

CCNP 4: Network Troubleshooting

Cisco Networking Academy Program

Version 3.0

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Target Audience

The target audience is individuals desiring to continue their post-CCNA preparation for a career as a network administrator, Level 2 support engineer, Level 2 systems engineer, network technician, or deployment engineer. This also includes CCNA certified individuals pursuing CCNP, CCIP, CCSP, CCDP, or CCIE certifications.

Prerequisites

Prior to taking this course, students should have completed CCNA 1 through 4 or the equivalent.

The following prerequisites are beneficial, but not required:

- CCNA certification
- Work experience

Course Description

CCNP 4: Network Troubleshooting is the last of four courses leading to the Cisco Certified Network Professional (CCNP) certification. CCNP 4 teaches students about the troubleshooting network problems. This course focuses on troubleshooting network problems. The course focuses on the documenting and baselining a network, troubleshooting methodologies and tools, and Layers 1 to 7 troubleshooting.

Course Objectives

The CCNP certification indicates knowledge of networking for the small office, home office (SOHO) market and enterprise markets and the ability to work in businesses or organizations with networks that have between 100 and 500 nodes. A CCNP certified individual should be able to perform the following tasks:

- Implement appropriate technologies to build a scalable routed network
- Build campus networks using multiplayer switching technologies
- Improve traffic flow, reliability, redundancy, and performance for campus LANs, routed and switched WANs, and remote access networks
- Create and deploy a global intranet
- Troubleshoot an environment that uses Cisco routers and switches for multiprotocol client hosts and services
- Perform entry-level tasks in the planning, design, installation, operation, and troubleshooting of Ethernet and TCP/IP networks

CCNP 4 is an important step toward achieving CCNP certification.

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

- Documenting and Baselining the Network
- Troubleshooting Methodologies and Tools
- Layer 1-7 Troubleshooting

Lab Requirements

Please refer to the CCNP Equipment Bundle Spreadsheets on Cisco Academy Connection (CAC).

Certification Alignment

The curriculum is aligned with Cisco Certified Network Professional (CCNP) exam.

Course Overview

The course is designed to be delivered in a 70 contact hour time frame. Approximately 45 hours will be designated to lab activities and 25 hours will be spent on curriculum content.

Course Outline

Module 1. Documenting and Baselining the Network

Overview

1.1 Network Baselining

- 1.1.1 Network baselining overview
- 1.1.2 Planning for the first baseline
- 1.1.3 Identifying devices and ports of interest
- 1.1.4 Determining the duration of the baseline
- 1.1.5 Using the baseline data
- 1.1.6 Identifying undesired network behavior
- 1.1.7 Identifying thresholds
- 1.1.8 Predicting long-term performance and capacity trends
- 1.1.9 Verifying policies

1.2 Network Configuration Documentation

- 1.2.1 Network configuration documentation overview
- 1.2.2 Identifying the components of a network configuration table
- 1.2.3 Identifying the components of a topology diagram
- 1.2.4 Discovering network configuration information
- 1.2.5 Describing the process of creating network documentation
- 1.2.6 Creating network documentation

1.3 Building-Block Approach

- 1.3.1 Identifying the components of an end-system configuration table
- 1.3.2 Identifying the components of an end-system topology table
- 1.3.3 Identifying commands and applications used to discover information about end-system configuration
- 1.3.4 Discovering end-system configuration information
- 1.3.5 Creating end-system network configuration documentation

Summary

Module 2. Troubleshooting Methodologies and Tools

Overview

2.1 Using a Layered Architectural Model to describe Data Flow

- 2.1.1 Encapsulating data
- 2.1.2 Bits on the physical medium
- 2.1.3 Network devices utilize control information
- 2.1.4 Decapsulation
- 2.1.5 OSI model versus TCP/IP model
- 2.1.6 Position of network devices in layered model

2.2 Troubleshooting Approaches

- 2.2.1 General troubleshooting process
- 2.2.2 Bottom-up
- 2.2.3 Top-down
- 2.2.4 Divide and conquer
- 2.2.5 Guidelines for selecting an approach

