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Scope and Sequence

CCNP: Building Scalable Internetworks v5.0

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Cisco Networking Academy CCNP Version 5.0
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Target Audience

Those desiring to continue their post-CCNA preparation for a career as a network administrator, Level 2 support engineer, Level 2 systems engineer, network technician, or deployment engineer. CCNA certified individuals pursuing CCNP, CCIP, CCSP, CCDP, or CCIE certifications.

Prerequisites

- Students should have completed CCNA 1 – 4 or equivalent.
- CCNA Certification desired but not required
- Work experience beneficial.

Course Description

CCNP: Building Scalable Internetworks is the first of four courses leading to the Cisco Certified Network Professional (CCNP) designation. CCNP: Building Scalable Internetworks introduces Cisco Networking Academy Program students to scalable IP networks.

Students will learn how to create an efficient and expandable enterprise network by installing, configuring, monitoring, and troubleshooting network infrastructure equipment (especially routers such as Cisco ISRs) according to the Campus Infrastructure module in the Enterprise Composite Network model.

Topics include how to configure EIGRP, OSPF, IS-IS, and BGP routing protocols and how to manipulate and optimize routing updates between these routing protocols. Other topics include multicast routing, IPv6, and DHCP configuration.

Course Objectives

The CCNP certification indicates knowledge of networking for the small-office, home-office (SOHO) market and enterprise markets and the ability to work in businesses or organizations whose networks have between 100 and 500 nodes. A CCNP certified individual should be able to:

- Implement appropriate technologies to build a scalable routed network
- Build campus networks using multilayer switching technologies
- Improve traffic flow, reliability, redundancy, and performance for campus LANs, routed and switched WANs, and remote access networks

- Create and deploy a global intranet
- Troubleshoot an environment that uses Cisco routers and switches for multiprotocol client hosts and services
- Perform entry-level tasks in the planning, design, installation, operation and troubleshooting of Ethernet, TCP/IP networks.

CCNP: Building Scalable Internetworks is an integral step towards achieving CCNP Certification. Upon completion of this course, students will have performed tasks related to:

- Internetwork scalability
- Routing protocol operation, configuration, and troubleshooting .
- EIGRP, OSPF, IS-IS, BGP
- Route optimization
- IP Multicast
- IPv6

Lab Requirements

Please refer to the CCNP Equipment Bundle Spreadsheets on Cisco Academy Connection (CAC)

Certification Alignment

The curriculum is aligned with ILSGs BSCI course and the 642-901 exam.

Course Overview

The course is designed to be delivered in a 70 contact hour time frame. Approximately 45 hours will be designated to lab activities and 25 hours on curriculum content. A case study on advanced routing is required, but format and timing are determined by the Local Academy.

