



Cisco Certified Internetwork Professional (CCIP)

(4 Modules: BSCI, QoS, BGP & MPLS)

Course Objective:

The CCIP (Cisco Certified Internetwork Professional) provides individuals working in service provider organizations with competencies in infrastructure IP networking solutions. CCIP professionals have detailed understanding of networking technologies in the service provider arena including IP routing, IP QoS, BGP, and MPLS. Courses in this certification include:

Module 1 : Building Scalable Cisco Internetworks BSCI (642-901)

Module 2 : Implementing Cisco Quality of Service (QoS) (642-642)

Module 3 : Configuring BGP on Cisco Routers (BGP) (642-661)

Module 4 : Implementing Cisco MPLS (MPLS) (642-611)

Prerequisite:

Valid CCNA Certification.

Certificate of Attendance :

Certificate of Attendance will be awarded to students completing the course achieving minimum 75% attendance.

Training Methodology & Materials:

- Practical hands-on sessions, 75% lab-based and 25% theory-based.
- Well-designed lab sessions to enhance further understanding of the courseware.

Training Duration:

Full-Time : 20days (5 days per module)

Time : 9.30am – 5.30pm

Part-Time : 40 sessions (twice a week)

Time : 7.00pm – 10.00pm

DETAILED COURSE OUTLINE

Module 1 : Building Scalable Cisco Internetworks BSCI (642-901)

The Building Scalable Cisco Internetworks (BSCI 642-901) is a qualifying exam for the Cisco Certified Network Professional CCNP®, Cisco Certified Design Professional CCDP®, and Cisco Certified Internetwork Professional CCIP™ certifications. The BSCI 642-901 exam will certify that the successful candidate has important knowledge and skills necessary to use advanced IP addressing and routing in implementing scalability for Cisco ISR routers connected to LANs and WANs. The exam covers topics on Advanced IP Addressing, Routing Principles, Multicast Routing, IPv6, Manipulating Routing Updates, Configuring basic BGP, Configuring EIGRP, OSPF, and IS-IS.

Implement EIGRP operations

- Explain the functions and operations of EIGRP (e.g., DUAL).
- Configure EIGRP routing. (e.g., Stub Routing, authentication, etc.)
- Verify or troubleshoot EIGRP routing configurations.

Implement multiarea OSPF operations

- Explain the functions and operations of multiarea OSPF.
- Configure multiarea OSPF routing. (e.g., Stub, NSSA, authentication, etc.)
- Verify or troubleshoot multiarea OSPF routing configurations.

Describe integrated IS-IS

- Describe the features and benefits of integrated IS-IS.
- Configure and verify integrated IS-IS.

Implement Cisco IOS routing features

- Describe, configure or verify route redistribution between IP routing IGPs. (e.g., route-maps, default routes, etc.)
- Describe, configure or verify route filtering (i.e., distribute-lists and passive interfaces).

- Describe and configure DHCP services (e.g., Server, Client, IP helper address, etc.).

Implement BGP for enterprise ISP connectivity

- Describe the functions and operations of BGP.
- Configure or verify BGP operation in a non-transit AS (e.g., authentication).
- Configure BGP path selection. (i.e., Local Preference, AS Path, Weight or MED attributes).

Implement multicast forwarding

- Describe IP Multicast (e.g., Layer-3 to Layer-2 mapping, IGMP, etc.).
- Describe, configure, or verify IP multicast routing (i.e., PIM Sparse-Dense Mode).

Implement IPv6

- Describe IPv6 addressing operations.
- Describe IPv6 interoperability with IPv4.
- Describe, configure or verify OSPF routing with IPv6 addressing.

Module 2 : Implementing Cisco Quality of Service (QoS) (642-642)

The QoS exam is one of the qualifying exams for the Cisco Certified Internetwork Professional, Cisco Certified Voice Professional, Cisco IP Telephony Design Specialist, Cisco IP Telephony Express Specialist, Cisco IP Telephony Operations Specialist, and Cisco IP Telephony Support Specialist certifications. The QoS 642-642 exam will test materials covered under the Implementing Cisco Quality of Service QoS v2.1 course. The exam will certify that the successful candidate has knowledge and skills necessary to configure and troubleshoot Cisco IOS routers running Quality of Service protocols in Service Provider and Enterprise environments. The exam covers topics on IP QoS, classification and marking Mechanisms, queuing mechanisms, traffic shaping and policing mechanisms, congestion avoidance mechanisms, link efficiency mechanisms, modular QoS command line interface, and QoS Best Practices.