2.3 Gathering Symptoms

- 2.3.1 Gathering symptoms for a network
- 2.3.2 Gathering symptoms from an end-user: hardware
- 2.3.3 Gathering symptoms from an end-user: software
- 2.3.4 Questions to ask an end-user
- 2.3.5 Flow charts for gathering network and end-user symptoms

2.4 Network Management Tools

- 2.4.1 Network management system frameworks
- 2.4.2 Knowledge base tools
- 2.4.3 Performance measurement and reporting tools
- 2.4.4 Event and fault management tools
- 2.4.5 Policy management tools

Summary

Module 3. Troubleshooting at the Physical Layer

Overview

3.1 Characteristics of Physical Layer Failure Problems

- 3.1.1 Critical characteristics – connectivity
- 3.1.2 Critical characteristics – upper layer component operation
- 3.1.3 Non-critical characteristics – equipment indicators
- 3.1.4 Non-critical characteristics – power failures
- 3.1.5 Non-critical characteristics – console messages

3.2 Characteristics of Physical Layer Optimization Problems

- 3.2.1 Performance lower than baseline
- 3.2.2 Exceeding cable design limits, poor quality cabling and connections
- 3.2.3 Noise
- 3.2.4 Collisions
- 3.2.5 Other data transmission issues
- 3.2.6 Resources
- 3.2.7 Utilization
- 3.2.8 Console messages

3.3 Windows and Cisco Commands for Physical Layer Information Gathering

- 3.3.1 End-system commands – common commands
- 3.3.2 End-system commands – windows only
- 3.3.3 End-system commands – UNIX/Mac OS
- 3.3.4 Common Cisco IOS commands
- 3.3.5 Cisco IOS show commands

3.4 Identifying Physical Layer Problems

- 3.4.1 Power related
- 3.4.2 Cabling faults – CAT5
- 3.4.3 Cabling faults – fiber and coax
- 3.4.4 Hardware
- 3.4.5 Collision Based problems – shared media
- 3.4.6 External interference
- 3.4.7 Configuration script errors
- 3.4.8 CPU Overload

3.5 Isolating Physical Layer Problems

- 3.5.1 Methodology

- 3.5.2 Tools for the job
- 3.5.3 Bad cabling
- 3.5.4 Cabling incorrect
- 3.5.5 Interface configuration
- 3.5.6 Operational statistics
- 3.6 Implementing Physical Layer Solutions
 - 3.6.1 Solving common problems – methodology
 - 3.6.2 ARP commands
 - 3.6.3 Solving common problems – windows, UNIX/MAC OS end-system commands
 - 3.6.4 Solving common problems – Cisco IOS commands
 - 3.6.5 Redundancy
 - 3.6.6 Solving common problems – support resources
- Summary

Module 4. Layer 2 Troubleshooting

Overview

4.1 Characteristics of Data Link Layer Problems

- 4.1.1 Data link layer problems overview
- 4.1.2 No component above the data link layer is functional
- 4.1.3 The network is functional, but operating at less than the baseline level
- 4.1.4 Framing errors
- 4.1.5 Encapsulation errors
- 4.1.6 Layer 2 to Layer 3 address mapping errors
- 4.1.7 Critical characteristics – no network layer connectivity
- 4.1.8 Upper layer component operation
- 4.1.9 Critical characteristics – console messages

4.2 End-System Commands for Gathering Data Link Information

- 4.2.1 Common end-system commands
- 4.2.2 Microsoft Windows end-system commands
- 4.2.3 UNIX/Mac operating systems end-system commands
- 4.2.4 General Cisco IOS commands
- 4.2.5 Cisco IOS show commands
- 4.2.6 The show cdp neighbors command

4.3 Troubleshooting Switched Ethernet Networks

- 4.3.1 Troubleshooting the Spanning Tree Protocol
- 4.3.2 Troubleshooting STP loops
- 4.3.3 Preventing STP loops
- 4.3.4 Troubleshooting incorrect STP root configuration
- 4.3.5 Troubleshooting Ethernet broadcast traffic
- 4.3.6 Troubleshooting Ethernet switch flooding
- 4.3.7 Troubleshooting VTP misconfiguration
- 4.3.8 Troubleshooting Etherchannel

