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IMPLEMENTING AND ADMINISTERING CISCO SOLUTIONS

DURATION: 5 DAYS COURSE CODE: CCNA FORMAT: LECTURE/LAB

COURSE DESCRIPTION

The Implementing and Administering Cisco Solutions (CCNA) v1.0 course gives you a broad range of fundamental knowledge for all IT careers. Through a combination of lecture, hands-on labs, and self-study, you will learn how to install, operate, configure, and verify basic IPv4 and IPv6 networks. The course covers configuring network components such as switches, routers, and wireless LAN controllers; managing network devices; and identifying basic security threats. The course also gives you a foundation in network programmability, automation, and software-defined networking.

This course helps you prepare to take the 200-301 Cisco® Certified Network Associate (CCNA®) exam. By passing this one exam, you earn CCNA certification.

This course will help you:

- Learn the knowledge and skills to install, configure, and operate a small- to medium-sized network
- Gain a foundation in the essentials of networking, security, and automation
- Prepare for the 200-301 CCNA exam, which earns CCNA certification

WHO SHOULD ATTEND

Entry-level network engineer

Network administrator

Network support technician

Help desk technician

PREREQUISITES

Basic computer literacy

Basic PC operating system navigation skills

Basic Internet usage skills

Basic IP address knowledge

There are no formal prerequisites for CCNA certification, but you should make sure to have a good understanding of the exam topics.

ABOUT THE EXAM

The 200-301 CCNA exam certifies your knowledge and skills related to network fundamentals, network access, IP connectivity, IP services, security fundamentals, and automation and programmability.

After you pass 200-301 CCNA, you earn CCNA certification.

LEARNING OBJECTIVES

Identify the components of a computer network and describe their basic characteristics

Understand the model of host-to-host communication

Describe the features and functions of the Cisco Internetwork Operating System (IOS®) software

Describe LANs and the role of switches within LANs

Describe Ethernet as the network access layer of TCP/IP and describe the operation of switches

Install a switch and perform the initial configuration

Describe the TCP/IP Internet layer, IPv4, its addressing scheme, and subnetting

Describe the TCP/IP Transport layer and Application layer

Explore functions of routing

Implement basic configuration on a Cisco router

Explain host-to-host communications across switches and routers

Identify and resolve common switched network issues and common problems associated with IPv4 addressing

Describe IPv6 main features and addresses, and configure and verify basic IPv6 connectivity

Describe the operation, benefits, and limitations of static routing

Describe, implement, and verify Virtual Local Area Networks (VLANs) and trunks

Describe the application and configuration of inter-VLAN routing

Explain the basics of dynamic routing protocols and describe components and terms of Open Shortest Path First (OSPF)

Explain how Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) work

Configure link aggregation using EtherChannel

Describe the purpose of Layer 3 redundancy protocols

Describe basic WAN and VPN concepts

Describe the operation of Access Control Lists (ACLs) and their applications in the network

Configure Internet access using Dynamic Host Configuration Protocol (DHCP) clients and explain and configure Network Address Translation (NAT) on Cisco routers

Describe basic Quality of Service (QoS) concepts

Describe the concepts of wireless networks, which types of wireless networks can be built, and how to use Wireless LAN Controllers (WLCs)

Describe network and device architectures and introduce virtualization

Introduce the concept of network programmability and Software-Defined Networking (SDN) and describe smart network management solutions such as Cisco DNA Center™, Software-Defined Access (SD-Access), and Software-Defined Wide Area Network (SD-WAN)

Configure basic IOS system monitoring tools

Describe the management of Cisco devices

Describe the current security threat landscape

Describe threat defense technologies

Implement a basic security configuration of the device management plane

Implement basic steps to harden network devices

COURSE OUTLINE

1. Exploring the Functions of Networking

What Is a Computer Network?