IP QoS Fundamentals

- Given a description of a converged network, identify problems that could lead to poor quality of service and explain how the problems might be resolved
- Define the term Quality of Service (QoS) and identify and explain the key steps to implementing QoS on a converged network

IP QoS Components

- List and explain the models for providing Quality of Service on a network
- Explain the purpose and function of the DiffServ model
- Describe the basic format of and explain the purpose of the DSCP field in the IP header
- Define and explain the different per hop behaviors used in DSCP
- Explain the interoperability between DSCP-based and IP-precedence-based devices in a network
- Given a list of QoS actions, correctly match the QoS actions to mechanisms for implementing QoS and identify where in a network the different QoS mechanisms are commonly used

Modular QoS CLI and Auto-QoS

- Given a network requiring QoS, explain how to implement a QoS policy using MQC
- Explain how AutoQoS is used to implement QoS policy

Classification and Marking

- Explain how link layer and network layer markings are used to define service classes and the different applications represented by each of these service classes
- Given a network and a description of QoS issues, use MQC CLI commands to classify packets
- Given a network and a description of QoS issues, use class-based marking to assign packets to a specific service class
- Describe the function of Network Based Application Recognition
- Describe the purpose of pre-classification to support QoS in various VPN (IPSEC, GRE, L2TP) configurations
- Describe QoS trust boundaries and their significance in LAN based classification and marking
- Identify the different classification and marking options available on Cisco L2 and L3 switching platforms

Congestion Management Methods

- List and explain the different queuing algorithms
- Explain the components of hardware and software queuing systems on Cisco routers and how they are effected by tuning and congestion
- Describe the benefits and drawbacks of using WFQ to implement QoS
- Explain the purpose and features of Class-Based WFQ (CBWFQ)
- Explain the purpose and features of Low Latency Queuing (LLQ)
- Identify the Cisco IOS commands required to configure and monitor LLQ on a Cisco router

- Describe and explain the different queuing capabilities available on the Cisco Catalyst 2950 Switch

Congestion Avoidance Methods

- Describe the drawbacks tail drop as a congestion control mechanism
- Describe the elements of a RED traffic profile
- Describe Weighted Random Early Detection and how it can be used to prevent congestion
- Identify the Cisco IOS commands required to configure and monitor DSCP-based CB-WRED
- Explain how ECN interacts with WRED in Cisco IOS

Traffic Policing and Shaping

- Describe the purpose of traffic conditioning using traffic policing and traffic shaping and differentiate between the features of each
- Explain how network devices measure traffic rates using single rate or dual rate, single or dual token bucket mathematical models
- Identify the Cisco IOS commands required to configure and monitor single rate and dual rate CB-Policing
- Identify the Cisco IOS commands required to configure and monitor percentage based CB-Policing
- Explain how the two rate limits, average rate and peak rate, can be used to rate limit traffic
- Identify the Cisco IOS commands required to configure and monitor CB-Shaping
- Identify the Cisco IOS commands required to configure and monitor Frame Relay adaptive CB-Shaping on Frame Relay interfaces

Link Efficiency Mechanisms

- Explain the various link efficiency mechanisms and their function
- Identify the Cisco IOS commands required to configure and monitor CB header compression
- Given a list of link speeds and a specific delay requirement, determine the proper fragment size to use at each link speed and identify the typical delay requirement for VoIP packets
- Identify the Cisco IOS commands required to configure and monitor Multilink PPP with Interleaving
- Identify the Cisco IOS commands required to configure and monitor FRF.12

QoS Best Practices

- Explain the QoS requirements of the different application types
- List typical enterprise traffic classes then identify the delay, jitter, packet loss and bandwidth requirements of each traffic class
- Explain the best practice QoS implementations and configurations within the campus LAN
- Explain the best practice QoS implementations and configurations on the WAN customer edge (CE) and provider edge (PE) routers

