CCNA 2: Router and Routing Basics

Cisco Networking Academy Program
Version 3.0
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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 1.
- Prior experience with computer hardware and command line computer interfaces desired but not required.
- Background in computer programming beneficial.

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, managing Cisco IOS Software, configuring 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 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 2 is an integral step towards achieving CCNA Certification.
Upon completion of this course, students will be able to perform tasks related to:
- Routers and their role in WANs
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?

- 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
- Focus on understanding routing tables
- Case study required; format and timing determined by Local Academy
- More interactive flash activities
- Sequence of > 40 eLabs
- Lab focus on 2-router labs
Course Outline

Module 1. WANs and Routers

Overview

1.1 WANs
   1.1.1 Introduction to wide-area networks (WANs)
   1.1.2 WAN devices
   1.1.3 WAN standards
   1.1.4 Introduction to routers in a WAN
   1.1.5 Router functions
   1.1.6 Academy approach to hands-on labs

1.2 WAN Technologies
   1.2.1 WAN services
   1.2.2 Circuit switching
   1.2.3 Packet switched services
   1.2.4 Cell switched services
   1.2.5 Other WAN services

1.3 Routers
   1.3.1 Router internal components
   1.3.2 Router physical characteristics
   1.3.3 Router external connections
   1.3.4 Management port connections
   1.3.5 Connecting console interfaces
   1.3.6 Connecting LAN interfaces
   1.3.7 Connecting WAN interfaces

Summary

Module 2. Introduction to Router

Overview

2.1 Operating Cisco IOS
   2.1.1 The purpose of Cisco IOS
   2.1.2 Router user interface
   2.1.3 Router user interface modes
   2.1.4 Cisco IOS features
   2.1.5 Operation of the Cisco IOS
Module 3. Configuring a Router

Overview

3.1 Configuring a Router

3.1.1 Command-line interface command modes
3.1.2 Configuring name of a router
3.1.3 Configuring router passwords
3.1.4 Examining the show commands
3.1.5 Configuring a serial interface
3.1.6 Executing adds, moves, and 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 descriptions
3.2.4 Login banners
3.2.5 Configuring message of the day (MOTD)
3.2.6 Host name resolutions
3.2.7 Configuring host tables
3.2.8 Configuration backup and documentation
3.2.9 Copying, editing, and pasting configurations

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
   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 Telnet operation
   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

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 Router File System
   5.2.1 IOS file system overview
   5.2.2 IOS naming conventions
   5.2.3 Configuration file management using TFTP
   5.2.4 Configuration file management by using cut and paste
   5.2.5 Managing IOS images with TFTP
   5.2.6 Managing IOS images with Xmodem
   5.2.7 File system verification
Module 6. Routing and Routing Protocols

Overview

6.1 Overview of Static Routing
   6.1.1 Introducing routing
   6.1.2 Static route operation
   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
   6.2.7 Hybrid routing protocol features and examples

6.3 Routing Protocols Overview
   6.3.1 Route determination
   6.3.2 Routing configuration
   6.3.3 Routing protocols (RIP, IGRP, OSPF, EIGRP, BGP)
   6.3.4 Autonomous systems and IGP versus EGP
   6.3.5 Distance vector routing
   6.3.6 Link state routing

Summary

Module 7. Distance Vector Routing Protocols

Overview

7.1 Distance Vector Routing
   7.1.1 Distance vector protocol updates
   7.1.2 Distance vector routing loop issues
   7.1.3 Defining a maximum count to prevent count to infinity
   7.1.4 Eliminating routing loops through split horizon
Module 8. TCP/IP Suite Error and Control Messages

Overview

8.1 Overview of TCP/IP Error Message

8.1.1 Internet Control Message Protocol (ICMP)
8.1.2 Error reporting and error correction
8.1.3 ICMP message delivery
8.1.4 Unreachable network
8.1.5 Using PING to test destination reachability
8.1.6 Detecting excessively long routes
8.1.7 Echo message
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 address
9.1.4 Determining L2 and L3 addresses from the route source to the route destination
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 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 using show ip route and show ip protocol
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
10.1.1 TCP operation description
10.1.2 Synchronization process (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
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 What are ACLs
11.1.2 How ACLs work
11.1.3 Creating ACLs
11.1.4 The purpose and function of wildcard mask bits
11.1.5 Verifying ACLs
11.2 Access Control Lists
   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