

**COURSE NUMBER:** CE3380

**COURSE TITLE:** IP Routing, IPv6 & Security

**COURSE DESCRIPTION:**

This course continues the learner's education in Internet Protocol (IP)-based communications with the concept of IP routing. In this course the learner will be introduced to packet switching and explore various methods of packet switching including static and dynamic routing; routing within private networks; routing between private networks; IPv6; and IP routing security.

**PREREQUISITES:** CE1210 – Basic Communications Networks

**CO-REQUISITES:** None

**CREDIT VALUE:** Four (4)

**COURSE HOURS PER WEEK:** Three (3)

**LAB HOURS PER WEEK:** Two (2)

**SUGGESTED TEXT:**

Graziani, R., & Johnson, A. (2012). *Routing protocols and concepts: CCNA exploration companion guide*. CA: Cisco Press. ISBN-13: 9781587132728; ISBN-10: 1587132729

**LEARNING RESOURCES:**

Cisco Networking Academy <http://www.cisco.com/web/learning/netacad/index.html>

**MAJOR TOPICS:**

- 1.0 Introduction to Packet Switching and Routing
- 2.0 Static Routing and Dynamic Routing
- 3.0 Distance Vector Routing Protocols
- 4.0 Link State Routing Protocols
- 5.0 Address Conservation and Routing
- 6.0 External Routing Protocols
- 7.0 Internet Protocol Version 6 (IPv6)
- 8.0 Internet Protocol Routing Security

## **LEARNING OBJECTIVES:**

The expected learning outcomes are that the learner will be able to:

### **1.0 Introduction to Packet Switching and Routing**

- 1.1 Describe the hardware components of a router
- 1.2 Describe the software components of a router
- 1.3 Describe the router boot sequence
- 1.4 Configure a router for basic operation using the Command Line Interface (CLI)
- 1.5 Explain the routing process including:
  - 1.5.1 Routing table
  - 1.5.2 Path determination and switching functions

### **2.0 Static Routing and Dynamic Routing**

- 2.1 Define static routing
- 2.2 Configure a router to use a static route
- 2.3 Verify the router configuration using the appropriate CLI commands
- 2.4 Verify the router operation using the appropriate CLI commands
- 2.5 Describe the operation of router discovery protocols such as Cisco Discovery Protocol (CDP)
- 2.6 Troubleshoot/resolve issues with static routes using the appropriate CLI commands
- 2.7 Define dynamic routing
- 2.8 State the benefits of dynamic routing over static routing
- 2.9 Differentiate amongst classes of dynamic routing protocols including:
  - 2.9.1 Distance Vector Protocols (DVP)
  - 2.9.2 Link State Protocols
  - 2.9.3 Interior Routing Protocols
  - 2.9.4 Exterior Routing Protocols

### **3.0 Distance Vector Routing Protocols**

- 3.1 Describe the operation of (DVP) in terms of network discovery and routing table construction
- 3.2 Explain how routing loops occur with DVP
- 3.3 Describe the methods employed to prevent routing loops with DVP
- 3.4 Differentiate amongst common DVP such as Routing Information Protocol version 1(RIPv1), RIPv2, and Enhanced Interior Gateway Routing Protocol (EIGRP)
- 3.5 Describe the operation of RIPv1
- 3.6 Implement a RIPv1 routing solution to meet a specified network design
- 3.7 Explain how RIPv2 improves upon RIPv1 and overcomes the limitations associated with RIPv1
- 3.8 Implement a RIPv2 routing solution to meet a specified network design

- 3.9 Explain the purpose of using authentication with router updates
- 3.10 Describe the structure of the routing table
- 3.11 Explain the process by which a router selects a route as the best path
- 3.12 Describe the operation of EIGRP
- 3.13 Implement an EIGRP routing solution to meet a specified network design
- 3.14 Explain how EIGRP makes its best path selection
- 3.15 Troubleshoot/ resolve issues with Distance Vector Routing protocols using the appropriate CLI commands

#### **4.0 Link State Routing Protocols**

- 4.1 Describe the operation of Link State Routing Protocols
- 4.2 Differentiate between common Link State Routing Protocols
- 4.3 Describe the Shortest Path First (SPF) algorithm
- 4.4 Describe the operation of Open Shortest Path First (OSPF)
- 4.5 Implement an OSPF routing solution to meet a specified network design

#### **5.0 Address Conservation and Routing**

- 5.1 Differentiate between Classful and Classless addressing
- 5.2 Explain how Classless Interdomain Routing (CIDR) conserves addresses
- 5.3 Explain how Variable Length Subnet Masks (VLSM) conserve addresses
- 5.4 Explain how classless addressing overcomes the limitations of classful addressing
- 5.5 Explain Route Summarization
- 5.6 Develop an IP addressing solution using VLSM
- 5.7 Implement a routing solution using VLSM

#### **6.0 External Routing Protocols**

- 6.1 Explain the operation of external routing protocols such as Border Gateway Protocol (BGP)
- 6.2 Explain the process by which BGP routes traffic between Autonomous Systems (AS)
- 6.3 Explain BGP Multihoming
- 6.4 Identify situations in which BGP would be recommended
- 6.5 Identify situations in which BGP would not be recommended
- 6.6 Describe the BGP topology
- 6.7 Explain BGP operation
- 6.8 Implement a BGP solution to route traffic between AS
- 6.9 Implement a BGP solution to route traffic within an enterprise network
- 6.10 Troubleshoot/ resolve BGP issues using the appropriate CLI commands

#### **7.0 Internet Protocol Version 6 (IPv6)**

- 7.1 Describe the issues associated with Internet Protocol version 4 (IPv4)
- 7.2 Explain how IPv6 overcomes the limitations of IPv4

- 7.3 Describe the IPv6 header structure
- 7.4 Explain the function of IPv6 extension headers
- 7.5 Explain the IPv6 addressing structure
- 7.6 Explain IPv6 address classes
- 7.7 Implement an IPv6 addressing solution in a routed network
- 7.8 Differentiate between IPv4 and IPv6 routing protocols
- 7.9 Implement an IPv4 to IPv6 transition to meet specified requirements
- 7.10 Use appropriate CLI commands to:
  - 7.10.1 Configure a router to use IPv6
  - 7.10.2 Confirm a router's IPv6 configuration

## **8.0 Internet Protocol Routing Security**

- 8.1 Identify router vulnerabilities
- 8.2 Configure security on a router using automated services
- 8.3 Configure security on a router using an external router management application
- 8.4 Prepare a security plan for network routers
- 8.5 Implement logging functions on a router
- 8.6 Configure routers for secure network management using Simple Network Management Protocol version 3 (SNMPv3)
- 8.7 Configure a router for secure remote access and administration
- 8.8 Implement Authentication, Authorization, and Accounting (AAA) in a routed network
- 8.9 Configure routing protocols for secure routing table updates

### **EVALUATION:**

Laboratories:	10%
Quizzes:	10%
Practical Exam:	40%
Final Exam:	40%

**DATE DEVELOPED:** March 2012

**DATE REVIEWED:**

**REVISION NUMBER:**

**DATE REVISED:**

*Note to instructor: Check PIRS to ensure this outline is the most current version*