

# CCNA 4: WAN Technologies

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**Cisco Networking Academy Program  
Version 3.1**

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## Target Audience

The target audience is anyone who desires a practical, 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 completion of this course requires the following:

- Reading Age Level (RAL) of 13
- Completion of CCNA 3

## Course Description

CCNA 4: WAN Technologies is the last of four courses leading to the Cisco Certified Network Associate (CCNA) designation. The course focuses on the following topics:

- Advanced IP addressing techniques
- Network Address Translation (NAT)
- Port Address Translation (PAT)
- Dynamic Host Configuration Protocol (DHCP)
- WAN technology and terminology
- PPP
- ISDN
- DDR
- Frame Relay
- Network management

Students will be required to apply information from CCNA 1, CCNA 2, and CCNA 3 to a network and should be able to explain how and why a particular strategy is used. This course will also help students prepare for the CCNA exam.

## 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 4 is an important step toward achieving CCNA certification.

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

- Network Address Translation (NAT) and Port Address Translation (PAT)
- Dynamic Host Configuration Protocol (DHCP)
- WAN technologies
- Point-to-Point Protocol (PPP)
- Integrated Services Digital Network (ISDN)
- Dial-on-demand routing (DDR)
- Frame Relay
- Network management

## Lab Requirements

Please refer to the CCNA Equipment Bundle Spreadsheets on Cisco 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 spent on curriculum content. A case study on structured cabling is required, but format and timing are to be determined by the Local Academy.

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

- Removal of Net Plus and TCS chapters
- Case study required with format and timing determined by the Local Academy
- Addition of more WAN terminology, especially cable modem and broadband
- Addition of Emerging Technologies Module
- Revision of Network management materials
- More interactive flash activities
- Sequence of over 40 e-labs

- More focus on hands-on labs
- More e-lab support for Academies without Adtrans

**The following changes have taken place since CCNA version 3.0:**

- Technical updates
- Improved readability

# Course Outline

## Module 1. Scaling IP Addresses

### Overview

#### 1.1 Scaling Networks with NAT and PAT

- 1.1.1 Private addressing
- 1.1.2 Introducing NAT and PAT
- 1.1.3 Major NAT and PAT features
- 1.1.4 Configuring NAT and PAT
- 1.1.5 Verifying PAT configuration
- 1.1.6 Troubleshooting NAT and PAT configuration
- 1.1.7 Issues with NAT

#### 1.2 DHCP

- 1.2.1 Introducing DHCP
- 1.2.2 BOOTP and DHCP differences
- 1.2.3 Major DHCP features
- 1.2.4 DHCP operation
- 1.2.5 Configuring DHCP
- 1.2.6 Verifying DHCP operation
- 1.2.7 Troubleshooting DHCP
- 1.2.8 DHCP relay

### Summary

## Module 2. WAN Technologies

### Overview

#### 2.1 WAN Technologies Overview

- 2.1.1 WAN technology
- 2.1.2 WAN devices
- 2.1.3 WAN standards
- 2.1.4 WAN encapsulation
- 2.1.5 Packet and circuit switching
- 2.1.6 WAN link options

#### 2.2 WAN Technologies

- 2.2.1 Analog dialup
- 2.2.2 ISDN

- 2.2.3 Leased line
- 2.2.4 X.25
- 2.2.5 Frame Relay
- 2.2.6 ATM
- 2.2.7 DSL
- 2.2.8 Cable modem
- 2.3 WAN Design
  - 2.3.1 WAN communication
  - 2.3.2 Steps in WAN design
  - 2.3.3 How to identify and select networking capabilities
  - 2.3.4 Three-layer design model
  - 2.3.5 Other layered design models
  - 2.3.6 Other WAN design considerations
- Summary

