

CCNA 3: Switching Basics and Intermediate Routing

Cisco Networking Academy Program
Version 3.0

Table of Contents

CCNA 3: SWITCHING BASICS AND INTERMEDIATE ROUTING.....	1
TARGET AUDIENCE.....	3
PREREQUISITES.....	3
COURSE DESCRIPTION.....	3
COURSE OBJECTIVES.....	3
COURSE OVERVIEW.....	4
COURSE OUTLINE.....	5
<i>Module 1. Introduction to Classless Routing.....</i>	<i>5</i>
<i>Module 2. Single-Area OSPF.....</i>	<i>5</i>
<i>Module 3. EIGRP.....</i>	<i>6</i>
<i>Module 4. Switching Concepts.....</i>	<i>7</i>
<i>Module 5. Switches.....</i>	<i>8</i>
<i>Module 6. Switch Configuration.....</i>	<i>8</i>
<i>Module 7. Spanning Tree Protocol.....</i>	<i>9</i>
<i>Module 8. VLANs.....</i>	<i>9</i>
<i>Module 9. VTP.....</i>	<i>10</i>
<i>Case Study: Access Control Lists (ACLs).....</i>	<i>11</i>

Target Audience

Anyone desires a practical, technical introduction to the field of networking. High-school, community college, and lifelong-learning students interested in careers as network technicians, network engineers, network administrators, and network help-desk staff.

Prerequisites

- Students should have Reading Age Level (RAL) of 13.
- Successful completion of CCNA 2.

Course Description

CCNA3: Switching Basics and Intermediate Routing is the third of four courses leading to the Cisco Certified Network Associate (CCNA) designation. The course focuses on advanced IP addressing techniques (Variable Length Subnet Masking [VLSM]), intermediate routing protocols (RIP v2, single-area OSPF, EIGRP), command-line interface configuration of switches, Ethernet switching, Virtual LANs (VLANs), Spanning Tree Protocol (STP), and VLAN Trunking Protocol (VTP). Particular emphasis is given to students being able to demonstrate the ability to apply learnings from CCNA 1 and 2 to a network and to be able to explain how and why a particular strategy is employed.

Course Objectives

The CCNA certification indicates knowledge of networking for the small-office, home-office (SOHO) market and the ability to work in small businesses or organizations whose networks have fewer than 100 nodes. A CCNA certified individual can:

- Install and configure Cisco switches and routers in multiprotocol internetworks using LAN and WAN interfaces
- Provide Level 1 troubleshooting service
- Improve network performance and security
- Perform entry-level tasks in the planning, design, installation, operation and troubleshooting of Ethernet, TCP/IP Networks.

CCNA 3 is an integral step towards achieving CCNA Certification.

Upon completion of this course, students will be able to perform tasks related to:

- Variable Length Subnet Masking (VLSM)

- Intermediate routing protocols (RIP v2, single-area OSPF, EIGRP)
- Switching Concepts
- Switches
- Switch Configuration
- Spanning Tree Protocol (STP)
- Virtual LANs (VLANs)
- VLAN Trunking Protocol (VTP)

Course Overview

The course has been designed for 70 contact hours. Approximately 35 hours will be designated to lab activities and 35 hours on curriculum content. A case study on structured cabling is required, but format and timing are determined by the Local Academy.

What has changed from CCNA versions 2.x?

- Removal of IPX, Network Management, and TCS Chapters
- Case study required; format and timing determined by Local Academy
- IGRP and Access Lists moved to CCNA 2
- Addition of VLSM (IP Address technique for “subnetting subnets”)
- Addition of RIP v2, EIGRP, and Single-Area OSPF routing protocols
- Addition of CLI configuration of switches
- Additional material on VLANs and VTP
- More interactive Flash activities
- Sequence of > 40 eLabs
- Lab focus on intermediate routing and command-line interface configuration of switches

Course Outline

Module 1. Introduction to Classless Routing

Overview

1.1 VLSM

- 1.1.1 What is VLSM and Why Use It?
- 1.1.2 A waste of space (IP addresses)
- 1.1.3 When to use VLSM
- 1.1.4 Calculating subnets with VLSM
- 1.1.5 Route aggregation with VLSM
- 1.1.6 Configuring VLSM

