IP addressing and routing in implementing scalable and secure Cisco ISR routers connected to LANs and WANs. The exam also covers configuration of secure routing solutions to support branch offices and mobile workers.

**Course outline:**

**Enterprise Network Frameworks and Architecture**
- Introduction
- Traffic Conditions in a Converged Network
- IIN: Cisco Intelligent Information Network
- 3 Phases of the Intelligent Information Network
- Cisco SONA Framework
- SONA Layers
- Updated SONA Framework
- Cisco Enterprise Architecture
- Architecture Types
- Cisco Hierarchical Network Model
- The Enterprise Composite Network Model
- Summary

**Implementation Plan**
- Introduction
- Creating an Implementation Plan
- Implementation Plan Approaches
- Methodologies and Models
- Cisco Lifecycle Services (PPDIOO) Model
- Implementation Plan Documentation
- Sample Implementation Plan
- Examples of Project Documents
- Summary

**IP Routing**
- Introduction
- IP Routing
- Third Option: OnDemand Routing
- Link-State vs. Distance Vector Protocols
- Classless vs. Classful Routing
- Discontinugous Subnets
- IP Classless Command
- Automatic Route Summarization
- Routing Table Criteria
- Administrative Distance
- Floating Static Route
- Demo: RIP Next Generation Setup
- Demo: RIP Next Generation Setup Continued
- Demo: Set up a Static Address
- Demo: Configure RIP Next Generation
- Demo: Configure RIP Next Generation Continued
- Demo: Troubleshooting
- Summary

**EIGRP Terminology**
- Introduction
- EIGRP Attributes and Capabilities
- Terminology of the EIGRP Protocol
- Tables Used with the EIGRP Protocol
- FD vs. AD
- Feasible Successor and Active vs. Passive Routes
- Major EIGRP Technologies
- Reliable Transport Protocols
- Neighbor Discovery and PDMs
- DUAL Finite-State Machine
- Packet Types Used by EIGRP
- EIGRP Administrative Distance
- EIGRP Metric Calculation and Bandwidth
- Summary

**Planning EIGRP Routing Implementation**
- Introduction
- EIGRP Deployment Prerequisites and Implementation
- EIGRP Verification and Documentation
- Summary

**EIGRP Routing**
- Introduction
- Enable EIGRP Routing
- Demo: Enable EIGRP
- Automatic Summarization
- Demo: Automatic Summarization
- EIGRP Commands
- Demo: Automatic Summarization
- Passive-Interface and Default Route Propagation
- Demo: Passive-Interface
- IP Default Network Command and Route Summarization
- Demo: IP Default Network
- Demo: Next Hop
- Interface Summarization
- Demo: Next Hop Continued
- Creating a Summary Route
- Demo: Summarization
- Summary

**EIGRP Enterprise WAN**
- Introduction
- WAN and Enterprise Considerations
- Demo: Frame Relay Using Dynamic Mapping
- Load Balancing with EIGRP
- Demo: EIGRP over Layer 3 MPLS VPN
- Demo: EIGRP over Layer 2 MPLS VPN
- Unequal EIGRP Cost Load Balancing
- EIGRP Bandwidth to Use on WAN LInks
- Summary

**EIGRP Authentication**
- Introduction
- Authentication in Routers
- Comparing MD5 to Simple Password
- Preparing to Configure EIGRP Configuration
- Demo: EIGRP Authentication
- The Configuration of EIGRP Authentication
- Demo: Configure the Keychain
- Summary

**Optimize EIGRP**
- Introduction

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- Demo: Enable Authentication with the Keychain
- EIGRP Scalability
- Query Process and Stuck-in-Active
- Summarization: SIA Solution
- Stub Networks
- Demo: Add IPv4 Addresses
- Demo: Add IPv4 Addresses Continued
- Demo: Configure EIGRP
- Demo: Configure EIGRP Continued
- Summary

**OSPF Terminology**
- Introduction
- OSPF: Open Shortest Path First
- Features of OSPF
- Characteristics of Link-State Protocol
- Advantages
- Terminology
- Router Types
- Internal and Backbone Routers
- Area Border Router
- Autonomous System Boundary Router
- BDR and DR Routers
- Summary

**OSPF Packets**
- Introduction
- What Are OSPF Packets Used For
- OSPF Hello Packet: Type 1
- OSPF DBD Packet: Type 2
- OSPF LSR and LSU Packets: Type 3 and 4
- OSPF LSAck Packet: Type 5
- Adjacent Neighbors
- Link-State Data Structures
- Summary

**OSPF Routing**
- Introduction
- Planning OSPF Deployment
- OSPF Implementation
- OSPF Verification
- OSPF Documentation
- Summary

