Scope and Sequence

CCNA 2: Router and Routing Basics

Cisco Networking Academy Program
Version 3.1

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Target Audience

The target audience is anyone who desires a practical and technical introduction to the field of networking. This includes high school, community college, and lifelong-learning students interested in careers as network technicians, network engineers, network administrators, and network help-desk staff.

Prerequisites

The successful completion of this course requires the following:

- Reading Age Level (RAL) of 13
- Successful completion of CCNA 1

The following prerequisites are beneficial, but not required:

- Prior experience with computer hardware and command line computer interfaces
- Background in computer programming

Course Description

CCNA 2: Routers and Routing Basics is the second of four CCNA courses leading to the Cisco Certified Network Associate (CCNA) designation. CCNA 2 focuses on initial router configuration, Cisco IOS Software management, routing protocol configuration, TCP/IP, and access control lists (ACLs). Students will develop skills on how to configure a router, manage Cisco IOS Software, configure routing protocol on routers, and set the access lists to control the access to routers.

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 with networks that have fewer than 100 nodes. A CCNA certified individual can perform the following tasks:

- 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 and TCP/IP Networks

CCNA 2 is a necessary step toward achieving CCNA certification.

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

- Routers and their roles in WANs

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- Cisco IOS
- Router configuration
- Router file management
- RIP and IGRP routing protocols
- TCP/IP error and control messages
- Router troubleshooting
- Intermediate TCP
- Access control lists

Lab Requirements

Please refer to CCNA Equipment Bundle Spreadsheets on Academy Connection.

Certification Alignment

The curriculum is aligned with the Cisco Internet Learning Solution Group (ILSG) INTRO and ICND courses.

Course Overview

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

The following changes have taken place since CCNA version 2.x:

- More emphasis on router configuration early in semester
- More efficient presentation and practice of IOS
- IGRP moved from CCNA 3 to CCNA 2
- Access lists moved from CCNA 3 to CCNA 2
- Revisions to TCP/IP coverage
- More focus on understanding routing tables
- Case study is required with format and timing determined by the Local Academy
- More interactive flash activities
- Sequence of over 40 e-labs
- Lab focus on 2-router labs

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The following changes have taken place since CCNA version 3.0:

- Technical updates
- Improved readability

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Course Outline

Module 1. WANs and Routers

Overview

1.1 WANs

- 1.1.1 Introduction to WANs
- 1.1.2 Introduction to routers in a WAN
- 1.1.3 Router LANs and WANs
- 1.1.4 Role of routers in a WAN
- 1.1.5 Academy approach to hands-on labs

1.2 Routers

- 1.2.1 Introduction to WANs
- 1.2.2 Router physical characteristics
- 1.2.3 Router external connections
- 1.2.4 Management port connections
- 1.2.5 Connecting console interfaces
- 1.2.6 Connecting LAN interfaces
- 1.2.7 Connecting WAN interfaces

Summary

Module 2. Introduction to Routers

Overview

2.1 Operating Cisco IOS Software

- 2.1.1 The purpose of Cisco IOS software
- 2.1.2 Router user interface
- 2.1.3 Router user interface modes
- 2.1.4 Cisco IOS software features
- 2.1.5 Operation of Cisco IOS software

2.2 Starting a Router

- 2.2.1 Initial startup of Cisco routers
- 2.2.2 Router LED indicators
- 2.2.3 The initial router bootup
- 2.2.4 Establish a console session
- 2.2.5 Router login
- 2.2.6 Keyboard help in the router CLI

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2.2.7 Enhanced editing commands
2.2.8 Router command history
2.2.9 Troubleshooting command line errors
2.2.10 The **show version** command
Summary

Module 3. Configuring a Router

Overview
3.1 Configuring a Router
3.1.1 CLI command modes
3.1.2 Configuring a router name
3.1.3 Configuring router passwords
3.1.4 Examining the **show** commands
3.1.5 Configuring a serial interface
3.1.6 Making configuration changes
3.1.7 Configuring an Ethernet interface
3.2 Finishing the Configuration
3.2.1 Importance of configuration standards
3.2.2 Interface descriptions
3.2.3 Configuring interface description
3.2.4 Login banners
3.2.5 Configuring message-of-the-day (MOTD)
3.2.6 Host name resolution
3.2.7 Configuring host tables
3.2.8 Configuration backup and documentation
3.2.9 Backing up configuration files
Summary

Module 4. Learning about Other Devices

Overview
4.1 Discovering and Connecting to Neighbors
4.1.1 Introduction to CDP
4.1.2 Information obtained with CDP
4.1.3 Implementation, monitoring, and maintenance of CDP
4.1.4 Creating a network map of the environment

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4.1.5 Disabling CDP
4.1.6 Troubleshooting CDP
4.2 Getting Information about Remote Devices
4.2.1 Telnet
4.2.2 Establishing and verifying a Telnet connection
4.2.3 Disconnecting and suspending Telnet sessions
4.2.4 Advanced Telnet operation
4.2.5 Alternate connectivity tests
4.2.6 Troubleshooting IP address issues
Summary

Module 5. Managing Cisco IOS Software

Overview
5.1 Router Boot Sequence and Verification
5.1.1 Stages of the router power-on boot sequence
5.1.2 How a Cisco device locates and loads IOS
5.1.3 Using the **`boot system`** command
5.1.4 Configuration register
5.1.5 Troubleshooting IOS boot failure
5.2 Managing the Cisco File System
5.2.1 IOS file system overview
5.2.2 IOS naming conventions
5.2.3 Managing configuration files using TFTP
5.2.4 Managing configuration file using copy-and-paste
5.2.5 Managing IOS images using TFTP
5.2.6 Managing IOS images using Xmodem
5.2.7 Environmental variables
5.2.8 File system verification
Summary