Module 3 : Configuring BGP on Cisco Routers (BGP) (642-661)

The 642-661 BGP exam is a qualifying exam for the CCIP certification. The 642-661 BGP exam tests material covered under the Configuring BGP on Cisco Routers (BGP) v 3.1 course. The BGP exam assesses a candidate's understanding of the theory of BGP, ability to configure BGP on Cisco IOS routers, and skills with troubleshooting on BGP. As a routing protocol, BGP is one of the underlying foundations of the Internet and new-world technologies.

BGP Overview

Introduction to BGP

- Given a network scenario, identify appropriate BGP usage and its limitations

BGP Session Establishment

- Given a typical BGP network scenario, describe the concept of BGP neighbors and the neighbor session establishment procedures

BGP Route Processing

- Given a diagram of an operational BGP network, describe interdomain route processing, route propagation and BGP path selection

Basic BGP Configuration

- Given a network consisting of multiple domains, successfully configure BGP

Monitoring and Troubleshooting BGP

- Given a configured BGP network, verify proper operation and perform the steps necessary to correct basic BGP configuration errors

Route Selection Using Policy Controls

Multi-Homed BGP Networks

- Given a customer scenario where connections to multiple ISPs must be supported, describe the need for influencing BGP route selection

AS-Path Filters

- Given a customer scenario where connections to multiple ISPs must be supported, successfully configure BGP to influence route selection using AS path filters

Prefix-List Filters

- Given a customer scenario where connections to multiple ISPs must be supported, successfully configure BGP to influence route selection using prefix-list filters

Outbound Route Filtering

- Given an operational BGP network, use outbound route filtering to minimize the impact of BGP routing updates on router resources

Route-Maps as BGP Filters

- Given a typical BGP network, correctly configure BGP to influence route selection using route maps

Implementing Changes in BGP Policy

- Given a typical BGP network, configure the route-refresh feature to minimize the impact of expediting BGP policy updates

Route Selection Using Attributes

BGP Path Attributes

- List BGP path attributes and functionality of each attribute
- Influencing BGP Route Selection with Weights
- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the weight attribute

BGP Local Preference

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the local preference attribute

BGP Multi-Exit-Discriminator (MED)

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using the Multi-Exit-Discriminator (MED) attribute

BGP Communities

- Given a customer scenario where multiple connections must be supported, successfully configure BGP to influence route selection using BGP community attributes

Customer-to-Provider Connectivity with BGP

Customer Connectivity Requirements

- Describe the requirements to connect customer networks to the Internet in a service provider environment

Static Routing Toward the Customer

- Given a service provider network, implement customer connectivity using static routing

BGP Customer Multi-Homed to a Single Service Provider

- Given a customer scenario where multiple connections to a single ISP must be supported, implement customer connectivity with BGP

BGP Customer Multi-Homed to Multiple Service Providers

Given a customer scenario where connections to multiple ISPs must be supported, implement customer connectivity with BGP

BGP Transit Autonomous System

Transit Autonomous System Functions

- Describe the function of a transit autonomous system and the need for IBGP and EBGP Interaction in a Transit AS
- Given a transit autonomous system, describe the interaction between EBGP and IBGP in relation to relevant BGP attributes

Packet Forwarding in Transit Autonomous Systems

- Describe the function of an IGP in forwarding packets through an autonomous system

Configuring a Transit Autonomous System

- Given a BGP network scenario, successfully configure an autonomous system to act as a transit backbone

Monitoring and Troubleshooting IBGP in Transit AS

- Given a configured BGP transit network, verify proper operation and perform the steps necessary to correct basic IBGP configuration errors

BGP Route Reflectors

Introduction to Route Reflectors

- Describe the function and operation of route reflectors in a BGP environment

Network Design with Route Reflectors

- Based upon established route reflector design rules, describe the concept of hierarchical route reflectors and their requirements

Configuring and Monitoring Route Reflectors

- Given an existing IBGP network, configure and verify proper operation of route reflectors to modify IBGP split-horizon rules