- Identify the components of a computer network and describe their basic characteristics
- Define a network and describe examples of networks
- 2019 Cisco Systems, Inc. Course Administration Guide 12

Components of a Network

- Identify common network components by function

Characteristics of a Network

- List the characteristics of a network

Physical vs. Logical Topologies

- Compare and contrast logical and physical topologies

Interpreting a Network Diagram

- Interpret network diagrams

Impact of User Applications on the Network

- Describe the impact of user applications on the network
- Summary Challenge

2. Introducing the Host-To-Host Communications Model

Host-To-Host Communications Overview

- Understand the model of host-to-host communication
- Identify the requirements of a host-to-host communication model

ISO OSI Reference Model

- Describe the ISO OSI reference model

TCP/IP Protocol Suite

- Describe the functions and purposes of the TCP/IP layers

Peer-To-Peer Communications

- Describe how peer-to-peer communication works

Encapsulation and De-Encapsulation

- Describe the process of encapsulation and de-encapsulation

TCP/IP Stack vs OSI Reference Model

- Compare the TCP/IP suite with OSI Reference model
- Summary Challenge

3. Operating Cisco IOS Software

Cisco IOS Software Features and Functions

- Describe the features and functions of the Cisco IOS Software
- List the features and functions of Cisco IOS Software

Cisco IOS Software CLI Functions

- List the functions and usage of Cisco CLI

Cisco IOS Software Modes

- Identify IOS Software modes on Cisco devices
- Discovery 1: Get Started with Cisco CLI
- Navigate Cisco CLI
- Topology
- Job Aids
- Task 1: Navigate Between EXEC Modes
- Task 2: Explore CLI Help
- Task 3: Manage Cisco IOS Configuration
- Task 4: Improve User Experience in the CLI
- Summary Challenge

4. Introducing LANs

Local Area Networks

- Describe LANs and the role of switches within LANs
- Define a LAN

LAN Components

- Identify the components of a LAN

Need for Switches

- Identify the need for the switches in a LAN

Characteristics and Features of Switches

- List the characteristics and features of switches
- Summary Challenge

5. Exploring the TCP/IP Link Layer

Ethernet LAN Connection Media

- Describe Ethernet as the network access layer of TCP/IP and describe the operation of switches
- Describe the types of Ethernet LAN connection media

Ethernet Frame Structure

- Describe the fields of an Ethernet frame

LAN Communication Types

- Describe different LAN Communication Types

MAC Addresses

- Define the structure and function of MAC addresses

Frame Switching

- Explain the basic concept of switching
- Discovery 2: Observe How a Switch Operates
- Describe how switches operate and build MAC table
- Topology
- Job Aids
- Task 1: Observe How a Switch Operates

Duplex Communication

- Compare half-duplex and full-duplex operation and also configure it on an interface
- Summary Challenge

6. Starting a Switch

Switch Installation

- Install a switch and perform the initial configuration
- Identify physical installation requirements

Connecting to a Console Port

- Connect to a switch console port

COURSE OUTLINE

- Switch LED Indicators
- Identify the conditions that are reflected by the LEDs on switches
- Basic show Commands and Information
- List fundamental show commands
- Discovery 3: Perform Basic Switch Configuration
- Configure switch from command line and verify the configuration
- Topology
- Job Aids
- Task 1: Configure a Switch from the Command Line
- Task 2: Verify the Switch Initial Startup Status
- Implement the Initial Switch Configuration
- FASTLab 1: Implement the Initial Switch Configuration
- Topology
- Job Aid
- Configuration Tips
- Answer Key
- Summary Challenge

7. Introducing the TCP/IP Internet Layer, IPv4 Addressing, and Subnets

- Internet Protocol
  - Describe the TCP/IP Internet Layer, IPv4, its addressing scheme, and subnetting
  - List the characteristics of IP
  - Decimal and Binary Number Systems
  - Describe the decimal and binary number systems
  - Binary-to-Decimal Conversion
  - Convert a binary number to a decimal number
  - Decimal-to-Binary Conversion
  - Convert a decimal number to a binary number
  - IPv4 Address Representation
  - Describe the components of an IPv4 address
  - IPv4 Header Fields
  - Identify the fields within the IPv4 header
  - IPv4 Address Classes
  - List the classes of IPv4 addresses
  - Subnet Masks
  - Explain the role of a subnet mask
  - Subnets
  - Describe the purposes and functions of subnets and their addressing schemes
  - Implementing Subnetting: Borrowing Bits
  - Describe how subnetting is implemented
  - Implementing Subnetting: Determining the Addressing Scheme
  - Describe implementing subnetting by determining the Addressing Scheme
  - Benefits of VLSM and Implementing VLSM
  - Describe the role of VLSM and also how to implement it
  - Private vs. Public IPv4 Addresses
  - Describe and differentiate between public and private addresses
  - Reserved IPv4 Addresses
  - Describe reserved IPv4 addresses
  - Verifying IPv4 Address of a Host
  - Verify the IPv4 address of a host
  - Summary Challenge