Course Outline

Module 1. Scalable Network Design

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Overview

1.1 IIN, SONA, and the ECNM

1.1.1 Technological Revolution Cycles

1.1.2 The Network as the Platform

1.1.3 The Intelligent Information Network (IIN)

1.1.4 The SONA Framework

1.1.5 Cisco Enterprise Architectures

1.1.6 The Hierarchical Network Model

1.1.7 The Enterprise Composite Network Model

1.2 Scalable Networks

1.2.1 Scalable Network Design

1.2.2 Five Characteristics of a Scalable Network

1.2.3 Making the Network Reliable and Available

1.2.4 Making the Network Responsive

1.2.5 Making the Network Efficient

1.2.6 Making the Network Adaptable

1.2.7 Making the Network Accessible But Secure

1.3 Converged Networks

1.3.1 Traffic Conditions in a Converged Network

1.3.2 Routing and Routing Protocols

1.4 ITA Topology

1.4.1 Overview of the International Travel Agency

1.4.2 The ITA Logical Topology

1.5 Overview of Course Labs

1.5.1 Lab 1-0 TCL Script Reference and Demonstration Module Summary Module Quiz

Module 2. EIGRP

Overview

2.1 EIGRP Fundamentals and Features

2.1.1 EIGRP Capabilities and Attributes

2.1.2 Underlying Process and Technologies

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Module 3. OSPF

Overview

3.1 Review of OSPF Fundamentals and Features

3.1.1 Link State Routing Protocols

3.1.2 Overview of OSPF Operations

3.1.3 OSPF Data Structures

3.1.4 OSPF Adjacency Database

3.1.5 OSPF Area Structure

3.1.6 OSPF Router Types

3.1.7 OSPF Terminology

3.1.8 Calculating the OSPF Metric

3.1.9 Link-State Data Structures

3.2 Review of OSPF Operation

3.2.1 OSPF Packet Types

3.2.2 OSPF Packet Header Format

3.2.3 Establishing OSPF Neighbor Adjacencies

3.2.4 Exchanging and Synchronizing LSDBs

3.2.5 Discovering the Network Routes

3.2.6 Maintaining Network Routes

3.2.7 Maintaining Link-State Sequence Numbers

3.2.8 Verifying Packet Flow

3.3 Implementing and Verifying OSPF

3.3.1 Configuring Basic Single-Area and Multiarea OSPF

3.3.2 Configuring Basic Single-Area OSPF Example

3.3.3 Configuring Basic Multiarea OSPF Example

3.3.4 Configuring a Router ID

3.3.5 Verifying the OSPF Router ID

3.3.6 Verifying the OSPF Operation

3.3.7 Example of the show ip route ospf Command

3.3.8 Example of the show ip ospf interface Command

3.3.9 Example of the show ip ospf neighbor Command

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3.7 Stub, Totally Stubby, and Not-So-Stubby Areas

3.7.1 Configuring OSPF Area Types

3.7.2 Using Stub and Totally Stubby Areas

3.7.3 Configuring Stub Area

3.7.4 OSPF Stub Area Configuration Example

3.7.5 Configuring Totally Stub Areas

3.7.6 Totally Stubby Area Configuration Example

3.7.7 Interpreting Routing Tables

3.7.8 Configuring Not-So-Stubby Areas

3.7.9 Configuring Not-So-Stubby Area Example

3.7.10 Configuring an NSSA Totally Stubby Area Example

3.7.11 Verifying All Stub Area Types

3.8 Virtual Links

3.8.1 OSPF Virtual Links

3.8.2 Configuring Virtual Links

3.8.3 Virtual link configuration example

3.8.4 Verifying a Virtual Link Configuration

3.9 Route Summarization

3.9.1 ABR and ASBR Implementation

3.9.2 OSPF Route Summarization Example

3.9.3 Configuring OSPF Route Summarization

3.9.4 Configuring Route summarization at ABR

3.9.5 Configuring Route Summarization at ASBR

3.9.6 Benefits of a Default Route in OSPF

3.9.7 Configuring a Default Route in OSPF

3.9.8 Example of Configuring a Default Route in OSPF

3.10 OSPF Authentication

3.10.1 OSPF Authentication Methods

3.10.2 Configuring Simple Password Authentication

3.10.3 Example of Configuring Simple Password Authentication

3.10.4 Configuring MD5 Authentication

3.10.5 Example of Configuring MD5 Authentication

3.10.6 Troubleshooting Simple Password Authentication

3.10.7 Troubleshooting MD5 Authentication

3.11 OSPF Lab Exercises

3.11.1 Single-Area OSPF Link Costs and Interface Priorities

3.11.2 Multiple-Area OSPF with Stub Areas and Authentication

3.11.3 OSPF Virtual Links and Area Summarization

3.11.4 OSPF over Frame Relay Module Summary Module Quiz

Module 4. Integrated IS-IS

Overview

4.1 IS-IS Fundamentals

4.1.1 Uses for IS-IS Routing

4.1.2 IS-IS and OSPF

4.1.3 IS-IS Routing

4.1.4 IS-IS Features

4.1.5 IS-IS Link-State Operation

4.1.6 Integrated IS-IS

4.1.7 Principles and Issues of IS-IS Design

4.1.8 The ES-IS Protocol

4.1.9 OSI Routing Levels

4.1.10 IS-IS and OSPF Network Design

4.1.11 Differences Between Integrated IS-IS and OSPF

4.2 ISO Addressing

4.2.1 NSAP Addresses

4.2.2 NSAP Address Structure

4.2.3 NSAP Address Example

4.2.4 Identifying Systems in IS-IS

4.2.5 NET Addresses

4.2.6 Subnetwork Point of Attachment, Circuits, and Links

4.2.7 IS-IS Routing Levels

4.5.5 Configuring Route Summarization in IS-IS

4.6 Configuring Basic Integrated IS-IS

4.6.1 IS-IS Lab

4.6.2 Verifying CLSN IS-IS Structures

4.6.3 Troubleshooting Integrated IS-IS Configurations

4.6.4 Troubleshooting Integrated IS-IS Configuration Example

4.7 IS-IS Lab Exercises

4.7.1 Configuring Basic Integrated IS-IS

4.7.2 Multi-Area Integrated IS-IS

4.7.3 Configuring IS-IS over Frame Relay Module Summary Module Quiz

Module 5. Route Optimization

Overview

5.1 Operating a Network Using Multiple Routing Protocols

5.1.1 Using Multiple Routing Protocols

5.1.2 Defining Route Redistribution

5.1.3 Redistributing Route Information

5.1.4 Using Seed Metrics

5.1.5 Seed Metrics Example

5.1.6 Defining Administrative Distance

5.1.7 Modifying Administrative Distances

5.2 Configuring and Verifying Router Redistribution

5.2.1 Configuring Redistribution

5.2.2 Redistributing Routes into a Classful Routing Protocol

5.2.3 Redistributing from Classless to Classful Protocols

5.2.4 Redistributing Routes into a Classless Routing Protocol

5.2.5 Redistributing Routes into OSPF Example

5.2.6 Redistributing Routes into EIGRP

5.2.7 Redistributing Routes into EIGRP Example

5.2.8 Redistributing Routes into IS-IS

5.2.9 Redistributing Routes into IS-IS Example

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5.2.10 Redistributing Static and Connected Routes