Module 6. Routing and Routing Protocols

Overview
6.1 Introduction to Static Routing
6.1.1 Introducing routing
6.1.2 Static route operation

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6.1.3 Configuring static routes
6.1.4 Configuring default route forwarding
6.1.5 Verifying static route configuration
6.1.6 Troubleshooting static route configuration
6.2 Dynamic Routing Overview
6.2.1 Introduction to routing protocols
6.2.2 Autonomous systems
6.2.3 Purpose of a routing protocol and autonomous systems
6.2.4 Identifying the classes of routing protocols
6.2.5 Distance vector routing protocol features and examples
6.2.6 Link-state routing protocol features and examples
6.3 Routing Protocols Overview
6.3.1 Path determination
6.3.2 Routing configuration
6.3.3 Routing protocols
6.3.4 IGP versus EGP
Summary

Module 7. Distance Vector Routing Protocols

Overview
7.1 Distance Vector Routing
7.1.1 Distance vector routing updates
7.1.2 Distance vector routing loop issues
7.1.3 Defining a maximum count
7.1.4 Eliminating routing loops through split horizon
7.1.5 Route poisoning
7.1.6 Avoiding routing loops with triggered updates
7.1.7 Preventing routing loops with hold-down timers
7.2 RIP
7.2.1 RIP routing process
7.2.2 Configuring RIP
7.2.3 Using the **`ip classless`** command
7.2.4 Common RIP configuration issues
7.2.5 Verifying RIP configuration
7.2.6 Troubleshooting RIP update issues

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7.2.7 Preventing routing updates through an interface
7.2.8 Load balancing with RIP
7.2.9 Load balancing across multiple paths
7.2.10 Integrating static routes with RIP
7.3 IGRP
7.3.1 IGRP features
7.3.2 IGRP metrics
7.3.3 IGRP routes
7.3.4 IGRP stability features
7.3.5 Configuring IGRP
7.3.6 Migrating RIP to IGRP
7.3.7 Verifying IGRP configuration
7.3.8 Troubleshooting IGRP
Summary

Module 8. TCP/IP Suite Error and Control Messages

Overview
8.1 Overview of TCP/IP Error Message
8.1.1 ICMP
8.1.2 Error reporting and error correction
8.1.3 ICMP message delivery
8.1.4 Unreachable networks
8.1.5 Using ping to test destination reachability
8.1.6 Detecting excessively long routes
8.1.7 Echo messages
8.1.8 Destination unreachable message
8.1.9 Miscellaneous error reporting
8.2 TCP/IP Suite Control Messages
8.2.1 Introduction to control messages
8.2.2 ICMP redirect/change requests
8.2.3 Clock synchronization and transit time estimation
8.2.4 Information requests and reply message formats
8.2.5 Address mask requirements
8.2.6 Router discovery message
8.2.7 Router solicitation message

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8.2.8 Congestion and flow control messages

Summary

Module 9. Basic Router Troubleshooting

Overview

9.1 Examining the Routing Table

9.1.1 The **`show ip route`** command

9.1.2 Determining the gateway of last resort

9.1.3 Determining the route source and destination

9.1.4 Determining L2 and L3 addresses

9.1.5 Determining the route administrative distance

9.1.6 Determining the route metric

9.1.7 Determining the route next hop

9.1.8 Determining the last route update

9.1.9 Observe multiple paths to destination

9.2 Network Testing

9.2.1 Introduction to network testing

9.2.2 Using a structured approach to troubleshooting

9.2.3 Testing by OSI layers

9.2.4 Layer 1 troubleshooting using indicators

9.2.5 Layer 3 troubleshooting using ping

9.2.6 Layer 7 troubleshooting using Telnet

9.3 Troubleshooting Router Issues Overview

9.3.1 Troubleshooting Layer 1 using **`show interface`**

9.3.2 Troubleshooting Layer 2 using **`show interface`**

9.3.3 Troubleshooting using **`show cdp`**

9.3.4 Troubleshooting using **`traceroute`**

9.3.5 Troubleshooting routing issues

9.3.6 Troubleshooting using **`show controllers serial`**

9.3.7 Introduction to **`debug`**

Summary

Module 10. Intermediate TCP/IP

Overview

10.1 TCP Operation

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10.1.1 TCP operation

10.1.2 Synchronization process or 3-way handshake

10.1.3 Denial-of-service attacks

10.1.4 Windowing and window size

10.1.5 Sequencing numbers

10.1.6 Positive ACK

10.1.7 UDP operation

10.2 Overview of Transport Layer Ports

10.2.1 Multiple conversations between hosts

10.2.2 Ports for services

10.2.3 Ports for clients

10.2.4 Port numbering and well known ports numbers

10.2.5 Example of multiple sessions between hosts

10.2.6 Comparison of MAC addresses, IP addresses, and port numbers

Summary

Module 11. Access Control Lists (ACLs)

Overview

11.1 Access Control List Fundamentals

11.1.1 Introduction ACLs

11.1.2 How ACLs work

11.1.3 Creating ACLs

11.1.4 The function of a wildcard mask

11.1.5 Verifying ACLs

11.2 Access Control Lists (ACLs)

11.2.1 Standard ACLs

11.2.2 Extended ACLs

11.2.3 Named ACLs

11.2.4 Placing ACLs

11.2.5 Firewalls

11.2.6 Restricting virtual terminal access

Summary

Case Study: Routing

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