8. Explaining the TCP/IP Transport Layer and Application Layer

- TCP/IP Transport Layer Functions
  - Describe the TCP/IP transport layer and Application layer
  - Explain the purpose and major functions of the TCP/IP transport layer
  - Reliable vs. Best-Effort Transport
  - 2019 Cisco Systems, Inc. Course Administration Guide 18
  - Contrast connection-oriented transport with connectionless transport
  - TCP Characteristics
  - Explain the characteristics of TCP in brief
  - UDP Characteristics
  - Describe the characteristics of UDP in brief
  - TCP/IP Application Layer
  - List the common applications that are provided by TCP/IP
  - Introducing HTTP
  - Define the function of HTTP
  - Domain Name System
  - Define the function of DNS
  - Explaining DHCP for IPv4
  - Describe DHCP operation
  - Discovery 4: Inspect TCP/IP Applications
  - Explore how TCP and UDP servers listen on particular ports that are made available on particular interfaces
  - Topology
  - Job Aids
  - Task 1: Inspect TCP/IP Applications
  - Summary Challenge

9. Explaining the TCP/IP Transport Layer and Application Layer

- Role of a Router
  - Explore functions of routing
  - Describe the role of a router in the IP packet delivery process
  - Router Components
  - Describe the physical characteristics of a router

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- Define the purpose and function of trunking
- Configuring an 802.1Q Trunk
- Describe how to configure an 802.1Q trunk
- Discovery 14: Configure VLAN and Trunk
- Configure and verify VLANs and trunks
- Topology
- Job Aid
- Task 1: Configure VLAN and Trunk
- VLAN Design Consideration
- Describe VLAN design and creation guidelines
- Troubleshoot VLANs and Trunk
- FASTLab 5: Troubleshoot VLANs and Trunk
- Topology
- Job Aid
- Configuration Tips
- Answer Key
- Summary Challenge

16. Routing Between VLANs

- Purpose of Inter-VLAN Routing
  - Describe the application and configuration of inter-VLAN routing
  - Describe the need for inter-VLAN routing
  - Options for Inter-VLAN Routing
  - Describe the options for inter-VLAN routing
  - Discovery 15: Configure a Router on a Stick
  - Configure Router on a Stick
  - Topology
  - Job Aids
  - Task 1: Include a Router Interface in a VLAN
  - Task 2: Configure a Router with a Trunk Link
  - Implement Multiple VLANs and Basic Routing Between the VLANs
  - FASTLab 6: Implement Multiple VLANs and Basic Routing Between the VLANs
  - Topology
  - Job Aids
  - Configuration Tips
  - Answer Key
  - Summary Challenge

17. Introducing OSPF

- Dynamic Routing Protocols
  - Explain the basics of dynamic routing protocols and describe components and terms of OSPF
  - Describe the idea behind dynamic routing protocols
  - Path Selection
  - Describe the purpose of administrative distance
  - Link-State Routing Protocol Overview
  - Explain the basic idea behind link-state protocols
  - Link-State Routing Protocol Data Structures
  - Describe the data structures that are used by link-state routing protocols
  - Introducing OSPF
  - Describe the features of OSPF
  - Establishing OSPF Neighbor Adjacencies
  - Describe how OSPF neighbor adjacencies are established
  - OSPF Neighbor States
  - Explain OSPF neighbor states
  - SPF Algorithm
  - Explain how OSPF decides what is the best path through the network
  - Building a Link-State Database
  - Describe how routers build and synchronize the link-state database
  - Discovery 16: Configure and Verify Single-Area OSPF
  - Configure and verify OSPF configuration
  - Topology
  - Job Aids
  - Task 1: Configure and Verify Single-Area OSPF
  - Routing for IPv6
  - Describe routing types for IPv6
  - Summary Challenge