1.2 RIP Version 2

- 1.2.1 RIP history
- 1.2.2 RIP v2 features
- 1.2.3 Comparing RIP v1 and v2
- 1.2.4 Configuring RIP v2
- 1.2.5 Verifying RIP v2
- 1.2.6 Troubleshooting RIP v2
- 1.2.7 Default routes

Summary

Module 2. Single-Area OSPF

Overview

2.1 Link State Routing Protocol

- 2.1.1 Overview of link state routing
- 2.1.2 Link state routing features
- 2.1.3 How routing information is maintained
- 2.1.4 Link state routing algorithms
- 2.1.5 Benefits and problems with link state routing
- 2.1.6 Compare and contrast distance vector and link state routing

2.2 Single Area OSPF Concepts

- 2.2.1 OSPF overview
- 2.2.2 OSPF terminology
- 2.2.3 Comparing OSPF with distance vector routing protocols
- 2.2.4 Shortest path algorithm

- 2.2.5 OSPF network types
- 2.2.6 OSPF Hello protocol
- 2.2.7 Steps in operation of OSPF
- 2.3 Single Area OSPF Configuration
 - 2.3.1 Configuring the OSPF routing process
 - 2.3.2 Configuring OSPF loopback address and router priority
 - 2.3.3 Modifying OSPF cost metric
 - 2.3.4 Configuring OSPF authentication
 - 2.3.5 Configuring OSPF timers
 - 2.3.6 OSPF propagating a default route
 - 2.3.7 Common OSPF configuration Issues
 - 2.3.8 Verifying the OSPF configuration
- Summary

Module 3. EIGRP

Overview

3.1 EIGRP Concepts

- 3.1.1 Comparing EIGRP with IGRP
- 3.1.2 EIGRP concepts and terminology
- 3.1.3 EIGRP design Features
- 3.1.4 EIGRP technologies
- 3.1.5 EIGRP data structures
- 3.1.6 EIGRP algorithm

3.2 EIGRP Configuration

- 3.2.1 Configuring EIGRP
- 3.2.2 Configuring EIGRP summarization
- 3.2.3 Verifying basic EIGRP
- 3.2.4 Building neighbor tables
- 3.2.5 Discover routes
- 3.2.6 Select routes
- 3.2.7 Maintaining routing tables

3.3 Troubleshooting Routing Protocols

- 3.3.1 Routing protocol troubleshooting process
- 3.3.2 Troubleshooting RIP configuration
- 3.3.3 Troubleshooting IGRP configuration

3.3.4 Troubleshooting EIGRP configuration

3.3.5 Troubleshooting OSPF configuration

Summary

Module 4. Switching Concepts

Overview

4.1 Introduction to Ethernet/802.3 LANs

4.1.1 Ethernet/802.3 LAN development

4.1.2 Factors that impact on network performance

4.1.3 Elements of Ethernet/802.3 networks

4.1.4 Half-Duplex networks

4.1.5 Network congestion

4.1.6 Network latency

4.1.7 Ethernet 10BASE-T transmission time

4.1.8 The benefits of using repeaters

4.1.9 Full-duplex transmitting

4.2 Intro to LAN Switching

4.2.1 LAN segmentation

4.2.2 LAN segmentation with bridges

4.2.3 The advantages and disadvantages of LAN segmentation with routers

4.2.4 The advantages and disadvantages of LAN segmentation with switches

4.2.5 Describe the basic operations of a switch

4.2.6 Ethernet switch latency

4.2.7 Layer 2 and Layer 3 switching

4.2.8 Symmetric and asymmetric switching

4.2.9 Memory buffering

4.2.10 Two switching methods

4.3 Switch Operation

4.3.1 Functions of Ethernet switches

4.3.2 Frame transmission modes

4.3.3 How switches and bridges learn addresses part 1

4.3.4 How switches and bridges filter frames

4.3.5 LAN segmentation using bridging

4.3.6 Microsegmentation

- 4.3.7 Microsegmentation Implementation
 - 4.3.8 Switches and collision domains
 - 4.3.9 Switches and broadcast domains
 - 4.3.10 Communications between switches and workstations
- Summary