**OSPF Verification and Configuration**
- Introduction
- Enable OSPF Routing and Network Identification
- Wildcard Mask
- Interface Bandwidth Definition and OSPF Router ID
- Demo: Configure Single-Area OSPF
- Router ID Definition
- Demo: Configure Multi-Area OSPF
- OSPF Verification: First Method
- Demo: Verify OSPF
- OSPF Verification: Second Through Fifth Methods
- Clearing the OSPF Routing
- Broadcast
- DR and BDR
- Election Manipulation and Router Priority
- Demo: Assign Router Priority
- Influencing the Election Process
- Demo: Configure Simple Authentication Key
- OSPF over MPLS
- Demo: Verify Simple Password Authentication
- NBMA
- Demo: IP Addresses
- Demo: Configure OSPF
- Demo: Routes
- Demo: Branch Routers
- Summary

**Routing Performance Issues**
- Introduction
- Usual Routing Performance Issues
- Running Different Protocols at the Same Time
- Performance Solutions for Routing Protocols
- Route Filtering
- Summary

**Multiple Routing Protocols**
- Introduction
- Simple Protocols and Complex Networks
- Multiple Protocols Running on One Network
- Complex Networks
- Redistribution
- Demo: Redistribution
- Redistributed Routes
- How to Select the Best Route
- Edge and Core Routing Protocols
- Loop Prevention and Redistribution Guidelines
- Summary

**Route Redistribution**
- Introduction
- Redistribution Command
- Demo: Redistributing into RIP
- Important Route Redistribution Information
- Demo: Redistributing into OSPF
- Default Metric for BGP, OSPF, and RIP
- Demo: Default Metrics
- Default Metric for EIGRP
- Demo: Apply Metrics for EIGRP
- Modifying the Administrative Distance
- Demo: Modify Administrative Distance
- Changing the Default Administrative Distance
- Demo: OSPF Routes
- Demo: EIGRP Routes
- Demo:
- Summary

**Routing Update Traffic**
- Passive Interfaces
- Static Routes and Route Maps
- Demo: Route Maps
- Demo: Route Maps Continued
- To Define a Route Map
- Various Route-map Commands for PBR
- Using Distribute Lists
- Demo: Distribute Lists
- Define a Filter for Incoming Routing Updates
- Demo: Incoming Filter
- Define a Filter for Outgoing Routing Updates
- Demo: Outgoing Filter
- Demo: Prevent Feedback Loops
- Demo: Outoging Filter Continued
- Prefix Lists
- Demo: Avoid Route Feedback
- Prefix List Configuration
- Demo: Prefix List
- Summary

**Path Control**
- Introduction
- Path Control Network Performance Assessment
- Considerations for Network Redundancy
- Path Control Integrated Strategy
- Prefix Lists and ACLs
- Summary

**Path Control Using Offset Lists**
- Introduction
- Demo: Prefix Lists
- Path Control Using Offset Lists
- Demo: Offset Lists
- Offset-List Definition
- Offset Lists Verification
- Demo: Verify Offset List
- Summary

**Path Control Using IOS IP SLAs**
- Introduction
- Path Control Using IOS IP SLAs
- Demo: Path Control Using IOS IP SLAs
- IP SLA Applications
- Demo: IP SLA Applications
- Operations, Responders, and Sources
- Demo: Operations, Responders, and Sources
- IP SLA Operations
- Demo: Operations
- IP SLA Operation Definition
- Demo: Steps to Configure IP SLAs
- ICMP Echo Operation Definition
- Demo: Define an SLA IP Operation
- icmp-echo Sub-Commands
- Scheduling an IP SLA Operation
- Demo: Schedule an IP SLA
- IP SLA Object Tracking Configuration
- Demo: Define Tracking Objects
- Tracking Delay Configuration
- Demo: Configure Tracking Delay
- IP SLAs and Static Routing
- Demo: Configure Static Route for IP SLA Tracking
- Demo: Static Routes Continued
- Summary

**Path Control Using Policy-Based Routing**
- Introduction
- Path Control Using PBR
- Demo: Intro to Path Control with PBR
- PBR Configuration
- Demo: Configure PBR
- PBR route-map Commands
- Demo: Logical PBR Operation
- Match Statements
- Demo: Match Statement
- match ip-address Command
- Demo: match ip-address
- Demo: Match with ACLs or Prefix Lists
- set Statements
- Demo: Match Packet Length
- set ip next-hop Command
- Demo: Set Statements
- set interface Command
- Demo: Set Conditions
- set ip default next-hop Command
- Demo: Set Commands Using PBR
- set default interface Command
- Demo: Next-Hop IP Address
- set ip tos Command
- Demo: Set Interface
- set ip precedence Command
- Demo: Default Next-Hop IP Addresses
- Configuring PBR on an Interface
- Demo: Default Interfaces
- Demo: Set IP Precedence Bits
- Summary