18. Building Redundant Switched Topologies

- Physical Redundancy in a LAN
  - Explain how STP and RSTP work
  - Describe physical redundancy in LAN
  - Issues in Redundant Topologies
  - Describe problems that may arise in redundant switched topologies
  - Spanning Tree Operation
  - Describe STP operation in the sample topology
  - Types of Spanning Tree Protocols
  - Describe variants of STP and the differences between them
  - Rapid Spanning Tree Protocol
  - Describe the Rapid Spanning Tree Protocol
  - PortFast and BPDU Guard
  - Demonstrate why PortFast and BPDU guard are important technologies
  - Summary Challenge

19. Improving Redundant Switched Topologies with EtherChannel

- EtherChannel Overview

COURSE OUTLINE

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- Discovery 23: Monitor the WLC
- Monitor the WLC
- Topology
- Task 1: Monitor the WLC
- Discovery 24: Configure a Dynamic (VLAN) Interface
- Configure a VLAN (dynamic) interface
- Topology
- Task 1: Configure a VLAN (Dynamic) Interface
- Discovery 25: Configure a DHCP Scope
- Configure a DHCP scope
- Topology
- Task 1: Configure a DHCP Scope
- Discovery 26: Configure a WLAN
- Configure a WLAN
- Topology
- Task 1: Configure a WLAN
- Discovery 27: Define a RADIUS Server
- Define a RADIUS server.
- Topology
- Task 1: Define a RADIUS Server
- Discovery 28: Explore Management Options
- Configure the SNMP location for the WLC
- Topology
- Task 1: Explore Management Options
- Summary Challenge

26. Introducing Architectures and Virtualization

- Introduction to Network Design
  - Describe network and device architectures and introduce virtualization
  - Describe the issues in poorly designed LANs
  - Enterprise Three-Tier Hierarchical Network Design
  - Describe the enterprise network design
  - Spine-Leaf Network Design
  - Describe characteristics of spine and leaf architectures
  - Cisco Enterprise Architecture Model
  - Describe the enterprise architecture model
  - Cloud Computing Overview
  - Describe the effect of cloud computing on enterprise network
  - Device Architecture
  - Describe the device architecture
  - Virtualization Fundamentals
  - Explain the need for virtualization, the concept of a virtual machine, and its components
  - Summary Challenge

27. Explaining the Evolution of Intelligent Networks

- Overview of Network Programmability in Enterprise Networks
  - Introduce the concept of network programmability and SDN and describe the smart network management solutions like Cisco DNA Center, SD-Access and SD-WAN
  - Explain the need for programmability, and automation and provide a high level Network
  - Programmability options in Enterprise Networks
  - Software-Defined Networking
  - Describe the basics of SDN and its role in enterprise network
  - Common Programmability Protocols and Methods
  - Describe the Common Programmability Protocols and Methods in the Model-driven Programmability Stack
  - Configuration Management Tools
  - Describe the Configuration Management Tools and compare and contrast agent-based and agentless configuration management solutions
  - Introducing Cisco DNA Center
  - Describe Cisco DNA Center
  - Discovery 29: Explore the Cisco DNA Center
  - Describe example analysis using Cisco DNA Center
  - Topology
  - Task 1: Explore Cisco DNA Center GUI
  - Cisco SD-Access
  - Explore Cisco SD Access and introduce concept of overlay networks
  - Introducing Cisco SD-WAN
  - Describe Cisco SD-WAN
  - Summary Challenge

28. Introducing System Monitoring

- Introducing Syslog
  - Configure basic IOS system monitoring tools
  - Explain why syslog is used
  - Syslog Message Format
  - Describe the format and severity levels of syslog messages
  - SNMP Overview
  - Explain why SNMP is used and how it works and its versions
  - Enabling Network Time Protocol
  - Describe how to enable NTP
  - Discovery 30: Configure and Verify NTP
  - Configure and verify NTP in Client Server mode
  - Topology
  - Job Aids
  - Task 1: Configure and Verify NTP
  - Configure System Message Logging