4.4 Troubleshooting ISDN

- 4.4.1 T1 framing errors
- 4.4.2 Troubleshooting ISDN primary rate switch types
- 4.4.3 Troubleshooting ISDN BRI to telco communications
- 4.4.4 Troubleshooting ISDN BRI dialer problems
- 4.4.5 Debugging ISDN call setup failures

4.5 Troubleshooting Frame Relay

- 4.5.1 Steps for troubleshooting Frame Relay
- 4.5.2 The show frame-relay lmi command
- 4.5.3 The show frame-relay pvc comma
- 4.5.4 Frame Relay encapsulation type
- 4.5.5 Troubleshooting Frame Relay using the line status
- 4.5.6 Ping the local IP address on a multipoint Frame Relay
- 4.5.7 Reconfiguring a subinterface

4.6 PPP and Layer 2 Considerations for Routed and Routing Protocols

- 4.6.1 Link Control Protocol
- 4.6.2 Troubleshooting PPP authentication PAP
- 4.6.3 Troubleshooting PPP authentication CHAP
- 4.6.4 IP split horizon checking
- 4.6.5 OSPF in an NBMA environment
- 4.6.6 The keyword broadcast
- 4.6.7 Excessive fragmentation

Summary

Module 5. Layer 3 Troubleshooting

Overview

5.1 Troubleshooting Network Layer Problems

- 5.1.1 What are network layer problems?
- 5.1.2 Isolating the problem methodology
- 5.1.3 Static routes, dynamic routing, summarization, redistribution, and combinations

5.2 Troubleshooting Static Routes

- 5.2.1 Static routes and classful lookups
- 5.2.2 Static routes and intermediate addresses
- 5.2.3 Static route optimization with serial networks
- 5.2.4 Static route optimization with Ethernet networks
- 5.2.5 Recurring static route installation and deletion
- 5.2.6 Using discard routes

5.3 Common IGP Routing Protocol Issues, Causes, and Solutions

- 5.3.1 Introduction
- 5.3.2 Missing or incorrect network or neighbor statement
- 5.3.3 Layer 1 or 2 down
- 5.3.4 Distribute-list in/out blocking
- 5.3.5 Access list blocking
- 5.3.6 Advertised network interface is down
- 5.3.7 Passive interface

5.4 Troubleshooting RIP

- 5.4.1 Incompatible RIP version types
- 5.4.2 Mismatched authentication key
- 5.4.3 Reaches RIP hop count limit
- 5.4.4 Discontiguous networks
- 5.4.5 Invalid source address
- 5.4.6 Flapping routes
- 5.4.7 Large routing tables

5.5 Troubleshooting IGRP

- 5.5.1 Discontiguous networks
- 5.5.2 AS mismatch
- 5.5.3 Misconfigured neighbor statement
- 5.5.4 Maximum paths
- 5.5.5 Candidate default

5.6 Troubleshooting EIGRP

- 5.6.1 Mismatched K values
- 5.6.2 Mismatched AS number
- 5.6.3 Stuck in active – determining the problem
- 5.6.4 Stuck in active – methodology for troubleshooting
- 5.6.5 Stuck in active – the ultimate solution
- 5.6.6 Duplicate router IDs
- 5.6.7 EIGRP error messages

5.7 Troubleshooting OSPF

- 5.7.1 Mismatched parameters
- 5.7.2 OSPF state issues
- 5.7.3 One side of point-to-point link is unnumbered
- 5.7.4 ABR not generating Type 4 summary LSA
- 5.7.5 Forwarding address is not known through the intra-area or interarea route
- 5.7.6 Route summarization problems
- 5.7.7 CPUHOG problems
- 5.7.8 SPF calculation and route flapping

5.8 Troubleshooting IS-IS

- 5.8.1 IS-IS adjacency problems
- 5.8.2 Some or all of the adjacencies are not coming up
- 5.8.3 Adjacency is stuck in INIT state
- 5.8.4 IS-IS adjacency instead of IS-IS adjacency formed
- 5.8.5 Route advertisement problems
- 5.8.6 Route flapping problem