5.2.11 Verifying Route Redistribution

5.2.12 Verifying Route Redistribution Example

5.2.13 Administrative Distance Problems with Redistribution

5.2.14 Administrative Distance Solution with Redistribution

5.3 Controlling Routing Updates

5.3.1 Controlling Routing Updates

5.3.2 Passive Interfaces

5.3.3 Passive Interface Considerations

5.3.4 Configuring Route Filtering Using Distribute Lists

5.3.5 Implementing the Distribute List

5.3.6 Filtering Routing Updates with a Distribute List

5.3.7 Controlling Redistribution with Distribute Lists

5.4 Policy-Based Routing

5.4.1 Defining Route Maps

5.4.2 Route Map Applications

5.4.3 Route Map Operation

5.4.4 Using Route Map Commands

5.4.5 The Match Command

5.4.6 The Set Command

5.4.7 Implementing Route Maps with Redistribution

5.5 DHCP

5.5.1 The Purpose of DHCP

5.5.2 Understanding the Function of DHCP

5.5.3 Configuring DHCP

5.5.4 DHCP Importing and Autoconfiguration

5.5.5 Configuring the DHCP Client

5.5.6 The IP Helper Address

5.5.7 Configuring the IP Helper Address

5.5.8 Customizing the Forwarded UDP Services

5.5.9 Configuring DHCP Relay Services

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5.5.10 Verifying DHCP Relay Services

5.6 Route Optimization Lab Exercises

5.6.1 Redistribution Between RIP and OSPF

5.6.2 Redistribution Between EIGRP and OSPF

5.6.3 Redistribution Between EIGRP and IS-IS

5.6.4 Manipulating Administrative Distances

5.6.5 Configuring the Cisco IOS DHCP Server Module Summary Module Quiz

Module 6. BGP

Overview

6.1 BGP Concepts and Terminology

6.1.1 Using BGP in the Enterprise Network

6.1.2 BGP Multihoming Options

6.1.3 Option 1: Default Routes from all Providers

6.1.4 Option 2: Default Routes and Partial Updates

6.1.5 Option 3: Full Routes from All Providers

6.1.6 BGP Routing Between Autonomous Systems

6.1.7 Path-Vector Functionality

6.1.8 BGP Routing Policies

6.1.9 Features of BGP

6.1.10 BGP Databases

6.1.11 BGP Message Types

6.2 EBGP and IBGP

6.2.1 BGP Neighbor Relationship

6.2.2 Establishing a Connection between External BGP Neighbors

6.2.3 Establishing a Connection between Internal BGP Neighbors

6.2.4 Synchronization within an Autonomous System

6.2.5 IBGP in a Nontransit Autonomous System

6.2.6 Routing Issues in a Transit Autonomous Ssystem

6.3 Configuring BGP

6.3.1 Basic BGP Configuration

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6.3.2 Activate a BGP Session

6.3.3 Shutting Down a BGP Neighbor

6.3.4 BGP Configuration Considerations

6.3.5 IBGP Peering Issue

6.3.6 BGP neighbor update-source Command

6.3.7 EBGP Peering Issue

6.3.8 Next Hop Behavior

6.3.9 BGP neighbor next-hop-self Command

6.3.10 Injection Routing Information into BGP

6.3.11 The BGP network Command Example

6.3.12 BGP Synchronization

6.3.13 BGP Synchronization Example

6.3.14 BGP Configuration Example

6.4 Advanced BGP Configuration and Verification

6.4.1 BGP Neighbor States

6.4.2 BGP Established and Idle States

6.4.3 BGP Active State Troubleshooting

6.4.4 Configuring a Peer Group

6.4.5 Configuring a Peer Group Example

6.4.6 BGP Peering

6.4.7 Configuring BGP Authentication

6.4.8 Troubleshooting BGP

6.4.9 Clearing the BGP Session

6.4.10 Hard Reset of BGP Sessions

6.4.11 Soft Reset of BGP Sessions

6.4.12 The debug ip bgp Command

6.5 Selecting a BGP Path

6.5.1 Characteristics of BGP Attributes

6.5.2 BGP Attributes

6.5.3 AS Path Attribute

6.5.4 Next-Hop Attribute

Module 7. IP Multicasting

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7.1.2 Unicast versus Multicast