COURSE OUTLINE

- FASTLab 10: Configure System Message Logging
- Topology
- Job Aids
- Configuration Tips
- Answer Key
- Summary Challenge

29. Managing Cisco Devices

- Cisco IOS Integrated File System and Devices
  - Describe the management of Cisco devices
  - Describe the file systems that are used by a Cisco router
  - Stages of the Router Power-On Boot Sequence
  - Describe the sequence of events that occurs during a router boot Loading and Managing System Images Files
  - Describe how to load and manage system images files
  - Loading Cisco IOS Configuration Files
  - Describe the process of loading Cisco IOS configuration files
  - Validating Cisco IOS Images Using MD5
  - Describe how to validate IOS images using MD5
  - Managing Cisco IOS Images and Device Configuration Files
  - Describe how to manage Cisco IOS images and device configuration files Discovery 31: Create the Cisco IOS Image Backup
  - Create the IOS image backup
  - Topology
  - Job Aids
  - Task 1: Create the Cisco IOS Image Backup
  - Discovery 32: Upgrade Cisco IOS Image
  - Upgrade IOS image
  - Topology
  - Job Aid
  - Task 1: Upgrade Cisco IOS Image
  - Summary Challenge

30. Examining the Security Threat Landscape

- Security Threat Landscape Overview
  - Describe the current security threat landscape
  - Describe the current threat landscape or threatscape
  - Malware
  - Describe malware
  - Hacking Tools
  - Describe hacking tools
  - Denial of Service and Distributed Denial of Service
  - Describe DoS and DDoS attacks
  - Spoofing
  - Describe spoofing
  - Reflection and Amplification Attacks
  - Describe reflection and amplification attacks
  - Social Engineering
  - Explain social engineering
  - Evolution of Phishing
  - Describe the evolution of phishing
  - Password Attacks
  - Examine password attacks
  - Reconnaissance Attacks
  - Examine reconnaissance attacks
  - Buffer Overflow Attacks
  - Explain buffer overflow attacks
  - Man-in-the-Middle Attacks
  - Explain man-in-the-middle attacks

31. Implementing Threat Defense Technologies

- Information Security Overview
  - Describe threat defense technologies
  - Describe information security
  - Firewalls
  - Describe firewalls
  - Intrusion Prevention Systems
  - Describe intrusion prevention systems
  - Introduction to Cryptographic Technologies
  - Describe cryptographic technologies
  - IPsec Security Services
  - Describe IPsec security services
  - Secure Sockets Layer and Transport Layer Security
  - Describe SSL and TLS protocols
  - Wireless Security Protocols
  - Describe wireless security protocols
  - Discovery 33: Configure WLAN Using WPA2 PSK Using the GUI
  - Configure WPA2 PSK
  - Task 1: Configure WLAN Using WPA2 PSK Using the GUI
  - Summary Challenge

32. Securing Administrative Access

- Network Device Security Overview
  - Implement a basic security configuration of the device management plane
  - List the actions that are required to secure a network device
  - Securing Access to Privileged EXEC Mode
  - Secure access to privileged EXEC mode
  - Securing Console Access
  - Secure console access to a network device
  - Securing Remote Access

COURSE OUTLINE

- Secure remote access to a network device
- Discovery 34: Secure Console and Remote Access
- Secure initial configuration
- Topology
- Job Aids
- Task 1: Secure Access to Privileged EXEC Mode
- Task 2: Secure Console and Remote Access
- Task 3: Enable SSH
- Configuring the Login Banner
- Configure the login banner
- Limiting Remote Access with ACLs
- Limit remote access with an ACL
- Discovery 35: Enable and Limit Remote Access Connectivity
- Enable and secure remote access connectivity
- Topology
- Job Aids
- Task 1: Limit Remote Access with ACLs
- Task 2: Configure the Login and EXEC Banners
- External Authentication Options
- Describe TACACS+ and RADIUS for external authentication
- Secure Device Administrative Access
- FASTLab 11: Secure Device Administrative Access
- Topology
- Job Aids
- Answer Key
- Summary Challenge