Advanced BGP Configuration

Limiting the Number of Prefixes Received from a BGP Neighbor

- Given a typical BGP network, successfully configure BGP to limit the number of prefixes received from a neighbor

AS-Path Prepending

- Given a typical service provider network with connections to multiple autonomous systems, use AS-Path prepending to influence the return path selected by the neighboring autonomous systems

BGP Peer Group

- Given a typical BGP network, use BGP peer groups to share common configuration parameters between multiple BGP peers

BGP Route Flap Dampening

- Given a properly configured BGP network, use route flap dampening to minimize the impact of unstable routes

Scaling IGP and BGP in Service Provider Networks

Common Routing Issues in Service Provider Networks

- Describe common routing concerns of service provider networks

Optical Networking Designs

- Describe the scalability issues of using OSPF and IS-IS as interior gateway protocols in a service provider network and list solutions for each

Scaling BGP in Service Provider Networks

Describe common scalability issues when using BGP in a service provider network and list solutions for each

Module 4 : Implementing Cisco MPLS (MPLS) (642-611)

The MPLS exam is a qualifying exam for the CCIP certification (Cisco Certified Internetwork Professional). The 642-611 MPLS exam will test materials covered under the Implementing Cisco MPLS course. The exam will certify that the successful candidate has knowledge and skills necessary to gather information from the technology basics to some of the more updated features and functions such as Traffic Engineering, Fast Reroute and any Transport over MPLS (AToM). The exam covers topics on MPLS Concepts, MPLS Label Assignment and Distribution, Frame-Mode/Cell-Mode MPLS Implementation on Cisco IOS Platforms, MPLS Virtual Private Networks Technology, MPLS VPN Implementation, Complex MPLS VPNs, and Internet Access from a MPLS VPN.

MPLS Fundamentals

- Explain basic core MPLS technology and concepts
- Explain the function of MPLS Labels and Label Stack
- Identify MPLS Applications

MPLS Operation

- Describe the characteristics and behaviors of Label Distribution in Frame-mode MPLS
- Explain Convergence in Frame-mode MPLS
- Describe the characteristics and behaviors of Label Distribution over LC-ATM Interfaces and VC Merge
- Describe the features of MPLS Label Allocation, Distribution, and Retention Modes
- Explain the process of LDP Neighbor Discovery

Frame-Mode/Cell-Mode MPLS Implementation, Configuration and Troubleshooting

- Identify the functions of CEF Switching
- Explain and configure Frame-mode MPLS on Cisco IOS platforms
- Monitor MPLS on Cisco IOS platforms - Frame-mode interfaces
- Troubleshoot Frame-Mode MPLS configurations on Cisco IOS Platforms
- Explain and configure Label-Controlled ATM MPLS
- Explain and configure LC-ATM MPLS over ATM Virtual Path
- Monitor LC-ATM MPLS on Cisco IOS platforms

MPLS Virtual Private Networks Technology

- Describe the characteristics and functions of Virtual Private Networks

- Describe Overlay and Peer-to-Peer VPNs
- Explain Major VPN Categorization
- Describe MPLS VPN Architecture
- Describe the MPLS VPN Routing Model

Explain the process of MPLS VPN Packet Forwarding MPLS VPN Implementation, Configuration and Troubleshooting

- Explain MPLS VPN Mechanisms supported on Cisco Platforms
- Configure VRF tables
- Configure MP-BGP Session between PE routers
- Configure Small Scale Routing Protocols
- Monitor MPLS VPN Operation
- Configure OSPF as the Routing Protocol
- Configure BGP as the Routing Protocol
- Troubleshoot basic MPLS VPN configuration errors

Complex MPLS VPNs

- Describe the advanced VRF Import/Export Features
- Explain the characteristics of Overlapping VPNs
- Explain the features of Central Services VPNs
- Describe Managed CE Router Service

Internet Access from a MPLS VPN

- Explain VPN Internet Access Topologies
- Describe VPN Internet Access Implementation Methods
- Describe the methods to Separate Internet Access from VPN Service
- Internet Access Backbone as a Separate VPN

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