5.9 Troubleshooting BGP

- 5.9.1 Troubleshooting BGP neighbor relationships
- 5.9.2 Troubleshooting BGP route advertisements
- 5.9.3 Troubleshooting routes not being installed in the IP routing table
- 5.9.4 The BGP next hop is not reachable
- 5.9.5 BGP routes getting dampened
- 5.9.6 Troubleshooting outbound and inbound BGP policy issues
- 5.9.7 Traffic takes a different interface what shows in routing table

5.10 Troubleshooting Redistribution

- 5.10.1 Redistribution problems with RIP

- 5.10.2 Redistribution problems with IGRP/EIGRP
- 5.10.3 Redistribution problems with OSPF
- 5.10.4 Redistribution problems with IS-IS
- 5.10.5 Redistribution problems with BGP

Summary

Module 6. Layer 4 Troubleshooting

Overview

6.1 Characteristics of Transport Layer Technologies

- 6.1.1 Common transport layer technologies
- 6.1.2 User Datagram Protocol
- 6.1.3 Transport Control Protocol
- 6.1.4 Standard access control lists
- 6.1.5 Extended access control lists
- 6.1.6 Static IP Network Address Translation
- 6.1.7 Dynamic IP Network Address Translation
- 6.1.8 NetBIOS and NetBEUI

6.2 Troubleshooting Transport Layer Issues on the Router

- 6.2.1 Common issues with extended ACLs
- 6.2.2 Gathering information on ACL operation
- 6.2.3 Optimizing access list operation
- 6.2.4 Common issues with IP NAT
- 6.2.5 Gathering information on NAT configuration and operation
- 6.2.6 Other useful information

6.3 Troubleshooting Transport Layer Issues on Network Hosts

- 6.3.1 Common transport layer issues with IP networks
- 6.3.2 Gathering transport layer information on Windows machines
- 6.3.3 Gathering transport layer information on UNIX machines
- 6.3.4 Common issues with NetBIOS networks
- 6.3.5 Gathering NetBIOS information

6.4 Troubleshooting Complex Network Systems

- 6.4.1 Identifying complex transport layer problems
- 6.4.2 Disassembling the problem

- 6.4.3 Solving the component problems
- 6.4.4 Dynamic NAT and extended ACLs
- 6.4.5 TCP load distribution with NAT

Summary

Module 7. Layer 1 - 7 Troubleshooting

Overview

7.1 Troubleshooting the Application Layer

- 7.1.1 Overview
- 7.1.2 Eliminating Layers 1 – 3
- 7.1.3 Eliminating Layer 4
- 7.1.4 Isolating application layer problems
- 7.1.5 Identifying support resources
- 7.1.6 Accessing support resources
- 7.1.7 Correcting application layer problems

7.2 Gathering Information on Application Layer Problems

- 7.2.1 Overview
- 7.2.2 Common TCP/IP commands
- 7.2.3 Platform specific TCP/IP utilities
- 7.2.4 Cisco IOS commands
- 7.2.5 System logs
- 7.2.6 Syslog destinations
- 7.2.7 Deciphering syslog messages
- 7.2.8 Protocol analyzers
- 7.2.9 Network management systems

7.3 Troubleshooting TCP/IP Application Layer Protocols

- 7.3.1 Overview
- 7.3.2 Client-server systems
- 7.3.3 Terminals and consoles
- 7.3.4 Web traffic
- 7.3.5 Electronic mail
- 7.3.6 File transfer
- 7.3.7 Network management and time protocols
- 7.3.8 Name resolution
- 7.3.9 Dynamic Host Configuration Protocol (DHCP)

7.4 Troubleshooting TCP/IP Application Layer Problems

7.4.1 Troubleshooting Telnet problems

7.4.2 Troubleshooting HTTP problems

7.4.3 Troubleshooting e-mail problems

7.4.4 Troubleshooting FTP problems

7.4.5 Troubleshooting DNS problems

Summary