33. Implementing Device Hardening

- Securing Unused Ports
  - Implement basic steps to harden network devices
  - Securing Unused Ports
  - Secure unused ports
  - Infrastructure ACL
  - Infrastructure ACL
  - Disabling Unused Services
  - Disable unused services
  - Port Security Overview
  - Describe port security
  - Discovery 36: Configure and Verify Port Security
  - Configure port security
  - Topology
  - Job Aids
  - Task 1: Configure and Verify Port Security with Static Learning and Default Violation Mode on SW1
  - Task 2: Configure and Verify Port Security with Sticky Learning and Default Violation Mode on SW1
  - Task 3: Configure Error-Disabled Port Automatic Recovery on SW1
  - Task 4: Configure and Verify Port Security with Dynamic Learning and Protect Violation Mode on SW2
  - Task 5: Configure and Verify Port Security with Dynamic Learning and Restrict Violation Mode on SW2
  - Mitigating VLAN Attacks
  - Describe VLAN attacks
  - DHCP Snooping
  - Describe DHCP attacks
  - Dynamic ARP Inspection
  - Explain ARP cache poisoning attack
  - Implement Device Hardening
  - FASTLab 12: Implement Device Hardening
  - Topology
  - Job Aids
  - Configuration Tips
  - Answer Key
  - Summary Challenge

LABS

Discovery 1: Get started with Cisco CLI
Discovery 2: Observe How a Switch Operates
Discovery 3: Perform Basic Switch Configuration
FASTLab 1: Implement the Initial Switch Configuration
Discovery 4: Inspect TCP/IP Applications
Discovery 5: Configure an Interface on a Cisco Router
Discovery 6: Configure and Verify Layer 2 Discovery Protocols
FASTLab 2: Implement an Initial Router Configuration
Discovery 7: Configure Default Gateway
Discovery 8: Explore Packet Forwarding
Discovery 9: Troubleshoot Switch Media and Port Issues
Discovery 10: Troubleshoot Port Duplex Issues
Discovery 11: Configure Basic IPv6 Connectivity
Discovery 12: Configure and Verify IPv4 Static Routes
Discovery 13: Configure IPv6 Static Routes
FASTLab 3: Implement IPv4 Static Routing
FASTLab 4: Implement IPv6 Static Routing
Discovery 14: Configure VLAN and Trunk
FASTLab 5: Troubleshoot VLANs and Trunk
Discovery 15: Configure a Router on a Stick
FASTLab 6: Implement Multiple VLANs and Basic Routing Between the VLANs
Discovery 16: Configure and Verify Single-Area OSPF
Discovery 17: Configure and Verify EtherChannel
FASTLab 7: Improve Redundant Switched Topologies with EtherChannel
Discovery 18: Configure and Verify IPv4 ACLs
FASTLab 8: Implement Numbered and Named IPv4 ACLs
Discovery 19: Configure a Provider-Assigned IPv4 Address
Discovery 20: Configure Static NAT
Discovery 21: Configure Dynamic NAT and PAT
FASTLab 9: Implement PAT
Discovery 22: Log into the WLC
Discovery 23: Monitor the WLC
Discovery 24: Configure a Dynamic (VLAN) Interface
Discovery 25: Configure a DHCP Scope
Discovery 26: Configure a WLAN
Discovery 27: Define a RADIUS Server
Discovery 28: Explore Management Options
Discovery 29: Explore the Cisco DNA Center
Discovery 30: Configure and Verify NTP
FASTLab 10: Configure System Message Logging
Discovery 31: Create the Cisco IOS Image Backup
Discovery 32: Upgrade Cisco IOS Image
Discovery 33: Configure WLAN Using WPA2 PSK Using the GUI
Discovery 34: Secure Console and Remote Access
Discovery 35: Enable and Limit Remote Access Connectivity
FASTLab 11: Secure Device Administrative Access
Discovery 36: Configure and Verify Port Security
FASTLab 12: Implement Device Hardening