**Advanced Path Control Tools**
- Introduction
- Cisco IOS Optimized Edge Routing
- Virtualization
- Cisco Wide Area Application Services
- Summary

**BGP Terminology and Concepts**
- Introduction
- EGP vs. IGP
- Demo: EGP vs. IGP Summary
- Autonomous Systems
- Demo: AS Summary
- IANA

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- Demo: IANA Summary
- AS Numbers
- Demo: AS Numbers Summary
- BGP
- Demo: BGP Summary
- IGP vs. BGP and Connecting Enterprise Networks
- Public IP Address Space and Connection Redundancy
- BGP and Enterprise Networks
- Demo: BGP Neighbors
- BGP Path Vector Characteristics
- Demo: BGP Operational Overview
- When to Use BGP
- Demo: BGP Between AS Summary
- When Not to Use BGP
- Demo: IGP and BGP Summary
- BGP Synchronization
- Demo: Connecting Enterprise Networks to an ISP
- BGP Table
- Path Attributes
- Default Local Preference Configuration
- More Path Attributes
- Summary

**Configure and Verify BGP**
- Introduction
- Planning BGP Deployment
- Demo: Connection and Routing Questions Summary
- BGP Implementation
- Demo: Public IP Address Space
- BGP Verification
- Demo: Using Static Routes
- Enabling BGP Routing
- Demo: Enable BGP Routing
- To Define BGP Neighbors
- Demo: Define BGP Neighbors
- To Define a BGP Peer Groups
- Demo: Define BGP Peer Group
- To Shut Down a BGP Neighbor
- Demo: Shut Down BGP Neighbor
- IBGP Source IP Address Problem
- Demo: Establish IBGP Session
- IBGP Source IP Address Solution
- Demo: IBGP Source IP Address
- neighbor next-hop-self command
- Demo: Configure Next Hop
- BGP Synchronization
- BGP Authentication
- To Hard Reset BGP Sessions and Soft Reset Outbound
- Summary

**Basic BGP Using Route Maps**
- Introduction
- Configuring Route Maps and Matching Access List
- Specify BGP Weight and Preference Value
- BGP Path Manipulation
- To Configure an AS ACL and Defaul Local Preference
- Summary

**Filter BGP Routing**
- Introduction
- BGP Routing Updates Filtering
- Planning BGP Filtering Using Prefix Lists
- Summary

**Branch Office Implementation**
- Introduction
- Branch Office Challenges
- Branch Office Design Considerations
- The Thin Branch
- Broadband Technology Deployment
- Wireless Broadband and Municipal Broadband
- WiMAX and Broadband Types
- Verify PPPoA and Configure a NAT Pool
- Bind the ACL and NAT Pool
- Configure Static NAT and Identify NAT Interfaces
- Create a Tunnel Interface
- Demo: Static NATing
- Demo: Static NATing Continued
- Summary

**Mobile Worker Implementations**
- Introduction
- Mobile Worker Connectivity
- Business-Ready Mobile User Solution
- Business-Ready VPN Components
- Summary

**Routing Traffic to Mobile Workers**
- Introduction
- Easy VPN Server
- Routing Services for VPN Subnets
- Proxy ARP and Remote User Connections
- Summary

**Introducing IPv6**
- Introduction
- IPv6 Introduction
- IPv6 Features and MTU Discovery
- New IPv6 Features
- IPv6 Address Specifics
- Abbreviating IPv6 Addresses
- Summary

**Verify IPv6 Unicast Addresses**
- Introduction
- Enable IPv6 Routing
- Enable CEF for IPv6
- IPv6 on an Interface and
- Static Route Types and RIPng
- Enable and Config IPv6 RIP Process on an Interface
- Summary

**Configure OSPFv3**
- Introduction
- IPv6 Protocol Implementation and OSPFv3
- Link-Local Addresses and Multiple OSPFv3 Instances
- Security and SA Types for IPv6
- OSPFv3 Routing Process Parameters and Router ID
- Enable an OSPFv3 Instance and Specify Packet Cost
- Change OSPF Priority and Define Stub Areas
- Routes at Area Boundary and Trigger SPF Recalc
- Demo: Enable OSPFv3
- Demo: Configure Branch Routers
- Demo: Troubleshooting
- Demo: Troubleshooting Continued
- Summary

**EIGRP for IPv6**
- Introduction
- EIGRP for IPv6
- Routing Parameters and Define Router ID
- Enable EIGRP for IPv6 and Identify Stub Router
- Summary Aggregate Address
- Demo: Configure EIGRP
- Demo: Configure Branch Routers and Headquarters
- Demo: Passive Interface
- Demo: Troubleshooting
- Summary

**Multiprotocol BGP**
- Introduction
- Multiprotocol BGP
- BGP Router ID, Peers, and Routing Sessions
- Identify Peers and Configure Routing Sessions
- Identify Peers and Apply a Route Map
- Summary