## **Module 3. PPP**

### Overview

- 3.1 Serial Point-to-Point Links
  - 3.1.1 Introduction to serial communication
  - 3.1.2 Time-division multiplexing
  - 3.1.3 Demarcation point
  - 3.1.4 DTE-DCE
  - 3.1.5 HDLC encapsulation
  - 3.1.6 Configuring HDLC encapsulation
  - 3.1.7 Troubleshooting a serial interface
- 3.2 PPP Authentication
  - 3.2.1 PPP layered architecture
  - 3.2.2 Establishing a PPP session
  - 3.2.3 PPP authentication protocols
  - 3.2.4 Password Authentication Protocol (PAP)
  - 3.2.5 Challenge Handshake Authentication Protocol
  - 3.2.6 PPP encapsulation and authentication process
- 3.3 Configuring PPP
  - 3.3.1 Introduction to configuring PPP
  - 3.3.2 Configuring PPP

- 3.3.3 Configuring PPP authentication
  - 3.3.4 Verifying the serial PPP encapsulation configuration
  - 3.3.5 Troubleshooting the serial PPP encapsulation configuration
- Summary

## **Module 4. ISDN and DDR**

### Overview

#### 4.1 ISDN Concepts

- 4.1.1 Introducing ISDN
- 4.1.2 ISDN standards and access methods
- 4.1.3 ISDN 3-layer model and protocols
- 4.1.4 ISDN functions
- 4.1.5 ISDN reference points
- 4.1.6 Determining the router ISDN interface
- 4.1.7 ISDN switch types

#### 4.2 ISDN Configuration

- 4.2.1 Configuring ISDN BRI
- 4.2.2 Configuring ISDN PRI
- 4.2.3 Verifying ISDN configuration
- 4.2.4 Troubleshooting the ISDN configuration

#### 4.3 DDR Configuration

- 4.3.1 DDR operation
- 4.3.2 Configuring legacy DDR
- 4.3.3 Defining static routes for DDR
- 4.3.4 Specifying interesting traffic for DDR
- 4.3.5 Configuring DDR dialer information
- 4.3.6 Dialer profiles
- 4.3.7 Configuring dialer profiles
- 4.3.8 Verifying DDR configuration
- 4.3.9 Troubleshooting the DDR configuration

### Summary

## **Module 5. Frame Relay**

### Overview

#### 5.1 Frame Relay Concepts



- 5.1.1 Introducing Frame Relay
- 5.1.2 Frame Relay terminology
- 5.1.3 Frame Relay stack layered support
- 5.1.4 Frame Relay bandwidth and flow control
- 5.1.5 Frame Relay address mapping/topology
- 5.1.6 Frame Relay LMI
- 5.1.7 Stages of Inverse ARP and LMI operation
- 5.2 Configuring Frame Relay
  - 5.2.1 Configuring basic Frame Relay
  - 5.2.2 Configuring a static Frame Relay map
  - 5.2.3 Reachability issues with routing updates in NBMA
  - 5.2.4 Frame Relay subinterfaces
  - 5.2.5 Configuring Frame Relay subinterfaces
  - 5.2.6 Verifying the Frame Relay configuration
  - 5.2.7 Troubleshooting the Frame Relay configuration
- Summary

## **Module 6. Introduction to Network Administration**

### Overview

#### 6.1 Workstations and Servers

- 6.1.1 Workstations
- 6.1.2 Servers
- 6.1.3 Client-server relationship
- 6.1.4 Introduction to NOS
- 6.1.5 Microsoft NT, 2000, and .NET
- 6.1.6 UNIX Sun, HP, and LINUX versions
- 6.1.7 Apple
- 6.1.8 Concept of service on servers

#### 6.2 Network Management

- 6.2.1 Introduction to network management
- 6.2.2 OSI and network management model
- 6.2.3 SNMP and CMIP standards
- 6.2.4 SNMP operation
- 6.2.5 Structure of management information and MIBs
- 6.2.6 SNMP protocol

6.2.7 Configuring SNMP

6.2.8 RMON

6.2.9 Syslog

Summary

## **Case Study: WANs**