7.1.3 Multicast Advantages and Disadvantages

7.1.4 Multicast Applications

7.1.5 IP Multicast Addresses

7.1.6 Layer 2 Multicast Addressing

7.1.7 Multicast Sessions

7.2 IGMP and Layer 2 Issues

7.2.1 Introducing IGMPv2

7.2.2 IGMPv2 Join Group and Leave Group Messages

7.2.3 Introducing IGMPv3

7.2.4 IGMPv2 and IGMPv3 Interoperability

7.2.5 Multicast in the Layer 2 Switching Environment

7.2.6 Multicast in Layer 2 Solutions

7.2.7 Cisco Group Management Protocol (CGMP)

7.2.8 IGMP Snooping

7.3 Multicast Routing Protocols

7.3.1 Protocols used in Multicast

7.3.2 Multicast Distribution Trees

7.3.3 Multicast Distribution Trees Identification

7.3.4 IP Multicast Routing

7.3.5 Protocol-Independent Multicast: Describing PIM-DM

7.3.6 Protocol-Independent Multicast: Describing PIM-SM

7.3.7 PIM Sparse-Dense-Mode

7.4 Multicast Configuration and Verification

7.4.1 Enabling PIM Sparse Mode and Sparse-Dense Mode

7.4.2 Inspecting the Multicast Routing Table

7.4.3 Finding PIM Neighbors

7.4.4 Checking RP Information

7.4.5 Checking the Group State

7.4.6 Configure a Router to be a Member of a Group

7.4.7 Configure a Router as a Statically Connected Member

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7.4.8 Verifying IGMP Snooping

7.5 IP Multicast Challenge Labs

7.5.1 Implementing IGMP and IGMP Snooping

7.5.2 Routing IP Multicast with PIM Dense Mode

7.5.3 Routing IP Multicast with PIM Sparse Mode

7.5.4 Routing IP Multicast with PIM Sparse-Dense Mode Module Summary Module Quiz

Module 8. IPv6

Overview

8.1 Explaining IPv6

8.1.1 Introducing IPv6

8.1.2 IPv6 Features

8.1.3 Large Address Space

8.2 IPv6 Addressing

8.2.1 IPv6 Addressing Architecture

8.2.2 Comparing IPv4 and IPv6 Headers

8.2.3 IPv6 Extension Headers

8.2.4 Defining Address Representation

8.2.5 IPv6 Address Types

8.2.6 IPv6 Global Unicast and Anycast Addresses

8.3 Dynamic IPv6 Addresses

8.3.1 Defining Host Interface Addresses

8.3.2 Link Local Address

8.3.3 Stateless Autoconfiguration

8.3.4 EUI-64 to IPv6 Identifier

8.3.5 IPv6 over Data Link Layers

8.3.6 IPv6 Multicasting

8.3.7 Permanent IPv6 Addresses

8.3.8 Addresses that are not Unique

8.3.9 Anycast

8.3.10 IPv6 Mobility

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8.4 IPv6 Routing

8.4.1 Describing IPv6 Routing

8.4.2 OSPFv3 and IPv6

8.4.3 Similarities Between OSPFv2 and OSPFv3

8.4.4 Differences Between OSPFv2 and OSPFv3

8.4.5 LSA Types for IPv6

8.4.6 Address Prefix and LSAs

8.5 Implementing and Verifying OSPFv3

8.5.1 Configuring OSPFv3 in IPv6

8.5.2 Enabling OSPFv3 on an Interface

8.5.3 Configuring OSPFv3 Routing Specifics
8.5.4 OSPFv3 Route Summarization

8.5.5 OSPFv3 Configuration Example

8.5.6 Verifying OSPFv3

8.5.7 Verifying OSPFv3 Neighbors

8.5.8 Verifying OSPFv3 Database

8.6 Using IPv6 and IPv4

8.6.1 IPv6 to IPv4 Transition Mechanism

8.6.2 Cisco IOS Dual Stack

8.6.3 Overlay Tunnels

8.6.4 Isolated Dual-Stack Host

8.6.5 Configuring Tunneling

8.6.6 Example if a Configured Tunnel

8.6.7 IPv6 to IPv4 Tunnel and Addresses

8.6.8 Translation of NAT-PT

8.7 IPv6 Challenge Labs

8.7.1 Configuring OSPF for IPv6

8.7.2 Using Manual IPv6 Tunnels

8.7.3 Configuring 6to4 Tunnels Module Summary Module Quiz

Case Studies

Case Study 1 EIGRP Case Study 2 OSPF with Four Routers Case Study 3 OSPF with Five Routers (Optional)

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Case Study 4 BGP