Module 5. Switches

Overview

5.1 LAN Design

- 5.1.1 LAN design goals
- 5.1.2 LAN design considerations
- 5.1.3 LAN design methodology
- 5.1.4 Layer 1 design
- 5.1.5 Layer 2 design
- 5.1.6 Layer 3 design

5.2 LAN Switches

- 5.2.1 Switched LANs, access layer overview
- 5.2.2 Access layer switches
- 5.2.3 Distribution layer overview
- 5.2.4 Distribution layer switches
- 5.2.5 Core layer overview
- 5.2.6 Core layer switches

Summary

Module 6. Switch Configuration

Overview

6.1 Starting the Switch

- 6.1.1 Physical startup of the Catalyst switch
- 6.1.2 Switch LED indicators
- 6.1.3 Verifying port LEDs during switch POST
- 6.1.4 Viewing initial bootup output from the switch
- 6.1.5 Examining keyboard help in the switch command-line interface
- 6.1.6 Showing the switch initial startup status

6.2 Configuring the Switch

- 6.2.1 Verifying the Catalyst switch default configuration
- 6.2.2 Configuring the Catalyst switch
- 6.2.3 Managing the MAC address table
- 6.2.4 Configuring static MAC addresses
- 6.2.5 Configuring port security
- 6.2.6 Executing adds, moves, and changes
- 6.2.7 Managing switch operating system images and device configuration files
- 6.2.8 1900/2950 password recover
- 6.2.9 1900/2900 firmware upgrade

Summary

Module 7. Spanning Tree Protocol

Overview

7.1 Redundant Topologies

- 7.1.1 Redundancy
- 7.1.2 Redundant topologies
- 7.1.3 Redundant switched topologies
- 7.1.4 Broadcast storms
- 7.1.5 Multiple frame transmissions
- 7.1.6 MAC database instability

7.2 STP Overview

- 7.2.1 Redundant topology and spanning tree
- 7.2.2 Spanning Tree Protocol
- 7.2.3 Spanning tree operation
- 7.2.4 Selecting a root bridge
- 7.2.5 Stages of spanning tree port states
- 7.2.6 Spanning tree recalculation
- 7.2.7 Rapid Spanning Tree Protocol

Summary

Module 8. VLANs

Overview

8.1 VLAN Concepts

- 8.1.1 VLAN introduction
- 8.1.2 Broadcast domains with VLANs and routers
- 8.1.3 VLAN operation
- 8.1.4 Benefits of VLANs
- 8.1.5 VLAN types
- 8.2 VLAN Configuration
 - 8.2.1 VLAN basics
 - 8.2.2 Geographic VLANs
 - 8.2.3 Configuring static VLANs
 - 8.2.4 Verifying VLAN configuration
 - 8.2.5 Saving VLAN configuration
 - 8.2.6 Deleting VLANs
- 8.3 Troubleshooting VLANs
 - 8.3.1 Overview
 - 8.3.2 VLAN troubleshooting process
 - 8.3.3 Preventing broadcast storms
 - 8.3.4 Troubleshooting VLANs
 - 8.3.5 VLAN troubleshooting scenarios
- Summary

Module 9. VTP

- Overview
- 9.1 Trunking
 - 9.1.1 History of trunking
 - 9.1.2 Trunking concepts
 - 9.1.3 Trunking operation
 - 9.1.4 VLANs and trunking
 - 9.1.5 Trunking implementation
- 9.2 VTP
 - 9.2.1 History of VTP
 - 9.2.2 VTP concepts
 - 9.2.3 VTP operation
 - 9.2.4 VTP implementation
 - 9.2.5 VTP configuration
- 9.3 Inter-VLAN Routing

- 9.3.1 VLAN overview
- 9.3.2 Introducing Inter-VLAN routing
- 9.3.3 Inter-VLAN issues and solutions
- 9.3.4 Physical, logical, and virtual interfaces
- 9.3.5 Dividing physical interfaces into subinterfaces
- 9.3.6 Configuring Inter-VLAN routing

Summary

Case Study: Access Control Lists (ACLs)